

THE UNIVERSITY OF MARYLAND
McNAIR SCHOLARS
UNDERGRADUATE RESEARCH JOURNAL



*Celebrating 20 Years of Student Research and Scholarship
(1991-2011)*

UNIVERSITY OF
MARYLAND

*“Whether or not you reach
your goals in life depends
entirely on how well you
prepare for them and how
badly you want them.*

You’re eagles!

*Stretch your wings and
fly to the sky.”*



DR. RONALD ERVIN MCNAIR, the second African American to fly in space, was born October 21, 1950, in Lake City, South Carolina to Carl and Pearl McNair. He attended North Carolina A&T State University in Greensboro, where, in 1971, he graduated magna cum laude with a B.S. degree in physics. In 1976, at the age of 26, he earned his Ph.D. degree in physics from the prestigious Massachusetts Institute of Technology. Ronald E. McNair was nationally recognized for his work in the field of laser physics. In 1978, he was one of 35 applicants selected from a pool of ten thousand for NASA’s space shuttle program and assigned as a mission specialist aboard the 1984 flight of the shuttle Challenger.

In addition to his academic achievements, he was the recipient of three honorary doctorates and numerous fellowships and commendations. He was also a sixth degree black belt in karate and an accomplished jazz saxophonist. He was married to Cheryl Moore and had two children, Reginald Ervin and Joy Cheray.

On the morning of January 28, 1986, McNair and his six crew members died in an explosion aboard the space shuttle Challenger. In his memory, members of Congress provided funding for the Ronald E. McNair Post-Baccalaureate Achievement Program to encourage low income, first generation college students to enroll in graduate studies. This program is dedicated to the high standard of achievement that Ronald E. McNair’s life represented.

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University of Maryland, College Park
Volume 3

*Celebrating 20 Years of Student Research and Scholarship
(1991-2011)*

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Acknowledgments

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Our colleagues at the U.S. Department of Education's
Office of Federal TRIO Programs
Associate Provost and Dean of Undergraduate Studies, Dr. Donna B. Hamilton
Research Mentors
McNair Scholars and their Families
Members of the Academic Achievement Programs Staff

A note about the structure of the journal: The journal includes abbreviated work of the students' final paper and represents combined efforts of students and their research mentors. The views expressed in the papers and abstracts are not intended to represent the views, beliefs, interests, values, or practices of the University of Maryland, College Park.

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From the Associate Provost and Dean for Undergraduate Studies



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MESSAGE FROM THE DEAN

Dear Reader:

It is such an honor to congratulate the McNair Scholars Program on this second edition of the University of Maryland McNair Scholars Journal. The edition includes the abstracts and scholarly papers of the participants from University of Maryland, College Park, Frostburg State University, and Saint Mary's College of Maryland.

For the past 18 years, the McNair Scholars Program has been an important asset and contribution to the research culture at the University. Since 1991, more than 300 students have benefited from the program's services, opportunities and research mentoring, and we are so very proud to have the program on our campus. We look forward to many years to come partnering with the McNair Scholars Program as we implement the University's strategic plan and diversity strategic plan.

I offer my sincere congratulations to the participants on their latest accomplishments as evidenced in this journal. The students' work in the world of inquiry and discovery, as demonstrated by the abstracts and papers, is a defining moment in their academic and intellectual life.

Finally, I encourage you, the reader, to get to know the McNair Scholars here at the University of Maryland, College Park. Support the scholars through your mentoring, generous time, or financial support for graduate school. To those of you who are already supporting the scholars and their graduate school pursuits, I thank you.

Sincerely,

A handwritten signature in cursive script that reads "Donna B. Hamilton".

Donna B. Hamilton
Associate Provost for Academic Affairs and
Dean for Undergraduate Studies

From the Executive Director**UNIVERSITY OF
MARYLAND**

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Dear Reader:

I am pleased to share with you the third edition of the *University of Maryland McNair Scholars Undergraduate Research Journal*. The journal embodies the spirit of Dr. Ronald McNair and the McNair Program itself. The collection of scholarly work demonstrates the McNair scholars' dedication to and passion for research and scholarship and their determination to overcome tremendous obstacles to arrive at this point in their academic journey. The body of work is also reflective of the support and care the scholars receive from family, community, AAP and University staff, and research mentors – all of whom are essential to the scholars' success. The publication represents the culmination of time spent in the field, in research labs, and in libraries to blaze new paths of intellectual discovery.

The diverse interests of a group of very special scholars are evident in the pages of the journal. Research projects undertaken by the McNair scholars focus on societal, family, communal, educational, health, technological and other issues that challenge the body, mind, and spirit. In the pages of this journal may be the next cure for a disease, the next effective practice for educators, the next defense strategy for a government, or the next set of innovative ideas that peak our interest and challenge our deeply held assumptions.

Pursuit of a Ph.D. degree is a serious and challenging undertaking. The abstracts and papers indicate that this group of young scholars has embraced fully the challenges of pursuing a graduate degree and contributing to new knowledge in the larger global community. I am very proud of each scholar, and I know you will be as you read through the journal. Congratulations, again, to Dr. Southerland for his leadership on his final McNair journal and we, the McNair family, wish him well on his new journey, and we wish all McNair graduates well on their journeys. As readers, we ask for your continued support as we approach our 21st year here at the University of Maryland.

Sincerely,


Jerry L. Lewis, Executive Director

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Economic and Social Barriers to HIV/AIDS Testing in African-American College Men

Abenaa Acheampong

Mentor: Dr. Carolyn Clymer Voorhees, Associate Professor of Public Health
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Abstract

In the United States currently, African-American men are now the subgroup in society to be disproportionately affected by HIV/AIDS. Although African-Americans represent 13% of the population in the United States, they represent almost half of the one million people living with AIDS (Hall, 2005). Through this research one will gain a deeper understanding of why African-American college men are not getting tested for HIV/AIDS at higher rates. Using the Health Belief Model, this study aims to address what could be potential barriers to HIV/AIDS testing. Because the aim is to identify root issues on why African American men in college are not getting tested, the best method to use is a focus group. Questions were developed that addressed possible social and economic barriers to HIV/AIDS testing. Five participants were recruited specifically to participate in a focus group, which lasted about 50 minutes. Additionally, 25 surveys were administered to a sample of African American undergraduate men around campus. The survey consisted of short answers and multiple choice questions. The results suggested that social factors such as isolation, invincibility, and stigma may be the biggest barrier to HIV testing. The results also suggested that interventions targeted towards communication in intimate relationships and families were needed to promote safe-sex practice and ease the fear of social isolation.

Introduction

The HIV/AIDS epidemic which was first detected in the early 1980's, still shocks modern day America. First considered a "homosexual's" disease (due to disproportionately high infection rates amongst that population), it soon became evident that this was not the case. Since the 1980's researchers have learned a lot about the virus and have been able to debunk many myths and falsehoods regarding it. From a public health standpoint, one of the most important myths to have been discredited was that HIV/AIDS only affected a certain population. The virus as we now know does not discriminate and this finding is supported by the fact that HIV/AIDS is no longer considered an epidemic, but a pandemic.

Though the United States government spends 17 billion dollars for HIV/AIDS related issues, prevention interventions have not curtailed the infection (Villaneva et al, 2007). There are currently over 40,000 new cases of HIV infections each year (Kalichman, 2007). According to the Center of Disease Control and Prevention, there are approximately 1 million people infected with HIV in the United States currently, and 21% of those people do not know they are infected (HIV/AIDS in the United States, CDC). African-Americans are now the subgroup in society to be disproportionately affected by HIV/AIDS. Because of this, some people even believe that there is a conspiracy around it. A study that was done in California showed that 27% of African Americans endorsed the belief that "HIV/AIDS is a man-made virus that the federal government made to kill and wipe out black people" (Ross, M et al, 2006). Although African-Americans represent 13% of the population in the United States, they represent almost 21% of those who were infected with HIV/AIDS from 1981-1988 (Sutton et al, 2009). Now, African-Americans represent half of the one million people living with AIDS (Hall, 2005). Additionally, African-Americans represent almost 40% of all Americans that have died of AIDS (Hall, 2005). This means that since the HIV/AIDS outbreak started, over 225,000 African Americans have died (Hall, 2005). According to the Center for Disease Control and Prevention, African Americans accounted for the 49% of those newly diagnosed with AIDS cases diagnosis in 2007 in all 50 states and the District of the Columbia (HIV/AIDS among African Americans, CDC).

African American men are disproportionately affected by HIV/AIDS when compared to African American women. In 2004, African-American men comprised 50% of the new cases of HIV (Coleman et al, 2007). The estimated lifetime risk for African American men to get HIV is 1 in 16 (Hall, 2005). However; the estimated lifetime risk for African American women to get HIV/AIDS is 1 in 30 (Sutton et al, 2009). When these findings are contrasted with men of

different races, the disparities that African-American men face are clearly evident. For example, African-American men are almost nine times more likely to be infected with HIV than White men (Essien et al, 2005).

In the case of African-American men, the most common mode of transmission in order is sexual contact with other men, injection drug use, and high-risk heterosexual sex (Coleman et al, 2007). In fact, men who have sex with men (MSM) and men who have sex with men and women (MSMW) account for 76.1% of all AIDS cases (Shoptow et al, 2009). MSM are African-American men who have sex with men but do not consider themselves homosexuals (Operario et al, 2008). MSMW are African American men who have sex with men and women (MSMW) but who do not form an identity around their sexual preference, which means they would not consider themselves bisexual (Operario et al, 2010). MSM/W may face alienation from cultural group if they were open about being homosexual or bisexual (Shoptow et al, 2009). Because of the prevalence of MSM and MSMW getting infected with HIV, many of the HIV/AIDS research deals with this topic. However; there are many factors may contribute to the spread of HIV amongst African Americans compared with Whites (Wheeler D et al, 2006).

There are other social issues in the African-American community that propagate the spread of HIV/AIDS. Such issues include stigma, socioeconomic issues, lack of awareness, and lack of education. The biggest social issue that encourages the spread of the virus and keeps African-Americans from getting tested is stigma. HIV/AIDS carries one of the biggest stigmas in the African American community, which tends to report high levels of religiosity (Holt, 2007). As a result, the common modes of transmission of HIV/AIDS are looked down upon as homosexual and bisexual practices are not viewed positively in many faith-based groups. Mamie Harris, the executive director of a faith-based HIV testing organization states "The empathy of HIV is dying. It's been out there for a very long time, and I think people have become dull of ear and dull of senses around it." During her work which provides HIV testing to churches, jails, prisons, homeless shelters, and rehabilitation clinics, she recalls a woman once telling her "Well, after all, you can prevent HIV, but you can't prevent breast cancer." Because there are other diseases that disproportionately affect the African-American population, preventable illnesses such as HIV/AIDS do not get any sympathy.

Focusing on the prevention of HIV/AIDS in African-American men is essential. Effective interventions that will help reduce the rates of transmission in African-American men will be a big advancement in reducing HIV/AIDS in the Black community (Whitehead, 1997). The highest mode of transmission for African American women is high-risk heterosexual activity (Whitehead, 1997). The aim of this study is to examine risk factors for HIV/AIDS in African-American college men. In conducting this study, there were several questions that needed to be answered. The first question: how does the increase in education deter individuals from involving in high-risk sexual behaviors? Do African-American men in college perceive HIV/AIDS as a real threat to them? What are the barriers that keep them from practicing safe sex if they don't? Most importantly, what could be done to help reinforce the fact that they should engage in safe-sex.

It is important that college student population to be studied in regards to HIV/AIDS related research because despite health education efforts; college students are reportedly continuing to practice unsafe sexual behaviors (Bontempi J et al, 2009). When looking at rates of partner concurrency in unmarried individuals, the rates were higher for those who were younger and were African-Americans (Carey M et al, 2010). Twenty-eight percent (28%) of men of sexually active adolescent men reported to have been engaged in partner concurrency within the last month (Carey M et al, 2010). HIV and AIDS are continued threats to the African-American community because of sexual risk taking behavior, specifically the lack of condom usage (Essien et al, 2005). In another study, it was revealed that condom usage was lowest in African-Americans and Hispanics (Essien et al, 2005). It is also no secret that alcohol and other illegal substances are circulated around college campuses. The prevalence of high-risk sexual behavior, marijuana use, and alcohol use has been found to increase among young adults (Simmons et al, 2010). High levels of drinking and frequency of binge drinking for males positively predicted HIV-risky behavior (Hittner et al, 2008).

The type of research this study is consistent with theories of health behavior, which aims to encourage the participants to engage in a specific health behavior. Similar studies can range from quitting smoking to participation in cancer screenings. In the case of this study, the aim is trying to increase HIV/AIDS testing rates amongst African-American undergraduate men in college. Since the number of HIV/AIDS cases reported among African Americans has been more prominent in the state of Maryland (Moore, 2008), it is even more appropriate for this study to be done at the University of Maryland. In order for this to occur, there is a need to properly identify the potential economic and social barriers that may prevent them from doing so. One of the most well-known theories used in health behavior research is the Health Belief Model. This model hypothesizes that a person's behavior depends on the value the

individual places on a goal and the individual's notion that a certain action will achieve their desired goal (Janz, 1984).

There are six dimensions of the Health Belief Model which include; perceived susceptibility, perceived severity, perceived barriers, and perceived benefits (Janz, 1984). The dimension of perceived susceptible theorizes that an individual will engage in a specific health behavior if they feel that they felt susceptible to a negative health effect. In this research study, the dimension of perceived susceptibility hypothesizes that if a participant feels that they feel they are at risk for HIV/AIDS then they are more likely to get tested from HIV/AIDS. The second dimension of the Health Belief Model is perceived severity, which states that the severity of an illness will likely encourage an individual to engage health behaviors. In regards to this study, we would expect the participants to be engaging in HIV/AIDS testing if they feel that this illness is severe. The dimension of perceived barriers is the notion that the more obstacles an individual faces, the less likely they are to engage in a health behavior. According to this model, the more obstacles a participant faces in doing a health behavior, the less likely they are to do the health behavior. The last dimension of the Health Belief Model is perceived benefits. When individuals correlate great benefits to engaging in a health behavior such as screenings for different ailments, they are more likely to participate in such health behaviors. Using the Health Belief Model, this study aims to address what could be potential barriers to HIV/AIDS testing. In this study, all six dimensions of the Health Belief Model will be tested. If the participants do not have a strong desire to avoid the illness, which will be evident in their lifestyle, and or if they do not see the importance of taking a health action, this could act as a potential hindrance to HIV/AIDS testing.

Methods

To identify root causes on why African American men in college are not getting tested, the best method to use is a focus group. Questions were developed that addressed possible social and economic barriers to HIV/AIDS testing. Five participants were recruited specifically to participate in the focus group, which lasted about 50 minutes. Recruitment was conducted through referrals. The participants of the focus group were asked a series of open ended questions about barriers to HIV testing, led by a moderator. The participants had the flexibility to be as open as they wanted or as brief as they wanted. The participants in the focus group were compensated \$5 for their participation. Additionally, 25 surveys were administered to African American men around campus. The survey consisted of short answers and multiple choice questions.

All the participants recruited were African-American male students attending the University of Maryland. Since this study is based on understanding why the African American male populations were not getting tested at higher rates, it is imperative that the subjects were African American males. I chose to look at African American males attending the University of Maryland College Park because this would be a more accessible population and would be generalizable to other large state universities. Five participants were recruited for the focus group and 25 participants to complete the survey. The 25 survey participants were recruited by randomly asking African American men around campus to complete it. They each received an information sheet about the study which included important contact information, if they had any questions. The protocol for this study was approved by The University of Maryland Institutional Review Board (IRB).

The data collected from this research was analyzed through the statistical software SPSS. Frequency analysis and chi square results are presented to test the relationship between categorical variables. The data collected from the focus group will be transcribed and analyzed according to the responses of the participants. There are minimal risks associated with this study. These include some social risks. The participants may feel embarrassed when answering certain questions. The focus group participants might also feel uneasy if they know other participants in the focus group. This study also provides benefits including further education about the importance of HIV testing. The will also be provided with information on places that provide free HIV testing.

Certain provisions were implemented to maintain the confidentiality of our participants. First, the participants were given an identification number which prevented the usage of their names on written notes from the interviews and the focus group. Only authorized staff such as the principal investigator and the reviewer could review the notes from the interview. At the end of the study, all notes, files, and tape recordings were destroyed.

All information regarding the purpose of this study was disclosed to the participants. There was no deceptive information in this study. The focus group participants had two consent forms given to them, one to sign and the other for their own records. The participants gave consent by signing a consent form. The consent forms were written in

English at a level that the average college student would understand. The survey participants received an information sheet that provides them with details about the research and other essential information. Once read, they completed the survey if they chose to. The participants had the researcher's contact information if there were any questions.

There can be many potential barriers in getting the accurate data for this study. The most prominent barrier was getting the questionnaires distributed to the targeted population. The data for this research study was collected during the summer months. This became a challenge because the majority of the college students had returned home. Being able to attract willing African-American undergraduate males became even harder, although there are many programs that are held at the University of Maryland during the summer which employs African-American males. Because the study targeted undergraduate African-American males enrolled at UMD, data could not be collected from those who met the criteria but were students at other colleges, limiting the pool of participants. This was a threat to external validity because it will not be an accurate or diverse sample of African-American men in college. Another potential threat to validity is that the chosen participants may not show up for one or both of the interventions. This would be due to the fact that mainly those who are interested in the research or those who have been asked because of proximity will complete the questionnaires.

Limitations

This study was aimed to investigate potential barriers to HIV/AIDS in African-American college men. To keep the variables under control, only University of Maryland College Park undergraduate African-American males were considered. This study was not meant to study the African-American male population as a whole and results may not be generalizable to the entire African-American male population. This study also was designed for the young adult population ages 18-25, not targeted towards the older or younger generations. The results may not be applicable to those not considered in the young adult population as they may have other factors that may serve as more prevalent barriers in their age groups. Lastly, this study is not aimed at African-American male population who do not attend college. African-American men who do not attend a college may not be able to relate to some of the questions asked pertaining to college life and the role of education on HIV/AIDS testing. Thus, the study may not be applicable to African-American who are not college educated and have not experienced campus life.

Questionnaire

A set of questions that adequately addressed the research questions was developed. A piloted test using six African-American males in college was implemented. One participant, after completing the questionnaire, was determined to be an ineligible because the candidate, according to his answers, has never engaged in any sexual activity. The questions were created based on health education, different risky health behaviors, barriers that could keep individuals from practicing safe sex, and the perceived susceptibility of the participants. These factors together in this study can illustrate why individuals chose to or not to engage in risky sexual behaviors that may lead to HIV/AIDS. This research can provide information on how to develop and implement HIV/AIDS prevention interventions in this subgroup.

Survey Questions

The purpose of this survey is to gain a better understanding to potential barriers to HIV/AIDS testing. Please answer the questions to the best of your ability.

1. Who do you think should be responsible for using a form of barrier protection?
 - A. Male
 - B. Female
 - C. Both
 2. How many sexual partners have you had since you have been to college?
 - A. 1-3
 - B. 4-8
 - C. 9-12
 - D. 12 or more
 3. Do you use a form of protection every time you engage in a sexual act?
 - A. Yes
 - B. Sometimes
 - C. No
 4. How many people have you had unprotected sex with while in college? _____
 5. Do you feel confident that you can practice safe-sex method?
 - A. Yes
 - B. Somewhat
 - C. No
 6. If you have had unprotected sex, what was the reasoning? Circle all that apply.
 - A. Alcohol
 - B. I was in a long-term relationship
 - C. Drugs
 - D. I trusted him/her
 - E. Did not have any form of protection at that time
 - F. Other
 7. What is your biggest concern about unprotected sex?
 - A. STDs
 - B. Personal Image/reputation
 - C. Pregnancy
 - D. HIV
 8. Do you believe that every time you engage in unprotected sex you put yourself at risk for HIV?
 - A. Yes
 - B. No
 - C. Don't really think about it
 9. How many times have you been tested for HIV/AIDS? _____
 10. What do you think is the biggest reason why people do not get tested for HIV _____
 11. Do you think stigma and negative society views might act as barrier to HIV/AIDS testing?
 - A. Strongly agree
 - B. Agree
 - C. Disagree
 - D. Strongly disagree
 - E. Has no effect

In what way _____

 12. Do you feel that you could get HIV/AIDS testing if you wanted to? _____
-

13. If you were to find out you were HIV positive, would you change your lifestyle? _____
 How? _____

14. Would you view a partner differently if they were prepared to provide protection during sexual activity?
 A. Yes
 B. No
 Explain your view whether positive or negative

15. Would you view a partner differently if they asked you to be tested of HIV/AIDS?
 A. Yes
 B. No
 Explain your view whether positive or negative

 Would your view be different for STI's? _____

16. Do you believe that your current lifestyle puts you at increased risk of HIV/AIDS/STI's
 A. Yes
 B. No

17. If you were to contract HIV/AIDS, do you feel that you would be a disgrace to your family and friends?
 A. Yes
 B. No
 Explain _____

18. If you were to contract HIV/AIDS, is there a possibility that you maybe disowned by some of your loved ones?
 A. Yes
 B. No

19. Has transportation, insurance or monetary issues hindered you from getting an HIV test?
 A. Yes
 B. No

20. If you were to contract HIV/AIDS, do you feel that you would have the monetary resources or have access to the monetary means to take care of yourself?
 A. Yes
 B. No

21. If you were infected with HIV/AIDS, would you want to know your status?

- A. Yes
- B. No

Why or why not? _____

Focus Group Questions

1. Do you feel that you have been well educated about safe sex practice and feel confident doing so?
 2. What is your definition of sex?
 3. What is your biggest fear about engaging in risky sexual behaviors?
 4. Do you feel like college settings promote risky sexual behaviors?
 5. Do you feel that it is safer to engage in risky sexual behaviors with other college students than the normal population? If so, do you think this can be a barrier to HIV/AIDS testing because many people feel safer?
 6. Do you feel that you have been well educated on HIV/AIDS?
 7. Can you give me an estimate of how many sexual partners you've had? How many of those are unprotected.
 8. Do you honestly feel that you may contract HIV/AIDS?
 9. Do you feel that you have access to places where you would be able to get HIV/AIDS testing? Do you feel that money or health insurance maybe a deterrent to HIV/AIDS?
 10. Why haven't you personally gotten tested for HIV?
 11. Because HIV is incurable, do you think that it can deter people from getting tested?
 12. How would your life change if you were found to be HIV positive? Would you notify all your sexual partners? If you found out that you were HIV negative, would you practice safer sex so you would remain negative?
 13. How do you think that society and stigma may act as barriers to getting tested for HIV/AIDS?
 14. What other social and economical factors has been deterring you from HIV/AIDS testing?
 15. Would you view a partner differently if they were prepared to provide protection during sexual activity? Why or why not?
 16. Would you view a partner differently if they asked you to be tested of HIV/AIDS? Why or Why not? Would your view be different if it were for STI's?
 17. Do you believe that your current lifestyle puts you at increased risk of HIV/AIDS/ STIs
 18. If you were to contract HIV/AIDS, do you feel that you would be a disgrace to your family and friends?
 19. If you were to contract HIV/AIDS, is there a possibility that you maybe disowned by some of your loved ones?
 20. Has transportation, insurance or monetary issues hindered you from getting an HIV test?
 21. If you were to contract HIV/AIDS, do you feel that you would have the monetary resources or have access to the monetary means to take care of yourself?
-

Ethical Consideration and Minimizing Error

There are some ethical dilemmas that needed to be addressed in this study. First, the topic of HIV/AIDS is a serious subject that can evoke certain emotions and thoughts. To ask the participants' questions regarding their lifestyle in terms of sexual relationships are a very sensitive situation needing extreme caution. Because the questionnaire may be seen as invasive, there were certain measures put in place to protect the participant. First, participants were given an information sheet which described the purpose of the research, the risk and benefits, and the contact information of people who they can contact if questions arose.

When administering the survey, all involved in the conduct of the research left the immediate area of the participants when they began to complete the survey. This was done to so that the participants could answer the questions in a comfortable environment and not feel as if someone was looking over their shoulders. When the participants finished taking the survey, they either placed the completed surveys randomly in a folder of other completed surveys or randomly in a folder right in front of them. This method of collecting the survey data was used to increase the level of confidentiality. Heightened comfort and confidentiality may lead to more accurate survey data. The participants are more likely to be inclined to answer truthfully knowing that there is very little chance that anyone, including the researcher can identify them.

For the focus group interview, the participants were given a consent form which outlined the basis of the project including the risk and benefits. As with the survey participants, the focus group participants did not have to answer any question they did not want to. The questions designed for the group interview dealt with the same topic as the questionnaire but they were not as invasive. The interview participants were given more general questions to discuss so that no one would feel uncomfortable or embarrassed since they were being recorded.

Results

Figure 1: Biggest Concern Figure 2: Times Tested

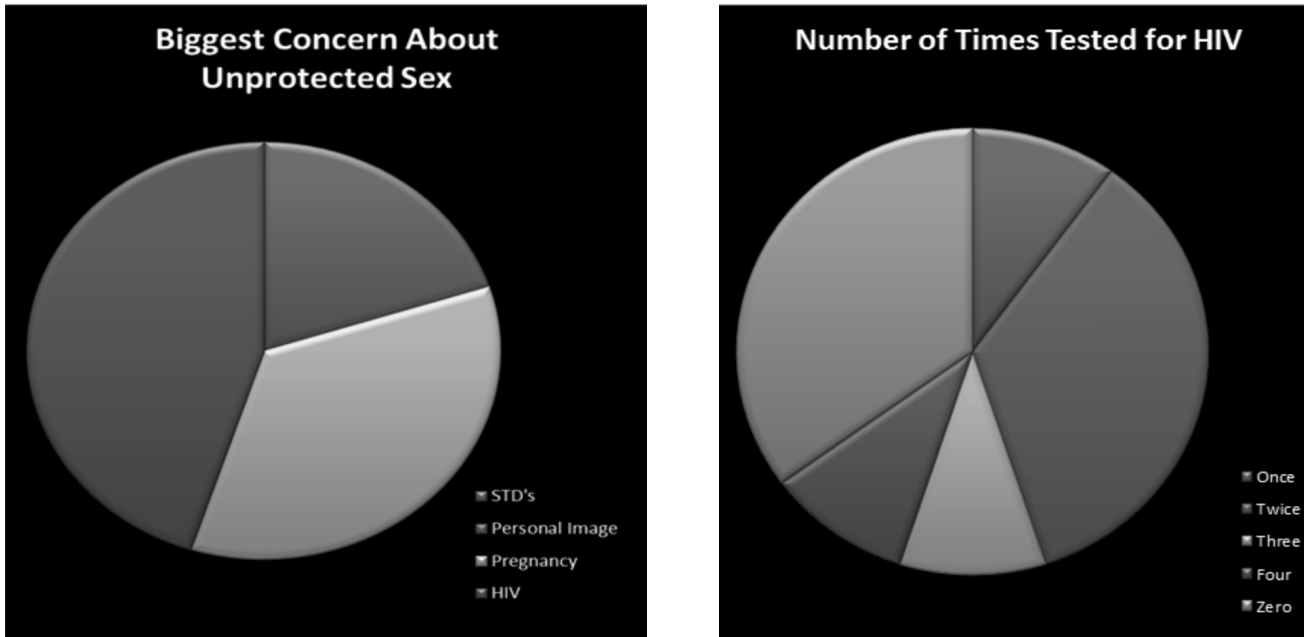


Figure 1. The results displayed in figure 1 illustrates that the biggest concern with unprotected sex amongst sexually active participants was HIV (45%) followed closely by pregnancy (35%). Other STD's represented (20%) of the participant's concern.

Figure 2. In figure 2, the number of times sexually active participants have been tested for HIV is shown. This figure reveals that 35% of the participants have never been tested for HIV. 65% of the group have been tested at least once.

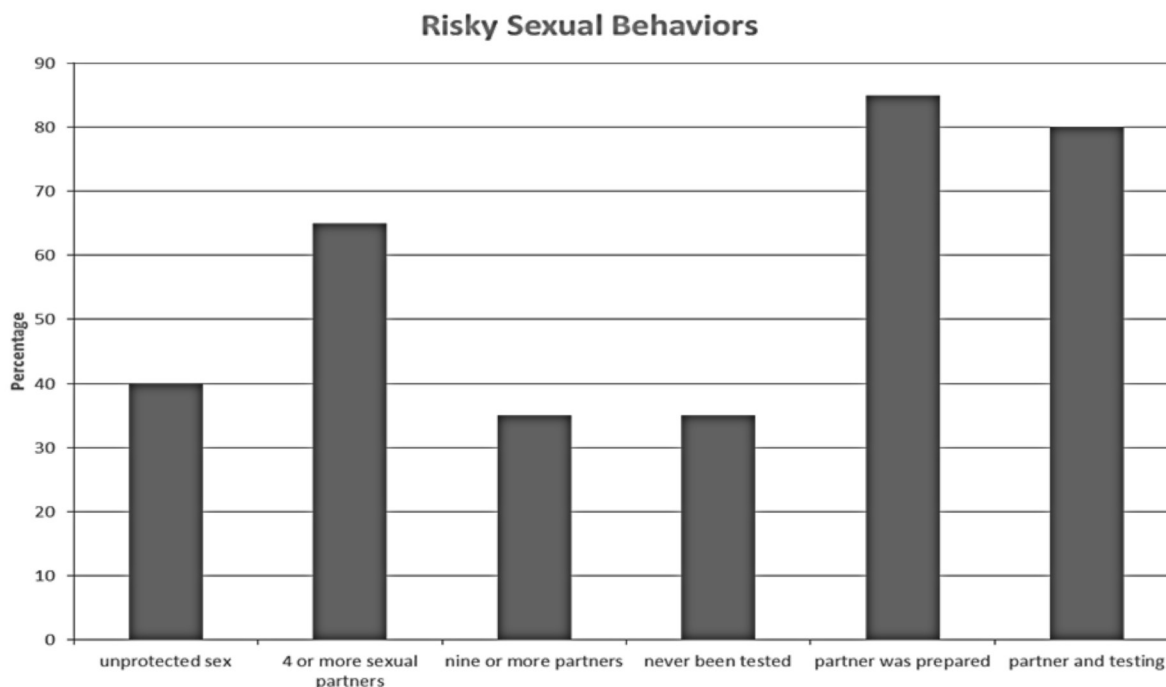


Chart 3

The results shown in this graph illustrates that participants in this study are clearly engaging in risky sexual behavior. 40% of the sexually active participants have engaged in unprotected sex, 65% have had four or more partners since they have been in college. Also, 35% of the participants answered that they have had nine or more partners. As stated earlier, 35% of the sexually active participants have never been tested. This graph also shows the attitude of the participants regarding safer sex practices. 85% of the participants stated that they would have a positive view of their partner if their partner carried protection in preparation for sexual encounters. In regards to testing, 80% of the participants stated that they would have a favorable opinion of their partners if their partners insisted on both of them getting tested for HIV and other STD's prior to sexual activity.

Current lifestyle and risk for HIV/AIDS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	25	92.6	92.6	92.6
	Yes	2	7.4	7.4	100.0
	Total	27	96.4	100.0	
Missing	System	0	0		
Total		27	100.0		

Chart 1

When asked if their current lifestyle puts them at risk for HIV/AIDS, the overwhelming majority (92.6%) answered no. Only 7.2% of the participants answered yes.

Disgrace of Positive HIV status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	9	33.3	33.3	33.3
	Yes	18	66.7	66.7	100.0
	Total	27	100.0	100.0	
Missing	System	0	0		
Total		27	100.0		

When asked if they felt that they would be a disgrace to their families if they were HIV positive, almost 67% of the participants felt that they would be. Only 33% said that they would not.

Possible Isolation from family for Positive HIV Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	19	70.4	70.4	70.4
	Yes	8	29.6	29.6	100.0
	Total	27	100.0	100.0	
Missing	System	0	0		
Total		27	100.0		

70% of the participants felt that a positive HIV status would not warrant isolation from family members. However, nearly 30% of the participants felt that they would be disowned by family members if they were infected with HIV.

The relationship between number of sex partners and the number of Unprotected sex

Crosstab

		Number of unprotected sex							Total
		.00	1.00	2.00	3.00	4.00	5.00	6.00	
Sex partners	1-3	7	2	0	0	0	0	0	9
	4-8	2	1	0	0	0	1	0	4
	9-12	1	1	1	1	0	0	1	5
	12+	1	0	0	0	1	0	0	2
Total		11	4	1	1	1	1	1	20

Chi-Square Tests 1

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	24.462 ^a	18	.140
Likelihood Ratio	19.266	18	.376
Linear-by-Linear Association	4.292	1	.038
N of Valid Cases	20		

a. 28 cells (100.0%) have expected count less than 5. The minimum expected count is .10.

The relationship between number of sex partners with biggest concern with unprotected sex

Crosstab 2

Count

		Concern			Total
		STD's	Pregnancy	HIV	
Sex Partners	1-3	3	3	3	9
	4-8	1	1	2	4
	9-12	0	2	3	5
	12+	0	1	1	2
Total		4	7	9	20

Chi-Square Tests 2

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.091 ^a	6	.797
Likelihood Ratio	4.351	6	.629
Linear-by-Linear Association	2.215	1	.137
N of Valid Cases	20		

a. 12 cells (100.0%) have expected count less than 5. The minimum expected count is .40.

The relationship between number of sex partners and risky current lifestyle

Crosstab 3

Count

		Current lifestyle		Total
		No	Yes	
Sex partners	1-3	9	0	9
	4-8	3	1	4
	9-12	4	1	5
	12+	2	0	2
Total		18	2	20

Chi-Square Tests 3

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.778 ^a	3	.427
Likelihood Ratio	3.501	3	.321
Linear-by-Linear Association	.480	1	.489
N of Valid Cases	20		

The results of the chi-square analysis did not produce any significant findings. This may be because of the very small sample size, not necessarily that there are no correlation between the variables.

Conclusion

In the United States alone, billions of dollars are spent on HIV/AIDS related expenses each year. With the high amount of expenditures, one would expect there to be many ways an individual can get tested for HIV/AIDS. Though there are ample resources in the Washington D.C. metropolitan area for individuals to get tested, 35% of the survey participants in the study who are sexually active have not been tested. It is imperative that these men get tested because as graph 1 of the results show that 40% of the participants have engaged in unprotected sex since they began college. The results also indicate that many of the African-American men who participated in this study have also had multiple sex partners; putting themselves and their partners at risk. According to the results, 65% of the survey participants have had sex with four or more partners since they have been enrolled in college, while another 35% have had nine or more partners. Since the purpose of this study was to find the underlying barriers to HIV/AIDS, the data taken from the focus group participants was used to explain the survey results.

The Health Belief Model is commonly used to encourage people to engage in specific health behaviors. One of the dimensions included in the module, perceived susceptibility, theorizes that an individual will engage in a specific health behavior if they feel that they were susceptible to a negative health effect. In this research study, it is appropriate to hypothesize that if a participant feels that they feel they are at risk for HIV/AIDS then they are more likely to get tested from HIV/AIDS. When the participants were asked if they felt that they put themselves at risk for HIV/AIDS every time they engaged in unprotected sex, 70% of the sexually active participants answered yes, while 30% of the participants answered no or that do not even think about it. When asked the same question to focus group participants, a discrepancy was found in their answers and in the answers on the surveys. Four out of the five focus group participants had a belief that HIV/AIDS was something that just could not happen to them. One participant stated "I feel like I'm immune," while another one noted "I feel like it's definitely a reality [but] it can't happen to me personally." 35% of the survey participants had not gotten tested for HIV, which is comparable number to the 30% who either do not care do or do not feel that they are at risk when engaging in risky sexual behavior. These results show that invincibility and apathy can act as a barrier to HIV/AIDS testing. According to the HBM, if an individual does not feel susceptible to HIV the less likely they will engage in testing.

The second dimension of the Health Belief Model is perceived severity, which states that the severity of an illness will likely encourage an individual to engage in positive health behaviors. In regards to this study, we would expect the participants to be engaging in HIV/AIDS testing if they feel that this illness is severe. However, the results illustrated the opposite. The severity of HIV/AIDS acted as a barrier to testing. In the survey, when the participants were asked to write what the biggest reason why people do not get tested, the overwhelming response was fear. This fear also took on many dimensions. Even though there are many medications that have proven effective in slowing the virus, many people still see a positive HIV status as an automatic death sentence.

The cost of medication and treatment for HIV/AIDS infected people can also be a source of fear. When asked if infected, would they have the monetary resources or have access to resources to take care of themselves, 45% of the survey participants answered no. One participant argues "I think economics is a real, real big deterrent especially once you have it you really don't have all the money to take care of your medical needs and everything. Then you get to the phase of all right what's the point? Let's say you do even come up with some type of medical treatment and everything. You're going to have to be doing it the rest of your life if you can afford it. If you can't afford it it's like most people are like all right what's the point? There's really no hope."

Another type of fear embedded with a possible positive HIV status is social isolation and stigma. In the focus group one participant states "It's like leprosy. You've got it and you just go over there and don't come into the general population. It's like you're a reject and an outcast. I feel like nobody wants to feel that kind of rejection from people because it hurts." Another participant adds "There are people I know who have HIV or AIDS and [others say] "oh how did they get it? Are they on the DL [secretly engaging in homosexual activity]? Were they getting a prostitute or something like that?" From the survey results, nearly 67% of the participants said that they would be a disgrace to their families if they were found to be HIV positive. Nearly 30% of the survey participants felt that they would be disowned by their families because of a positive status. A majority of the focus group participants stated that they came from religious background in which pre-marital sex is forbidden, so there is no way to explain to their families how this happened. One participant summed the idea of social isolation and HIV by saying "It's a lot like the Scarlet Letter type of thing like oh you sinned and all this. People just start judging. I think people would see it as they know it's like a 50/50 chance of going into testing that you can be positive or negative. Just like having that chance of being

positive and knowing what comes after just seeing how society treats people with it that kind of deters people from getting tested.”

The dimension of perceived barriers is the notion that the more obstacles an individual faces, the less likely they are to engage in a health behavior. According to this model, the more obstacles a participant faces to get tested for HIV, the less likely they are to get tested. However, the data collected from the survey and the focus group were consistent in suggesting that this might not be relevant to HIV/AIDS testing. One hundred percent (100%) of the sexually active survey participants and the focus group participants felt that they can get tested if they really wanted to. Also nearly, 95% of the survey participants and 4 out of the 5 focus group participants have never been prevented from getting tested because of lack of resources since in college. This includes monetary resources, transportation, insurance issues, or ignorance of testing location. The barrier hindered one focus group participant from HIV testing in the past was insurance. He was fearful of his insurance being notified of that event; however, he later got tested after learning he could do anonymous testing, which your identity would be concealed. These results suggest that social reasons maybe the biggest barriers to HIV testing than resources.

The last dimension of the Health Belief Model is perceived benefits. When individuals correlate great benefits to engaging in a health behavior such as screenings for different ailments, they are more likely to participate in such health behaviors. This did not prove to be the case for in this study. When asked if they would want to know their status if they were HIV positive, nearly 95% of the survey participants and all of the focus group participants said yes. The reasons were so they could live healthier, stop engaging in sexual activity, and start treatment sooner. However, this showed a discrepancy because though the participants said these things, 35% of the sexually active participants have never been tested and 40% have engaged in unprotected sex.

In conclusion, the results suggest that social factors such as isolation, invincibility, and stigma may be the biggest barrier to HIV testing. There also needs to be interventions targeted towards communication in intimate relationships and families. The results showed that 80% of the participants would have a favorable view of their partners if they suggested getting tested. Improving the dialogue between partners regarding HIV testing and other STD's may increase testing rates. Also, many participants were fearful of the reaction of their families if they were HIV positive. Communication between families about sensitive topics such as HIV/AIDS is needed to reassure individuals that they would still be loved by their families no matter the circumstance may also increase testing rates.

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Mutant Transformation of Pathogenic *Neisseria* Strains

Emmanuel Ajudua

Abstract

Neisseria gonorrhoeae is a bacterium that produces ~700,000 new gonococcal diseases in the US each year. While gonorrhea is localized to the urethra in men, in women it can spread to the cervix, uterus and fallopian tubes. Lipooligosaccharide (LOS) is a surface antigen embedded in the outer membrane of all *Neisseria* strains that causes disease. However, with commensal *Neisseria* strains disease does not occur. The commensal strains, with the exception of two, all contain a third heptose attached to their core. We hypothesized that if a third heptose could be added to the LOS Beta chains of *Neisseria gonorrhoeae*, then the LOS would become less virulent. The proposed gene sequence that codes for the *HepIII* transferase (enzyme that adds heptose) was located. The DNA was extracted and run in a PCR reaction to amplify the proposed gene sequence, which was then purified. PLES2 plasmid DNA was introduced to competent DH5 α MCR cells by heat shock transformation to make multiple copies. The resultant cells were plated onto LB+Ampicillin+Xgal for selectivity and restreaked for growth. As research continues the plasmid will be isolated from the *E. coli* and the purified gene will be inserted into the plasmid. After a few tests, the plasmid with the gene will be inserted into *Neisseria gonorrhoeae* to observe effects.

Introduction

Neisseria gonorrhoeae is a bacterium that causes ~700,000 new gonococcal diseases in the US each year (Center for Disease Control and Prevention [CDC], 2006), costing over one billion dollars annually (Kaiser Family Foundation, 2002). After Chlamydia, Gonorrhea is the second most notifiable sexually transmitted disease in the U.S. (CDC, 1995). If left untreated, it can cause urethritis in men, and lead to pelvic inflammatory disease in women (Fleming & Wasserheit, 1999). Gonococcal infections have also been found to increase susceptibility to and transmission of HIV infections (Rottingen, Cameron & Garnett, 2001). Although the national gonorrhea case rate (120.9 cases per 100,000 populations) has remained fairly stable over the past decade, it increased for the second consecutive year in 2006; particularly in western states. In these areas, rates of Gonorrhea among African Americans, adolescents, young adults and gay males remain high. (CDC, 2006). Due to these increased infection rates, emergence of antimicrobial – resistant *N. gonorrhoeae* strains, and the reproductive and economic implications of gonorrheal infection, the ability to prevent and control gonorrhea has become an important health issue (Eng & Butler, 1997).

Problem Statement

Antimicrobial- resistant *N. gonorrhoeae* strains are becoming a significant obstruction in the control of Gonorrhea. Ciprofloxacin-resistant and quinolone- resistant *N. gonorrhoeae* have become more prevalent in the U.S. (CDC, 2001a; CDC, 2001b), leaving only one group of antimicrobials, cephalosporins, to treat gonorrhea (CDC, 2002). Given the high possibility that *N. gonorrhoeae* strains will become cephalosporin-resistant, new measures to deal with gonorrhea are being sought. One of these new measures is the study of Lipooligosaccharide (LOS) structures. LOS is an important virulence determinant of the *Neisseriaceae* and is composed, in part, by the toxic Lipid A compound that causes disease. Although the genetic basis of LOS production in pathogenic *Neisseria* has been studied extensively, not much research has studied the genetics underlying LOS production in commensal *Neisseria*.

Purpose of Study and Research Question

This study will examine the effects of modifications to the gonococcal virulence determinant, LOS, on the pathogenicity of *Neisseria gonorrhoeae*. The use of data gathered from 16S RNA sequencing of commensal and pathogenic LOS structures, and the analysis of their phylogenetic relationships, has shown that commensal strains with the exception of two, have a third heptose attached to their core. This poses the question:

1. *What roles do LOS modifications play in lessening the immune response to LOS' presence?*

This study will observe the effects of transforming *N. Gonorrhoeae* with the gene that codes for the enzyme that adds the third heptose, *HepIII*. The *HepIII* gene will be extracted from *N. sicca* 4320.

Significance of Study

The successful transformation and expression of *HepIII* in *N. gonorrhoeae* has much significance. If the immune response is lessened by the addition of a third heptose to *N. gonorrhoeae*, it could provide important information towards a future gonorrhoeal vaccination.

Analysis and Discussion of the Literature and Presentation of Framework

Neisseria spp.

The genus *Neisseria* is known to consist of 11 similar species of bacteria. The genus was named after Albert Ludwig Sigismund Neisser, the German Physician and Bacteriologist who first described the organism responsible for gonorrhoea. The genus consists of aerobic, gram-negative, generally diplococci bacteria that are also oxidase-positive, catalase – negative, non-motile and non-endospore forming (Stein, 2006). *Neisseria* have grown over time with humans and are typically commensal inhabitants of the mucous membranes and upper respiratory track of mammals (Knapp, 1988a). Of the species, *N. gonorrhoeae* is the only strict human pathogen; the others show limited virulence, but can cause disease in immunocompromised hosts. Studies have shown the body can be colonized by multiple strains of the *N. sicca* and *N. subflava* group, without any side effects. Even strains of *N. meningitidis* can be found in the upper respiratory tract in dormant states. (Knapp 1988b). The actual pathogenesis of *Neisseria* is caused by a strong inflammatory response of the body to an infection, as opposed to the direct activity of bacterial toxins.

Disease

In males, the most common manifestation of gonococcal infections is urethritis. After a few days (2 to 8), discharge becomes more profuse, purulent and in some cases blood is discharged. Epididymitis is also caused by gonococcal infections, but is seen more in men younger than 35 years of age. When left untreated, it becomes very painful and increases the chances of infertility. In women, the endocervix is the most common site of infection, appearing in 80–90% of all recorded gonococcal infections, followed by the urethra (80%) and the rectum (40%). Symptoms of female gonococcal infection may include vaginal discharge, dysuria, intermenstrual bleeding, dyspareunia and mild lower abdominal pain, but many cases of infection are asymptomatic, and show no symptoms (Wong, Lutwick, Heddurshetti & Cebular, 2009). In congruence with an approaching menstrual period, the female's condition may progress to Pelvic Inflammatory Disease (PID), which affects 10–20% of women with gonorrhoea. PID is a secondary disease of gonococcal infection that can also be asymptomatic or symptomatic. Patients with symptoms may experience sharp lower abdominal pain and fever. The long term effects of PID include sterility and the possibility of ectopic pregnancies, the life threatening condition in which the zygote grows outside of the uterus (Hook & Hansfield, 1999). Disseminated gonococcal infections (DGI) result from the spread of gonorrhoea into the blood or joints. DGI's generally begin with bacteremia, fever, malaise, and skin lesions which eventually lead to severe septic joint disease (Hansfield, 1984)

Virulence Factors

The ability for *N. gonorrhoeae* to cause disease is due to its many different virulence factors which include, but are not limited to Type IV pili, Opa proteins and Lipooligosaccharides.

Type IV Pili

Pili are filamentous hair-like appendages on the outer membrane of *N. gonorrhoeae*, used for initial attachment of the bacteria to host cells. They are primarily assembled from multiple copies of the structural protein, pilin. The ability for pili to help *N. gonorrhoeae* avoid its hosts' immune response is due to their antigenic variation, a process by which an organism alters the composition of its pili (Hagblom et al., 1985). They are composed of two terminal regions; the N-terminal is the highly conserved region, homologous in the meningococcus and gonococcus, while antigenic variation occurs predominately in the C-terminal region (Deal et al., 1985).

Opa Proteins

Opa Proteins are integral proteins embedded in the outer membrane of *N. gonorrhoeae*. They are synthesized by the bacteria as precursors that contain signaling for inner membrane transport. A gonococcal strain can have up to 11 different *opa* genes, variably expressed by way of a process called phase variation. This process allows the gonococcus to

turn the expression of the Opa proteins on and off, independent of one another (Robertson & Meyer, 1992). Unlike *Neisserial* pili, opa proteins are not required for initial colonization of a host. However, they are associated with cellular binding on a more intimate level. After primary attachment of the bacteria to the cell via pili, Opa proteins have been shown to mediate epithelial binding (de Vries, F.P. et al., 1998).

Lipooligosaccharide

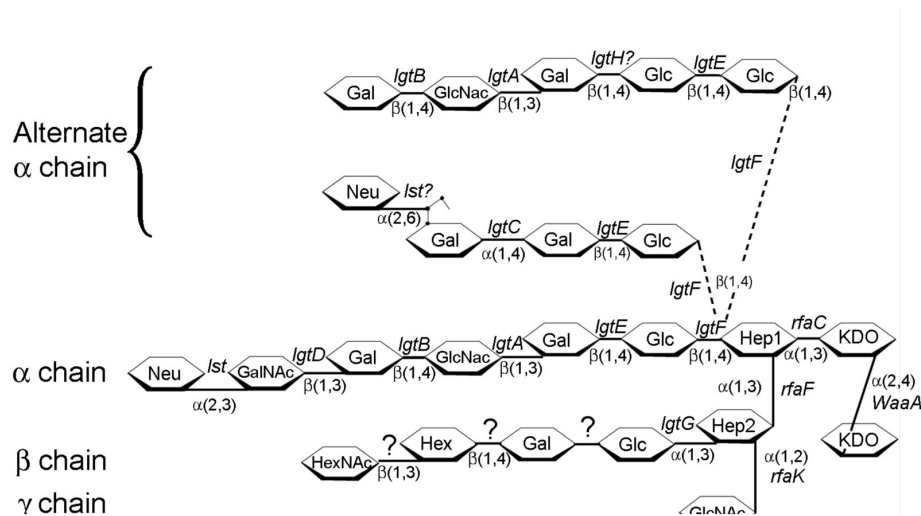
Lipooligosaccharide (LOS) is another important virulence determinant of pathogenic *Neisseria*. It is a glycolipid on the outer membrane involved in immune system evasion (Apicella et al., 1986), host cell invasion and attachment to epithelial cells (Song et al., 2000), mediation of damage to the fallopian tubes (Gregg, et al., 1981) and stimulation for the production of bactericidal antibodies. Not only does LOS allow *Neisseria* to invade the reproductive system in women and the urethra in men, but it also allows the organism to grow in the mouth, throat, eyes and anus (Stein, 2006).

LOS Physiology

Neisserial LOS's have been studied using chemical (Gibson et al., 1993; Griffiss et al., 1987), physical (Yamasaki et al., 1994), biological (Griffiss, 1994), and genetic methods (Petricoin, Danaher & Stein, 1991). They are amphipathic molecules composed of a hydrophilic carbohydrate moiety, also known as the oligosaccharide, and a hydrophobic lipid A moiety. The Lipid A portion is responsible for anchoring the oligosaccharide chains to an inner core embedded in the membrane. The inner core is a conserved portion of the LOS structure made from two KDO and two heptose residues. These residues connect the outer core of the LOS to the lipid A anchor. The genes responsible for LOS synthesis have been found in seven genomic locations (refer to figure 1). The region *kdtA* codes for the enzyme needed to add the two KDO molecules of the inner core to the lipid A moiety (Tzeng et al., 2002); *rfaC* encodes the gene whose product adds a heptose residue to KDO (Zhou, Lee & Apicella, 1994); *lgtF* and *rfaK* initiate the alpha chain and synthesize the gamma chain (Kahler et al., 1996); *rfaF* adds a second heptose to the first heptose residue (Petricoin III & Stein, 1989); *lgtABCDE* code for most of the genes responsible for alpha chain elongation (Gotschlich, 1994); *lgtG*, encodes the gene responsible for beta chain synthesis (Banerjee et al., 1998), and *lst* adds a sialic acid cap to the oligosaccharide chain (Gilbert et al., 1996).

The LOS structures in all *Neisserial* strains possess genes with a high homology to *rfaC* and *rfaF*. In addition, structural data analysis on *Neisserial* LOS has shown that the inner core of all commensal and pathogenic *Neisserial* strains contain two KDO molecules. Genes adjacent to the *rfaC* and *rfaF* genes, also known as flanking genes, show conservation amongst the meningococcus and gonococcus, but high divergence in commensal strains. Analysis of *Neisserial* 16S RNA sequences show that amongst the commensal strains there is a homolog of heptosyltransferase three, the enzyme that adds a third heptose to the inner core. This suggests that most commensal strains differ from pathogenic strains by the presence of a third heptose.

Figure 1: Pathogenic LOS structure



Gonococcal Vaccines

In recent years, *N. gonorrhoeae* has developed resistances to antibiotics that call for more expensive antibiotics treatments with broader spectrum activity. The treatment of gonorrhoeae with sulfonamides, penicillin's, tetracycline's and erythromycin have all proven to be ineffective with the emergence of relative or absolute multi-resistant strains (Whittington & Knapp, 1988); by 1988 about one third of all gonococcal isolates in the United States had one form of resistance or another (Schwarz et al, 1990). This led to the use of a cephalosporin or fluoroquinolone for the treatment of uncomplicated gonorrhoea. With the introduction of these broad spectrum antibiotics there has been relative stability in *N. gonorrhoeae*'s pattern of antimicrobial susceptibility. However, theoretical concerns arise about the gonococci's potential to form resistance to the broad spectrum treatments. Resistance to fluoroquinolones and cephalosporins have been induced in the lab, which caused previously susceptible gonococci to become clinically resistant immediately. This possibility of acquired resistance is making it more and more necessary to develop a vaccine for controlling the disease.

Summary and Implications of Literature

Vaccinations have proven to be a very effective prevention method of disease, but development of a neisserial vaccine has been halted for a number of reasons. One of the problems is not knowing which components of the virulence determinants would elicit the protective immune response needed. In addition, neisserial virulence determinants are able to change surface antigen composition frequently due to antigenic variation, making it harder to find a component of interest. By studying various aspects of neisserial LOS over the years, its importance in pathogenesis and immunobiology has become very well understood. LOS's are a group of complex glycolipids embedded in the outer membrane of Gram- negative bacteria. They possess many different antigenic determinants that have been found to be important in acquired and natural immunity. The understanding of LOS genetic biosynthesis in commensal and pathogenic *Neisseria* has opened doors to the understanding of differences in LOS structure of the two.

Pathogenic Neisserial LOS's have been studied more extensively than commensal Neisserial LOS's have in the past. Recent studies on the commensal *Neisseria* have shown differences in the inner core structures of their LOS that could be the difference between pathogenicity and commensalism in Neisserial strains. There is an addition of a third heptose to the second heptose in commensal Neisserial LOS that is not present in gonorrhoeae strains that are able to cause disease. This finding could prove to be a pivotal discovery towards the development of a vaccine.

Presentation and Discussion of Analytic Framework

This study will observe the effects of a *Hep III* transformation on the pathogenicity of *N. gonorrhoeae*. *Hep III* is the gene that codes for the enzyme responsible for adding the third heptose to the inner core of commensal *Neisseria*. Upon completion of a successful transformation, the *N. gonorrhoeae* should begin to express the *Hep III* and produce a third heptose on its LOS structure. The hypothesis is that the production of this third heptose will destroy the stereochemistry that allows gonococcal LOS to be pathogenic and interact with host cells. If our hypothesis is correct, it could prove to be a major breakthrough, and a step in the direction of a gonococcal vaccine. To achieve this the gene of interest will be inserted into a plasmid vector. That plasmid vector will then be introduced to the *N. gonorrhoeae* and be taken up by the bacteria. Once it enters the bacteria it should begin to produce heptosyl transferase.

Research Design and Methodology

The genome as pertaining to Neisserial LOS has been almost completely mapped by the Stein Lab, University of Maryland, College Park. Using 16s RNA sequences of Neisserial strains, the coding sequence for the *Hep III* gene has been located and was used to order a primers that would produce our gene of interest via PCR.

Bacterial Strains, Plasmids, Primers and Restriction Enzymes. The bacterial strains, plasmids, primers and restriction enzymes used to conduct this study are all listed in Table 1.

Table 1

Bacterial Strains		
DH5 α -MCR <i>E. coli</i> cells		New England Biolabs
<i>N. sicca</i> 4320		Dr. Herman Schneider WRAIR
<i>N. gonorrhoeae</i> F62		Dr. Fred Sparlug UNC, Chapel Hill
Plasmid		
pLES 2	Construction and characterization of a new shuttle vector, pLES2, capable of functioning in <i>Escherichia coli</i> and <i>Neisseria gonorrhoeae</i> .	Dr. Daniel C. Stein et al.
Primers		
NS Hep 3F	5'-CCC GGA TCC AGG AGC AAA CTA TGT CCC TGG CC -3'	This work
NS Hep 3R	5'- AAA GGA TCC GGT TTC AGA CGG CCT TTT CAT ATG GAA -3'	This work

Diluting Primers Upon receipt of the primers the stock tubes were centrifuged. The primers were then diluted with elix water at a 1:10 ratio of nanomoles of primer to microliters of elix water. Then 10 μ L was taken from that stock tube and inserted in another tube. It was also diluted at a 1:10 ratio of stock primer to elix water.

Expand Long Template Polymerase Chain Reaction (ELT-PCR) Using diluted primers a mixture of 0.5 μ L dNTP, 2.5 μ L Buffer 1, 0.5 μ L NS Hep 3F, 0.5 μ L NS Hep 3R, 21 μ L elix water, 0.25 μ L DNA polymerase and 1 μ L of *N. sicca* 4320 DNA was made; The total was 26 μ L. The mixture was run in thermocycler at 95°C for two minutes, 41 cycles of 95°C for 30 secs, 63°C (annealing temp.) for 30 secs and 72°C for six minutes over night.

Gel Electrophoresis For analysis of the PCR product, 100 mL of 1x TBE buffer was mixed with 0.8- 1.0g agarose and microwaved for 2:15 at 50-60% power. After microwave a spin bar was placed in the mixture and 10 μ L of ethidium bromide was added. While cooling down the mixture was placed inside a bucket of water on a hot plate with a magnetic spin function. When the mixture was cooler, but not solid, it was poured in a gel plate and a 20 lane comb was placed inside the plate. After the agarose mixture solidified, the product was ran on the gel electrophoresis for 45 min using lambda digest as the ladder. After gel analysis showed bands around 4 kb, the size of the gene of interest, the DNA was purified using the QIAquick PCR purification system by QIAGEN and stored in the refrigerator.

E. Coli Transformation In order to produce multiple copies of the plasmid, 200 μ L of DH5 α -MCR cells were obtained from the -80 °C freezer, making sure not to touch the cells, but to hold the top due to their extreme sensitivity to heat. They were thawed on ice for 10 minutes until the liquid and solid separated. While thawing the cells, two plastic 10 mL centrifuge tubes were placed on ice so that the cells remained cold once they were transferred. A 5 μ L amount of pLES2 plasmid (Stein et al., 1983) was added to one of the cold centrifuge tubes, which was followed by 100 μ L of DH5 α -MCR competent cells in both tubes. The samples were incubated on ice for 10 minutes and then transferred to a 37 °C water bath for 2 minutes. After 2 minutes they were immediately transferred back to ice. Then 900 μ L LB broth was added bringing the total volume to 1 mL and the tubes are incubated in the rotary shaker for 30 minutes. Upon completion of the 30 minutes, two sets of three volumes (10, 100 and 250 μ L) of transformation mix were plated on separate Ampicillin+Xgal plates O/N @ 37°C. The mixture with the plasmid served as the experimental and the mixture without it was the control.

Alkaline Lysis Plasmid DNA Miniprep Purification Using a sterile toothpick, half of the cells were scraped from the overnight culture plates and suspended in 100 μL of GTE in a microcentrifuge tube; the tube was vortexed. Fresh, ice cold lysis solution was made from 100 μL of 1% SDS solution and 100 μL 0.2 M NaOH. The 200 μL mixture of lysis was added to the vortexed tube and then inverted gently five times to mix it. The mixture was incubated on ice for five minutes, and then 150 μL of cold potassium acetate was added. The tube was inverted several times to mix the contents and then incubated on ice for 10 minutes. The tube was put in the microcentrifuge at 10,000 rpm for 10 minutes at 4°C. The supernatant was transferred to a new tube and 3 μL of RNase was added to it. The mixture was incubated for 10 minutes at room temperature, and then combined with 375 μL of phenol/chloroform/iaa. The solute was vortexed and then spun again in a centrifuge for 5 min. The top layer of the supernatant was removed into a fresh tube making sure not to collect any gunk at the top or bottom of the mix. Ethanol was added in twice the volume of the supernatant extract and incubated on ice for about 30 minutes to allow DNA precipitation. The mixture was spun again at 10,000 rpm at 4°C and the supernatant was discarded carefully, making sure not to get rid of DNA at the bottom of the tube. The tube was allowed to dry on its side until the residual ethanol evaporated, and resuspended in 30-50 μL of elix water. The sample was analyzed on a gel to make sure the plasmid was purified from the cells and the DNA was then stored at 4°C.

Digestion The purified plasmid was digested in 3 separate tubes and the purified PCR product was digested in its own tube. One of the purified plasmid tubes served as a digestion control, the other served as the ligase control, and the last tube was the experimental mixture. In the three plasmid tubes, 8 μL of plasmid DNA was inserted and in the PCR tube the same amount of PCR product was added. All four tubes contained 3 μL of Buffer 4, 3 μL of BSA 10X, 1 μL of Bam H1 enzyme and 15 μL of elix water for a total of 30 μL in each tube. The tubes were then incubated in a 37°C water bath overnight. The next day both samples were purified using the QIAquick PCR purification system by QIAGEN.

Ligation From each of the digestion products 4 μL was taken and combined in one test tube to make 8 μL of DNA total, which was labeled as the experimental. Another tube was labeled ligase control and contained 8 μL of plasmid. The digestion control was not touched. Then 2 μL of T4 DNA ligase buffer, 0.5 μL of T4 DNA ligase and 9.5 μL of Elix water were added to the ligase control and experimental for a total of 20 μL . The mixtures were incubated in 14°C (anti freeze bath) overnight, and in the morning were placed in a 65°C water bath for 10 minutes to deactivate the ligase. After ligation another *E. coli* transformation with all the controls was performed and plated on ampicillin with Xgal plates. The colonies on the experimental plate were white, meaning that the transformation of the *E. coli* with the plasmid containing the target gene was successful. Another Alkaline Lysis Plasmid DNA Miniprep Purification was conducted.

Transformation of *N. Gonorrhoeae* For every 1mL of GCP, 10 μL of 4.2% NaHCO_3 , 1M MgCl_2 (filtered), and kellokgs (White & Kellogg, 1965). Enough of the mixture was made for three tubes. Then 5 μL of purified DNA (plasmid + target gene) was added to 1 mL of the media. The mixture was place in a rotary shaker at 37 °C and run for 4 hours. The mix was then plated onto GCK+ampicillin in amounts of 1 μL , 10 μL , 100 μL and 250 μL .

Colony PCR A PCR was prepared with all the components except the DNA polymerase. Half of a colony was attained using a yellow pipette tip and pipetted up and down into the PCR reaction. The other half of the colony was streaked onto a new GCK+ampicillin plate. The tube was heated at 95 °C for 5 minutes, then DNA polymerase was added and PCR continued as normal. Once PCR is done, run on a gel and analyze.

Findings, Conclusions and Recommendations for Future Research

Findings

Due to the fact that this research is currently being conducted and has not been completed, there are no findings on the effect of the addition of a third heptose to gonococcal LOS. It is expected that the addition of the third heptose will decrease the pathogenicity of the *N. gonorrhoeae* in vitro. LOS structure is stereospecifically compatible with its function in causing disease in the body, and the addition of a heptose could possibly destroy LOS stereochemistry causing it to lose its functionality. However, whilst conducting the research we were able to establish phylogenetic relationships between commensal and pathogenic strains, which proved that although most *Neisserial* strains have a high homology to *rfaF* and *rfaC*, the genes surrounding them varied between the commensal strains and the gonococcus/meningococcus. The *HepIII* gene was found in all commensal strains except *N. cinera* and *N. lactamica*, which implies

that commensal strains differ from pathogenic strains by the additions of the third heptose to the Beta chain. Genes for Synthesis of LPS were found in commensal strains, but only *N. sicca* 4320 actually produced LPS. The presence of the glycosyl transferase genes in this strain alone, suggests that horizontal gene transfer occurred; likely from a meningococcus. The KDO residues are the molecules that serve as a base to which transferases add the core and branched oligosaccharides of LOS to. All *Neisserial* strains examined had a gene that encoded for KDO transferase and all *Neisserial* strains studied possessed two KDO residues. Lastly, in pathogenic *Neisseria* the *rfaK* gene codes for an enzyme that adds N-acetylglucosamine (GlcNAc) to the beta chain to form a gamma chain. It has been found amongst test samples that only pathogenic *Neisserial* strains and those close to it possess the ability to synthesize the GlcNAc on a gamma chain.

Conclusions

It is evident from the analysis of the data collected that genetic acquisition/loss of genetic information as well as recombination has occurred in the *Neisseria* genus. The *Neisseria* species that appear to have limited pathogenicity all have the ability to add a third heptose to the LOS core, with the exception of *N. cinerea* and *N. lactamica*. If the transformation is done successfully, the expectation is to see the heptose added to the LOS core. Once added, the stereochemistry of the LOS would be altered, which would cause it to lose its functionality. The potential benefits of this going as expected range from further understanding of the mode of virulence in *Neisserial* strains to a possible vaccine.

Future Research

Once the effect of the addition of the Heptose to the core residue has been analyzed stereochemically, the next step would be to observe whether the changes affect *N. gonorrhoeae*'s virulence. Transformed *N. gonorrhoeae* would be placed in plates containing human epithelial cells, incubated with the cells and then observed for lysis.

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Knowing Your Name: Hearing and Recognition in Infants

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Abstract

Infants are constantly placed in situations where they are exposed to multiple sources of sound including orators, music, television, or other causes of background noise. Young infants have the ability to separate streams of speech and selectively attend to speech signals, however little is known about the performance of infants and the cues used to recognize speech in the presence of background noise. In order to comprehend language development in infants, we must be able to understand how they acquire language despite noisy situations. This quantitative study seeks to examine how well infants from 3.5 – 5.5 months pay attention and process speech when in the presence of competing background noise. The head-turn preference procedure was conducted, and stimuli were created based on the infants own name and a foil name, presented in constant and varying-amplitude noise in order to test the infants' ability to recognize their own name (a familiar word) despite the opposing noise. Preliminary results indicate that infants displayed a preference for their own name under the constant-amplitude condition only. This suggests that the varying-amplitude condition is too distracting for infants to recognize speech and may not be as useful for their language acquisition in comparison to constant-amplitude. However, due to the lack of participation, further testing must continue to gain significant results and to draw further conclusions among infants of this age group.

Introduction

Problem Statement

How well do infants pay attention to a speaker when other acoustic elements are present? Research shows that young infants, 1 year or less, are limited in their speech recognition unless the background noise was 10 dB less intense than the speaker (Newman, 2005). If signal-to-noise ratios are closer together, infants will have difficulty attending to speech under noisy conditions. For young infants to recognize speech in environments where there are multiple talkers, background music, or television sets, the signal-to-noise ratio must be significantly higher than for adult listeners (Newman, 2009). Yet, this may not be accomplished in real-world situations. Therefore, there is a need to examine how well infants recognize and process speech when in the presence of background noise using settings which are more typical in their everyday life.

Purpose of Study

In order to fully understand language development in infants we must understand their speech recognition ability in the presence of noise. Studies have been conducted in quiet environments; however, infants frequently find themselves in the presence of noise and are then given greater opportunities to separate speech signals. Infants that are able to separate voices and attend selectively to a particular speaker could be at an advantage for learning language than infants who are unable to do so (Newman, 2005). Understanding speech signals in noise could strengthen infant's ability to acquire language. They are able to group and identify differences in acoustic properties, while choosing to pay attention to the target signal over the distracter signal. As we identify streaming in infants, we can assume that those able to segregate speech signals are using cognitive processes and those unable to succeed in these areas may have difficulty identifying speech in the presence of noise.

The current study will identify whether infants 4 months of age are able to recognize speech in the presence of competing amplitude-modulated background noise. Using a common word, their own name, we will identify whether or not they show a preference for their own name over the foil name in the presence of different noise environments. In order to learn language in noisy situations infants must have the capacity to stream speech signals, and process the necessary information to gain an understanding of what is being stated. The goal of this research is to understand what acoustic environments are best for infants recognize speech signals.

Overall, if infants are able to listen longer to their name in noisy settings we can confirm that those situations are not too distracting for them to segregate speech signals. Based on the length of time that each infant spent looking

towards the sound source during the head- turn preference procedure we can identify that they were able to pay attention despite the constant or varying noise backgrounds.

Research Questions

In this study there are several research questions we will address. First, can an infant differentiate his/her own name versus a foil name with competing background noise? Second, what type of noise is “easier” for infants to stream speech signals: constant amplitude or varying amplitude? Lastly, will the infant be distracted by the background noise? In this study, we will examine how well 4 month old infants listen and recognize their own name with amplitude-modulated noise at 5 Hz, as well as how infants pay attention and learn from speech under noisy conditions.

Delimitations of Research

English-only speakers were not the sole participants in this study because the child’s own name was used. Therefore, language was not a factor for eligibility of the study because the child could respond to their own name regardless of language barriers. Infants of 3.5 – 5.5 months were used to better understand the early stages of language development and speech recognition. Children with hearing impairments were not used because we wanted to study normal hearing infants and identify their reactions to the different noise conditions.

Definitions Related to Research

There are several terms that will be discussed, including: streaming, selective attention, head turn preference procedure (HPP), foil name, response box, infant directed speech (IDS), signal-to-noise ratio, amplitude modulated, and masking.

Streaming. The ability to group together sounds and separates them from sounds that are coming from another source (Gleason & Ratner, 1998).

Selective Attention. The ability to choose which items to stream and what sounds you will pay attention to.

Head-turn Preference Procedure (HPP). This procedure is conducted within a three sided pegboard booth. “Loudspeakers are mounted into the walls of the two side panels at about the level of the infant’s head. A small red light is mounted on each of the side panels in the vicinity of the loudspeaker. The center panel which the infant faces has a small green light mounted at the infant’s eye level” (Nelson, Jusczyk, Mandel, & Myers, 1995, p.112).” Trials begin by drawing infants attention to the center light. Once the infant attends to the light, it is turned off and a flashing light appears on one of the side panels. “Once the infant turns to that side, the stimulus begins to play. It continues (and the side light keeps flashing) until the infants turns away for at least a continuous period of 2 s (or until the entire stimulus for that trial has been played. The infants looking time is the total time the infant orients to the sample (Nelson et. al., 1995, p.112).”

Foil Name. An unfamiliar name is created and matched for syllable stress based on infant’s real name or name most commonly called.

Response Box. A button box attached to the computer in the experimenter booth, which is used to input data and to code the infants behavior during the experiment. The response box includes right, left, away, and center keys to code for the infants head turns during the study.

Infant Directed Speech (IDS). Refers to the intonation, stress, pitch, and overall manner that we use to speak to infants rather than adults (Gleason & Ratner, 1998).

Signal-to-Noise Ratio. The ratio of the signal to the corresponding noise (Yost, 2007).

Amplitude-Modulation. The encoding of a carrier wave by variation of its amplitude in accordance with an input signal (Gelfand, 2009). For the present study, there was not an input signal, and the carrier wave varied over time, sinusoidally.

Masking. The process by which the threshold of audibility for one sound is raised by the presence of another (masking) sound (Yost, 2007).

Review of the Literature

The following section reviews empirical studies that address speech recognition, auditory stream segregation, and the signal-to-noise ratio. The review of literature supports the need for additional research to add to the body of knowledge of speech segregation in infants and to understand the environments necessary to support positive language acquisition.

Speech Recognition in Noise

Developing infants are learning to selectively attend to speech; however they may find it difficult to do so in settings that have more than one auditory signal. Newman (2005) suggests that infants at 5 months are unable to attend to their own names when the intensity of the background noise increases and is relatively close to the level of the speaker. Nevertheless, infants at this age show a capacity for speech discrimination, but they are still limited in their ability to separate auditory signals.

Infants are better equipped to segregate speech signals when there are multiple-talkers rather than single-talkers in the background; however, this is the opposite separation pattern of adults (Newman, 2009). Single-talker settings vary in amplitude level over time, and are easier for adults to recognize speech. A single voice has much more varying-amplitude than does a combination of voices. When there is multi-talker babble, these variations average out. Newman (2009) identified that time-varying acoustic properties in single voice conditions are more distracting to infants than multiple voice conditions and infants were able to hear their own name under competing multi-talker conditions rather than single-talker. Interestingly, the authors state that this finding could be due to the acoustic properties of the single-voice background, either attracting the infants' attention or serving as a masker for the speech stream (Newman, 2009).

Auditory Stream Segregation

Auditory stream segregation, known as streaming is defined as the situation in which a "temporal sequence of sounds is organized into two or more perceptual auditory entities or 'streams,' which can be individually followed by listeners and are generally considered arising from different acoustic sources (Miller and Heise, 1950; Bregman, 1978; as cited in Grimault, Bacon & Micheyl, 2002, p.1340)." In other words, listeners are able to separate sound signals that are coming from two separate sound sources. Adult listeners find it easier to separate multiple streams of speech if they are from separate locations in space, speakers have different fundamental frequencies or genders, or visual facial information is presented from the speaker that differentiate the voices (Broadbent, 1954; Cherry, 1953; Poulton, 1953; Brokx & Nooteboom, 1982; Darwin & Hukin, 2000 as cited in Barker & Newman, 2004). However, stream segregation is a task that can be quite difficult for adults if these cues are not present (Plyler, Bahng, & Von Hapsburg, 2008). Likewise, these cues may be beneficial for both adults and infants. Yet, little information has been gathered on what ages infants are able to use these cues and limited research identifies the necessary cues that enable infants to stream speech signals.

Signal-To-Noise-Ratio

Infants require a "greater signal-to-noise-ratio than adults to achieve a given level of performance" (Nozza, Rossman, Bond, & Miller, 1990, p.340). If the background noise and speaker are too close in frequency and noise level, the infant will not be able to identify differences among the two acoustic signals, and will not show a preference for one or the other. Newman and Jusczyk (1996) identified that infants can selectively attend to a specific talker when that talker is more intense than the background speaker or when the speakers are of different genders or differ in other ways (i.e. tone, pitch). Overall, infants are more likely to have difficulty attending to speech signals if the background noise level is closer to the level of the orator.

Summary and Implications of the Literature

Recognition and speech perception have been studied in infants for many years. The information gathered identifies that there are still gaps in the research and there is not a clear understanding of when and how infants recognize speech in noisy environments and what cues may help or hinder their speech discrimination. The developmental timeline of infants' ability to listen and detect speech in the presence of noise is still in the works, and further research is needed to understand what settings are best to assist in the development of language. Infants need to be able to separate speech from background noise in order to learn language, especially considering that their common environments involve the presence several acoustic sources. Infants and adults differ in their abilities to recognize speech in the presence of noise, and there are several possibilities for these differences. We hope to uncover what is causing this difference in recognition patterns. Infants are clearly still developing and their auditory and language skills are not as matured as adults, but we would like to identify what stages in their development that they are able to accomplish speech recognition and what components assist in their development of language acquisition.

Research Design and Methodology

Participants

Infants were recruited from brochures sent out to parents who had newborns and those that responded were placed in the laboratory database. Research assistants then called and scheduled appointments for infants that were allocated to Dr. Rochelle Newman's laboratory and were the appropriate age for the study. A total of nine infants participated in this study as of June 23, 2010 (3 females, 6 males). The children were all between 3.5 – 5.5 months of age. Upon arrival, caregivers were given two consent forms (one for keep for their records and one for the research laboratory) indicating the child was allowed to participate as well as be videotaped during the session. Caregivers were asked to fill out a questionnaire regarding the infant's language and developmental history at the time of the study. Also, biographical information was requested in order to ensure diversity among participants. This included race, ethnicity, and educational background of each parent. Due to fussiness or crying, some children were unable to complete the study and were not included in the data set.

Stimuli

A target speech stream and a distracter speech stream were recorded prior to the infants scheduled appointment. Recordings were made in a sound attenuated room, and were amplified, recorded at 44.1 kHz sampling rate (digitized by a 16-bit analog-to-digital converter), and then stored on a computer disk. Foil names were created based on the syllable stress of the child's name, or commonly known name. Only female voices were used in the recordings, and only one speaker recorded for each participant. Infant-directed speech was used to record stimuli. Two practice stimuli (musical passages) were created to orient participants to the task.

Apparatus

The experiment was conducted within a three-sided booth consisting of white pegboard panels (4ft x 6ft). Side panels consisted of a red light and loudspeaker located behind the pegboard. The center panel had also a light and small hole for the video camera, which recorded all the sessions. Behind the center panel the experimenter observed the session through a monitor and coded the infant's behavior on the computer, a Macintosh G3. Coding identifies whether or not the child was looking at the sound source or not. Coding was conducted through a response box during the sessions to signal the initiation and end of flashing lights on either right, left, or center panels. The computer controlled the presentation of stimuli based on the coding of the experimenter. Curtains were hung from the ceiling to top of the test booth and back side of the booth was closed by a black curtain to eliminate all other distractions of the room.

Figure 1. Testing booth, where caregiver and infant would sit during the study.



Figure 2. Experimenter booth, experimenter sits and codes the behavior of the infant on the computer through a response box. The tester used the television set above to observe the infant.



Procedure

The caregiver was instructed to hold the infant on their lap while sitting in the center of the test booth. The head-turn preference procedure was used during the study (Nelson et. al., 1995). To reiterate, every trial began with a blinking light in the center of the front panel in order to attract the infant's attention. Once the infant was acquainted with this signal, the flashing light was shut off and one of the side lights of either two panels began to flash. If the infant oriented to the flashing light of either side panel then the loudspeaker on that side would also begin playing the stimuli. The stimulus would continue playing until its completion or until the child looked away for at least 2 consecutive seconds. Listening time was based on the amount of time the infant spent looking at the flashing light. Data collection included the duration of the stimuli, the infants looking time at the flashing light, and the direction of head turns. All of these specific details were recorded on the computer during the experiment.

There were two sections of this experiment. A practice phase and a test phase. The practice phase familiarized the infants with the task before the actual test began. The infants heard musical passages, which were 14.9 seconds long. Infants had to acquire at least 25 seconds of listening time to each musical selection in order to move into the test phase. Once the listening criterion was achieved the test phase began. The test phase included the foil name and the infants' name in constant and varying noise. There were 16 trials separated into 4 blocks. Each block consisted of one of the four conditions: foil name in constant noise, foil name in varying amplitude noise, own name in constant noise, and own name in varying noise.

The experimenter used a response box to indicate whether the infant looked center, right, left, or away from the source (flashing light). The experimenter and caregiver listened to masking music over headphones during the experiment in order to prevent bias during the test or during coding responses.

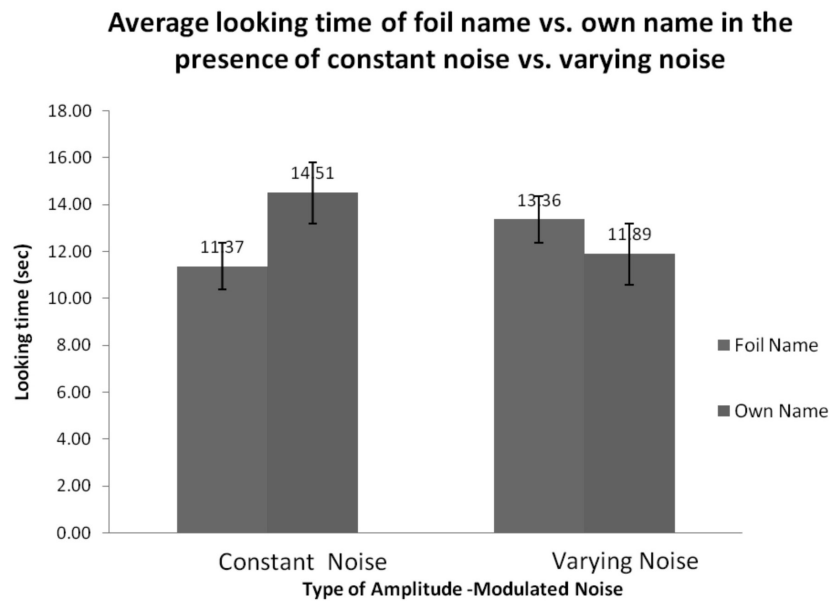
Data Collection

Foil/ Name Varying Noise vs. Foil/ Name Constant Noise				
Identifier	Foil Constant	Name Constant	Foil Varying	Name Varying
2IJ	6.85	13.86	16.10	10.80
3CR	12.99	8.37	11.38	11.66
4OB	8.52	8.05	3.92	5.61
5AP	12.52	10.95	17.03	10.52
6JL	4.77	9.16	3.72	8.28
8LD	7.73	10.02	10.02	8.92
9MS	16.43	25.30	25.30	17.22
11TM	17.92	22.95	19.56	10.35
13WH	14.56	21.90	13.24	23.67
N= 9				
Mean	11.37	14.51	13.36	11.89
Standard Deviation	4.58	6.92	7.06	5.41
Comparison of name and foil in constant noise				
Probability	0.07			
T-Value	2.06			
Comparison of name and foil in amplitude-varying noise				
Probability	0.51			
T-Value	0.68			

Table 1. Raw data of looking times for each participant of the study from May 2010 to June 2010.

Note: Identifier refers to participant number, based on the order that each participant was scheduled for the study along with the initials of their first and last name.

Figure 3. Mean looking time of 9 participants for own name and foil name conditions in the presence of constant and varying noise. Looking times ranged from 11.37sec to 14.51sec, with the constant own name condition displaying highest average.



Data Analysis Strategies

Currently, data was analyzed using t-tests comparing the name constant to the foil constant and name varying to the foil varying conditions in order to identify whether infants listened more to their own name, than the foil name in each type of noise. This technique was used to relate the size of the difference to the amount of variation among the infants and determine a consistent pattern. Figure 3 was created to observe the average looking times as well as overall preferences (if any) among the four conditions.

Strategies for Minimizing Bias and Error

To prevent the speaker from recording the infants' own name and foil name in a manner that would be more appealing to the infant, speakers were not told which were target or foil names. During the testing session, experimenters were aware of which names were the targets. However, both the experimenter and caregiver wore Peltor aviation headphones and listened to masking music during the session to avoid influencing the child's behavior or coding of head movements.

Results, Conclusions, and Recommendations for Future Research

Results

In figure 3, the mean listening times were calculated for the four different conditions. Infants averaged 14.51 seconds of listening to their own names in the constant noise while the foil name only averaged 11.37 seconds of listening time. However, in the varying noise condition, the own name stimuli averaged at 11.89 seconds while the foil name averaged at 13.36 seconds. Though there is not a large enough sample for significant findings, we can identify that participants are recognizing their own name more so in the presence of constant noise than in varying noise. We found that infants listened longer to their own name in the presence of constant noise [$t(8) = 2.06, p = 0.07$] but failed to do so under the when the background consisted of a varying amplitude [$t(8) = 0.68, p = 0.51$].

In table 1, the raw data is presented to identify the exact listening times at which the participants responded. The data shows no significant results. Although, there is a small difference between the constant noise own name condition and the varying noise foil name condition, the results display a preference for the own name condition in constant noise.

Limitations of the Study

In the present study infants were not provided visual cues. Infants were unable to make use of visual cues by seeing the expression of the speakers' face, which could aid in the separation of speech and noise (Hollich, Newman, & Jusczyk (in press)). However, because the use of visual information was not provided for participants we cannot identify whether or not infants would respond to their name in the presence of varying noise. We did not compare whether children are normally placed in quiet or noisy living conditions. Therefore, the study cannot identify if those infants who are more likely surrounded by noisy environments on a daily basis were able to stream better in comparison to children who are more exposed to quiet settings. There could be differences among children that are raised in noisy environments versus children raised in quiet environments, however these differences were not acknowledged in this study. Measures of the daily signal-to-noise ratios for each infant were not identified and could not be used to explain the results of the current study. Thorough data was not gathered on the progression of the infants' language and overall maturation, thus developmental factors were not considered in addressing the results of the study. Cultural accents were not identified during the time of the study. Participants who are spoken to under living conditions with accents from other cultures may respond differently when hearing their name with infant directed speech and an American accent. However, we did not identify these differences among participants; therefore cross-cultural differences were not gathered. Also, because additional age groups were not used in this study, comparisons among different ages could not be made at the time of the experiment.

Conclusions

The results of the present experiment suggest that infants are able to identify speech in the presence of constant noise rather than varying noise. The purpose of this study was to identify how well developed speech recognition was in infants in the presence of competing background noise consisting of two different noise conditions. Drawing on the findings at this point during the study we can detect that infants are showing a preference for their own name in the presence of constant noise, therefore the constant noise was not too distracting for them to recognize speech signals. Infants cannot utilize varying noise and instead must try harder to perceive the speech signals. Overall, infants were able to push past the noise and recognize speech better in constant noise. However, because the sample set consisted of nine participants, the data collected shows no significant findings. In order to expand on this topic, the sample size will need to increase in order to have substantial data set for further conclusions.

Recommendations for Future Research

Certain participant names may be more complex and have more syllables than other participants. Simple names with fewer syllables may be easier for infants to recognize in the presence of noise. The simplicity of names may be the cause of the differences among the looking times of some participants in certain conditions rather than others. In future studies, perhaps more complex names can be compared to infants with less difficult names in the presence of noise. Also, the personal exposure levels of quiet and noisy environments were unknown. Perhaps by identifying the environments that infants' are more or less exposed to on a daily basis we can then get a better understanding for the preliminary results found. Infants exposed to noisier conditions may have the advantage over infants that are not exposed to those same situations. In addition, future studies are needed to address the changes over the developmental stages of infants and identify when they are able to understand speech signals under different noise conditions.

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Terramechanics: Testing Wheel Designs for Planetary Surfaces

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Abstract

Planetary Exploration Missions have been an ongoing aspect of the NASA tradition since 1957. In an effort to better understand the surfaces, atmospheres, and geographic properties of planets in the solar system, the planetary rover was invented. In 1997, the Pathfinder landed on Martian terrain. The Pathfinder contained an important robotic vehicle, the planetary rover Sojourner. Sojourner, developed by United States scientists and engineers, was the first rover to land on the surface of Mars. On soft, usually sandy, rocky surfaces the planetary rover has engaged in loss of traction and wheel slippage. In order to investigate wheel-surface interaction, an automated test simulation system was designed and built in the Space Systems Laboratory and the Manufacturing building at the University of Maryland. Experiments that tested the draw-bar pull produced at varying weights with multiple wheel designs in a manual test simulation system state were conducted in an effort to confirm previous assumptions. In an effort to measure the force required to pull a weighted cart through the sandy surface, a series of tests were conducted in which the force was measured over a short period of time using the test simulation system. Wheel-slippage occurred in several cases as the weight increased on the more narrow wheels. After the force was measured and recorded with the force gauge and the Logger Pro III software, the depth of the tread was measured. This process of collecting data was repeated for three different wheels and each wheel was tested under four and then six different weight conditions. In a continuation of the current experiment, a second experiment will be conducted in the near future to determine the draw-bar pull produced from varying wheel designs in an automated test simulation system with varying weights. Also, future experiments will test the torque produced from the wheel-surface interaction.

Introduction

“Ten months ago, as Spirit was driving south beside the western edge of a low plateau called Home Plate, its wheels broke through a crusty surface and churned into soft sand hidden underneath.” (Brown & Webster, 2010)

One of the major issues surrounding wheel-surface interaction is the wheel-slippage issue. Presently, there does not exist any valid explanations as to why rovers are unable to avoid wheel-slippage on planetary surfaces, specifically on Mars. The primary goals for a planetary rover are the capacity to navigate in an unknown, hostile terrain, recognize and negotiate obstacles, deploy scientific instruments, and acquire samples from scientific targets (A. Ellery, 2005). Although the Sojourner made astounding landmarks as the first rover to successfully land and explore the Martian surface, it also experienced several problems related to navigating through the rocky, clay-like, sandy surface. In spite of all the issues that Sojourner faced while attempting to navigate through the intransigent Martian surface, the one that created the most frustration among the NASA Jet Propulsion Laboratory scientists and engineers was the issue surrounding wheel-slippage (“MARS PATHFINDER,” 1997). Because of wheel-slippage, the scientists and engineers thought very critically about every move the Sojourner made. Due to several factors involved in space exploration, the wheel-surface interaction and concerns surrounding wheel-slippage represent the need for improvements in planetary rover wheel designs for future space missions.

Purpose of Study and Research Questions

Influencing better wheel designs for future planetary rovers requires conducting a series of three or four experiments in an attempt to reconcile several contributing agents associated with wheel-slippage. These agents consist of wheel design, wheel load, surface conditions, and design limitations. Currently, the focus is on the draw-bar pull produced from three different wheel designs tested on a simulated martian-like surface. In an effort to build a working test simulation system and collect meaningful data in reference to the tested wheel designs. Two sets of questions were derived and separated into categories of Current and Future research questions.

Current Research Questions:

1. Can a test simulation system be designed that reliably allows evaluation of multiple wheel designs?
2. What procedures must be followed to obtain repeatable data?
3. How can the sensors and test setup be calibrated?
4. Does weight affect the pull force necessary to make a wheel roll across a surface?

Future Research Questions:

1. How do surface characteristics affect the necessary pull force?
2. In what configuration does the wheel start to slip?
3. How can a wheel be designed to operate more effectively without slipping on a given surface?

Significance of Research

In order to affect the future wheel design of planetary rovers, it is essential to propose solutions that produce applicable findings. These findings ensure that further research will be conducted by proposing an applicable solution that will impact future designs of planetary rover wheels. Additionally, this data can also be applied to earth-based wheel operated designs. As a result, designs such as wheel chairs, scooters, and cars can benefit from a design-based feature that allows for functionality on soft surfaces, such as sand. Furthermore, for the past 27 years, planetary rovers have experienced wheel slippage issues on planetary surfaces. If a solution could be proposed to limit the issues surrounding wheel-slippage, the rovers would have a less challenging time navigating throughout planetary surfaces. Not only would a valid solution ease navigational surface problems, but also it would permit the planetary rover the maneuverability, on these intrasigent surfaces, needed to carry out the mission. The solution would serve to limit the setbacks NASA missions face based on planetary surface interference. Thus, the experimental goal would be to make advancements toward a solution beneficial in limiting current set backs.

The experiment was broken down into three phases and had an essential relationship with each componential phase. The design of the test simulation system was needed to complement the design of the wheel assembly cart which, in turn, needed to be correctly calibrated in order to collect accurate draw bar pull measurements. In the first phase of this project the test simulation system was built. It was later calibrated which in turn allowed accurate measurements of the force required to roll a wheel along a sandy surface (draw bar pull). This system was initially designed to be assembled around the existing sand-box test facility. However, after deliberating and testing different designs in real-time, the design was modified, and the test system was configured to attach to the existing sand-box test facility. The design also entailed some adjustment capabilities so that dimensional modifications could be made; if necessary, for future testing. Additionally, after the test simulation system was designed and assembled, it needed to be calibrated in order to accurately obtain force measurements during the testing. The next phase of the project was to design and build a wheel assembly cart. The wheel assembly cart was a two-wheeled cart designed with an axle that runs underneath the cart for an even weight distribution. The cart was designed so that it could be easily attached and removed from the test simulation system. This design provided the modifiable nature which was useful so that different wheel configurations could be mounted and tested. It also provided space so that different weights could be added to load up the wheels as they were being tested. Data were collected during the final phase of the preliminary project to search for interesting trends. This was completed by measuring the results of different wheel designs, loaded with different weights, and being rolled along known sandy surfaces. Data were collected and recorded for each configuration. As a result of the data suggesting interesting trends, new configurations will be tested in the future.

Delimitations of Research

During the designing, analyzing, and building phases of the experiment, several limitations presented themselves in the form of budget restrictions, limited laboratory materials, and complications with the design structure, in addition to issues surrounding the laboratory's milling machinery. As these limitations presented themselves as inhibitors of research progress, they were handled in a manner that would not cause major setbacks in the completion process. Alternative laboratories, such as the wind tunnel, were used to mill the fixture that attached to the cart. The design of the structure was also altered in order to adjust for the inefficiencies based on the unavailability of the milling machinery. Instead of milling the legs of the aluminum structure, holes were created below the surface of the test sand box. This allowed for the building of a test simulation system that was directly attached to the sand box instead of around the testing facility.

Definitions

The index terms that will be used throughout this entire paper can be described by the following definitions. Some terms are defined for this particular experiment, so they can not be referenced for any future studies.

Wheel-surface Interaction. The physical energy transfer in the interaction between the robots mobility system e.g. automobile locomotion (wheels) and the planetary terrain (A. Ellery, 2005).

Planetary Rovers. Two words are combined to complete this definition, planet and rover. Planet is a large non-luminous ball of rock or gas their orbits a star (Planet, 2004). Rover is a vehicle for exploring the surface of an extraterrestrial body (as the moon or Mars) (Rover, 2010).

Wheel-slippage. The act of the wheel interacting with the surface, in turn causing wheel to slip on the surface based on the geographical properties of the surface.

Martian Surface. This term is composed of two words, Mars and surface. Mars is the fourth planet in order from the sun and conspicuous for its red color (Mars, 2010). Surface is the exterior or upper boundary of an object or body; and external part or layer to all outward appearances (Surface, 2010).

Space Exploration. The investigation of the universe beyond Earth's atmosphere by means of manned and unmanned spacecraft (Space Exploration, 2010).

Terramechanics. The interaction of a wheeled instrument and a surface, also referring to the analysis of surface properties for multiple terrain types (Kushwaha, 2010).

Torque. A force that produces or tends to produce rotation or torsion; a measure of the effectiveness of such a force that consists of the product of the force and the perpendicular distance from the line of action of the force to the axis of rotation (Torque, 2010).

Planetary Surface. The two words that complete this definition are planet and surface. Planet is a large non-luminous ball of rock or gas their orbits a star (Planet, 2004). Surface is the exterior or upper boundary of an object or body; and external part or layer to all outward appearances (Surface, 2010).

Draw-bar Pull. The difference between soils thrust and motion resistance (A. Ellery, 2005).

Test Simulation System. The aligned track fixture used to pull multiple wheeled carts along the simulated sandy Martian surface.

Analysis and Discussion of the Literature

Background information regarding planetary rovers, planetary surfaces, Terramechanics, and complications with wheel slippage will be discussed in this chapter. This information provides context for the experimental design. The review of literature supports the need for this experiment in an effort to eventually design a better planetary rover wheel.

Planetary Rovers

The Viking to Mars Project of 1975 made history as "the first mission to land on another planet and return with both imaging and non imaging data over an extended period of time" ("Viking to Mars", 2010). Since that time planetary rovers have been sent on missions to discover and investigate properties of planets in the solar system. On July 4, 1997 the Pathfinder, an interplanetary space craft, successfully landed in on Martian soil containing the pyramid shaped "Mars station complete with camera, weather tower and instrument-laden rover named Sojourner, in an historic safe landing on the Martian surface at 1707" (Curtis, 2005). Sojourner, the first successful rover to land on the surface of Martian soil, lasted 12 times its design lifetime of 7 days. After the success of Sojourner, rovers Spirit

and Opportunity were sent to explore Mars in 2004. Spirit and Opportunity had a mission that consisted of obtaining geographical information on the surface of Mars. While these current rovers had an improved design lifetime of 6 months they each have far surpassed their design lifetime as they are still on Martian soil 6 years later.

Planetary Surfaces

While Spirit and Opportunity have achieved great success they have also experienced several issues on Mars surfaces. Mars has a sandy almost clay stricken and rocky surface and the rovers tend to have difficulty navigating through this terrain. As well, other planetary surfaces such as the lunar surface has a sandy loose disheveled appearance comprised of dust and rock clast (Liang, Hai-bo, Zong-quan & Jian-guo, 2010). These surfaces are also referred to as regolith (Ishigami, Miwa, Nagatani, & Yoshida, 2007). Surfaces such as the Lunar and Martian soil, contribute to the challenging issues faced by the rovers on planets in the solar system. Not to mention the weather patterns on the lunar and Martian surfaces are unpredictable which also contribute to the difficulty faced by rovers in reference to their navigation through this difficult terrain after storms.

While traveling through Martian terrain, Spirit entered a low plateau area entitled “Home Plate” and broke through a hard surface into a soft sandy terrain underneath. Needless to say, Spirit became entrapped in the terrain of the Martian Surface. On January 26, 2010, after 10 perpetuate months of making attempts to release Spirit from the draconian Martian surface, NASA headquarters announced that Spirit would now act as a stationary observer (Brown & Webster, 2010). Although there are many benefits of the Spirit acting as a stationary observer it is inauspicious that the full mission of Spirit can not be completed. The mission included observation of the complete left side of the planet Mars.

Terramechanics

Terramechanics play a major role in the process of analyzing the issues that may present themselves as rover wheels and planetary surfaces interact. Terramechanics is often described as the interaction of a wheeled instrument and a surface, usually referring to different surfaces and the analysis of the surface properties (Kushwaha, 2010). An experiment conducted at the Harbin Institute of Technology located in China, describes terramechanics as encompassing several measurable properties of the rover, elements of planetary surfaces and their interactions. Furthermore, it associates terramechanics theory with mechanical design, performance evaluation, simulation, soil parameter identification, mobility control, and path planning (Liang et al., 2010). In this experiment the focus lies in the interaction between the wheel and the surface of the planet which in most cases if not all lead to the issues associated with wheel- slippage.

Future planetary exploration missions will require rovers to perform challenging mobility tasks in tough terrain (Volpe, 2003). Wheel terrain interaction plays a critical role in the rough terrain mobility (Bekker, 1956, 1969; Wong, 1976). A robot traveling through loose sand has very different mobility characteristics than one moving across firm clay, for example (Iagnemma, Kang, Shibly, & Dubowsky, 2004). “It is important to estimate terrain physical parameters online, because this would allow a robot to predict its ability to safely traverse terrain (Iagnemma, Shibly, & Dubowsky, 2002). Due to the fact that different surfaces can have several dangerous characteristics for rovers, it is essential to understand the relationship of the rover wheel with every plausible surface.

Complications Regarding Wheel Slippage

Spirit and Opportunity were originally sent to Mars to explore the geographical properties of the planet. These twin robots were developed to be geologists, and their task was to find answers regarding the history of water on Mars (“Mars Exploration,” 2010). In order to accomplish this goal several factors had to be taken into consideration. One important factor is the wheel slippage or wheel slip-sinkage complication. The surface of Mars is very similar to the Moon as mentioned previously; these surfaces are covered in regolith. For the planetary rover, these surfaces are considered challenging terrain. “While moving on such a challenging terrain, severe slip-sinkage will occur for rover’s wheels, making the vehicle decrease tractive performance, deviate from scheduled path, and even get stuck in the soil. Slip-sinkage is an important failure for the planetary rover’s moving on deformable terrain” (Liang et al., 2010). “In 2005, it took five weeks for the “Opportunity” Mars Rover to escape from the Purgatory Dune after getting stuck” (Liang et al., 2010). Although the planetary rover can not combat every obstacle it faces on a planetary surface, it can be better equipped to successively traverse the terrain. This includes the capability of minimizing the time it takes the rover to release it’s self when it becomes entrapped in the surface.

Summary and Implications of the Literature

The information mentioned in the sections planetary rovers, planetary surfaces, Terramechanics, and complications with wheel design confirm the issues faced by planetary rovers at this time. The articles mentioned in these sections suggest that there is indeed a need for a solution to the wheel slippage issue. Several of the mentioned articles, analyze the relationship between surfaces and rover wheels. Although in all of the mentioned articles, there has not yet been an attempt to design a wheel that interacts successfully with multiple terrains, with no human interference. Research suggests that there is a need for a better wheel design; therefore the findings of this experiment will complement current research in the field of planetary rovers. As the relationship between the draw-bar pull force and the depth of the tread is further explored, the goal of developing a better wheel design for the planetary rover is within reach.

Research Design and Methodology

Purpose of Study and Research Questions

As mentioned in chapter one, it is imperative to recognize the issues that the planetary rover faces when traversing planetary terrain under multiple weather conditions. Due to several factors involved in space exploration, the wheel-surface interaction and concerns surrounding wheel-slippage, there is a need for improvements in planetary rover wheel designs for future space missions.

Influencing better wheel designs for future planetary rovers requires conducting a series of three or four experiments in an attempt to reconcile several contributing agents associated with wheel-slippage. These agents consist of wheel design, wheel load, surface conditions, and design limitations. Currently, the focus is on the draw-bar pull produced from three different wheel designs tested on a simulated martian-like surface. In an effort to build a working test simulation system and collect meaningful data in reference to the tested wheel designs. Two sets of questions were derived and separated into categories of Current and Future research questions.

Current Research Questions:

1. Can a test simulation system be designed that reliably allows evaluation of multiple wheel designs?
2. What procedures must be followed to obtain repeatable data?
3. How can the sensors and test setup be calibrated?
4. Does weight affect the pull force necessary to make a wheel roll across a surface?

Future Research Questions:

1. How do surface characteristics affect the necessary pull force?
2. In what configuration does the wheel start to slip?
3. How can a wheel be designed to operate more effectively without slipping on a given surface?

Data Collection and Data Sources

Data was collected using a force gauge and Logger Pro III software. The data was then read into an Excel spreadsheet document for further analysis. The draw-bar force measurement was collected from each of wheel, under each weight condition for the duration of the testing. A single trial consisted of the following:

- Smooth the sand within the test simulation system.
- Set the cart on the pristine track.
- Add weight to the cart.
- Check the balance of the cart, and the alignment of the wheels.
- Roll the cart along, over a certain distance.
- Read and record the pull force necessary to make the wheels roll.
- Measure the depth of the tire treads within the sand.
- Identify situations where wheel slippage occurs.

The draw-bar pull force measurement was recorded in our system during each trial as each set of wheels road across the surface of the sand for a period of five seconds. In the span of five seconds, 251 variations of the drawbar pull force measurements were recorded in the Logger Pro III software. In order to gain an accurate draw-bar pull force measurement, the average drawbar pull force was recorded. Once the average drawbar pull force was recorded,

the depth of the wheel tread was measured. The tread was measured accurately through the use of the sand smoother mechanism and a tape measure. This depth measurement was recorded in our spreadsheet and used for comparison of the other two wheels, under the same weight condition.

Data Analysis Strategies

Based on the data collected, the research questions posed in the initial study can be answered. After several improvements and alterations a reliable test simulation system was developed in the Space System Laboratory and stationed in the Manufacturing Building, both located at the University of Maryland, College Park. This system allowed for multiple wheel designs to be tested reliably. The data represented in Table IV represents the relationship between the draw-bar pull force and the wheel. It is evident that as the weight increases for each type of wheel, a greater draw-bar pull force is required to pull the wheel through the sand. Furthermore, our data set was rich enough to answer some of the future research questions as well. The wheel configuration starts to slip when weight is added to the one inch wheel, the two inch wheel configuration also slips during and after the fourth weight condition (Table VI). There are two main conclusions that can be made regarding the overall analysis of the collected data. First, the more weight is added to the wheel, the more the sand will compact, and thus a greater draw bar pull force is required to move the system and slippage may occur. In our cases for the narrower wheel type's slippage did occur as the wheels had to bear more weight.

Strategies for Minimizing Bias and Error

Two sets of experimental procedures were conducted in an effort to obtain meaningful data. In the first set of experimental procedures the draw-bar pull force and the depth measurement were recorded under weight conditions of 2 pounds, 5 pounds, 10 pounds, and 20 pounds. Under these conditions, the weight was too heavy to record a meaningful data. In the last two conditions the weight was too heavy for the wheels. The axle of the 2 inch wheel was bent under the same conditions; furthermore slippage occurred in every trial for the last two weight conditions. Due to the fact that wheel slippage occurred under every weight condition for the last two test wheels, it was necessary for us to repeat the experiment under new weight conditions. Repeating this experiment would provide an opportunity to collect the data necessary to draw purposeful conclusions.

In the second set of experimental procedures the drawbar pull force and the depth measurement were still observed and recorded. Although in this second set of experimental procedures the weight conditions were altered to six different weights including 0 pounds, 1 pound, 2 pounds, 3 pounds, 4 pounds and 5 pounds. I did these little weight conditions, very attractive results were derived. Furthermore wheel slippage occurred as expected and the one-inch wheel under every weight condition. Although slippage occurred in the second set of experimental conditions, the results were experimentally validated because they didn't occur as a result of a malfunctioning test system or inconsistencies within the wheel assembly cart fixture.

By conducting the experimental procedures under two sets of weight conditions, the data collected was quickly analyzed and errors in the experimental procedures were uncovered. This allowed for the identification of the experiment to bias and error in our test apparatus and data collection tools. After conducting the second set of experimental procedures it was determined that the first set of experimental procedures contained bias in the test apparatus and errors within the interaction of the force gauge and the wheel assembly cart.

Limitations of the Study

Several limitations occurred in the process of conducting experiments and procedures. These limitations occurred in the form of a dragging crossbar, forced a wheeled treads, altered wheel assembly cart fixture and friction between the track and the crossbar. These presented issues limited the completion of the experiment in an expedited manner. Not only did these issues inhibit the completion of our experiment but they also required the experiment to be repeated. Through repeating this experiment several of the limitations disappeared under the lower weight requirements, thus allowing for meaningful data to be collected and the limitations of the experiment to be resolved.

Findings, Conclusions and Recommendations for Future Research

Findings

A series of six weight conditions were comprised (Table II) in order to obtain meaningful data. The weights tested played essential role on the accuracy and precision of the data collection process. Three different wheels were tested, each having different treads and wheel widths (Table III). The differences in wheel widths allowed for data analysis in comparing the wheels and the depth of the wheels treads.

Table II

Condition	Weight (lbs)
1	0
2	1
3	2
4	3
5	4
6	5

Table III

Wheel	Width (in)
1	4
2	1
3	2

The draw bar pull force was collected for each wheel under the six weight conditions (Table IV). The draw-bar pull force was measured in Newton's (N).

Table IV. The force under each tested condition for the three wheel types.

	1 (N)	2 (N)	3 (N)	4 (N)	5 (N)	6 (N)
1	2.27	3.10	3.67	4.82	5.58	8.20
2	2.15	3.53	5.52	6.52	8.89	11.05
3	2.87	3.36	5.16	7.10	9.10	12.03

The depth of the tread, for each tested wheel under the six weight conditions was measured (Table V). The depth was measured from the bottom of our test system to the bottom of the tread in the sand, and this measurement was recorded in inches.

Table V. The depth of the tread for each tested condition for the three wheel types.

	1 (in)	2 (in)	3 (in)	4 (in)	5 (in)	6 (in)
1	0.063	0.075	0.084	0.125	0.125	0.131
2	0.234	0.281	0.375	0.406	0.469	0.500
3	0.125	0.156	0.200	0.250	0.319	0.438

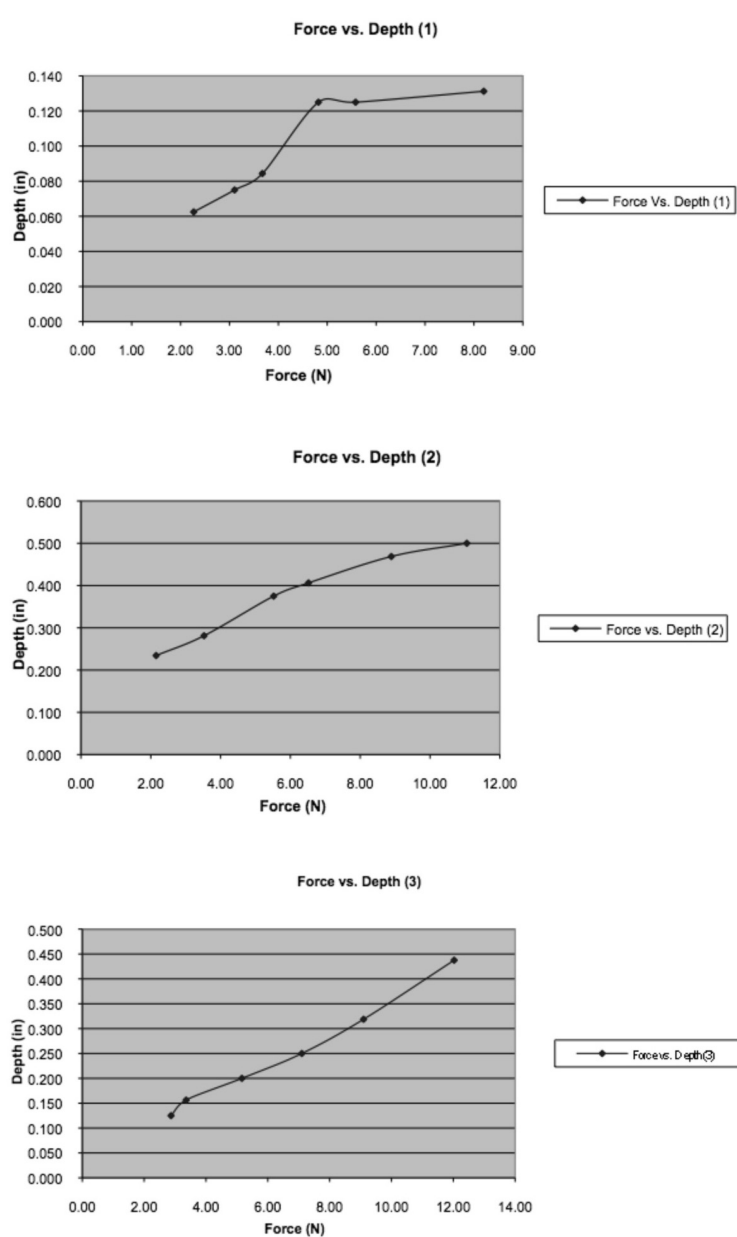
Wheel-slippage occurs with four wheels two (1 in) and three (2 in). Slippage occurs in every trial for wheel two, although it does not occur throughout under the first weight condition (Table VI). In the case of the third wheel slippage is not seen until the fourth weight condition (Table VI). In the fourth weight condition slippage does not occur throughout the entire trial which is denoted by s/, but in the preceding weight conditions slippage is relevant throughout the entire trial. Slippage does not occur in any of the tested weight conditions for the first wheel (4 in) (Table VI).

Table VI. The s denotes slippage and the n denotes no slippage. The s/ means Wheel-slippage does not occur throughout the entire trial.

	1 (lb)	2 (lb)	3 (lb)	4 (lb)	5 (lb)	6 (lb)
1	n	n	n	n	n	n
2	s/	s	s	s	s	s
3	n	n	n	s/	s	s

There is an increasing relationship between the depth and the draw-bar pull force (Fig. 1) for the first wheel. Under heavier conditions the depth of the wheel in the sand increases in smaller increments. While the depth of the second wheel increases in a constant manner in large increments when compared to the first wheel (Fig. 1). The third wheel experiences a drastic jump in the depth measurement under the 5 pound weight condition (Fig. 1).

Figure I. Result of the force and depth data sets for the three tested wheels.



Conclusions

Several steps were taken toward the overall goal of this research which is to suggest a better planetary rover wheel design for future planetary rovers. The test system did not function properly with extremely heavy weights so a new test trial was conducted in an attempt to obtain meaningful and repeatable data. The limitations of the study appeared in the form a limited budget, non functioning materials, and the malfunctioning milling equipment in the Space Systems laboratory. After redesigning the structure of the test simulation system, the milling equipment was no longer required. After subjugating several obstacles that presented themselves and hinders to the research process, a functional test simulation system was built. With this functioning test system repeatable data was collected, analyzed and interpreted. By understanding the relationship between the draw-bar pull force and the weight applied to the wheels, our research concluded that the more the weight added to the wheel the more the sand will compact which in turn requires a greater draw-bar pull force.

Recommendations for Future Research

Because interesting trends were also unveiled between the depth of the wheel tread and draw-bar pull force, future research is necessary to determine explanations of these trends. In the near future, tests that explain the relationship of wheels with multiple surfaces will be conducted. In addition, research that involves testing different wheel types as well obtaining the torque calculation will also be conducted. The information from these future experiments will provide much needed insight as to which wheels are most efficient for planetary surfaces. More importantly, these experiments will lend insight to the direction of our research. By conceptualizing this direction, the focus will be narrowed which will allow for a great leap towards the overall goal of developing a multi- surface transversal rover wheel.



Appendices

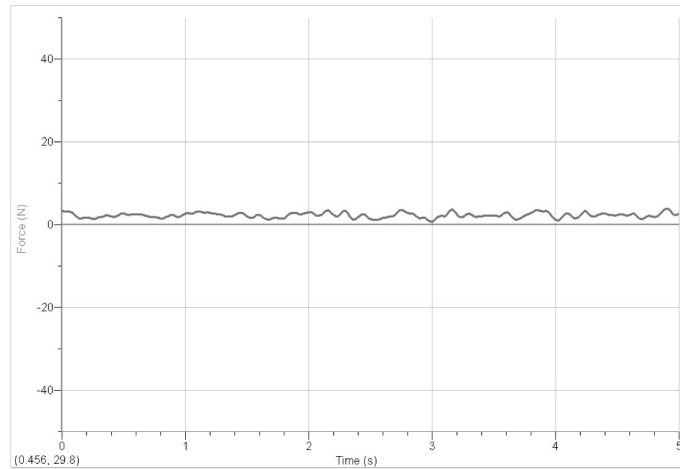
Appendix A: Raw Data

Data for the first wheel (4in) with no weight

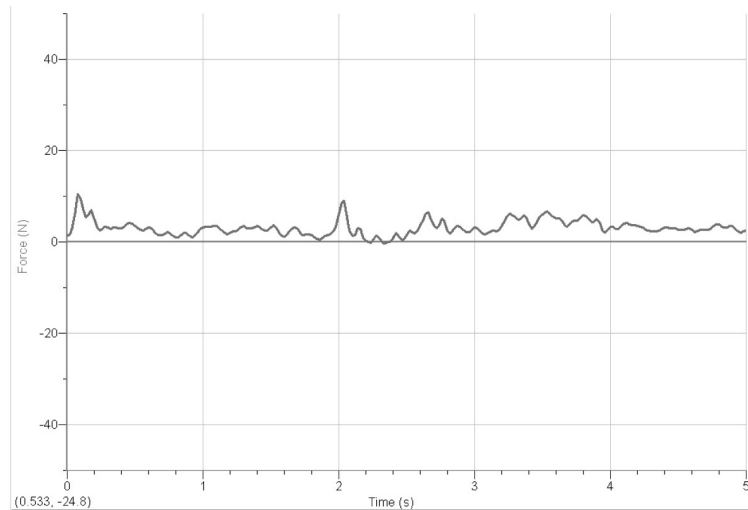
Trial 1 Data: Weight 1

Time (s)	Force (N)	Avg Force	Depth
0	3.305556	2.2684391	0.0625
0.02	3.185897		
0.04	3.185897		
0.06	3.096154		
0.08	3.036325		
0.1	2.497863		
0.12	1.899573		
0.14	1.510684		
0.16	1.42094		
0.18	1.600427		
0.2	1.75		
0.22	1.75		
0.24	1.480769		
0.26	1.391026		
0.28	1.540598		
0.3	1.779915		
0.32	1.899573		
0.34	2.07906		
0.36	2.318376		
0.38	2.138889		
0.4	1.959402		
0.42	1.809829		
0.44	1.929487		
0.46	2.258547		
0.48	2.587607		
0.5	2.647436		
0.52	2.497863		
0.54	2.40812		
0.56	2.467949		
0.58	2.557692		
0.6	2.497863		
0.62	2.497863		
0.64	2.438034		
0.66	2.318376		
0.68	2.138889		
0.7	2.019231		
0.72	1.839744		
0.74	1.809829		
0.76	1.779915		
0.78	1.600427		

Appendix B: Graphs of Raw Data



Wheel 1 with no weight



Wheel 1 with 1 lb

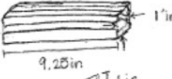
Appendix C: Initial Sketches of Apparatus

Dimensions & Materials : For Cart and Cross Piece Connectors

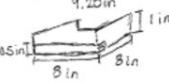
7.75in x 7.75in Steel Plate




9.25in 80-20 1" material



8in x 8in rectorset
Pieces for
Cart



Stabilizing Pieces
for 80-20 1" (2)
1.75in x 3in




Wheel (2)
rim 3.75" diameter
tire 6.5" tire
thickness 3"



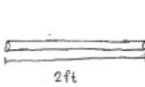
1" 80-20 cross piece
connection between
cart and track
3.55 ft



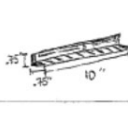
1" 80-20 connector (2)
1" piece



2ft Metal 832 rod
Al / Not threaded
For wheel Axle

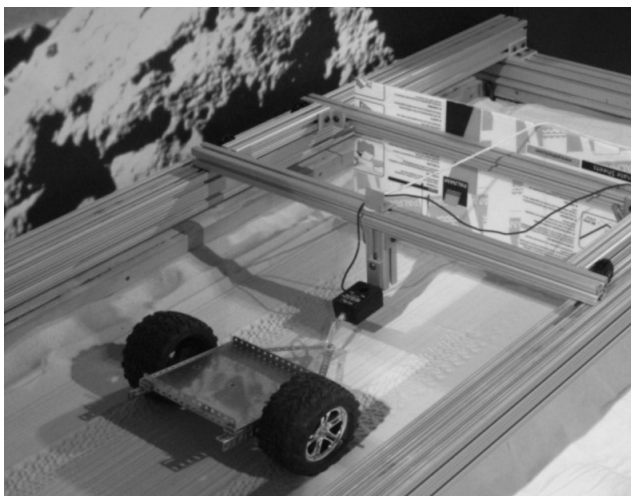
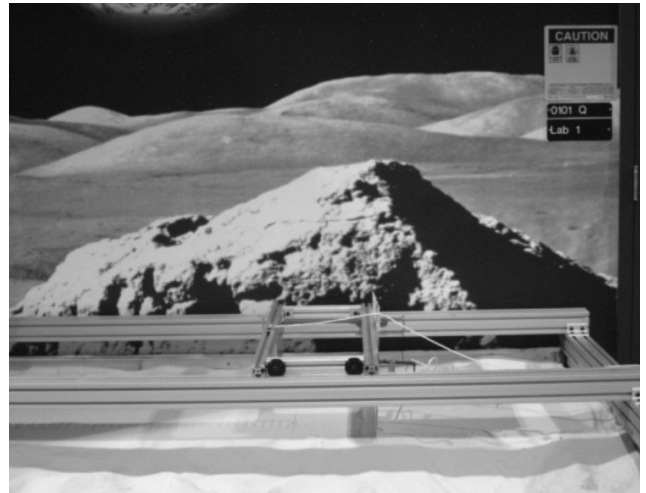
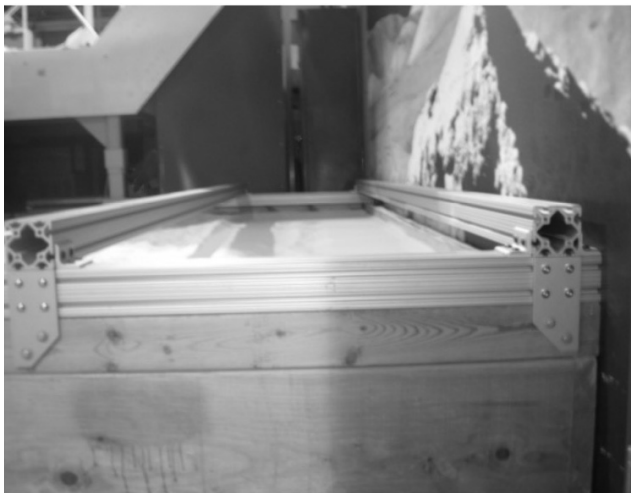
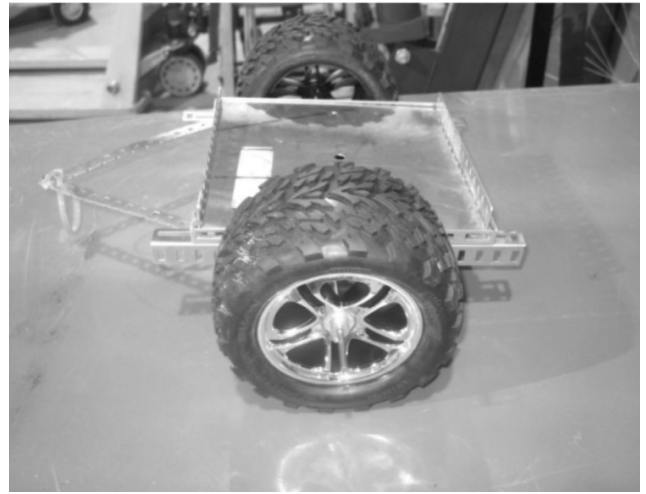
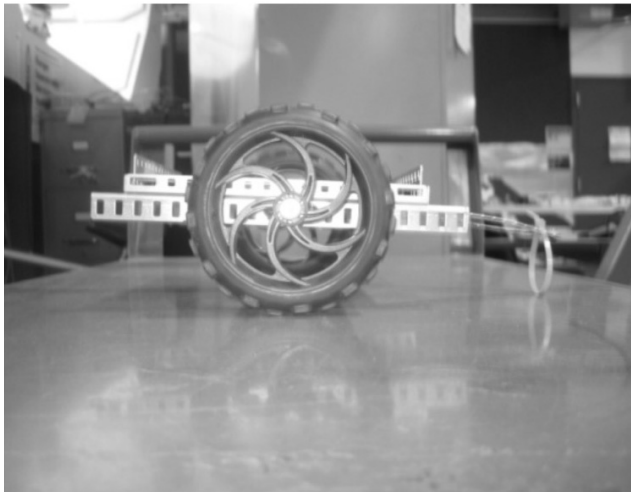


Additional rector
set pieces for cart
assembly with wheels
and axle (2)



75 in by 10 in

Appendix D: Images of the Apparatus



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Two-Photon Characterization of Substituted (T8) Cage Silsesquioxanes¹

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Abstract

An efficient source of alternative energy has yet to be developed. Solar energy, the most viable and sustainable source of renewable energy, remains less effective due to limitations in absorbing materials to convert direct sunlight into useful solar cell devices. However, this flaw can be circumvented if solar panels had the capability to convert infrared radiation into useable energy. The focus of this study is the evaluation of the non-linear optical properties of silsesquioxane (caged {T8}) molecules through ultrafast two-photon spectroscopy to determine their applicability in creating more effective solar energy devices (Laine et al, 2010; Sulaiman et al, 2008). The two photon absorption measurements were carried out using 770 to 830nm, 30 femto-second pulses. The results revealed that there are maxima for the cross sections near 800nm for the different caged molecules studied. The increase in cross section is correlated with increasing substitution of electron donating groups on the cage. This data provides further support for these materials to be used in applications of near infrared solar absorption devices.

Introduction

Although the contribution and significance of many fields of chemistry are being increasingly exposed to the public through mass media, the contributions of physical chemistry seem to be unseen and therefore insignificant in public view point. The primary purpose of this paper is to report the findings and the conclusions of the characterization study and through conveying the importance of these elements, the contributions of physical chemistry can be revealed. The investigations of physical chemistry are driven by global problems (energy, medicine, & technology) and gaps in scientific knowledge. In this respect, physical chemistry is no different; however, in this branch of chemistry the focus of solving these critical issues rely heavily on the application of materials' physical properties. One such property is the non-linear optical property of certain materials. This study will focus on the improvement of solar cell devices by evaluating the non-linear optical properties of cage (T8) silsesquioxanes molecules to determine their absorbing efficiency and sensitivity in near infrared spectral region.

Solar energy remains the most viable and sustainable form of alternative energy. However, with the vast supplies of cheap fossil fuels, historically, the underdevelopment solar technology was not a pressing issue. Recently, predictions of decreasing oil extraction efficiency of known oil reserves has intensified fears of oil peaking. These fears come at a time when projected energy estimates show that future demand for energy will be drastically increased (Rath, 2007). Concerns of oil peak could be alleviated with the ability to switch to cheap coal for increased energy production, but as concerns of global climate change are rising, the amount of coal generated power is being reduced. A better method of providing cheap energy production is needed globally and especially in the US.

¹ I would like to thank the Chemistry Department for allowing me the opportunity to come to Michigan and Prof. Goodson for providing me with a place and project so that I could acquire more research experience. Also special thanks are required for the members of the Goodson Lab that answered my questions and enabled me to have a successful summer; thanks Goodson Lab.

The United States is the largest consumer of oil production in the world. Rath (2007) reports that, “In the United States nearly 40% of energy usage is provided by petroleum oil”. Much of the uses for oil are divided into transportation and generation of industrial electricity (Energy Administration, 2007). If no alternative source or combination of sources can be found to replace the energy output of coal and the declining efficiency of oil reserves, a national and global energy crisis could ensue. Governmental policies have tried to take steps to limit American dependence on foreign oil by investing in alternative energy and reducing dependence on oil for certain sectors such as transportation and “industrial only electricity generation”. Nevertheless, no energy substitutes have been found; it is therefore necessary to systematically and incrementally improve upon the solar technology available today, in order to avert a possible energy crisis.

Stability in energy production for the future can be realized. Rapid improvements to solar technology can be achieved through the application of better absorbing materials. Currently, solar cell devices operate by converting ultraviolet radiation, a small portion of the sun’s energy output, into electrical energy (via the photoelectric effect). Consequently, solar energy production would be more effective if the cell devices could absorb the infrared radiation in direct sunlight in order to maximize the transfer of solar energy into usable energy output.

- The primary research questions the study will address are:
- Can solar cell technology be improved?
- Does the cage silsesquioxanes molecules studied have high cross-section values in the infrared region?
- How does the addition of more electron donors affect the two-photon cross section of the molecules?

Background and Research Plan

Background

Solar Technology. The continued growth and expansion of society and the global economy needs energy. It is, therefore, prudent and essential that the production efficiencies of alternative energy sources are increased in order to create stability within the global economy for the future, as the inevitable depletion of fossil fuels draws closer. Fossil fuels are imperative to social-economic sustainability as they provide the means for industrial and commercial production, transportation, industrial agriculture and farming (rising of livestock for consumption), and electricity generation.

Fossil fuels provide 37.4×10^{14} btu of domestic electricity generation for the US. Currently, only coal burning can take on the burden of sustaining demand for domestic electricity production; however, due to international concerns of global climate change, political mandates have been implemented to regulate and decrease the amount of coal burning to decrease carbon dioxide emissions (Energy Administration, 2009). The inability to use coal for large scale energy production leaves the United States in a precarious position, as no forms of alternate energy can produce electricity to the required magnitude, yet, without energy its society will fall. The goal of alternate forms of energy is to relieve the load of energy production from fossil fuels.

Of the forms of alternative energy, solar energy production remains the most viable, renewable, and practical. Solar energy uses the phenomena created by the sun to produce energy. The sun, which is the source of all life on earth, is a constant source of energy which produces 89 petawatts of sunlight per year which is enough energy to sustain global demand with excess (Smil, 2003). The inherent problems with solar cell devices are efficiency, only a small fraction of the sun’s output radiation can be currently transformed into useable energy, and production cost.

Solar energy can be used to create electric power or heat. Solar energy production can be categorized into two forms; the first uses the electromagnetic radiation sunlight to create electricity or heat and other use is wind energy to create electricity. Wind energy is actually due to the uneven heating of the planet. Generally, this term solar energy is used to describe the ability to use the sun’s radiation output in order to harvest its energy in the form of electricity for industrial and domestic uses. It is this form of solar energy, the use of solar radiation to create electricity, which the paper will focus on.

Solar energy can be transformed into electricity in two ways. The first form is through the direct conversion of the ultra-violet radiation present in sunlight into electricity through the use of semiconductors. The second method of electricity generation is formed indirectly through steam, in which the thermal heat of the sunlight is concentrated through the use of mirrors, panels, and parabolic collectors to focus on to containers filled with water. As the water turns to steam, the steam causes the turbines to rotate. The rotation of the turbine acts as cranks to generate electricity.

This study will focus on the limitations of current photovoltaic cell devices and explore current research for the advancement of solar cell technology the possibilities to improve contemporary cell technology.

Semiconductor photovoltaic cells work by generating electric power by converting ultraviolet radiation from the sun into electricity through the photoelectric effect. The photoelectric effect can be described as reaction in which a photon of light interacts with a surface, usually metal, causing electrons to be released. The freed electrons can then flow from the p to n-junction in the presences of an electric filed causing a change in voltage across the junction, causing energy to be produced.

Semiconductor cells can uses various types of silicone, amorphous and crystalline, but crystalline is the most common. The greatest limitation of silicone is that in order to efficiently generate electricity the compound has to be ultra-pure. The purification is a costly and time consuming procedure. The silicone cells have a lifetime of about thirty years; however most of time is spent during the purification processes. As the demand for photovoltaic devices increases, the expanded production of these devices will cause the price of silicone to decrease.

Organic thin-films are the cheapest types of photovoltaic cells. However, the flaws with current organic films are their poor charge transfers and separation properties; these flaws decrease efficiency of the thin films far below that of silicone based devices.

As the need of alternative energy increases, this necessity will engender greater funding for solar research to extend the properties of absorption, charge transfer, and charge separation of cell devices. It is the extension of these properties which will create the next generation of highly effective and more powerful solar energy harvesting devices. Current research areas for extending the capabilities of cell devices are infrared absorbing material, quantum dots, microfabrication, organic thin films, the use of solar concentrators and photovoltaic cells (Boston College, 2010; Gesellschaft, 2008; Ludwigs, 2010; Naughton, 2010; Ohio State University, 2009; Vaynzof, 2010).

Non-linear materials. Non-linear optical materials are defined as “the modification of the optical properties of a material system by the presence of light” (Boyd, 1992). The term non-linear describes the interaction of light with the material as being different than that of normal chromophores or molecules that absorb, scatter, and/or transmit light. Usually, changes in material by a non-linear interaction is evident with a change in the refractive index of the material itself as a response to a high intensity light source such as a laser. Non-linear optical materials can be classified in two regimes inorganic compounds (crystals and nan-particles) and organic compounds.

Examples of these crystals are Ti: Sapphire, LBO (Lithium Tri-Borate) and BBO (Beta Barium Borate) crystals. These crystals are used in the application of advanced lasers systems and optical set-ups. The non-linear response of the Ti: sapphire allows for the creation of ultra-short pulses and also crystal's self-focusing ability (electronic Kerr effect) which stabilizes of the short-pulsed laser. The properties of LBO crystals allow them to be utilized for frequency doubling and tripling of pump lasers and for uses in optical parametric amplifiers (OPA) and oscillators (OPO) (Osico Technologies, 2008). BBO crystals are used in optical set to create sum frequency generation and harmonic generation.

Organic materials are gaining popularity because their low cost, manipulability, and variability in structure, synthesis, and properties. The chemistry concepts of bonding and electronic orbitals are central in describing the attributes of organic compounds. Molecules exhibit four types of energies; however only the electronic, vibrational, and rotational levels can interact with photons, to “exhibit quantization effects” (Parsad, 2008). In organic materials, it is their bonding structure of the σ - and π -bonds of the molecule which, is composed of overlapping electronic orbitals of individual atoms, allow the molecules to respond to light. Prasad (2008) defines this interaction of light as determined by the “symmetry elements of the molecule” which are composed of the behavior of the molecular orbitals and other energy states. In general the amount or increase of chain conjugations allows the absorption spectral of the organic molecules to be shift further down the electromagnetic spectrum.

Nano-particles such as gold and silver are also predicted to be valuable non-linear materials for biological imaging and sensing. Nano-cluster of gold and silver possess unique characteristic that are different from bulk materials which allows the electronic response to stimuli to resemble that of organic molecules than that of bulk metals or semi-conductors.

Non-linear optical materials are predicted to bring a revolution the major global concerns of health and medicine, energy, and technology through imaging and sensing, photodynamic therapy, optical limiting, non-linear data storage and absorption abilities of the materials.

Health and Medicine. While advances in medicine have come a long way in recent decades, gaps in knowledge and limited understanding still exist when it comes to the dynamic structures of molecules and the interactions that lead to the spread of disease. Through the uses of imaging, sensing, and photodynamic therapy, medical and biological fields

hope to gain increased knowledge of the body and its interaction with pathogens in order to devise more effective ways at eliminating disease.

Imaging allows for increased understanding of molecular interactions and dynamic conformations of molecular components such as protein, RNA, cell membranes within the body to determine their roles in disease prevention and proliferation. Non-linear microscopy allows for improved imaging over tradition microscopy techniques because the technique allow for deeper penetration and displays more surface details of the material (Denk, Strickler, & Webb, 1990).

Sensing is related to imaging; however, the main goal of sensing is to be used as an early detection tool in order to predict the onset of disease. Currently, sensing has been used particularly with Alzheimer's disease to tract and visualize the disease as it progresses. Recently a method of detection was identified with the sensing of amyloid β to determine if a patient has or is developing the neurodegenerative disease (Elsevier, 2010; Wang et al, 2010).

Photodynamic therapy and medicine delivery systems allow for hyper-branched molecules to connect to disease cells such as cancers and destroy them by acting either as a cytotoxin or by releasing encapsulated cancer medication. The medicines can activate with the use of infrared radiation to provide medicines to a particular target area (Prasad, 2003).

Energy and Technology. Optical limiting is a non-linear optical property that absorbs high intensity light or more accurately the material output intensity varies only by a small amount with large changes in input intensity. In many military advanced fighter systems the aircrafts rely on sensors to operate; however, the advantage of this military technology has a major flaw that could leave it to be susceptible to attack, high intense light. To improve upon this defect, optical limiters could be used to absorb the high intensity while allowing the sensors to operate with the less intense light.

Non-linear optical storing method improve memory capacity through the use of a three dimensional storage technique that allows data to not only be stored on the surface of the materials, but also at certain depths within the materials. This technique has the potential to create tetra-byte or higher storage capacity with a small amount of material.

Silsesquioxanes. Within the macromolecule science there is big push to document and understand the properties of silsesquioxanes, which are silicone based molecules whose structures have the empirical formula R_nSiO_n , in which R group substituent can be a hydrogen or any type of alkyl, alkylene, aryl, arylene, or organo-functional derivatives of alkyl, alkylene, aryl, or arylene groups. There several core structures of silsesquioxane; these cores come about with the parameter in which the molecules are synthesized. In particular, recent research has placed a special interest on the cage molecules also called cage (T8) silsesquioxanes, polysilsesquioxanes, or POSS for their unique properties. These qualities categorized by the molecules' non-linear properties, the robustness, versatility, and compatible with a variety compounds (Baney, 1995; Laine, 2005, Sulaiman, 2008). In addition silsesquioxanes, provide property control over uncooperative synthesized polymers or compounds. Studies have recorded the molecules' ability to allow for physical property controls such as radiation absorption and in situ formation of nanoscopic glass layers on material surfaces, improving gas and liquid barrier, stain resistance, resistance to environmental degradation, radiation absorption, adhesion, printability, time dependent mechanical and thermal properties such as heat distortion, creep, compression set, shrinkage, modulus, hardness and abrasion resistance, electrical and thermal conductivity, and fire resistance (Baney, 1995; Li, 2003; Lichtenhan, 2005; Lin, 2003; Lu, 2005; Zhao, 2005). The high applicability of these molecules lead to massive interests from diverse fields, the implication and research of these materials even has influences on nanotechnology and micromachining.

The first commercialization of silicones began with silsesquioxane chemistry, in 1930 propelled by the research teams of Corning Glass Works and General Electric Company (Baney, 1995). Historically, the early uses for silsequioxanes were in resin used for electrical wiring at high temperatures due to the materials extreme heat resistance and low electrical conductivity. As knowledge and patents began to devise more techniques to create and modify the silsesquioxane molecules, more applications were developed for the uses of the materials.

The applications of the molecules can be best described by the category in which they fit in; however, some of the base properties of silsesquioxanes seem to overlap although the specific strengths of the properties vary depending on the composition and preparation of the materials. These core properties are high heat resistance, low electric conductivity, oxidative stability, hydrophobicity, strong chemical resistances, high dielectric strength and volume resistivity. The three categories can be represented by polyphenylsilsesquioxanes, polymethylsilsesquioxanes, and co-polymers, a mixture of the first two categories.

The first category, polyphenylsilsesquioxanes, is mainly used for coating of electronics and optical devices with a major emphasis on the utilization for photoresists, interlay dielectrics, protective films for semiconductor devices and optical fiber coatings (Baney, 1995; Lichtenhan, 2005; Zhao, 2005). Other non-related applications for the molecules are used in separation membranes, and carcinostatic drugs. The molecules in this study will fall into this grouping. These materials possess non-linear optical properties and can even be synthesized to be transparent which allows for their use with current solar cell technology.

Polymethylsilsesquioxanes have many diverse applications. Utilized as a coating, it can be used to provide adhesion to rubber and plastics and protective (non-stick, water resistant and abrasion resistant) films on paper, plastic, rubber, metal surfaces, integrated circuits and electrical devices (Baney, 1995; Li, 2003; Lin, 2003; Lu, 2005; Zhao, 2005). Its uses have also found their way into cosmetics and binders for ceramics (Baney, 1995).

Co-polymers are mixtures of polyphenylsilsesquioxanes and polymethylsilsesquioxanes in order to improve the weakness of one compound with the inherent qualities of the other. For example, polyphenylsilsesquioxanes exhibit brittleness, but by incorporating polymethylsilsesquioxanes helps to create better cohesion.

Two-Photon Absorption. Before explaining the technique of two-photon absorbance spectroscopy, it is imperative to have the knowledge of two-photon absorbance and understand its relationship to non-linear optical materials. First, however, it is customary to recognize the physicist that formed the theory of two-photon absorbance in 1931, Maria Goppert-Mayer. This conclusion was made an astounding 30 years before the first laser was constructed to demonstrate the theoretical concepts.

Two-photon absorption is a quantum, non-linear optical phenomena in which two coherent photons are absorbed simultaneously by a material. As the two-photon absorption is a quantum effect it can be represented by the equation:

$$P(t) = \chi^{(1)}E(t) + \chi^{(2)}E^2(t) + \chi^{(3)}E^3(t) + \chi^{(4)}E^4(t) + \dots + \chi^{(n)}E^n(t)$$

The equation represents the anharmonic oscillator model which describes the displacement of the charges of an organic system by the interactions of an incoming electric field. This displacement of charge is defined as polarization. $P(T)$ represents the polarizability of the material model as a power series in an electrical field strength. $E(t)$ represents the electric field strength and the terms $\chi^{(n)}$ are known as the n th order susceptibility coefficients. The discussion of nonlinear two-photon absorption would be incomplete without mentioning the mathematical representation of the wave interaction with nonlinear material because the nonlinear absorption effect is defined as a quantum event (having both the properties of a particle and a wave). The wave equation in nonlinear media given as:

$$\nabla^2 E - \frac{n^2}{c^2} \frac{\partial^2 E}{\partial t^2} = \frac{4\pi}{c} \frac{\partial^2 P}{\partial t^2}$$

where n is the refractive index and c is the speed of light in a vacuum.

The two-photon absorption process is described as a third order polarizability of the material given by the equation.

$$P^{(3)}(t) = \chi^{(3)}E^3(t)$$

Conceptually polarizability of the material means that:

if a small signal at frequency ω_s is propagated through the medium in the presence of a strong pump signal ω_p , the frequencies chosen such that $\omega_s + \omega_p$ equals some transition frequency of the material, then the transition can take place through simultaneous absorption of those two photons. (Bhaskar, 2007); (Boyd, 1992)

Two-photon absorption process can be described in two ways non-degenerative and degenerative absorption. Degenerative two-photon absorption, utilized in this experimentation, can be more easily explained through comparisons with traditional one-photon absorbance. This effect differs from one-photon absorbance because the chromophores or light absorbing molecules in solution are absorbing two long-wavelength photons to reach the similar first singlet excited state as oppose to one shorter wavelength (higher energy) photon. The word similar is used to describe the first singlet state because in principle, one-photon and two-photon excitation follow different selection rules meaning that the energy state reached by one-photon excitation is different from that reached by two-photon excitation (Webb, 1997). Nevertheless, it is easy to understand the idea of two-photon absorption conceptually by

saying that the initial interaction of a photon with a material excites the material by a certain amount from the ground state and the second interaction of the material with a coherent photon excites to materials by the same amount so that the material reaches the first singlet excited state (Ajat thesis; Lakowicz, 2003). It is again important to emphasize the photons interactions are simultaneous, meaning no intermediate levels or steps are involved. Two-photon absorbance also varies from one photon absorbance through the Beers and Lambert law which states that for one photon absorption the amount of light absorbed is linearly related to the intensity of the incident light. However, two-photon absorbance is related to the square of the intensity of the incident light which graphically represents a quadratic dependence intensity of the incident light. "As a result of the quadratic dependence two-photon excitation, most of the excitation occurs at the focal point of the excitation, where the local intensity is highest." (Lakowicz, 2003). Physically, this concept can be observed as a narrow band of fluorescence as the intensity beam enters the solution that becomes focused and intensified at the focal point of material (usually observed to be near the center of the solution). It is this property of two-photon absorption that allows the technique to have diverse applications.

Two photon absorbance (excitation) is gaining popular in through techniques such as lithography, fluorescence microscopy, imaging, photon dynamic therapy, and optical limiting; however, for the sake of this paper the focus will be on the use of two-photon absorbance as a spectroscopic tool to characterize non-linear optical properties of the cage silsesquioxane molecules which forms the theoretical framework or research plan of this investigation.

Two-Photon Excitation Fluorescence (TPEF) employs picosecond or femtosecond pulsed laser sources to concentrate the available light energy into ultra-short pulses. In the spectroscopy set-up, the intensity of incident light can then be varied through the use of a neutral density filter. By changing laser intensity, the quadratic dependence of input intensity to fluorescence intensity can be verified. Fluorescence intensity is measured orthogonal by PMT in photo counting mode. The spectroscopic technique utilizes a known standard that absorbs around the same wavelength as the samples for comparisons of the two-photon absorption measurements. The absorption measurements are used to determine the two-photon cross sections to characterize the sample's two-photon excitation response.

Research Plan

Since the caged (T8) molecules exhibit the properties of durability against chemical and biological degradation, are highly weather resistance, have high heat resistance, can be manipulated to have versatile structures, have recorded non-linear properties and are transparent in UV light, then theoretically, the compounds represent effective material to improve the efficient of solar cell devices by absorbing infrared radiation. First, however, caged (T8) silsesquioxanes absorption efficiencies and sensitivity to two-photon excitation in the infrared region must be evaluated. Although, not much literature can be found confirming abilities of silsesquioxane as solar cell devices there has been extensive research in using the caged molecules in improving or developing more sensitive photo-resist and the applications of the molecules in providing effective coatings of electronics and absorptive coatings for radiation (Baney et al, 1995). The study conducted by Sulaiman showed quantitative data that the NH_2 VinylStilbeneOS molecule has a high cross section of 810 GM at 780nm. By increasing conjugated with pi-conjugated systems and long conjugated carbon side chains to similar NH_2 VinylStilbeneOS molecules, a method can be devised to extend the absorption maximum of the similar molecules into the infrared range of the electromagnetic radiation spectrum.

In order to confirm hypothesis that the caged molecules represent better absorbing materials, the sensitivity to two-photon excitation of $\text{Nboc}_n\text{StilOS}$ and $\text{Ace}_n\text{StilOS}$ molecules are required to be tested through the use of infrared and near-infrared ultrafast laser pulses to evaluate the prospective design of creating more efficient solar cell devices.

Methodology

Investigated systems. The molecules investigated have the same T8 caged silsesquioxane core structure, composed of eight silicon atoms which act as the vertices of the cubic structure. The phenyl groups attached to the silicon atoms allow for various r-groups to be substituted onto the cage molecule (figure 1). Two types of substituent groups are attached the cubic structure for investigation which are Nboc and Ace groups (figure 2). The molecules will have the name of $\text{Nboc}_n\text{StilOS}$ and $\text{Ace}_n\text{StilOS}$, respectively with the number n to represent how many group of the type Nboc and Ace are present on the cube. Each of the systems of molecules were accurately weighed and dissolved in a known amount of the solvent DCM (di-chloromethane) so that the stock concentration was approximately on the order of 1×10^{-4} molar.

Figure 1. The figure displays the chemical structure from the 8 substituted core to the 16 and 23 substituted caged molecules.

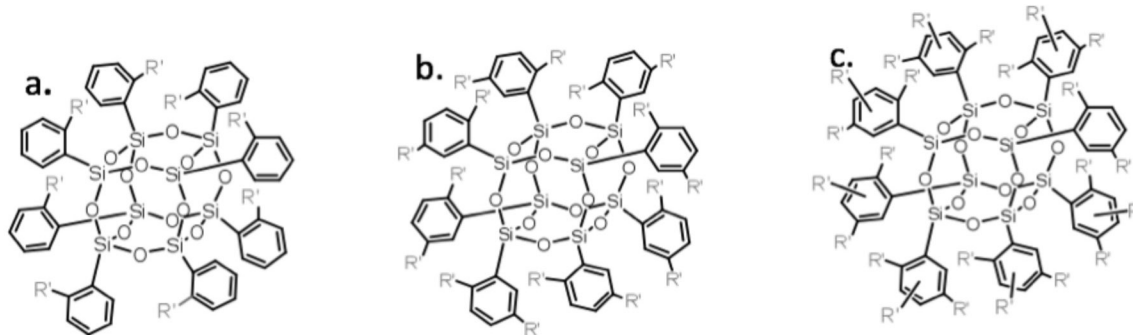


Figure 2 (a) The R-group classified as the Noboc. **(b)** The chemical structure of the substituent Ace.



Quantum Yield. In order to determine the quantum yield or quantum efficiency, steady measurements and photoluminescence emission data were needed. Steady state measurements were carried out on an Agilent (Model No. 8341). The initial absorbance measurements were also used to determine extinction coefficients of the compounds. Photoluminescence measurements were carried out on Fluoromax-2 fluorimeter; the concentrations of the compounds were diluted so that the absorbance of the compounds was below .1 to avoid saturating the fluorimeter. Bis-MSB [p-bis (o-methyl-styryl) benzene] was used as the emissions standard. Quantum yield was calculate using the formula

$$\Phi_{PL(x)} = \left(\frac{A_x}{A_s}\right) \left(\frac{F_x}{F_s}\right) \left(\frac{n_x}{n_s}\right)^2 \Phi_{PL(s)}$$

where $\Phi_{PL(x)}$ is the quantum yield, A is the absorbance at the excitation wavelength, F is the integrated area of the curve for the emission spectra, n is the refractive index of the solvent, and $\Phi_{PL(s)}$ is the known quantum yield of the standard.

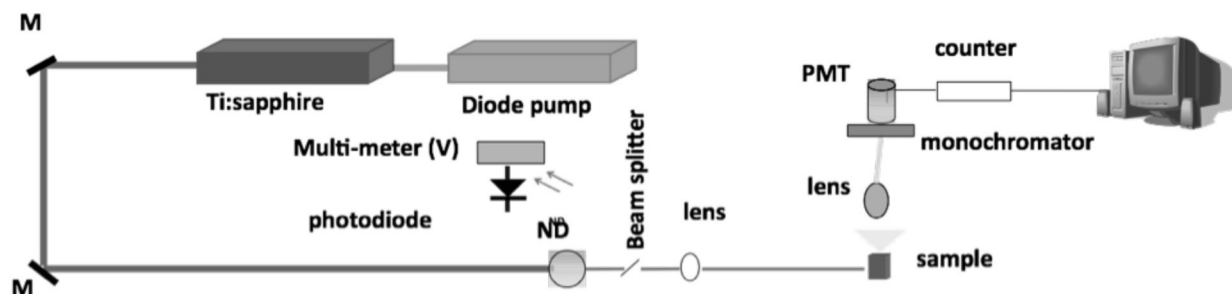
Cross Section. The cross section values were determined using the equation

$$F(t) = \frac{1}{2} \eta \delta c n \frac{g_p}{\pi \lambda f \tau} \phi \langle P(t) \rangle^2$$

in which F(t) is fluorescence counts measured in number of photons per seconds. η is fluorescence quantum yield (dimensionless). δ is two-photon absorption cross section with the units centimeters⁴*second per photon-molecule. c is defined as concentration of the molecule; its units are molecules per centimeters³. n represents the refractive index of the solvent (dimensionless), used to approximate the refractive index of the sample. g_p is shape factor of the beam pulses which is 0.664(dimensionless) for Gaussian pulses. λ is wavelength which is measured in centimeters. f is frequency of laser source. τ is pulse duration in seconds. ϕ is collection efficiency which is also dimensionless. P(t) is the input intensity with the units of photons per centimeters² per second. Courmarin 307 was used in as the two-photon absorbance standard (Xu and Webb, 1996).

TPEF Laser Set-up. The laser used for the Two-Photon Excitation Fluorescence (TPEF) measurements is a mode-locked Ti: Sapphire laser that is pump using a diode laser (figure 3). The diode pumping beam (Millennium Laser) is produced by two lanthanide bars within the laser cavity which are placed in a direct current source of about 34.7 Amps or 3.75 Watts of power. The bars emit 1064nm beam which strikes a temperature controlled LBO (Lithium Tri-Borate) to produce 532nm beam green light used to activate the Ti: Sapphire crystal within the Kapteyn-Murane oscillator cavity.

Figure 3



The femto-second pulses are generated within the laser and the nonlinear effective occurs within in the crystal which creates 800nm infrared light with the change of the crystal's refractive index. The beam passes through the cavity and compresses until the gain increases to exceed the output coupler and a powerful collimated laser beam is produced.

The resulting beam first travels through a colored filter to eliminate any scattered green light from the pump beam. A small portion of the beam is siphoned off using clear optical glass (beam splitter) onto a fiber optic cable connected to a spectrometer. Next, the majority beam is directed through a series of mirrors around the table, through a neutral density (ND) filter, and unto a beam splitter (optical glass) which directs a portion of the beam to a semiconductor diode which is connect to a voltmeter. The ND filter is used to relate the power of the laser to voltage. The main beam then passes through a focusing mirror and on to the sample.

As the beam strikes the sample it is focused within the material of the sample (non-linear effect) and a focused fluorescence is emitted from the sample. A collect mirror orthogonal from the sample collects the fluorescence; the fluorescence passes from the mirror through a monochromator, tuned to a specific wavelength, and is measured by a photomultiplier tube (PMT).

The PMT relates the amount of counts to a voltage difference. This voltage difference is converted into a current by a semiconductor diode contained within the counter. The counter is interfaced with a computer through a bus card which displays the fluorescence intensity as counts/seconds using the LabView Software.

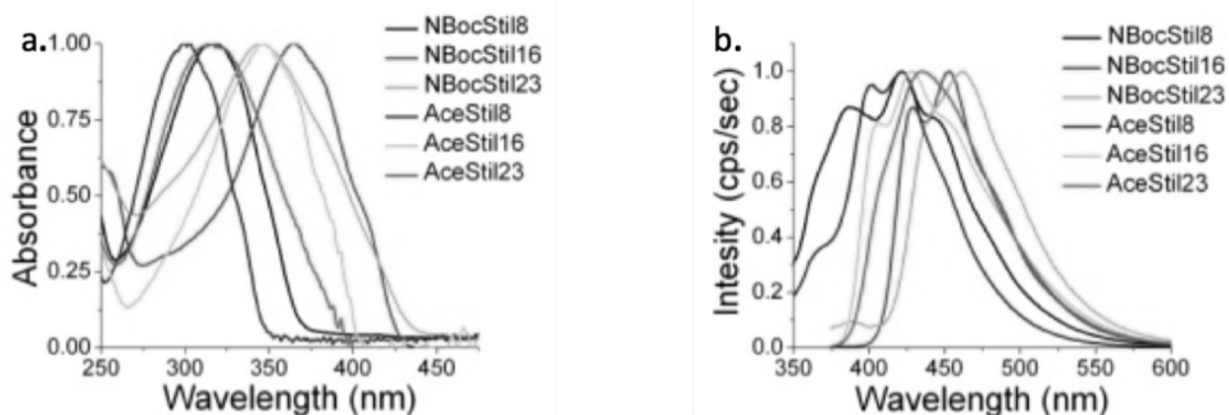
Results/Discussion

Results/Discussion

The discussion of results will only provide a general picture of what the measured values (cross section, quantum yield, stoke shift) represent toward the application of improved solar technology. Explanations of the red-shifted absorbance and emissions spectra of the Nboc_nStilOS and Ace_nStilOS systems using their molecular orbital structure, of HOMO and LUMO, or the possible 3-D electronic orbital configuration of the caged molecules will not be examined in this paper.

Steady State Analysis. The spectra shown in figure four displays the absorbance and emission data of the studied Nboc and Ace compounds. One obvious trend in the data is that both the absorbance and emission spectra are shifted with the addition of increasing electron donating groups with the exception of Nboc₁₆StilOS and Ace₁₆StilOS which have absorbance red-shifts larger than Nboc₂₃StilOS and Ace₂₃StilOS, respectively.

Figure 4: The figure displays (a.) the absorbance spectra and (b.) the emission spectra of the studied compounds.



Using the steady state values reported by Sulaiman, comparisons can be constructed using the similar StilbeneOS values and the values measured from either parent molecule from this study (chart 1). The absorbance values of Nbc₈StilOS (max: 317nm) is lower than that of the un-substituted silsesquioxane molecule (HVinylStilbeneOS) which has an absorbance max of 335 nm. The emission spectra of Nbc₈StilOS displays a maximum at 421 nm compared to the maximum of HVinylStilbeneOS at 385 nm. The longer range between the absorption maximum and emission maximum of Nbc₈StilOS allows for a greater Stokes shift of 104nm than the 50 nm shift of HVinylStilbeneOS. The increase in Stokes shift is indicative of increased charge transfer among the eight ligands for the Nbc₈StilOS. The charge transfer can be further supported with quantum yield of Nbc₈StilOS which has a value of 7% which is much lower than value measured for un-substituted silsesquioxane molecule (36%).

Nbc₁₆StilOS and Nbc₂₃StilOS exhibit red-shifts in the absorbance and emission spectra. The shift in absorbance of the Nbc₁₆StilOS molecule was particularly interesting because its red-shift was greater than that of Nbc₂₃StilOS; however, an explanation for the increased shift in absorbance spectra could be that it allows for a smaller Stoke shift for Nbc₁₆StilOS. The Stokes shifts were 87nm (Nbc₁₆StilOS) and 118 nm (Nbc₂₃StilOS). Quantum efficiency values were 43% (Nbc₁₆StilOS) and 5% (Nbc₂₃StilOS).

Comparisons of Ace₈StilOS and HVinylStilbeneOS showed a lower absorbance maximum at 300nm and a higher emission maximum of 422 nm. Since the stoke shift with this compound (122 nm) is greater than that of the value measured for un-substituted silsesquioxane molecule, it was also indicator for increased ligand interactions for the Ace₈StilOS molecules. The quantum yield of Ace₈StilOS (4%) was also shown to be lower than that of HVinylStilbeneOS (36%) and Nbc₈StilOS (7%).

Both Ace₁₆StilOS and Ace₂₃StilOS are red-shifted in absorbance and emission from the initial eight-substituted parent molecule shown in figure 4. The quantum yield of Ace₁₆StilOS (45%) is larger than Ace₂₃StilOS (19%), but the quantum yield of Ace₂₃StilOS is closer to Ace₈StilOS. The molecule Ace₂₃StilOS has a Stokes shift of 122 nm, which is almost identical to the eight-substituted molecule.

The increase in ligand interactions is emphasized through-out this section because these interactions are imperative for better absorbing materials as it allows charged to be delocalized around individual molecules and clusters of molecules which increase the probability and efficiency of charge separation that can be used to generate electricity.

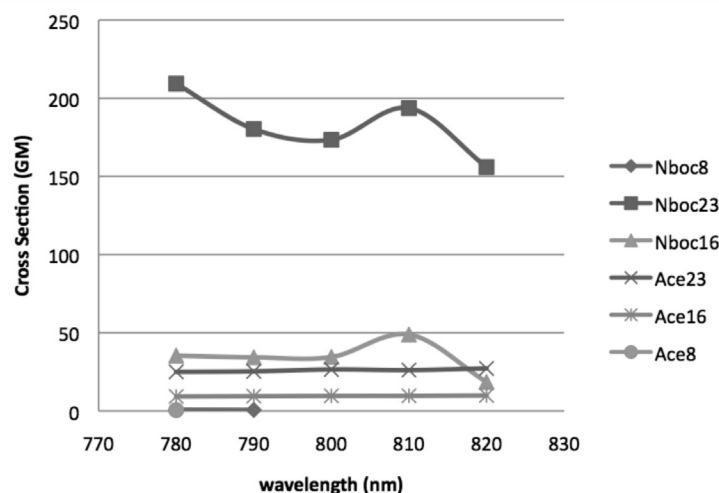
Chart 1

	Abb.	λ_{abs}	λ_{emis}	ϵ	QY	Cross Section (@780nm)	Cross Section Maxima	Stokes Shift (nm) $ \lambda_{\text{abs}} - \lambda_{\text{emis}} $	Cross Section per ligand (GM)
		(nm)	(nm)	($\text{M}^{-1}\text{cm}^{-1}$)					
	Nboc								
	R ₈	317	421	4.05E+04	0.07	0.751		104	
	R ₁₆	366	453	5.66E+04	0.43	35	49 (810nm)	87	3.1
	R ₂₃	345	463	6.33E+04	0.05	209	194 (810nm)	118	8.4
	Ace								
	R ₈	300	422	6.86E+04	0.04	0.485		122	
	R ₁₆	345	429	1.29E+05	0.45	9.24	9.86 (820nm)	84	0.6
	R ₂₃	314	435	1.09E+05	0.19	25	27.15 (820nm)	121	1.2
	HVinylStilbeneOS	335	385		0.36	25		50	3.1
	MeVinylStilbeneOS	338	394		0.22			56	
	MeOVinylStilbeneOS	345	418		0.16	110		58	13.8
	NH2VinylStilbeneOS	358	482		0.06	810		124	101

Chart 1 displayed the steady state values determined for the Nboc_nStilOS and Ace_nStilOS molecules. The values displayed below the chart are values reported by Salaiman, 2009.

Cross-Section Analysis. While the steady state measurements of Although, Nboc₈StilOS and Ace₈StilOS resembled Stoke shift and quantum yield values more similar to NH2VinylStilbeneOS than HVinylStilbeneOS, the cross section values were nonexistence in the infrared region, which was expected, as the absorbance spectra of the studied molecules indicate maximum two-photon absorption in the 600 nm range. Cross section values did appear for the molecules Nboc₁₆StilOS, Nboc₂₃StilOS, Ace₁₆StilOS, and Ace₂₃StilOS (see chart 1). Yet, only the molecules Nboc₁₆StilOS (49GM) and Nboc₂₃StilOS (118GM) showed peaks in the near infrared region of 810 nm.

In addition to the peak at 810nm, Nboc₂₃StilOS shows a potential peak at 780 nm which was an indicated peak in Sulaiman study for NH2VinylStilbeneOS. The appearance of the potential maximum could suggest that the occurrence could be a response solely of the attached amine addition or a combination of both the electronic structure of amine group contribution and ether-type addition. The peak is classified as a potential peak because cross values have yet to be determined for wavelengths lower than 780nm.

Figure 5: The graph contains the cross section results for all studied compounds.

Data for both systems displayed a correlation in two-photon cross section with the addition of more electron donating groups. Although, the correlation between donating groups and cross is apparent, more evidence would be needed to determine if the correlation is linear or logistic and to determine if the increase of donating groups will display increased charge transfer capabilities.

Conclusion and Recommendations

Conclusion

Cross section data supports the use of Nboc₂₃StilOS as a more efficient absorbing material for future solar cells devices. Nboc₂₃StilOS showed across section maximum in the near infrared region of ~ 810nm of about 200GM, with another suspected peak at 780 nm. The decrease in quantum yield from Nboc₁₆StilOS (43%) to Nboc₂₃StilOS (5%) can be interpreted as an increase in ligand interactions which allow for charge transfer or delocalization of charges across the surfaces of the molecules. The charge transfer characteristic can also be seen by plotting the cross section per ligand which increases to a maximum of 3.1GM /ligand (Nboc₁₆StilOS) to a maximum of 8.4GM/ligand (Nboc₂₃StilOS). Cross section data showed a correlation of increasing donating groups with increasing cross section in the infrared region for both systems of compounds, Nboc_nStilOS and Ace_nStilOS. Strong charge-transfer abilities promotes to the possibility to then insert metals within the core of the cages to separate the charges shared on the ligands. These findings allow for a small step forward in the direction of achieving a more efficient use of solar power. This small step could in turn create a prospective future where energy production would be dominated by clean and renewable energy sources and not fossil fuels.

Recommendations

Results have shown Nboc₂₃StilOS to have the characteristics of better absorbing material; therefore, more knowledge is need to understand the excited-state dynamics, molecular orbital configuration, and possible 3-D electronic structure of the caged molecule that enable the molecule to have a cross section maximum in the near-infrared region. Since solar cell devices also require strong charge separation properties, research into devising and implementing methods to insert molecules or atoms with high charge separation properties into the center of the cage must also be explored. The implementation of these fore-mentioned strategies would allow construction of more efficient infrared solar cell devices to begin, providing substantial increases in solar energy production for a future with increasing energy demand.

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Evaluating the Effectiveness of a Domestic Violence Course: Change in Knowledge and Civic Attitudes

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Abstract

The effectiveness of a domestic violence course was evaluated to investigate whether changes occurred in general knowledge about domestic violence and in civic attitudes as a result of participation in the college course. Knowledge on support needed for survivors of intimate partner violence, and about the role of the advocate when working with intimate partner survivors were subscales investigated from the general knowledge about domestic violence. This study is significant because we cannot assume that the course is effective in teaching students about domestic violence unless we empirically evaluate whether change in knowledge occurred over the semester. A total of twenty-two participants completed the pre and post surveys. The findings indicated that students gained knowledge regarding general understanding of domestic violence and knowledge regarding the role of the advocate when working with intimate partner survivors. There were no changes in knowledge about the support needed for survivors of intimate partner violence and in civic attitudes. This evaluation of the effectiveness of the course contributed to the literature about educational programs focused on intimate partner violence for adolescents as programs exist that are focused on educating students in middle school and high school, but not in college. Many programs have been offered outside of educational environments; this study indicated that a course provided at a university was effective in educating college students about domestic violence. Increase in knowledge might lead to fewer IPV incidents which have demonstrated to cause health consequences. Future research may provide ways of how to teach college students about domestic violence and possibly reduce future involvement in violent relationships. Recommendations include to replicate the study with larger number of participants and include a service learning component would be critical to measure for changes in civic attitudes.

Keywords: domestic violence, dating violence, intimate partner violence, civic attitudes

Problem Statement

Intimate partner violence (IPV) affects women of all ages, ethnicities, socioeconomic, religious, and personality groups (Ganley, 1995). Intimate partner violence or domestic violence is defined as “a pattern of assaultive and coercive behaviors, including physical, sexual, and psychological attacks, as well as economic coercion, that adults or adolescents use against their intimate partners” (Ganley, 1998, p. 16). Tjaden and Thoennes found that college women are at higher risk for being in abusive relationships compared to the broader population (as cited in Nabors, Dietz, & Jasinski, 2006). Female victims suffer more consequences than males (Afifi et al., 2008). The consequences include depression, suicidality, post-traumatic stress disorder, alcohol abuse, and drug abuse (Golding, 1999). Given the negative consequences associated with intimate partner violence and the high incidence of this type of violence in dating relationships, interventions are needed to educate college women about domestic violence. Furthermore, programs that serve victims of intimate partner violence are often understaffed and in desperate need for volunteers (Brown & O'Brien, 1998). College students represent an untapped resource that could be used to assist in providing needed services to victims of domestic violence should they begin to endorse attitudes regarding the importance of volunteering within their communities.

Purpose and Research Questions

The purpose of this study was twofold: (1) to evaluate the effectiveness of one college course that focuses on teaching university students about domestic violence, and (2) to assess change in civic attitudes among students enrolled in a class on domestic violence. While evaluating the effectiveness of the course the following questions were addressed:

1. To what degree did college students learn about domestic violence, from the beginning to the end of the semester when enrolled in a domestic violence course?
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2. To what degree did the college students' attitudes about the importance of volunteering to help others (civic attitudes) change as a result of learning more about domestic violence?

Significance

The study was important for three reasons. First, by enrolling in the domestic violence course offered at the University of Maryland, college students may become educated about domestic violence. Educating more college students about domestic violence may decrease the risk of women being in abusive relationships in the future. Second, we cannot assume that the course is effective in teaching students about domestic violence unless we empirically evaluate whether change in knowledge occurred over the semester. Third, studying civic attitudes may demonstrate an increase of civic attitudes from the students. If there is a change in the students' attitudes about the importance of volunteering to help others, it may lead to more students taking civic action which benefits society. This investigation examined data collected at the beginning and end of the domestic violence course to determine if students gained knowledge about intimate partner violence and increased their civic attitudes.

Definitions related to research

The U.S. Department of Justice (2009) reported that the majority of victims of intimate partner violence are women, thus the focus of this research was on female victims of domestic violence. Intimate partner violence or domestic violence, for the purposes of this study, has been defined as a pattern of assaultive and coercive acts, including economic coercion, by adults or adolescents towards their intimate partner, which includes physical, sexual, and psychological aggression (Ganley, 1998). Civic attitudes were defined as "attitudes toward the responsibility to help others and solve societal problems" (Bringle, Phillips, & Hudson, 2004, p.197). The definition of dating violence as "the use or threat of physical force or restraint carried out with the intent of causing pain or injury to another within a dating relationship," by Sugarman and Hotaling, 1989, (as cited by Lewis & Fremouw, 2000, p. 106) was used for this research.

Summary

Increasing knowledge about intimate partner violence may help decrease the number of victims and increase attitudes towards engaging in volunteer service to assist victims of domestic violence. Studies of models and prevention programs on educating students regarding domestic violence have found that improvement in knowledge and attitudes due to prevention programs, but some of the participants in the programs were pressured to be part of the program. Not all participants in the programs voluntarily took part.

Teaching students about domestic violence has been addressed through different methods and it has been shown that educational service learning programs for students increase knowledge and change attitudes that justify domestic violence, but what seems to be missing is the evaluation of civic attitudes as a result of the increase domestic violence knowledge. In addition, not all the instructional programs have been evaluated for their effectiveness nor have been offered as a separate college course. Thus, the present study may contribute to what is missing in the literature. The contribution was determining how effective the domestic violence course was, which enables us to ascertain that college students' knowledge on domestic violence has improved as a result of the course. The findings of how effective the course was, because of the enhancement of education on intimate personal violence for college women, will hopefully increase the number of courses on domestic violence in other college institutions. Also, if the hypothesis about the increase in knowledge on domestic violence was confirmed, then students would be more aware of the high need for help for domestic violence victims. Thus, civic attitudes may increase for the students. Assessing the change in civic attitudes could demonstrate how the course has lead students to become more aware of the importance to volunteer in their communities. The increase in the awareness of helping victims of intimate personal violence could be beneficial in motivating people to solve a major societal problem.

Delimitations of Research

To date, research addressing educating about intimate partner violence lacks follow up after the programs. In addition, some research included participants who were pressured into participating in the prevention program. Furthermore, the studies that seek to change civic attitudes were limited by only focusing on service learning and not taking into account other courses from different areas that may influence changes in civic attitudes. This study

evaluated the effectiveness of educating domestic violence by using pre surveys and following up with a post survey. In addition, civic attitudes were measured as the course may have an influence on changes in civic attitudes.

Analysis and Discussion of the Literature

Intimate Partner Violence/Domestic Violence

In 1993, the Declaration on the Elimination of Violence against Women made intimate partner violence recognizable as a public issue (Meyer, 2000). There has been extensive literature on the hazardous effects for females as victims of domestic violence. Tjaden and Thoennes (2000) gathered data from the National Violence Against Women telephone survey, that represented the nation's population, and found women were the main victims that reported intimate perpetrated rape, physical assault, and stalking. They also experienced a plethora of life threats and fear of physical injury.

Consequences of Intimate Partner Violence

Intimate partner violence is a public health problem that presents physical and psychological problems (Cunningham, 2008). In the study by Afifi et al. (2008), the consequences of intimate partner violence for women were investigated. Positive correlations were found for women who experienced intimate partner violence and mental health disorders. Associated with domestic violence among women were externalizing disorders which included disruptive behavior disorder and substance use disorder, as well as internalizing disorders such as anxiety disorders and suicidal ideation. Another consequence, found by Ganley (1995), is that the victim becomes isolated by not having outside contact. Some victims do keep contact with friends and family, but with the intimate partner regulating the relationship. In addition, an added consequence of intimate partner violence is that some victims do not claim that they are experiencing domestic violence. The health care practitioners then prescribe inappropriate treatments for the victim's injuries or illness. If the victim does not discuss the intimate partner violence occurring then it is difficult to obtain support from others and prevent future violence. Furthermore, a meta-analysis, conducted by Golding in 1999, found that the occurrence of depression, suicidality, posttraumatic stress disorder, and alcohol abuse or dependence was common for battered women. For each consequence that battered women experienced, there were at least 10 studies that provided support for these effects of intimate partner violence.

Dating Violence

Based on the studies by Bryant and Spencer (2003), and Straus (2004), a range of 20% to 50% of college students experience dating violence at particularly high rates. The International Dating Violence Survey, by Straus (2004) indicated that even at the universities with the lowest rates of severe assault more than 4% of students had used severe forms of violence in their romantic relationships. The forms of violence include physical aggression such as using a solid object to hit their partner. Also, severe punching and kicking occurs. Violent partners choke, and consistently slam their partner against a wall. Other forms of violence include the victims being intentionally burned or scalded by their partner.

Consequences of Dating Violence

There is a particularly high risk of domestic violence among adolescent females between the ages of 14 to 18 (Smith, White, & Holland, 2003). A study by Silverman, Raj, Mucci, and Hathaway (2001) assessed risks of young women who have experienced dating violence. The results provided information about the consequences of dating violence. The data obtained indicated that the consequences of those women include health concerns. The consequences include substance use such as heavy smoking, binge drinking, drunk driving, and cocaine use. Also, adolescent girls manage their weight in an unhealthy manner by using diet pills and laxatives. In addition, they engage in risky sexual behavior. The dangerous activities include having sex before the age of 15 years, having unprotected intercourse, and having multiple sexual partners. In addition, these severe sexual behaviors may lead to female adolescents becoming pregnant. Furthermore, suicidal thoughts and attempted suicide are additional risks associated with dating violence.

Education Programs for Young Women about Dating Violence

Several education programs have been developed in schools to respond to the high risk of dating violence among adolescents (Weisz & Black, 2001). What should be customized for education programs about dating violence are empirical findings on dating violence. Also, the program assessments should use psychometrically sound measures to assess change.

Research Evaluating Education Programs about Dating Violence

Several studies have reported on interventions to teach college and high school women about dating violence. One study by Schwartz et al. (2006) introduced sorority and fraternity members to an interactive dating violence prevention program. The program focused on gender role stereotypes that contribute to relationship violence, identifying the numerous forms of relationship violence, and increasing social responsibility surround the issue. The intervention was student led by a student organization made up of 14 peer educators in the Student Speaker Bureau (SSB). The students in SSB received a stipend for their commitment to the program. The program focused on the contribution of gender role socialization to dating violence, the cycle, and healthy communication skills. The intervention included a variety of educational media, an educational lecture modeled after a talk show, and a panel discussion with participants as the audience. To evaluate the program, participants completed a pre- and posttest. Then, paired *t* tests were conducted on the 290 participants. The results demonstrated a decrease in stereotypical and misogynistic attitudes about dating violence. A limitation of the study was that every year the national offices mandate the majority of sororities and fraternities to have an educational program and thus the members were required to participate.

Another study assessed the Safe Dates program on primary and secondary prevention of dating violence that included 1,886 students throughout fourteen schools (Foshee, Bauman, Arriaga, Helms, Koch, & Linder, 1998). The intervention consisted of school activities such as theater performance by peers, a 10-session curriculum, and a poster contest. It also consisted of community activities which provided special services for adolescents in an abusive relationship and community service provider training. The goals of the intervention included improving conflict management skills, changing customs related with partner violence, and decreasing gender stereotyping. The program was evaluated with pre and post questionnaires from the beginning and then months after the program. The results indicated a decrease in dating violence norms and gender stereotyping. Therefore, Safe Dates program was an effective intervention that demonstrates prevention of adolescent dating violence. One limitation was that the study was conducted in a neighborhood that had an overrepresentation of minorities who had limited education.

Another study evaluated the Sexual Assault and Dating Violence prevention program which was presented in association with the local Rape Counseling Center (Weisz & Black, 2001). The purpose of the study was to create a program that would provide support for the findings of Foshee et al.'s 1998 study. The program was an 18 week session that was gender separated. The goal of the program was to increase knowledge, intolerance, and appropriate behavior in response of sexual assault and dating violence. The evaluation consisted of pre and post tests as well as a follow up of the pretest. The results were consistent with Foshee et al.'s 1998 study demonstrating that changes in knowledge and attitudes can be preserved. In addition, there were differences between genders' attitudes about sexual assault and dating violence. There were high attitudes by girls compared to boys for pretest and posttest. High attitudes meant an increased intolerance for dating violence. Yet, no changes were shown in knowledge between genders. Even with the positive outcomes, a limitation was that, despite the program being voluntary, several males in the program were pressured to attend sessions by their mothers.

The efficacy of the Dating Violence Prevention Program was evaluated in terms of effect on attitudes justifying dating violence (Avery-Lead, Cascardi, O'Leary, & Cano, 1997). The goals were to promote equity in dating relationships, challenge attitudes for violence as a solution to conflicts, recognize productive communication skills, and support resources for victims of aggression. The program was applied to 193 high school health classes, specifically juniors and seniors, in a Long Island, New York, school. The evaluation consisted of a pre and post assessment of the program. The findings of this study demonstrated a decrease in attitudes justifying dating violence. The program has proven to be effective in changing adolescents' beliefs and attitudes towards justifying dating violence. However, a drawback was that the program was implemented in a health class. All students were required to take the health class, so the program did not have voluntary participants.

In some school-based prevention programs for high school students, the programs of study include increasing awareness and deteriorating myths related to relationship violence. Evaluations of six school-based prevention programs

accounted for enhanced understanding about dating violence issues, changes in attitudes about dating violence, and a decrease in committing dating violence (Wolfe & Jaffe, 1999). Another school-based prevention program was for middle school students from an urban area. After evaluations with pre and post tests the conclusions were that the program increased knowledge and improved attitudes towards different ages, except college students (Wolfe & Jaffe, 1999).

Educational programs that increased civic attitudes have been focused on service-learning. In one study, 144 undergraduate students taking service learning courses participated. The goal of the study was to investigate the specific factors such as amount of time spent volunteering, contact with service beneficiaries, and the level of reflect in service, that affect the outcomes among service-learners. The study was evaluated with pre and post questionnaires. The results indicated that time, contact, reflections, and talking about service experiences affects students' civic and academic outcome. Service learning programs that were evaluated demonstrated increase in civic attitudes. What this study did not take into consideration was that courses in different disciplines that also address service-learning may have had an influence as well.

Summary of Literature Review

Several studies on evaluating domestic violence educational programs have been shown to increase knowledge in domestic violence and influence attitudes. There have been some studies that have had voluntary participants, but many participants were pressured to enroll in these programs. In addition, no studies have been found on educational programs focused on domestic violence that measure civic attitudes.

Analytic Framework

Based on Ausubel's Meaningful Reception Learning theory (1973), for students to have learned effectively in the domestic violence course, all readings had to possess relevance to each other (Ivie, 1998). The coursework throughout the semester focused on domestic violence as a whole and each reading had some relation to the previous one. Ausubel's Meaningful Reception Learning Theory is concentrated on learning in school settings and how people learn critical information from verbal and textual presentations. The theory partially explains the approach of adding applicable information to previously learned concepts just as was done in the domestic violence course. The class presented concepts on domestic violence and for the next time the class met applicable information was discussed that related to the previous lesson taught earlier in the week.

For the "Meaningful" component of the theory, acquiring concepts at the beginning will lead to learning new notions that are connected in the existing cognitive structure, if learned soon after. In relation to the domestic violence course, students obtained information at the beginning of the course and throughout the semester learned new relevant ideas. As long as the information obtained at the beginning of the course connected to the new concepts then what should have resulted is meaningful learning from the students.

In terms of the "Reception" part of the theory, verbal learning is considered effective. Verbal learning is when content is discussed by the students so that the content may be integrated. In the domestic violence course, students engaged in class discussion on the readings and engaged in role play practice sessions. By verbally discussing the concepts, students are integrating the information into their cognitive structures rather than just memorizing. The Meaningful Reception Learning Theory focuses on how the information is approached for students to meaningfully learn information. The domestic violence course assigned readings each week, implemented discussions, and role play sessions. All of the strategies used in the course, according to Ausubel's Meaningful Reception Learning Theory, should effectively change student learning about domestic violence.

Research Design and Methodology

Purpose of Study and Research Questions

The purpose of this study was twofold: (1) to evaluate the effectiveness of one college course that focuses on teaching university students about domestic violence, and (2) to assess change in civic attitudes among students enrolled in a class on domestic violence. A college course that taught university students about domestic violence was assessed for this study. Our research addressed the following questions:

Research Question 1

To what degree did the college students learn about domestic violence when enrolled in a course focused on intimate partner violence as assessed at the beginning and end of the semester?

Hypothesis 1

Students will increase in knowledge about domestic violence as a result of enrollment in the course.

- a. Students' scores on the General Knowledge of Domestic Violence Subscale will increase from pretest to posttest.
- b. Students' scores on the Support Needed for Survivors Subscale will increase from pretest to posttest.
- c. Students' scores on the Knowledge about the Role of the Advocate when Working with IPV Survivors Subscale will increase from pretest to posttest.

Research Question 2

To what degree did the students' civic attitudes change as a result of enrollment in a domestic violence?

Hypothesis 2

Students will increase in civic attitudes at the end of a college domestic violence course.

- a. Students' scores on the Civic Attitudes Scale will increase from pretest to posttest.

Participants

The participants in this study consisted of 22 undergraduate students ($N = 22$), enrolled in a semester course in psychology that focused on educating the students about theory and research relevant to domestic violence. There were 34 participants who completed the pre-test survey but only 22 of the 34 completed both pre and post surveys. The participants were predominantly women. To ensure confidentiality, participants' demographic characteristics were not collected.

Procedure

At the beginning of the semester, the students who were enrolled in the domestic violence course were invited to participate in a study on the effectiveness of the course. The professor teaching the course left the room while the teaching assistant described the study to the students. The students were told that participation was optional. Also, to protect the students in class, they were told that the survey was anonymous, confidential, and the professor would not know who volunteered. The teaching assistant distributed consent forms for students to read. The students who agreed to participate signed the consent form and then received the survey. Students were asked to write down a random four digit number, instead of their names, when filling out the survey because the researchers needed to link pre-and post-test scores. After the students completed the surveys, the teaching assistant gave the surveys to the administrative assistant to hold until the semester grades were submitted.

Post-test data were collected on the last day of class. The professor left the room and the teaching assistant invited participation from the students for the survey. The same protocol as the beginning of the semester was carried out, except there were no consent forms to fill out because this was completed at the beginning of the semester. Of the 35 students who enrolled in the domestic violence course, 34 participants filled out the pre-test survey. Twenty-two participants completed the post survey, resulting in a 65% return rate. The pre and post surveys measured knowledge on domestic violence, support, advocacy, and civic attitudes. In this study, only the knowledge of domestic violence and civic attitudes data were examined.

Measure

The constructs of interest for this study were assessed using the Knowledge of Intimate Partner Violence Scale (KIPVS) and the Civic Attitudes Scale (Mabry, 1998). The three hypothesized subscales of KIPVS measure for domestic violence included General Knowledge of Intimate Partner Violence Subscale, Support Needed for Survivors Subscale, and Knowledge about the Role of the Advocate when Working with IPV Survivors Subscale.

Knowledge. General understanding regarding domestic violence was assessed using the General Knowledge of Intimate Partner Violence Subscale of the Knowledge of Intimate Partner Violence Scale (O'Brien & Goodman, 2009). This subscale consisted of six items assessing knowledge of domestic violence, e.g., "A key factor contributing

to a woman's decision about whether to leave an abusive relationship is her ability to support herself and her children economically." Response options ranged from 1 to 7, where 1 indicated "strongly disagree" and 7 represented "strongly agree." To score the measure, two questions were reverse coded and the items were summed. High scores indicated substantive knowledge regarding domestic violence.

Support. Knowledge regarding how much support survivors need was assessed using the two item Support Needed for Survivors Subscale of the Knowledge of Intimate Partner Violence Scale (O'Brien & Goodman, 2009). One item was reversed, e.g., "Almost all violence survivors need formal support (e.g., help with housing, food, legal advice) more than they need informal support (i.e., support from family and friends)." Response option varied from 1 "strongly disagree" to 7 "strongly agree." High scores signified substantive knowledge regarding the support needed for survivors.

Advocate. Understanding regarding the role of the advocate was assessed using Knowledge about the Role of the Advocate when Working with IPV Survivors Subscale of the Knowledge of Intimate Partner Violence Scale (O'Brien & Goodman, 2009). This subscale included six items, e.g., "It is much more important for advocates to offer a relationship than to offer advice" with five of those items reversed. Response options ranged from 1 to 7, where 1 indicated "strongly disagree" and 7 represented "strongly agree." For each item, the participants indicated the degree to which they strongly disagreed (1) to strongly agreed (7). High scores indicated superior knowledge in the role of advocates who work with IPV survivors.

Civic Attitudes. Civic attitudes were assessed using the Civic Attitudes scale (Mabry, 1998). There were five items assessing civic attitudes, e.g., "It is important to help others even if you don't get paid for it." The choices for answering ranged from 1 to 5, where 1 indicated "strongly disagree" and 5 represented "strongly agree." High scores meant that the student believed in the importance of volunteering by giving back to the community.

Data Analysis Strategies

First, descriptive statistics for each scale were computed (see Table 1). The descriptive statistics included minimum and maximum scores from a scale, mean of the scores, and standard deviation. The standard deviation represents the variation from the average data set (Pigott & Wu, 2008). The higher standard deviation signifies greater dispersion across the data. Second, to evaluate changes from the pre (time 1) and post (time 2) surveys, four paired T-tests were used by utilizing the results of the paired samples statistics (see Tables 2, 3, 4, 5, 6, 7, 8, 9). According to Sosulski and Weiss (2003), paired *t* tests compare the average mean of two observations. In this study, we compared scores at time 1 and time 2 for two scales and three subscales of importance to the domestic violence course. The computer program SPSS, which is a resource for statistical analysis, was used to conduct the paired *t* tests.

Descriptive statistics indicated that the participants scored in the high range for time 1 and time 2 for the general knowledge of intimate partner violence Subscale measure. A high range means that the participants had a great amount of knowledge at the beginning and at the end of the course regarding general knowledge of intimate partner violence. For time 1 the minimum score was 3.67, the maximum score was 6.50, mean of scores was 5.14, and standard deviation was .70. For time 2 the lowest score was 4.17, the highest score was 7, mean of scores was 6.08, and standard deviation was .65.

With regard to the Support Needed for Survivors Subscale measure, the participants scored in the high range for time 1 and time 2. What scoring high range means is that the participants, when taking the survey both times, had an elevated level of knowledge on support needed for survivors. For time 1 the lowest score was 3.5, highest was 7, the mean of these scores was 5.44, and the standard deviation was 1.13. Time 2 had similar results with a minimum score of 3.5, maximum score of 7, mean score of 5.88, and standard deviation of 1.05.

The Knowledge about the Role of the Advocate when Working with IPV Survivors Subscale measure for time 1 demonstrated a moderate range score by the participants. A moderate range indicated that the participants had some knowledge about the role of an advocate when working with IPV survivors. For time 2 participants scored in the high range. The high range means that the participants had robust amounts of knowledge. Results for time 1 are as follows. The lowest score was 3.33, the highest score was 6.17, mean of scores was 4.42, and standard deviation was .60. For time 2 the lowest score was 3, the highest score was 6.67, mean of the scores was 5.55, and standard deviation was .89.

For time 1 and time 2, participants scored in the high range of the Civic Attitudes Scale which signifies that participants had a high level of civic attitudes at pre and post testing. For time 1 the lowest score was 3, highest was 5, the mean of these scores was 4.40, and the standard deviation was .52. Time 2 had similar results with a minimum score of 3.2, maximum score of 5, mean score of 4.55, and standard deviation of .48.

The *t* test results for the subscales were determined to be statistically significant if the probability of success, *p*, was less than 0.01. The results of the paired *t* test analyses indicated the following. Participants’ knowledge changed significantly from the first day of class to the last day of class with regard to General Knowledge of Intimate Partner Violence Subscale ($t = -5.38, df = 21, p = .00$). My hypothesis that students scores on the general Knowledge would increase from pretest to posttest was supported taking into account General Knowledge of Intimate Partner Violence Subscale.

The knowledge regarding the support needed for survivors indicated no statistical change from pre to post test ($t = -1.48, df = 21, p = .15$). My hypothesis with regards to Support Needed for Survivors Subscale was not supported because from pre to post test there was no significant increase. From time 1 to time 2 there was a significant change in participants’ knowledge pertaining to Knowledge about the Role of the Advocate when Working with IPV Survivors Subscale ($t = -5.66, df = 21, p = .00$). Thus, my hypothesis about students’ scores increasing from pretest to posttest was supported regarding Knowledge on Role of the Advocate when Working with IPV Survivors Subscale. A summary of the results from time 1 to time 2 is graphed in Figure 1.

Based on the paired sample *t* test considering the Civic Attitudes scale, there was no significant change in participants’ beliefs in the value of helping others in their society ($t = -.73, df = 21, p = .47$). My hypothesis regarding Civic Attitudes Subscale was not supported. No statistically significant results led me to conclude that increased in civic attitudes did not occur as a result of this college domestic violence course.

Table 1 Descriptive Statistics on Knowledge of Intimate Partner Violence and Civic Attitudes Scales

Scale	N	Time 1				Time 2				
		Min	Max	Mean	SD	N	Min	Max	Mean	SD
General Knowledge of IPV Subscale	34	3.67	6.50	5.14	.70	22	4.17	7.00	6.08	.65
Support Needed for Survivors Subscale	34	3.50	7.00	5.44	1.13	22	3.50	7.00	5.88	1.05
Knowledge About the Role Of the Advocate When Working With IPV Survivors	34	3.33	6.17	4.42	.60	22	3.00	6.67	5.55	.89
Civic Attitudes Scale	34	3.00	5.00	4.40	.52	22	3.20	5.00	4.55	.48

Table 2 Paired Samples Statistics on General Knowledge of IPV Subscale

Pair 1	Mean	N	SD	SEM
T1 General Knowledge of IPV Subscale	5.02	22	.75	.16
T2 General Knowledge of IPV Subscale	6.08	22	.65	.14

Table 3 Paired Samples T-Test Differences on General Knowledge of IPV Subscale

	Mean	SD	SEM	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Pair 1								
T1 General Knowledge of Intimate Partner Violence Subscale	-1.06	.92	.19	-1.47	-.65	-5.38	21	.00
T2 General Knowledge of Intimate Partner Violence Subscale								

Table 4 Paired Samples Statistics on Support Needed for Survivors Subscale

Pair 1	Mean	N	SD	SEM
T1 Support Needed for Survivors Subscale	5.45	22	1.18	.25
T2 Support Needed for Survivors Subscale	5.88	22	1.05	.22

Table 5 Paired Samples T-Test Differences on Support Needed for Survivors Subscale

	Mean	SD	SEM	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Pair 1								
T1 Support Needed for Survivors Subscale	-.43	1.36	.29	-1.03	.17	-1.48	21	.15
T2 Support Needed for Survivors Subscale								

Table 6 Paired Samples Statistics on Knowledge on the Role of the Advocate when Working with IPV Survivors Subscale

Pair 1	Mean	N	SD	SEM
T1 Knowledge about the Role of the Advocate when Working with IPV Survivors Subscale	4.54	22	.63	.13
T2 Knowledge about the Role of the Advocate when Working with IPV Survivors Subscale	5.55	22	.89	.19

Table 7 Paired Samples T-Test on Knowledge on the Role of the Advocate when Working with IPV Survivors Subscale

Pair 1	Mean	SD	SEM	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
T1 Support Needed for Survivors Subscale	-1.00	.83	.17	-1.37	-.63	-5.66	21	.00
T2 Support Needed for Survivors Subscale								

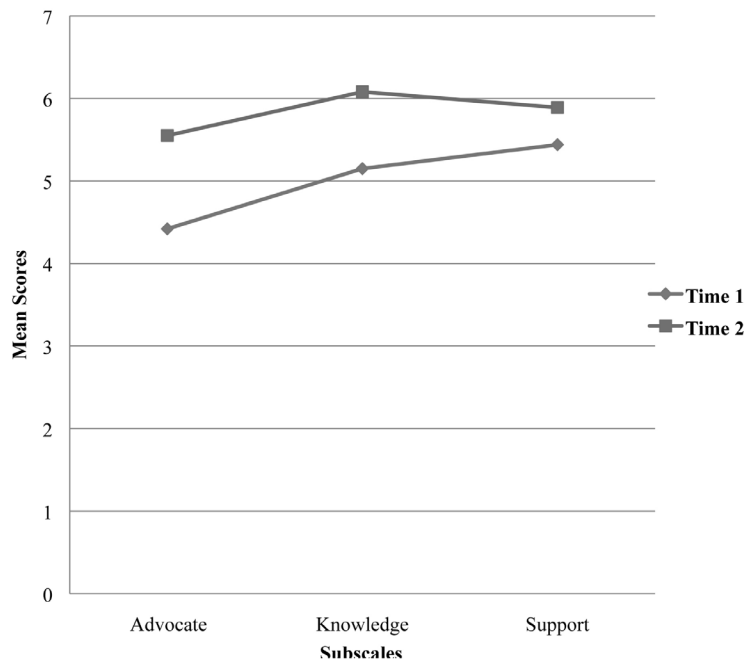
Table 8 Paired Samples Statistics on Civic Attitudes

Pair 1	Mean	N	SD	SEM
T1 Civic Attitudes Scale	4.49	22	.40	.08
T2 Civic Attitudes Scale	4.55	22	.48	.10

Table 9 Paired Samples T-Test on Civic Attitudes Scale

Pair 1	Mean	SD	SEM	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
T1 Civic Attitudes Scale T2 Civic Attitudes Scale	-.06	.40	.08	-.24	.11	-.73	21	.47

Figure 1. KIPVS Subscale at Two Time Points



Strategies for Minimizing Bias and Error

To minimize bias and error, students did not place their names on the surveys. Instead, a 4 digit code number was used to connect the pre and post tests. Also, some questions were reversed to make sure students were attentive when responding.

Ethical Considerations

Steps were taken to guarantee that all procedures for the research were done in an ethical manner. To conduct this research at the University of Maryland, the researchers obtained permission through the Institutional Review Board (IRB). Also, participation in the study was optional. In addition, consent forms were provided for the students to educate the students about the procedures of the study. In addition, the identity of the participants remained anonymous.

Discussion

Findings

The literature suggested that change in knowledge regarding domestic violence occurs in domestic violence educational programs. There have been evaluations to demonstrate the effectiveness of the programs; likewise this study has demonstrated the effectiveness of one domestic violence college course with regard to increases in general knowledge about domestic violence and the role of advocates in working with victims of domestic violence. However, there were no changes in knowledge on the support needed for survivors of domestic violence or civic attitudes. The evaluation of the course based on this study demonstrates the class is effective with regard to advancing knowledge concerning the domestic violence generally and the role of an advocate when working with IPV survivors more specifically.

Increased knowledge regarding the support needed for survivors of domestic violence and change in civic attitudes was not a focus based on the literature, but for this study it was measured. The hypothesis that there would be an increase of knowledge regarding support needed for survivors of domestic violence was not supported. The findings for the support subscale not demonstrating an increase in knowledge may be because there were only two questions for each survey. Having just two questions is a small number to obtain significant results when working with sample *t* test. An additional explanation for why I found what I did concerning the support subscale is that for time 1 the scores were already in the high range. The students in the class may have had other influences that led to a superior level of knowledge on support needed for survivors of domestic violence.

In addition, the findings did not support the hypothesis that there would be an increase in civic attitudes at the end of a college domestic violence course. Perhaps people who already had high civic attitudes may have enrolled in the class. In addition, there may not have been an increase because there may have been other influences before the students took the course that created a high level of civic attitudes for the students. Another explanation for why I did not find what I hypothesized is that the class did not focus in trying to change the students civic attitudes rather just teach them general knowledge about domestic violence. A service learning component to the class might be more likely to cause an increase in civic attitudes.

This study improves upon past studies by having participants voluntarily take the evaluated course and by educating college students. In previous literature, studies, such as Schwartz et al. (2006) and Weisz and Black (2001) programs that educated young men and women on domestic violence were evaluated. Both studies based on the literature had involuntary participants. This study had students who voluntarily signed up for the domestic violence course and took the surveys. In regards to the study by Wolfe and Jaffe (1999) there were evaluations of six school-based prevention programs for high schools and middle schools. The present study discussed, improves upon the past study because there is a focus on college students who are also at risk for domestic violence. This study is important because by educating more college students, especially college women, on domestic violence it could lessen the occurrence of dating violence. Minimizing the risk of dating violence is important in society because of the seriousness of consequences.

Limitations of the Study

One limitation that constrains this research was the limited number of students in the study. With the data collected, changes in attitudes were found; however having a larger sample size would enable us to test for relationships that may not have emerged as significant because of the small sample size and inadequate power in this study. Thus, generalizations cannot be made for domestic violence courses taught in other schools.

A second limitation is that the participants were undergraduate students. High school students, as well as graduate students, who are taught at school about domestic violence could display different results, or rather, contribute to our knowledge about the effectiveness of programs designed to increase knowledge about domestic violence. Furthermore, the undergraduate students in the class were predominantly women; and studies are needed that assess changes in attitudes among young men. An additional limitation was that one of the measures was developed by the primary researchers for this study and support has not yet been demonstrated for the psychometric properties of the instrument.

Conclusion

Despite the limitations, however, the results of these analyses do provide an important contribution to the literature. If evaluating the course demonstrates an increase in knowledge of IPV, then the course may continue to be taught and further evaluated to study emerging relationships not yet found.

Recommendations for Future Research

Based on this analysis of the effectiveness of one college domestic violence course, students evidenced changes in general knowledge about domestic violence and understanding about the role of the advocate in working with victims of domestic violence. Yet, for future research it would be recommended to replicate the study with a higher number of participants and to use instruments with tested psychometric properties. In addition, including a service learning component would be important to assess for changes in civic attitudes.

By replicating the study with the above recommendations, additional information about the effectiveness of the domestic violence course could emerge. It is important to continue research on this study as dating violence is a high risk factor for college students. If an evaluation of the domestic violence course demonstrates an increase in knowledge on intimate partner violence, it may lead to more people becoming aware of the occurrence and consequence of domestic violence. As society becomes more aware of this salient issue, additional precautions may be taken by people who could be involved in a violent relationship. The consequences of intimate partner violence relationships are severe and include depression, suicidality, posttraumatic stress disorder, and alcohol abuse. If women take a domestic violence class, their increase in knowledge might lead to fewer IPV incidents which have shown to cause health consequences. Future research may provide ways of how to teach college students about domestic violence and possibly reduce future involvement in violent relationships.

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The Migration of Salvadoran Social Activists into the Washington, D.C. Metropolitan Area: A Research Proposal

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Abstract

Various factors lead to the “unprecedented” migration of millions of Central Americans, and more specifically, Salvadorans, to the United States (Lungo Uglés, 1996). One of the factors was an ongoing civil war in El Salvador throughout the 1980s and early 1990s that quickly gained U.S. support, and contributed to the deaths of at least 80,000 people and the displacement of roughly 20 percent of the total Salvadoran population (Cordova, 2005). This study looks at a specific subset of Salvadorans that migrated to the United States during and after the conclusion of the war. Through qualitative methodology, the use of case studies, and a literature review on texts highlighting social activists in Latin America, this study attempts to examine what the motives were for Salvadoran social activists to migrate to the Washington, D.C. metropolitan area after participating in a 12-year civil war. By interviewing individuals that immigrated to the Washington, D.C. Metropolitan Area after participating in the Salvadoran civil war as social activists, this study will reveal information about this subset of Salvadorans such as: (1) their immigration process, (2) their current living situation in the U.S., (3) their ties with El Salvador despite leaving that country, (4) their experiences within the war as social activists, and (5) their thoughts on the result of the war. Moreover, this study will also reveal information about the social movement itself in El Salvador before and during the war, along with its distinct characteristics.

Introduction

I was entering my third year in college when I, along with other curious second generation Latino students, learned and became conscious to the fact that we lived amongst the second largest community of Salvadoran-Americans in the United States. We learned this fact through our United States Latino Studies course, where we also learned about the Treaty of Guadalupe Hidalgo, the Chicano Movement in the 1960s, and the various migration waves of Latin Americans throughout the 1900s, among other key moments that lead up to the state of Latinos in the U.S. today. Learning about Latinos in the U.S. was a new experience for my classmates and I, as we got the opportunity to learn about our history for the first time in a classroom environment. This class pushed my inner thrive to learn more about my own Salvadoran history and understand *why* my family members decided to follow a migration wave into the United States. I soon learned that the majority of my family that left El Salvador in the 1980s did so for their safety. They fled El Salvador in the middle of what felt like a never-ending civil war, and migrated along with thousands of other Salvadorans to the Washington, D.C. Metropolitan Area. Finally being able to understand the reasons for thousands of Salvadorans to emigrate from their troubled country allowed me to somehow feel connected with my Salvadoran history. For the first time, I could explain why so many Salvadorans now live in the United States.

As a second-generation Salvadoran-American growing up in Prince George’s County, Maryland, I had learned very little about not only my own identity as a Latino, but also my identity as a Salvadoran-American living in the Washington, D.C. Metropolitan Area. Coming from a family that migrated to the United States as early as 1975, and living in an area with a large Salvadoran population, I developed an interest to learn more about my identities as a Latino and as a second-generation Salvadoran-American. Unfortunately, learning about my identity could not be accomplished through K-12 school, as little to no emphasis was put into teaching about Latinos in the U.S. This study is, in a way, an opportunity for me to learn more about my identity and Salvadoran history, as well as the identities and histories other second generation Salvadoran-Americans who went through the same or similar experiences as I have.

This study is merely a continuation of my curiosity to learn more about my Salvadoran history and its complexities. While learning about the Salvadoran civil war and its makeup, I was curious to learn more about the social activists that challenged their government for political change. I knew that I had an aunt who lives in Maryland that identified herself as a social activist, but it was something that she preferred not to talk about. Once I learned about the patriotism that social activists displayed for their country through the written stories of Eugenia, a commander in the FMLN;

Omar Cabezas, a social activist from Nicaragua; and various other stories from a book titled “Sandino’s Daughters,” I knew that fighting for their beliefs was the number one priority, and they would stop at nothing to complete their goals. I wondered why, then, a social activist would decide to migrate to the U.S. after fighting for a cause that this country actively fights against. Through a qualitative methodology and the use of interviews, this study will attempt to uncover what the motives were for Salvadoran social activists to migrate to the U.S. after participating in a 12-year civil war.

A Glance at the Salvadoran Civil War

This paper will make references to the Salvadoran civil war in order to have a better understanding of how historical events in El Salvador lead up to the present context of Salvadorans living in the Washington, D.C. Metropolitan Area. The Salvadoran civil war officially lasted 12 years, from 1980 until 1992. This war was fought between a U.S.-backed Salvadoran government and a Left-wing organization comprised largely of peasants, laborers, students, and others, called the Frente Farabundo Martí para la Liberación Nacional, or the Farabundo Martí National Liberation Front (FMLN), that “began a military campaign against the [Salvadoran] military forces and repressive government organizations” (Cordova, 2005).

In 1980, extreme Right-wing death squads were formed, targeting “labor leaders, intellectuals, professionals, organizers, Catholic priests, lay workers, and anyone who attempted to change the social system (Cordova 2005). These individuals were responsible for the assassination of Archbishop Oscar Romero, a vocal and nationally known activist within the Catholic Church who preached about Liberation Theology and the freedom of the oppressed. As stated by Cordova (2005), “the early 1980s were marked by an escalation of military repression, political assassinations, and large-scale violations of human rights in the civilian population.” In this classic Left versus Right war, the conclusion was dealt with by the United Nations through a peace accords signed in 1992 by the Salvadoran President Cristiani and the FMLN. The accords lead to the demobilization of both parties’ troops, and formally ended a war that left 80,000 people dead and forced a displacement of 20 percent of the total Salvadoran population (Cordova, 2005).

Salvadorans Migrate to Washington, D.C.

Throughout the 1980s and continuing onto the 21st century, Washington, D.C. has evolved into the third largest home for Central American migrants, whether documented or undocumented, in the United States of America (Repak, 1995). As stated by Repak (1995), “in recent decades, increasing numbers of Central Americans were leaving their countries because of internal wars, human rights abuses, and economic hardships... Washington, D.C. [has] become a magnet for international migrants.” Of all the Central American migrants, however, Salvadorans have established the most noticeable presence. In the mid 1990s, *The Washington Post* “estimated that 80,000 Salvadorans lived in the District and 100,000 more resided in the surrounding suburbs” (Repak, 1995). 180,000 migrants in the Washington, D.C. Metropolitan Area alone are staggering numbers in comparison to the 15,000 Salvadorans that legally entered the United States in the 1960s (Repak, 1995). The high rate of Salvadoran migration into the Washington, D.C. Metropolitan Area has been an ongoing phenomenon since the 1970s, correlating with events that happened prior to, and during El Salvador’s 12-year long “popular” civil war (Cordova, 2005). Throughout the prolonged civil war, El Salvador faced a displacement of 20 percent of its total population as thousands of individuals sought to escape government repression and economic constraints in their home country. The majority of these individuals migrated to the U.S. (Cordova, 2005).

Washington, D.C. has become a centralized location for developing Salvadoran communities as “the Salvadoran population settled mostly...near the area of Adams Morgan, Park and 14th Street; and 16th street and Columbia Road, N.W.,” and then later dispersed throughout the suburbs of Maryland and Virginia (Luna, 2008). Seeking a land of better opportunities, Salvadorans who escaped the civil unrest of their country made Washington, D.C. their new home – a city that just so happens to be the face of the U.S. federal government. This is ironic because while job opportunities were booming in Washington, D.C., Salvadoran migrants ended up living in the same city where key U.S. government figures made decisions on national immigration and foreign aid policies that directly affected them and their country. Salvadoran migrants lived next door to the government officials that decided to aid the Salvadoran government during the civil war, aiding mainly through military efforts that contributed to thousands of deaths in a 12-year span. During these times, however, the new Salvadoran migrants probably cared more about their financial success rather than where their political views stood. If that meant going to the nation’s capital, then so be it.

Research Questions

The research questions that will guide this study attempt to merge the topics of social activism and migration together in order to get a better understanding of the social conditions in which FMLN supporters lived through in El Salvador and to help uncover why they decided to migrate into the Washington, D.C. Metropolitan Area. Past research from Repak (1995) does not mention whether the migrants interviewed for that book were actively involved in the Salvadoran civil war or not. This leaves readers to make the assumption that most, if not all, Salvadoran migrants did not play a role in the civil war. This study focuses on a particular sub-group of migrants that were involved in the Leftist movement during the Salvadoran civil war. Throughout this study, the following question and sub questions will be addressed:

1. What were the motives for Salvadoran social activists to migrate to the United States after participating in a 12-year civil war?
 - a. What has happened to the Salvadoran social activists that migrated to the United States?
 - b. What attitudinal changes do they have after the war?

Purpose of Study

The purpose of this study is twofold. In one hand, this study will contribute to the scholarly work of authors such as Repak (1995) and Cordova (2005) on Salvadoran migration into the Washington, D.C. Metropolitan Area. This will be done by studying a subset of the Salvadoran migrant group that lives in the Washington, D.C. Metropolitan Area despite their participation in the social movements during El Salvador's civil war. The second portion of this study involves delving into the lives of social activists as they recall their experiences during the FMLN movements, and then share why they made the decision to migrate to a country that they once referred to as their "enemy" (Alegría, 1987). The purpose of doing this is so that readers could gain a better understanding as to why Salvadorans emigrated from their country and settled in the Washington, D.C. Metropolitan Area. In this case, the Salvadorans who emigrated were not only civilians, but also individuals who played active roles throughout the war.

Significance of Research

The significance behind this research could be substantial from a historical perspective. In the literature used to help guide this study, authors have never taken into consideration the fact that there may be Salvadoran migrants living in the U.S. today who were involved in social activist movements. This could possibly be because social activists in Latin America were simply not expected to leave their country. They were sworn to do anything within their power to overthrow their country's government. This meant that emigrating from their country would be considered an act of betrayal for abandoning their people and not living up to the expectations of fighting for a revolution until their death (Alegría, 1987).

This study would be the first step into documenting a different aspect of the Salvadoran migration into the Washington, D.C. Metropolitan Area. Another significance and contribution of this research is that it will help reveal information about the social movement in El Salvador itself, through the eyes of social activists before, during, and after their active participation in the war. Gender issues and recruiting methods will be revealed in this study through the eyes of the individuals being interviewed, as well as how the Salvadoran social movement differs from other movements in Latin America. The individuals interviewed in this study will be asked to explain the various gender roles in the FMLN, as well as the recruiting methods that FMLN employed. This will help reinforce the idea that women played essential roles in revolutionary movements, help determine to what extent females were allowed to take part in a revolution, and help reveal how FMLN was able to recruit members into their organization.

Literature Review

In order to get a better understanding of the social conditions that the FMLN supporters lived through in El Salvador, one must first learn about the Salvadoran civil war itself. This section will provide an overview of events leading up to the civil war, including the first major peasant revolt in 1932, and the formation of FMLN through various organizations. This section will also give an overview of the influence that the U.S. had on this war by aiding the Salvadoran military in an effort to prevent the FMLN supporters from winning the war and overthrowing the current government.

Background

Throughout the mid 1800s and onto the early 1900s, El Salvador served as an agricultural supplier, producing indigo and coffee as its main crops (Schmidt, 1996). By the late 1800s, however, coffee sales surpassed that of indigo. The high demand for coffee meant better opportunities for El Salvador to increase its national income. According to Schmidt, “large estates dedicated to this crop became the basis of the wealth of the famous ‘14 families,’ a new oligarchy whose grip over Salvadoran life contributed to the development of revolutionary conditions” (1996). Exporting coffee proved to be successful for El Salvador until the great depression severely impacted coffee prices. The individuals that suffered the most from this depression were the indigenous and peasants that worked the land in El Salvador. The poor working conditions that these individuals lived through from having “no money, food, or shelter,” caused them to revolt against the oligarchy government (Cordova, 2005). This revolt, which was deemed a communist threat, was unsuccessful as the Salvadoran National Guard executed anywhere from 10,000 to 30,000 indigenous workers in a span of three weeks (Cordova, 2005). The National Guard also assassinated the rebels’ leader, Farabundo Martí, whose name would be taken up in the 1980s by the guerrilla organization, Farabundo Martí National Liberation Front (FMLN).

Political and economic tension continued from 1932 until the start of the Salvadoran civil war, as military presidents reigned and used military force to suppress anyone that spoke out against the government. The economic state of El Salvador was also unbalanced, as it went in the favor of only the wealthiest families in the country. By the 1960s, income distribution was noticeably unequal. In 1961, 12 percent of rural families were landless, and by 1975, the percentage went up to 29 (Lungo Uclés, 1996). Lungo Uclés (1996) notes the following:

Between 1960 and 1979, Salvadoran industry expanded at an average rate of better than 6 percent per year – almost twice the pace of growth of the agricultural sector. Few of these benefits reached the Salvadoran lower classes, however, particularly those in the countryside.

If one were to simply glance at the Salvadoran industrial production and Gross Domestic Product on a national scale without knowledge of the unbalanced income distribution, El Salvador would look like an economically flourishing country. The unequal income distribution on social classes, however, is one of various reasons that lead the country of El Salvador into war. Lungo Uclés (1996) notes how unequal the income distribution was:

Income distribution was highly unequal: 63 percent of Salvadoran families earned slightly more than 28 percent of total income, averaging less than 10 dollars per month per family; the wealthiest 6.2 percent of families, on the other hand, gained the share of total income, averaging about 650 dollars each. The poorest 20 percent of Salvadorans earned one-fiftieth of the country’s income, while the most comfortable 20 percent earned two-thirds.

As the income distribution became even more unbalanced, labor unions began to form to seek better wages, better working environments, and benefits (such as health care for workers). In the 1970s and 1980s, the Catholic Church also became active in its practice of Liberation Theology, which “address the social realities of the poor in this world” (Cordova, 2005). Archbishop Óscar Romero increasingly took the side of the poor, preaching Liberation Theology not only in masses, but also in his own radio show. As a result of priests working with students and labor workers, various organizations were created such as Young Christian Students, Young Christian Workers, Young Christian Farm Workers, etc. (Cordova, 2005).

The Salvadoran government identified student-based organizations and labor unions as communist movements. By the late 1970s, death squads were formed through the military and national police force (Cordova, 2005). Members of the death squads were typically soldiers or policemen dressed in plain clothes that would target and assassinate any particular person or group that was thought to have communist intentions. Only weeks after Archbishop Romero wrote a letter to President Jimmy Carter pleading to not send military aid to El Salvador, a member of the Salvadoran death squad shot him in the heart during mass (Cordova, 2005).

The Civil War

While the Salvadoran government was putting pressure to eliminate any communist efforts, there were Leftist organizations that were seeking a revolution in the country of El Salvador. With Cuba having a successful revolution, and Nicaragua on the verge of overthrowing the Somoza dictatorship, the Leftist organizations in El Salvador felt a pressure to have a revolution as well. In 1980, five different organizations merged together to form the Frente

Farabundo Martí para la Liberación Nacional, or Farabundo Martí National Liberation Front (FMLN) (Lungo Uclés, 1996). This militant and well-organized group of individuals had the proper recruitment strategies to gain forces and fight against the Salvadoran military. One of the most unique features of the Salvadoran civil war is the fact that women were active participants in the movement. From nurses to commanders, women were an integral part of the Salvadoran civil war. After the demobilization that took place in El Salvador, it was determined that “approximately 40 percent of the FMLN membership, 30 percent of the combatants, and 20 percent of the military leadership were women” (Kampwirth, 2002).

Despite Archbishop Romero’s plead to President Carter about not sponsoring the civil war, the U.S. gave the Salvadoran government \$5.9 million in direct aid for the war months later. Between 1980 and 1988, the amount of aid given to El Salvador from the U.S. reached \$3.4 billion, with a peak \$196.5 million given for direct aid to the war in 1984 alone (Lungo Uclés). That money allowed the Salvadoran military to purchase weaponry, pay soldiers, and make whatever other purchases they needed to defeat the FMLN forces. FMLN on the other hand, would have to use survival strategies to gain weaponry. Tactics such as taking a soldier’s gun and ammunition were critical for social activists in order to sustain constant attacks. While the war did start in the countryside, it gradually moved to the cities and became an urban warfare (Cordova, 2005).

After 12 years of continuous battle, 80,000 deaths, 9,000 disappearances, and about 20 percent of the total Salvadoran population was displaced (Cordova, 2005). It was also determined that “more than 95 percent of...human rights abuses were carried out by the armed forces and its death squad allies” (Kampwirth, 2002). In 1992, the Salvadoran civil war came to a conclusion. The United Nations mediated a peace accords between the Salvadoran President Cristiani and the FMLN. By December 14, 1992, both FMLN and the government troops were demobilized, and the end of the war was celebrated (Cordova, 2005). A year after the conclusion of the war, an amnesty law was enacted in El Salvador that protected both the military and the FMLN from any human rights abuse accusations. This law ultimately benefited more military members as the 95 percent of human rights abuses mentioned by Kampwirth (2002) would never be taken up in court. There is a disconnect between the awkward ending of the civil war and today, as no one besides the social activists know what happened to them after the war itself. This study will attempt to mend that disconnect so that it can be understood why some social activists decided to migrate to the U.S.

Methods

This empirical study will employ qualitative methodology, the use of case studies, and will analyze texts as well as images in order to gain an understanding as to why Salvadoran social activists migrated to the Washington, D.C. Metropolitan Area. For this study, 25 individuals will be asked to participate in individual interviews. These individuals should be Salvadorans that currently reside in the Washington, D.C. Metropolitan Area, and were participants of the Salvadoran activist movements during the civil war. Of the 25 individuals, either 8 or 10 individuals will be selected for the study. Due to the nature of the study, half of the participants will be Male, and the other half will be Female. This will be to ensure that there are no bias results for the questions regarding gender roles in the movement. Questions that will be asked in the interviews will reveal information about the participants such as: their immigration process, what their current living situation is like in the U.S., whether or not they have ties with El Salvador despite leaving that country, their experiences within the war as social activists, and their thoughts on the results of the war. The interview questions can be found in the appendix of this paper. Images from social activist movements will be analyzed in this study in order to confirm the gender roles and relations.

Images

Images of social activists during the Salvadoran civil war will also be analyzed in this study. They can be found in an online site from a non-profit museum named “The Museum of the Word and the Image.” This museum is based in El Salvador, and is “dedicated to investigating, rescuing, preserving and displaying to the public various elements of Salvadoran history and culture” (Museo). The website has a database with pictures, videos, and books that have relevant information to the civil war. Once I obtain the right to use and analyze these images, they will be used to help confirm any descriptions that the interviewers may share. These images serve as proof that women were very much a part of the social activist movements, just like men.

Texts

Apart from the text used for the literature review portion of this research, various texts were read to help develop interview questions for the participants. Texts such as *Guerrilla Warfare*, by Ernesto Che Guevara; *Las mil y una Historias de Radio Venceremos* (*The thousand and one stories of Radio Venceremos*), by Jose Ignacio LópezVigil; *Fire From the Mountains*, by Omar Cabezas; *They Won't Take Me Alive*, by Claribel Alegría; *Sandino's Daughters*, and *Gathering Rage* by Margaret Randall. With the exception of *Guerrilla Warfare*, these books retell the stories of various social activists from El Salvador and Nicaragua. This is critical in understanding the social conditions that these individuals underwent while they were social activists in their countries. It is through these stories that one becomes aware of the struggles and triumphs of a social activist. Much of the information covered in these books is not found in articles. Topics such as gender issues in the social movements, recruitment efforts, the sustainability of a social activist organization, and the personal struggles of individuals can only be grasped through these texts. These texts will help guide and analyze the results of this study. *Guerrilla Warfare* is helpful in understanding the militant aspect of forming an organization that will forcefully overthrow a government, like in the case of Cuba. This text has been used as a manual for guerrilla forces in their revolutionary movements. Social activists in the novels read often make references to this manual.

Interviews

Due to the qualitative nature of this study, interviews are the means by which I will be collecting my verbal data. Since this study bridges the topics of migration into the Washington, D.C. Metropolitan Area and social activism in El Salvador during the 1980s, the interview questions ask participants to reveal information such as (1) their immigration process, (2) their current living situation in the U.S., (3) their ties with El Salvador despite leaving that country, (4) their experiences within the war as social activists, and (5) their thoughts on the result of the war. In order to extract all this information, the interview questions have been organized in three groups: "Immigration," "El Salvador," and "Postwar." This will allow me to easily extract information in a more organized manner.

Conclusion

Since this study has not yet been implemented, this section will describe which part of the research phase I am in, what I plan to do in the upcoming year, and when I plan to conclude the study. The interview questions have been written (see appendix) and are ready to be used pending approval from the Institutional Review Board (IRB). I expect to get approval from the IRB in the upcoming weeks so that I can begin to look for potential interviewees. Due to the delicate nature of this study, it is important to gain the trust of each individual that will be interviewed. For this reason, I plan on first interviewing my aunt who considers herself a social activist. From there, I will ask for her help to obtain the number of participants needed. The interviews of each applicant with their transcripts should be completed by the end of Fall 2010 semester. I will then continue this study by analyzing the interviews and images during Spring 2011, and will finalize the project by next year.

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Appendix 1

Interview Questions/Preguntas de entrevista

Immigration/inmigración

How long have you been living in the United States?
¿Cuánto tiempo tiene de vivir en los Estados Unidos?

Where in the United States do you reside?
¿Dónde vive en los EE.UU.?

What influenced your decision to immigrate to the United States?
¿Cuáles factores influyeron su decisión de emigrar a los EE.UU.?

Why did you decide to live in the Washington, DC metropolitan area?
¿Por qué decidió vivir en el área metropolitana de Washington, D.C.?

What occupation do you currently have?
¿En qué trabaja?

¿How and why did you immigrate / come to the United States?
¿Cómo y por qué inmigró a los EE.UU.?

How would you describe your life in the United States today? Is it what you expected?
¿Cómo describiría su vida en los EE.UU.? ¿Es lo que usted esperaba?

Are you satisfied with your decision to immigrate? Why?
¿Cuán satisfecho/a está con su decisión de inmigrar? ¿Por qué?

El Salvador

Do you visit El Salvador? If yes, how often? Why?
¿Visita usted El Salvador? Si lo hace, ¿con cuánta frecuencia? ¿Por qué?

Did you leave any immediate family members in El Salvador? Who?
¿Tiene familia en El Salvador? ¿A quiénes?

What are your memories of El Salvador in the 1980s?
¿Qué memorias tiene de El Salvador en los años 80?

Were you involved in any social activist movements during the 1980s?
¿Estuvo usted involucrado/a en algún movimiento activista social en los 80?

How did you become involved? Why?
¿Cómo se incorporó? ¿Por qué?

How long did you participate?
¿Cuánto tiempo participó?

What or who influenced your decision to join the movement?
¿Qué o quiénes influyeron en su decisión a incorporarse al movimiento?

What contributions do you think you made to this movement?
¿Cómo contribuyó usted al movimiento?

How do you think others perceive you when they find out you were involved in the movement?
¿Cómo cree usted que otros lo/la perciben al saber que usted estuvo en el movimiento?

In your eyes, who was a part of the movement? Why did they join?
En su opinión, ¿quiénes formaron parte del movimiento? ¿Por qué participaron?

How involved were peasants in the movement (as suggested by Che Guevara)?
¿Cuán involucrados estuvieron los campesinos en el movimiento (como sugiere Che Guevara)?

What do you think was the average age for social activists in the movement?
Según usted, ¿cuál era el promedio de edad de los activistas en el movimiento?

In your opinion, how did the number of women compare to the number of men in the movement?
En su opinión, ¿cómo se comparaba el número de mujeres y hombres en el movimiento?

What were the different gender roles and relations like within the movement?
¿Cómo eran los roles de las mujeres y los hombres en el movimiento? ¿Cómo era las relaciones sociales entre ellos?

How were these social activists recruited?
¿Cómo se reclutaba activistas sociales al movimiento?

Do you think that the Catholic Church had an impact in recruitment efforts? How and why?
¿Piensa usted que la iglesia católica tuvo un impacto en el reclutamiento? ¿Cómo y por qué?

Postwar/postguerra

What are your thoughts about the result of the war?
¿Qué piensa usted ahora de la guerra y de sus resultados?

How has your involvement in the movement impacted your life today?
¿Cómo ha impactado su participación el movimiento en su vida actual?

Do you feel that your involvement in the movement affected your immigration process? Why and how?
¿Piensa usted que su participación en el movimiento ha afectado su proceso de inmigración hoy día? ¿Cómo y por qué?

Would you like to share anything else about your experience as a social activist?
¿Quisiera decir algo más sobre sus experiencias como activista social?

Thank you/Gracias

Understanding Great Britain: A Case Study of Britain's Asiam Female Muslim Population

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Abstract

This qualitative case study research project examines the perceptions towards Muslim women in Great Britain after 2001. This study is based upon a historical framework that seeks to determine the historical developments of perceptions, both positive and negative,—after determining what said perceptions were—that ranged across all aspects of life: the political, social, public, and private. The women in this study range, in majority, from Pakistan, and are anchored in its discussion about young Muslim women ranging from 18 years of age to 30 years of ages that reside in Great Britain.

This qualitative case study answers one main research question that serves as an umbrella effect for the smaller four subset questions that guided and constrained this project. These questions reveals an extreme lack of discussion about the different and distinct experiences of Muslim women from Muslim men living in the West, specifically Great Britain for the constraints of this paper, the almost complete lack of appearance of Muslim women in the public sphere, especially women whom chose to wear the veil. These findings are supported by evidence collected from many forms of media, demographic and statistical evidence all of whom is based and firmed by modern scholarship.

The findings of this study revealed key conclusions: 1) There is complete absence of Muslim women outside of the veil issue; 2) Muslim women are seen as a threat to “Western lifestyle” and 3) gives insight into the growing Islamic Feminist Movement through the actions of young Muslim women. Through the use of literature, media, politics, and the historical process this study focuses on the perceptions towards Muslim women in all walks of life.

Introduction

The 1979 Iranian Revolution, or more commonly known as the Islamic Revolution, has had a lasting and continual impact on the external and internal of the Islamic and non-Islamic nation-states and societies. Since the Islamization politics of Ayatollah Khomeini, Western society and politics have been laden by growing and intensifying fears of Islam—through the help of 9/11, the London Bridge bombings, and the Madrid bombings—that have helped in creating and establishing racial and ethnic tensions and stereotypes. This continual process and issue known as Islamophobia, leads on to the problem embedded in this case study: the negative perceptions towards Muslim women in Great Britain.

This study does not follow the belief that Muslim women are a threat to the society and culture of the West but seeks to understand why and in what fashion Muslim women in Great Britain are seen as a problem and in what ways are they discussed. This problem is exaggerated b the lack of information in sources that focus on the experiments of Muslim women in the West; except for cases relating to the various forms of the veil—the hijab, naqib, burka, etc.

Purpose of Proposed Research and Research Questions

The purpose of this study was to explore and understand the historical process and development of perceptions, negative and positive, towards Muslim women in Great Britain in seeking to better understand British perceptions to all “Black” immigrants within Great Britain. This study also generally and broadly explored said perceptions towards Caribbean, African, Indian, and other Asian immigrants to Great Britain. This study is not interested in the reasons behind why European Muslim women chose to veil themselves or the important implications said actions have on British, and more globally the larger Western society. Instead this research only focuses on the perceptions towards young Muslims—veiled and unveiled—which involves an understanding of said women themselves but all an understanding of the perpetrators of the perceptions—negative and positive—towards these women.

Taken as a case study, Great Britain allowed this research to better understand the specific and diverse cultures and societies within the Islamic Diaspora through the constraints of the following research questions:

1. What is the demographic makeup of the Muslim population in Great Britain?
2. What, if any, are the perceptions towards Muslims in Great Britain? Muslim women?
3. How are Muslim women depicted in the public sphere? The political?
4. How does modern scholarship address the issue of Muslim women in Great Britain?

Taken together, these three questions fall under a larger and broader umbrella questions: What, if any, are the perceptions, positive and negative, towards young Muslim women in Great Britain.

Significance of the Study

The significance of this study can be summarized into three topics and themes

1. Affects on political decision-making
2. Islamic Diaspora and Islamophobia
3. Growing Fundamentalism

Affects on Political Decision-Making

Since the 1979 Iranian Revolution, the Western population has become constantly and consistently enamored with images of a growing fundamentalist Middle East with little to no positive feeling towards the governments and peoples of Western societies. This sparked an interest, in said Western societies, in gaining more knowledge about Middle Eastern politics, society, and culture so that proper Foreign affairs decisions can be made about how to properly handle one's nation's self interest while still gaining partnerships in international politics.

Islamic Diaspora and Islamophobia

While Islam is the second largest religion in the world with one billion plus self identifiers; members of this Diaspora also identify with Islam according to cultural and ethnic definitions. This research and those similar seek to understand this large and eclectic population. By understanding the differences and similarities within this population, researchers and politicians will then be able to better understand the environment in which Islamic fundamentalism becomes appealing to members of this population; especially members living in Western nations and societies.

Growing Fundamentalism

The recent actions of the Christmas underwear bomber (www.bbcnews.com) has shown that Islamic fundamentalism is becoming more and more attractive to peoples that have historically been considered "immune" to such tactics and beliefs. Fundamentalism is spreading. American citizens, European citizens, children of non-fundamentalism families and backgrounds, peoples whom the police would never consider as potential suicide bombers have become attracted to extremist groups. This is a major problem that must be researched and understood so that: 1) a better understanding can occur of this large and diverse population and 2) the fight against these extremist groups can continue and hopefully result in less human casualties.

Researches like this and many others seek to understand this drastic and very fatal shift and how to combat the growing interest in Islamic Fundamentalism.

Definitions

The following definitions, most of which are used very commonly, are the meanings of these words when used in context of this research and paper.

Muslim – an individual that religiously, culturally, and/or ethnically defines himself/herself as Muslim.

Islamic Fundamentalism – refers to Sunni or Shiite extremist groups and/or non-governmental institutions that promote martyrdom tactics towards Western peoples/cultures/societies/etc..

Great Britain – all lands belonging to that of the United Kingdom: England, Scotland, Wales, and Northern Ireland.

Islamophobia – the fear that Islam (its beliefs and practices), especially in its extremist fundamentalist form, will "infect" one's Western society and permanently change the government, peoples, culture, society, and landscape of that nation.

Analysis and Discussion of the Literature and Presentation of Analytic Framework

Primary Sources

The qualitative part of my research involved the use of primary and secondary sources. The use of primary sources (tabloids, newspapers, blogs and websites) allowed for me to get an in-depth look at the minds of Britons. As primary source documents tell a lot about a population and what is deemed important enough to spend money and time on printing and writing about it.

Tabloids and Newspapers

During my research, I spent a lot of time analyzing the following UK tabloids: “Mirror”, and “The Sun”. While reading the stories and comments made by viewers of these three different tabloids a few similarities became apparent: 1) the intended audience for said tabloids, 2) the lack of information on people of color and 3) lack of information and anything with Islam.

As one reads through each respective website it becomes glaring obvious that these sites are geared towards male Britons specifically White male Britons. This is important because of the nature of the tabloid business. The point of these tabloids are to make money from as much people as possible, therefore, by limiting the intended audience of the literary I was able to conclude that: 1) there is an inherent bias within British culture towards anyone who is not White male Briton and 2) by limiting their intended audience the owners and editors of these tabloids allow me to determine that Muslim women are not deemed and audience in which profit can be made.

Secondly, the lack of information on/towards people of color gives us insight into British culture and society that is very important in this research. This lack of information shows that people of color, who do make up a considerable amount of the British population, are not a viable audience. This is an important point because it leads us to understand that while Britain is a mixed culture and society, there still exists bias and racism that affect day to day life. The above points lead to the question of so what? Why should I care about British bias towards people of color in a research project on Muslim women? The answer leads us to our next point.

The above points allows me to point one more conclusion, that since tabloids are catered towards White male Britons and there is a major absence of people of color there will be little to no content/information about Islam in general or Muslim women specifically. As my research took me further and further into these tabloids my hypothesis proved correct. There was no information about or towards Muslim women. This lack of information gives us just as much, if not more, information about British culture. Tabloids reflect the current trends and consistent interest of a culture and nation, therefore because there is no information about Muslim women—who do make up an important part of British population—shows these women are deemed unimportant and unnecessary to the common arena of British society and therefore no discussion, negative or positive is necessary.

Blogs and websites

After gaining such important information from researching UK tabloids, I sought more information to confirm or deny my results I took the next step and begin investigating blogs and websites ranging across different topics and themes. While researching the blogs, my result mirrored that the information found from researching the tabloids. However, while researching certain websites, I came across websites centered on Neo-Nazism and KKK-like beliefs and agendas. These sites were informative in their nature due to the information that was present and not present. The deemed “enemies” of the United Kingdom, according to the writers and producers of these sites, were any non-White Britons who according to these sites had no right to be there. The constraints of this research is not interested in the personal and political beliefs of said groups, however, one particular behavior pattern of these groups is important to this research project: the tendency to connect Islam with Muslim males. This behavior is very important for this research because of the removal of Muslim women from the forefront of said groups’ discussions.

Topic Two: Secondary Sources

Finding and analyzing primary source document, while important and necessary for the legitimacy of this project, made up only fifty percent of the literary sources. The use of modern scholarship serves two main and important purposes. First, by finding, researching and analyzing documents/books/texts/ journal articles I was able to determine if the conclusions and findings determined from an analysis of the primary sources documents discussed above accurate and sound. Secondly, secondary source documents are important in a research project of this nature because it is of

the utmost importance for I to be in discourse with members of higher education especially in fields that discuss information dealing with the topic of this research.

Strengths, Limitations, and Implications of Literature

While researching and analyzing both primary and secondary source documents, my research was strengthened by the in-depth discourse on Islam, its impact and implications and Western societies, real and imagined and so forth. However, after much researching and analysis I found that a major gap in the literature existed surrounding scholarly discourse on the impact of Muslim women on Western society, real or imagined and positive or negative, that limited that amount of information gained throughout this project. The reasons behind this gap in the literature is not important at this stage in the research, however, what is important is that this gap exists. Outside of the overwhelming information found on Muslim women and the various forms of the veil, this gap in literature limited the nature of the researching in terms of its ability to discourse with the scholarly environment.

Research Design and Methodology

Purpose of Proposed Research and Proposed Research Questions

The purpose of my proposed research is three fold. Firstly, this research is important for its impact on the research community because it will add to the continuing discourse in said community about the growing impact and implications of Islam in the Middle East and North Africa as well as its growing appearance in Western societal landscapes. By posing this research interest and its subsequent research questions this project was able to successfully pose, conduct, research, analyze and present findings that adds to the numerous amount of research already done and possible future research.

Secondly, as an undergraduate student vastly interested in the implications of Islam outside of the Arabian Peninsula, this research project stemmed from a growing and intensifying interest in “non-traditional Islam.” By using the phrase “non-traditional Islam” I seek to veer away from the belief system held by many, whom are greatly ignorant of Islam, that “traditional Islam” equates with tanned men with long beards speaking Arabic and pronouncing the name of Allah before a bomb was set off. By us “non-traditional Islam” I put into words my desire to learn more about a population that follows a set of rules and edicts dictated by religious, cultural, ethnic and gender-specific boundaries that has since Islam’s conception become intertwined and in some cases blurred. As a historian, I must here make the clarification that these boundaries and their dilution over time are not specific to Islam and that Islam follows a patten similar to that followed by the other two great monotheistic religions, Judaism and Christianity, with Islam being the “child” of the trio.

Finally, the purpose of this purposed research was to educate the masses. As with things in higher education, the experts are those who have devoted years to immersing themselves in the literature and have been in discourse with scholars and other experts, however, those who are not involved in higher education or are not interested or invested in the topic, or those similar, of this project fall into the category of the masses. This project, like many others, seeks to be in direct discourse with members in higher education but also seeks to inform members of the masses about a population and topic that is negatively sensationalized in Western societies.

The purpose of the research questions served to create proper boundaries for this project. By posing questions that were the perfect mixture of general and specific for the time constraints of this project, I was able to ask appropriate questions of which I could and did answer at the conclusion of my research.

Literature Sources and Methods for Analyzing the Literature

Researching involves undertaking the task of not only finding sources and literature but also analyzing what was found and what was not found. Gaining my sources from peer reviewed journal articles, websites and blogs, newspapers and tabloids, and books I analyzed the literature with the following criteria:

1. Does this literary sources discussion topics pertaining to my topic?
2. Does this source hold a discussion about Islam? Islam in Great Britain?
3. Does this source enlighten me about: Islam, Muslim women, Great Britain, Britons, political and social structures of Great Britain’s immigrant population?
4. Is this source gender specific?

5. Does this source hold a discussion about Muslim women? If so, what is said and in what context? If not, why is not said and why?
6. Where did the author of this source gain its primary and secondary source information?
7. Does this source hold Muslim women in a positive or negative light?
8. Are Muslim women discussed? In what context are Muslim women discussed?
9. By using these questions I was able to shift through the eclectic amount of literature having to do with my research so that I could focus properly and specifically as well as properly analyze the texts.

Anticipated Limitations of Future Research

At the conclusion of this research project I was able to determine that future research on this topic or topics similar will encounter limitations in the literature. While the interest in Islam has greatly increased in the last thirty years much of this discussion deals solely with a discussion about the “Islamic experience” from the male perspective. As men and women are inherently different and experience different modes of social and cultural indoctrination. These inherent differences will hinder future research specific to Muslim women and their inherent experiences.

Findings, Conclusions and Recommendations for Future Research

Findings from the Literature Related to the Proposed Research Questions

Findings from this research can be properly analyzed and explained through the understanding of each individual question.

Question One: What is the demographic make-up of the Muslim population in Great Britain?

According to the UK mid-2003 report, the United Kingdom has a total population of 59.6 million people; of Christianity is the largest religious group with 71.5% self-identifiers with Islam being the second. This data is important because it shows that this research project has a Muslim population in Great Britain in which to study.

This study focuses on the Asian Muslim population in Great Britain. Again relying on literature, I was able to focus my research on Pakistani, Bangladeshi, and Indian Muslims.

Question Two: What, if any, are the perceptions towards Muslims in Great Britain? Muslim women?

By breaking down these perceptions towards Muslims into two categories I was able to see if there were any actions/reactions to Muslims as a whole and then compare and contrast those holistic actions to only Muslim women, my interest group. Through researching the primary and secondary literature I was able to determine that perceptions towards Muslims in the public and political sphere were surrounded around Muslim males and their supposed threat to British society.

When seeking to understand if any perceptions towards Muslim women existed I found a gap in both my primary and secondary sources. There was little talk surrounding Muslim women and their impact on British society even though they represented a good portion of the second largest religious group in Great Britain. This lack of information shows that Muslim women are deemed unimportant to the greater society: they are neither a threat nor a friend, they are placed in the neutral and ambiguous middle where little conversation is done about them except on the issue of the veil.

Question Three: How are Muslim women depicted in the public sphere? The political?

The depiction of Muslim women in Great Britain can be categorized into two major headings: ambiguously and negatively. Firstly, the depiction of Muslim women in the public sphere is ambiguous in nature due to the lack of discussion about said women. This lack creates a gray area in British society; Muslim women are a major part of British society and yet they lack public discussion, negative or positive, about this population group which shows their ambiguous place in society. In other words, Muslim women are members of British society but because there is little discussion about them in tabloids and news papers I am able to see the true nature of British society and culture versus that of population statistics.

Secondly, the depiction of Muslim women in the political sphere tends to veer towards negative discussion and Muslim women and the veil. As has become glaringly evident, Muslim women who chose to veil themselves are seen as a major threat to Western society and thought. Whether or not this line of thinking is correct is outside of the scope of

this project, however, this project does deal with the fact that such discussion and line of thinking exists. In other words, because British society believes that Muslim women who chose to veil themselves are a threat, negative perceptions are created and intensified towards Muslim women in Great Britain.

Question Four: How does modern scholarship address the issue of Muslim women in Great Britain?

Modern scholarship, secondary source documents in this research project, addressed the experiences of Muslim women either as those similar to that of Muslim men or as only existing in a discussion of the veil. This assessment of course does not involve a discussion of Islamic Feminism literature as it is out of the constraints of this project and paper. This limitation within modern scholarship shows great insight in Islamic culture and society. One must remember that religion is separate from culture which in turn is separate from ethnicity. The culture of the Islamic Diaspora is patriarchal in nature; this is not constrained to the Muslim population as Western societies are patriarchal in nature as well. By having literature that focuses, for majority, on the experiences of Muslim men as the experiences of Muslim men and women, I am able to determine there a limitation in the literature because of the nature of Islamic culture.

Conclusions Based on Analysis of the Literature

This project has show important flows in British society and Western societies at large. The absence of Muslim women from the public eyes shows “their lack of importance”. This

A second conclusion drawn from this research is the threat to Western lifestyle that Muslim women and the veil are said to present. This conclusion is important because it shows that in the minds of Western societies Muslim women = veiled women. This presents a problem as not all Muslim women veil themselves and those who do chose to veil themselves do so for varying reasons and those who do veil wear the veil to varying degrees.

The final conclusion form this research project has shown that there is a major gap in sources about Muslim women that does not touch on the subject of the veil. I do not seek to lessen the importance attached to the veil in the eyes of Muslims; I however seek to understand this population from different angles and points of views which is very necessary for a better understanding of the Islamic Diaspora.

Recommendations for Future Research

At the conclusion of this research, I would recommend future research in the growing field of Islamic Feminism and its impact on Middle Eastern and Western societies. This research would be of great importance to our modern society because it would study the type(s) of feminism, the impacts and implications of feminism on an historical patriarchal society. Another recommendation for future research would be an exploration of Muslim women who do not wear the veil in contrast to those who do. This research would be important because it would allow for an understanding of the veil and the many reasons Muslim women chose to veil themselves or chose to refrain from the wearing of the veil—both in Western and Muslim societies.

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Current Benefits Offered to Maryland State Employees: How This Has Affected the University of Maryland, College Park LGBTQI Faculty and Staff

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Abstract

The purpose of this study is to identify and explore how the current benefits offered to Maryland state employees has affected the University of Maryland, College Park Lesbian, Gay, Bisexual, Transgender, Queer, and Intersex (LGBTQI) faculty and staff and their same-sex domestic partner. Examining how Federal and Maryland State Laws govern employee benefits offered at the University of Maryland, College Park could reveal inequity, if any inequities exist among LGBTQI faculty and staff and their same sex domestic partner. Within this paper I disclose the inequity mandated by the federal government and pertains to how the benefits are taxed for LGBTQI employees. Unveiling on a state level how LGBTQI faculty and staff are unable to utilize their employee benefit of both the Family Medical Leave Act (FMLA) to care for their LGBTQI partner and how tuition remission is not extended to their domestic partner as well. The conceptual framework utilized is Adams equity theory. The core concept of Adams equity theory is the employee interpretation of fairness, essentially the evaluation of social exchange in relationships (Dalton & Cosier, 1983). Fairness is measured by the efforts an employee puts into their job and the rewards they receive. In this particular study the efforts of being and fulfilling their requirements as an employee and the rewards are the benefits being offered. The following questions guided this study: (1) what are the current benefits offered to all faculty and staff members employed at the University of Maryland, College Park? (2) How are the current benefits achieved and maintained?

Introduction

The Lesbian, Gay, Bisexual, Transgender, Queer, and Intersex (LGBTQI) leadership class I took my junior year at the University of Maryland, College Park (UMCP) elucidated and highlighted various styles of leadership. "Exploring Leadership for College Students who want to Make a Difference," written by Susan R. Komives, Nance Lucas, and Timothy R. McMahon (2007) brought forth one stratifying element of leadership in which they introduced the "Relational Leadership Model" (p. 73). The Relational Leadership Model is comprised of five primary components, which are inclusive, empowering, purposeful, ethical, and process-oriented. Komives, Lucas, and McMahon continue by stating how:

This approach to leadership is purposeful and builds commitment toward positive purposes that are inclusive of people and diverse points of view, empowers those involved, is ethical, and recognizes that all four of these elements are accomplished by being process-oriented. (p. 74)

Thus Relational leaders are inclusive, empowering, purposeful, ethical, and process-oriented. Therefore, the framework of the Relational Model is connecting and incorporating these five key elements within one's leadership role to motivate a positive social change. The core components of the Relational leadership model has guided my leadership role to motivate a positive social change for LGBTQI employees hired at the University of Maryland, College Park by conducting research and highlighting how LGBTQI employees and their domestic partner are subjected to inequitable benefits. I will continue by highlighting how the work of Eric Marcus (2002) in "Making Gay History: The Half-Century Fight for Lesbian and Gay Equal Rights," has further developed my leadership role.

Eric Marcus (2002) in "Making Gay History: The Half-Century Fight for Lesbian and Gay Equal Rights," gives in depth comprehension of the trials and tribulations the LGBTQI community has faced both on an individual and national level. In particular, I was moved by Marcus's discussion of the period from 1973 to 1981, which he refers to as the Coming of Age. The "Coming of Age" for the LGBTQI movement was just past the June 28th 1969 Stonewall

riot. Marcus stresses the importance of visibility by stating:

To young gay people who were coming of age just a few years later, in the early to mid-1970s, the world was a dramatically different place from what it had been in 1968. The lesson for both surviving and newly formed gay and lesbian organizations was that lasting change would take time and require persistent hard work... [m]uch would still depend on the courage of individual gay men and women to publicly acknowledge their homosexuality. (p. 187)

Highlighting how the 70's were a time of being openly gay, Marcus (2002) introduces the notion that, "the fight for gay and lesbian equal rights had evolved through: the development of organizations and discussion groups beginning in 1950," (p. 187). He illustrates how:

[L]ocal gay rights organizations across the country focused on immediate issues, such as the passage of gay rights legislation. In dozens of cities they succeeded in convincing elected officials to protect gay men and women from discrimination by adding "sexual orientation" or similar phrases to existing antidiscrimination laws. ... [and how]... organizations also focused their efforts on combating police harassment, overturning state sodomy laws, and increasing visibility in the media. (p. 187)

Marcus's discussion of the impact and effectiveness of organizations enabled me to understand the importance of becoming an effective leader to motivate social change of the LGBTQI community by realizing the importance of visibility.

Incorporating the ideology of the Relational Leadership Model with the works of Marcus was and still is effective in bringing about a social change for the LGBTQI community. Yet, more importantly, in my opinion this model has developed leadership identity within the queer community by fortifying and bringing visibility to each sub group of the community; hence the L, the G, the B, the T, the Q and the I!

In the introduction I brought forth the importance of LGBTQI organizational development and how these developments create visibility. Most importantly I quoted the work of Marcus (2002) in which he stressed how:

... local gay rights organizations... succeeded in convincing elected officials to protect gay men and women from discrimination by adding "sexual orientation" or similar phrases to existing antidiscrimination laws. These laws often already included provisions forbidding discrimination based on race, color, creed, gender, and religion. (p. 187)

As Marcus (2002) stated there are federal provisions protecting classes of race, color, creed, gender, and religion. Consequently, creating invisibility on a federal level for LGBTQI citizens since sexual orientation is not a protected class. As a result there is not a federal law mandating same-sex domestic partners of employees entitlement to the benefits guaranteed to heterosexual married couples. Therefore the LGBTQI employees have no federal protection at all. Examining how federal and Maryland State law affects the University of Maryland, College Park LGBTQI faculty and staff will create visibility for the LGBTQI community as well as display my leadership role for LGBTQI social justice.

Problem Statement

The obstacles that some Lesbian, Gay, Bisexual, Transgender, Queer, and Intersex (LGBTQI) employees at the University of Maryland, College Park experience due to homophobia and heterosexism reveal inequity within the system. Nichols and Scott (2005) in "Campus Climate for Lesbian, Gay, Bisexual, Transgender (LGBT) Faculty and Staff" contend that:

The Climate for LGBT faculty and staff is clearly an important concern for many campus citizens. While much of the environment is viewed as generally positive by both LGBT and non-LGBT respondents, the lack of equity in benefits remains the largest concern for LGBT faculty and staff. Both groups indicated that additional improvements to the climate can be made with targeted investments ranging from increased leadership communication to enhancing the infrastructure for entities that serve the LGBT community. (p. iii)

The lack of equity in benefits at the University of Maryland, College Park (UMCP) enabled the faculty and staff members who self-identify as LGBTQI and non-LGBTQI colleagues to observe how heterosexism and homophobia within their campus climate prevented equity in the workplace. LGBTQI faculty and staff at the University of Maryland, College Park:

Spoke of the individual burden they bore as a result of the lack of benefits; many more expressed the view that this exclusion sends a message that they are less valued than their colleagues, or that it is okay to continue to discriminate against this group of people (Nichols & Scott, 2005, p. ii)

LGBTQI faculty and staff conveyed how this inequity devalues them and creates the message that discrimination is okay. More importantly this campus report was published four years before the state extended benefits to LGBTQI employees however inequities still exist. Federal policies and Maryland state law govern health insurance, medical plans, and benefits for all Maryland state employees. Therefore the inequities that some self-identified LGBTQI faculty and staff encounter are not necessarily a reflection of the University of Maryland, College Park itself. With that being stated here is my research question: How has the current benefits offered to Maryland state employees, affect the University of Maryland, College Park LGBTQI faculty and Staff and their same sex domestic partner? This is a problem worthy of investigating for 2 reasons: (1) examining the current benefit options for LGBTQI faculty and staff hired at the University of Maryland, College Park, will reveal the inequity between LGBTQI and non-LBGTQI faculty and staff (2) learning how the benefits are achieved and maintained may reduce future inequities, if any inequities exist.

Purpose of Study and Research Questions

The purpose of this study is to identify and explore how the current benefits offered to Maryland state employees has affected the University of Maryland, College Park LGBTQI faculty and staff and their same sex domestic partner. In order to determine how the current benefits offered to Maryland state employees has affected the University of Maryland, College Park LGBTQI faculty and staff and their same sex domestic partner one must figure out the current benefits and how these benefits are achieved and maintained. Given that the purpose of this study is to address inequitable benefits among faculty and staff employed at the University of Maryland, College Park the following questions will guide this study:

1. What are the current benefits offered to all faculty and staff members employed at the University of Maryland, College Park?
2. How are the current benefits achieved and maintained?

Significance of Research

Examining employee benefits will expose inequity based upon sexual orientation. According to Rubenstein (1993), "There is no natural law against employment discrimination" (p. 74). As a result current benefits offered to LGBTQI employees and to LGBTQI same sex domestic partners at UMCP must be examined in order to disclose inherit heterosexism. Secondly, illustrating how these benefits are achieved and maintained will make evident of the inherit homophobic burden bestowed upon LGBTQI faculty and staff.

Summary of Analytic Framework

Although several theories exist regarding equity theory, Adams equity theory anchored this study. Goodman and Friedman (1971) define Adams' Theory by illuminating how:

Inequity exists for Person whenever he perceives that the ratio of his outcomes to inputs and the ratio of Other's outcomes to Other's inputs are unequal. This may happen either (a) when Person and Other are in a direct exchange relationship or (b) when both are in an exchange relationship with a third party and Person compares himself to Other. Outcomes refer to rewards such as pay or job status which Person receives for performing his job. Inputs represent the contributions Person brings to the job, such as age, education, and physical effort. Outputs, a term not used in the definition, refer to products of Person's work, such as the number of interviews completed or pages proofed. (p. 271)

Based upon Adam's Equity theory, the measurement of equity is illustrated below:

Inequity exist when:

$$(P) \quad O:I \neq (O) \quad O:I$$

Therefore, inequities exist when LGBTQI employee outcome, input ratio does not equal heterosexual employee outcome, input ratio. This inequity is present when LGBTQI employee same-sex domestic partner do not receive the same benefits as married heterosexual spouses or when LGBTQI employees are taxed heavily by the IRS for the same benefits offered to non-LGBTQI employees and the taxation bestowed upon LGBTQI employees cease to exist for non LGBTQI employees.

Delimitations of Research

Delimitations of the research within this particular study has little or nothing that focuses on hiring and promotion discrimination, recruitment and retention discrimination, mentorship and leadership discrimination, LGBTQI safety on campus and LGBTQI safe space signs displayed within departments, benefits options at other institutions within in the University System of Maryland besides University of Maryland, College Park (if they differ), on campus resources for LGBTQI faculty and staff. Additionally missed voices of LGBTQI individuals who did not participate within the studies articulated within the literature, focus groups, or case studies used to guide this study contributed to delimitations of research.

Definitions Related to Research

LGBTQI: stands for Lesbian, Gay, Bisexual, Transgender, Queer, and Intersex. However, what exactly constitutes an individual to be Lesbian, Gay, Bisexual, Transgender, Queer or Intersex? According to the *LGBTQ America Today: An Encyclopedia*, they define Lesbian as a person who “encompasses a broad range of definitions that include, but are not limited to, sexual and social relations between women” (Hawley, 2009, vol. 2, pg. 661). Gay is defined as a term “specifically to men who are exclusively sexually attracted to men, though it is often used to describe all people who have sexual desire for people of their own sex” (Hawley, 2009, vol. 2 p. 422). Bisexual is defined as “a person’s capacity for sexual/emotional/romantic attraction to people of more than one gender” (Hawley, 2009, vol. 1 p. 132). As Susan Stryker puts it, transgender is defined as “people who move away from the gender they were assigned at birth” (cited in Hawley, 2009, vol. 3 p. 1210). Queer is defined as “a synonym for odd or strange... questionable character... male homosexual practices,” (Hawley, 2009, vol. 3 p. 978). Intersex is defined as “ a biological condition wherein an individual is born exhibiting genetic characteristics of both biological sexes,” (Hawley, 2009, vol. 3 p. 595).

Analysis and Discussion of the Literature and

Presentation of Analytic Framework

In the introduction, I proposed the research question: How has the current benefits offered to Maryland state employees, affect the University of Maryland, College Park LGBTQI faculty and staff and their same-sex domestic partner? In order to answer the research question the following questions will guide this study:

1. What are the current benefits offered to faculty and staff employed at the University of Maryland, College Park?
2. How are they achieved and administered?

Research Question #1: What are the current benefits offered to faculty and staff employed at the University of Maryland, College Park?

The current health insurance, medical plans, and benefits offered to all faculty and staff members employed at the University of Maryland, College Park consists of the following:

- Medical
- Vision
- Dental
- Prescription Coverage
- Mental Health/Substance Abuse Plan

- Personal Accident and Dismemberment Coverage
- Flexible Spending Account
- Life insurance
- Long Term Care
- Long Term Disability
- Tuition remission
- Sick Leave
- Family Medical Leave Act (FMLA)
- Leave of Absence Without Pay (LAW)

Research Question #2: How are benefits achieved and maintained?

Benefits are achieved and maintained by becoming employed at the University of Maryland, College Park and maintained by fulfilling Maryland state laws and policies as well as federal laws and policies that govern the health insurance, medical plans, and benefits for all Maryland state employees. So, how has the current benefits offered to Maryland state employees, affect the University of Maryland, College Park LGBTQI faculty and staff and their same sex domestic partner? The benefits aforementioned affect UMCP LGBTQI faculty and staff and their same sex domestic partner because they are inequitable. They are inequitable for two main reasons: the first is mandated by the federal government and pertains to how the benefits are taxed, the second consisting of tuition remission being offered to married heterosexual spouses and dependents yet are not offered to same sex domestic partners and dependents. Cahill and Tobias (2007), authors of “Policy Issues Affecting Lesbian, Gay, Bisexual, and Transgender families,” illustrates the inequity between domestic partners and married couples by stating:

Even when same-sex couples earn the same as heterosexual married couples, they often pay more in taxes and are eligible for fewer elements of the social safety net, such as Social Security survivor benefits. For example, domestic partner health insurance, when offered, is taxed as income. In comparison, spousal health insurance, which married heterosexual couples can access, is tax-exempt... [while] [l]ow- and moderate-income gay families confront obstacles because many public policies and private employers do not recognize their families. Poor lesbians and gay men grapple with a welfare system that increasingly favors married heterosexual couples over single parents and all unmarried couples, including same-sex couples. (2007, p. 18)

The inequity illustrated by Cahill and Tobias (2007) currently exists within the state of Maryland. LGBTQI faculty and staff benefits are taxed as income whereas non-LGBTQI benefits are tax-exempt. Currently LGBTQI employees have their premiums deducted the same way as heterosexual employees. The issue is how same sex partner benefits are deducted and imputed differently than that of heterosexual spouses. Currently, heterosexual spouses and dependent deductions consist of the employee paying 20% of the annual benefit out of pocket while the state subsidy covers the remaining 80%. LGBTQI partners and dependents premiums are subjected to pre-tax and post-tax deductions that result in imputed income. Imputed income is explained on page 5 of the “State of Maryland (July 2010-June 2011) Guide To Your Health Benefits,” stating that:

For each group health insurance plan where there is an Employee contribution and State subsidy in which you enroll your domestic partner and your domestic partner’s eligible dependents, you are subject to tax withholding on the State’s contribution towards the coverage for those dependents not qualified as tax dependents under the IRS code. In other words, the State’s contribution towards coverage for your domestic partner and your domestic partner’s dependents is considered wages and is included in your taxable gross income subject to tax withholdings.

The table below creates a visual interpretation of the pre-tax, post-tax, and imputed income of LGBTQI employees plus domestic partner medical coverage benefit. The information listed in the table below can be found in the State of Maryland: Guide to Your Health Benefits, July 2010-June 2011 website.

Benefit Coverage:	Monthly Deduction	Bi-Weekly Deduction
Post-tax	\$61.68	\$30.84
Pre-tax	\$49.35 = \$111.03-\$61.48	\$24.68
Imputed Income	\$301.17 = \$362.85- \$61.68	\$150.59
Non-LGBTQI	\$111.03	\$55.51

The Employee premium is \$61.68 and that is the post-tax deduction. When you subtract \$61.48 from Employee + one coverage, which is \$111.03- \$61.48 = \$49.35. The \$49.35 amount is the monthly pre-tax deduction. Lastly, imputed income is the Fair Market Value (FMV) subtracted from the post-tax deduction, “in this example, the FMV equals the total cost (Employee plus State contributions) for **Employee Only** coverage, which is \$362.85 per month,” (University Human Resources, n.d.). So, when the employee premium is subtracted from the FMV the remaining balance is the imputed income, which is **\$362.85-\$61.68= \$301.17**. While married heterosexual employees and their spouse monthly deduction is **\$111.03**, hence a \$200 monthly difference. As a result, we are able to grasp how the “lack of equity” in employee benefits expressed within the UMCP Campus Climate Report still exists. Most importantly the lack of equity in imputed income is not a law or policy of the state of Maryland; it is mandated by the federal government, facilitated through the Internal Revenue Service (IRS).

The second benefit that is achieved by being employed at UMCP yet diminishes once one discloses their sexual orientation is the Family Medical Leave Act (FMLA). The FMLA is a federal law and was signed into congress by President Clinton in 1995. The FMLA guarantees a 12 week unpaid leave during a 12 month period for the birth of a child, adoption, care of a family member, or serious health condition so that a employee would not lose their job. However the FMLA does not apply to same-sex couples or partners. Cahill and Tobias (2007) stresses how the FMLA, “discriminates against same-sex couple families” (p.38). They continued by explicating the discrimination same sex couples endure by arguing that, “The federal FMLA provides up to twelve weeks of unpaid leave after the birth or adoption of a child, to facilitate recovery from a ‘serious health condition,’ or to care for an immediate family member who is extremely sick. But ‘family’ is defined specifically to exclude same-sex couple families” (Cahill and Tobias, 2007, p. 38). Cahill and Tobias highlights how the federal definition of family is based upon the Defense of Marriage Act (DOMA), in which they state how “DOMA...[bans] federal recognition of same-sex marriages...allowing states to refuse to recognize such marriages performed in other states” (p. 30). They continue by illustrating how:

DOMA defined marriage as a union between a man and a woman. The bill thereby ensured that federal benefits would be denied to same-sex couples if, at some point in the future, they won the right to marry in any particular state. DOMA also enabled states to ignore valid marriages entered into by same-sex couples in other states. (p. 61)

As for the state of Maryland, LGBTQI faculty and staff are unable to utilize their FMLA benefit to care for domestic partners.

The third and final benefit that is not extended to domestic partners of LGBTQI employees is tuition remission. Tuition remission is offered to both full-time and part-time employees, and is extended to their spouse and dependent children. However, tuition remission is not extended to the spouse and or dependent children of domestic partners. Each eligible employee, spouse, and dependent can register for a maximum of eight credits for fall and spring semester, four credits for winter term, and a total of eight credits combined for summer session I and summer session II. Full-time and part-time employees are eligible for tuition remission benefits at any University System of Maryland (USM), as well as Baltimore City Community College, St. Mary’s College of Maryland, and Morgan State University

(University Human Resources, n.d.). Coursework must be done at the employee's home campus unless the program is not offered at the home campus" (University Human Resources, n.d.). Strikingly, tuition remission is not offered to domestic partners. Tuition remission applies to employees and married heterosexual couples only.

Research Design and Methodology

Research design and methodology for this particular study consisted of qualitative research and literary analysis of the current benefits offered to Maryland state employees. Focusing on the impact that it has had on LGBTQI employees hired at the University of Maryland, College Park. The methodology consisted of utilizing the data that were examined by the Campus Climate report conducted at the University of Maryland, College Park. The purpose of the Campus Climate Report was to figure out, What is it like to be a sexual or gender identity minority – LGBTQI – and work at College Park? The focus of the study examined LGBTQI faculty and staff interpretation of equity in comparison to non-LGBTQI faculty and staff. Additionally I relied heavily upon the data that can be found in the State of Maryland: Guide to Employee Benefits handbook and the Associate Director of Employee Benefits, Dave Reiger to clarify and confirm accuracy of inequity bestowed upon LGBTQI faculty and staff and their domestic partners aforementioned in the above literature section.

Findings, Conclusions and Recommendations for Future Research

Findings

The findings of the Campus Climate Report conducted on campus in 2005 concluded that inequity exist between LGBTQI employees and non-LGBTQI employees due to the "lack of equity" in employee benefits. When this report was conducted benefits for LGBTQI employees ceased to exist, LGBTQI employees was not granted benefits until 2009. However, the Campus Climate Report is relevant because inequity continues to exist even after the extension of benefits. Inequity in LGBTQI employee benefits is currently present because their benefits are treated as income and is taxed heavily. Additionally their same sex domestic partner is denied their benefit of tuition remission and the Family Medical Leave Act even though they fit the same criteria of their married heterosexual colleagues.

Conclusions

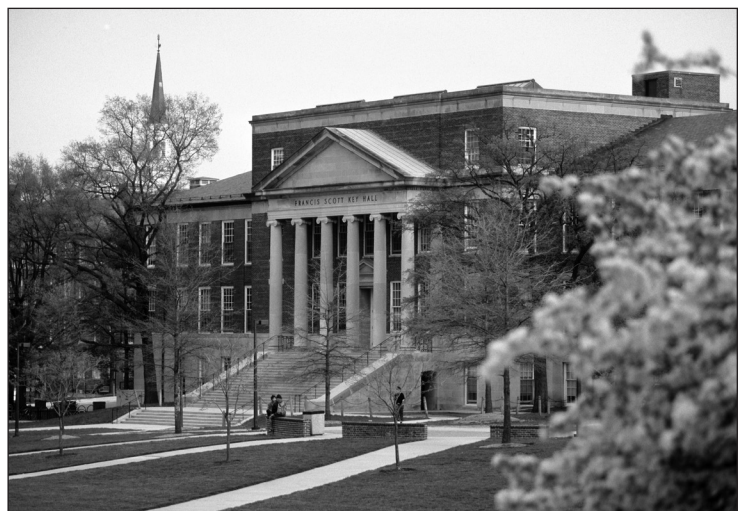
Based on the analysis of the literary research I was able to conclude that the University of Maryland, College Park LGBTQI faculty and staff and their domestic partner do not receive equitable benefits. Each and every employee hired at the University of Maryland, College Park are entitled to every benefit offered. However inequity is present when heterosexual married spouses are entitled to receive tuition remission and LGBTQI domestic partners are not entitled to receive remission tuition. Inequity continues because currently LGBTQI employees cannot utilize their employee benefit of the Family Medical Leave Act to care for a domestic partner yet married heterosexual employees are capable of utilizing their employee benefit of the Family Medical Leave Act. Furthermore, LGBTQI inequity will continue to exist because the federal government treats the benefits offered to LGBTQI employees as if it is income and their benefits are taxed heavily. Whereas non-LGBTQI employees' benefits are tax free.

Recommendations for Future Research

In the future I would like to research LGBTQI workspaces within a particular state that allow LGBTQI marriage. Researching LGBTQI workspaces within states that allow marriage will enable me to compare and contrast the differences among benefits offered. Most importantly researching LGBTQI workspaces that accept LGBTQI marriage will enable me to determine if the benefits are equitable in comparison to their married heterosexual co-worker.

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The Art of Appreciation: The Value of Art and Its Role in a University Community

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Abstract

The visual arts play an important role in the aesthetic environment. The condition of the aesthetic environment has the potential to have positive or negative effects on people. Understanding the importance the visual arts play in enhancing an academic and social environment within a university campus is important in order to maximize the role of the university. The university today has become the chief agent in formulating and handing on our cultural tradition- this is what its visual environment should make visible. By providing visual artwork which represents social responsibility and artistic substance, as well as by offering an educational forum in which dialogue between artist and viewer and art and community is encouraged the university can provide outside learning experiences for students and faculty to be continually engaged in critical thinking about abstract concepts and academic issues. Research surrounding the possible negative or positive effects the conditions of an aesthetic environment can have on individuals is lacking and the scope does not extend as far as college, rather focusing on the visual environments of elementary schools. When considering the role of the visual arts in terms of its display within the buildings of a university community the value and importance can often be overlooked or greatly misunderstood. The purpose of this research inquiry can be defined in with three progressive goals; identify key characteristics to evaluate tangible attributes which make a visual art piece “valuable” and thus significant for an academic community, find research and literature which will support an understanding of the value and importance of viewing and purchasing art in a tangible context for a university, and finally developing a measure to discover and recognize how members of the university community perceive the role of the arts in their environment. With this proposal I hope to bring attention to the importance of the visual arts in higher education and the role of the arts in enhancing an academic environment.

Introduction

The visual arts play an important role in academic community, fostering critical thinking, inspiring creativity, and pushing viewers to move past the tangible knowledge into that which can only be conceived through a process of deeper engagement and thought. When considering the role of the visual arts in terms of its display within the buildings of a university community the value and importance can often be overlooked or greatly misunderstood. The tendency for the visual arts to be seen as frivolous and perhaps less important than other ventures occurring within a universities academic community, is a trend that is seen across various stages of educational systems. In times of financial crisis the arts are often quickly weaned down.

There are many advocates for the art in education cause, there are various organizations and associations which stand to protect the visual arts place within education, however what is missing from the argument is strong empirical research surrounding what tangible, measurable benefits can be documented from an education that embraces the importance of the arts.

When considering the role of visual arts within a university community the perceived value is even more precarious. What is the university’s responsibility to the student body in terms of art and culture? The role of the visual arts within a university does not follow an outline which would might be found in an elementary school, the value may not come from requiring students to engage with some tactile form of art, rather in a more reasonable sense to make art viewing a common part of every students daily experience by displaying meaningful and thoughtful visual art displays.

Therein lays the problem, with an economy that is current financial crisis how would one justify the purchasing of expensive contemporary art over other cost reducing benefits for students like scholarships? In essence the justification of art purchasing lies in the ability to convey what in explicit terms the importance of viewing and interacting with visual arts, the benefit to the university community as a whole, and the university plays in providing enriching opportunities to not only compliment the college experience, also to enhance the academic communities across discipline.

The purpose of this research inquiry can be defined in with three progressive goals; identify key characteristics to evaluate tangible attributes which make a visual art piece “valuable” and thus significant for an academic community, find research and literature which will support an understanding of the value and importance of viewing and purchasing art in a tangible context for a university, and finally developing a measure to discover and recognize how members of the university community perceive the role of the arts in their environment.

Within this research proposal the initial investigation begins with understanding all of these aspects defined with the purpose in a more literal way. What role do the visual arts play within a university’s center for student life building, where students from every academic background have an opportunity to interact with the art? The aesthetic environment of educational buildings plays an important role in the student’s interactions within that environment, thus this proposal will focus on the value the visual arts add to an aesthetic environment as a whole.

What makes purchasing art important or valuable? Answering the question how to justify the purchasing of expensive contemporary art, the same question could be posed to almost every academic community. While it would be ideal for the university to admit as many students as the possible can and making college more affordable through scholarships by cutting back funding for projects on campus. The college experience is made up of mixture of experiences which work together to create a cultural awareness. It is during this time that the university has an opportunity to influence and provide an academic experience that results not only well taught students, but contributors to a cultural society beyond themselves and those who look like them. The visual environment of university communities is an important component of fostering culture and outside-of-the-classroom experiential learning opportunity. Edward Sekler (1965), in his classic essay *The Visual Environment*, for *The Fine Arts and the University*, writes:

It goes without saying, however, that there are a number of factors which make the responsibility of the university greater than that of most other big organizations. One of them is the special cultural impact and prestige which, of necessity, is attached to its actions. The university today has become the chief agent in formulating and handing on our cultural tradition- this is what its visual environment should make visible... For this reason a university cannot apply to its visual environment the same considerations of economical profitability that would prevail in a commercial undertaking. (p.86)

Setting the university apart from other entities instills the idea that because there is something special which sets it apart, in the sense of its goals and responsibilities the argument for the importance of culture within that small environment can be made more profoundly.

Developing a tangible understanding the visual arts provide for an academic setting will provide empirically based and founded support for the merit of the arts which are often overlooked. It is also important to understand the types of visual art a university should invest in to provide maximum benefit for the school and the students.

Theoretical Perspectives

When considering theories which provide understanding to the importance of the aesthetic environment as it relates to educational settings, two theories, looking at them in correlated manner, influenced and added support to the ideas within this literature review. The first theory used was Bronfenbrenner’s Ecological Systems Theory, an educational psychology theory which specifies four types of nested environmental systems, with bi-directional influences within and between the systems. Bronfenbrenner posits that development is an influenced by interacting systems with the child at the center. The outer layers, larger more abstract concepts trickle down to affect the child in more specific ways as you move through each layer.

The innermost system is identified as the Microsystem. The microsystem is the setting where the individual lives; it includes family, peers, school, classroom environment, and neighborhood. This system is where the most direct interaction with the individual occurs, with the individual also helping to construct the settings within this system.

The Mesosystem refers to how the relations between entities in the microsystem. How home interacts with school and school interacts with peer relationships.

The next system the Exosystem does not directly involve the individual, but still impacts them. A common example would be a parent’s job does not directly affect the child, however the experience the parent has at the job and how this experience affects the individual is where the interaction becomes evident.

The Macrosystem discusses larger, broader concepts such as the culture the individual lives in and the many manifestations of incontrollable aspects that affect them, such as socioeconomic status, ethnicity, and country of origin.

Understanding how all these interconnected systems affect each individual is an important part of creating an effective learning environment. Universities create atmospheres that will be comfortable and stimulating for students of vastly varying backgrounds. Even more important to understand is the microsystem which directly relates to my inquiry about the importance of the environment on learning and social interactions. Within the microsystem are areas which directly impact the individual, the classroom and in this case the university can be seen as the classroom as social interactions and academic endeavors occur in various buildings across campus and is concentrated within a center for student life which brings together students from different backgrounds with common goals, a place to study, a place for relief and relaxation, and exciting activities that provide an outlet.

The second theory used for to understand aesthetic needs in general is found in Abraham Maslow's theory of personality, Maslow's Hierarchy of Need. According to Maslow we are all motivated by needs and our needs motivate us to action. Humans are born with their most basic needs known as biological and physiological needs such as air, food, drink, warmth, sex and, sleep. Abraham Maslow's Hierarchy of Needs helps to explain how these needs motivate us all. Maslow's Hierarchy of Needs states that we must satisfy each need in turn, starting with the first, which deals with the most obvious needs for survival itself. Only when the lower order needs of physical and emotional well-being are satisfied are we concerned with the higher order needs of influence and personal development. In order the needs are listed as follows; biological and physiological needs, safety needs, belongingness and love needs, esteem needs, recently added cognitive and aesthetic needs, and finally a need for self actualization.

Understanding aesthetic needs in terms of human satisfaction as a step before the ability for self actualization gives merit to the validity of the importance of an aesthetically pleasing environment.

Delimitations

While this study will investigate the role art within a university environment, this study will not address areas of art education or introducing the creative arts into academic curriculum. This study while addressing the importance of the aesthetic environment will not address the physical environment in terms of architecture. The discussion of the aesthetic environment will be used as a means to open up an inquiry of the explicit role the visual arts play within the aesthetic environment and to what extent does the role affect the university. This study will also be focusing primarily the value of having timely art within an area students of any academic background will have access, for a example a student center for life, as opposed to an art building which may not be beneficial for the campus community as a whole.

Definitions

In this section I would like to take an opportunity to define some commonly used terms within this proposal and put them in an explicit context in how it relates to discussion and use of them.

- **Visual Arts:** art form that includes the traditional fine arts such as drawing, painting, printmaking, sculpture, which are primarily visual in their construction.
- **Value:** The definable characteristics of an individual art piece which make it relevant, aesthetically pleasing, and beneficial for a university community to experience.
- **Aesthetic Experience:** An individual's personal interaction with the intrinsic features of a piece of art that elicits their attention and reflection encouraging deeper thought and critical thinking of subject matter with in the piece.
- **Visual/Aesthetic Environment:** The aspects of an environment or space which make it visually stimulating and appealing which go beyond architecture and into the creative and artistic sensibilities of creating an inviting environment, specifically for this study, the thoughtful selection of works of visual art on display in an engaging environment

Analysis and Discussion of Literature

Literature Review

Effects of Esthetic Surroundings

Psychologists such as Maslow and Mintz (1956) have found that visual-esthetic surrounding can have significant effects upon persons exposed to them. In their classic 1956 study, *Effects of Esthetic Surroundings: Initial Effects of Three Esthetic Conditions Upon Perceiving "Energy" and "Well Being" in Faces* where they set out to address the

lack of experimental studies on the effects of beautiful and ugly environments upon people. Tested short-term effects of three visual esthetic conditions; “beautiful room” (BR), “average room” (AR), and “ugly room” (UR).

Participants were taken to different rooms where they were left alone by some pretense and allowed to essentially soak in the atmosphere after which they were asked to rate feelings of well being, energy, fatigue, and displeasure from their perceptions of people’s expressions on note cards. The average ratings for “energy” and “well being” in the beautiful room were significantly higher (beyond the .001 level) than ratings in the ugly room mean of the ratings given by subjects in both the average and ugly rooms was in the range defined as “fatigued” and “displeased” significantly higher (beyond .05 level) than ratings in average room. The average ratings in average room were higher, but not significantly than ratings in ugly room. The group in the in the “beautiful” room gave significantly higher ratings (more “energy” and “well-being”) than groups in either the “average” or “ugly” rooms.

Essentially what this study suggest is that the conditions of our environments may affect our perceptions well being and energy which could in turn affect our social interactions with others within the same environment. While this study presented some interesting information regarding possible effects of negative or positive esthetic environments the results are not transferable due to a small sample size. Also the effects of the conditions may have been short term, and how could they prove that the subjects were affected explicitly by the aesthetic condition of the room.

Perceived Quality of Care

Arneill and Devlin (2006) conducted a study, *Perceived quality of care: The influence of the waiting room environment*, to understand what potential effects the aesthetic environment of physician’s waiting areas would have on potential patient’s perceptions of the physician’s quality of care. The study involved 147 college students (ages 18-24 yrs) and 58 senior citizens, (ages 59-90 yrs). Participants viewed 35 slides of physicians’ waiting rooms all varying in condition. They were asked at the beginning of the study to rate the physicians quality of care based solely on having viewed an image of their waiting room. The primary hypothesis was that perceived quality of care would be greater for waiting rooms that were nicely furnished, well-lighted, contained artwork, and were warm in appearance versus waiting rooms that had outdated furnishings, were dark, contained no artwork or poor quality reproductions, and were cold in appearance.

Factor analyses of the care and environment ratings produced factors consistent with the hypothesis making the results were consistent with their hypothesis. Participants largely rated those rooms which were nicely furnished as having better quality of care than those physicians whose waiting rooms were perceived cold and out dated.

Other literature focusing on the visual environment as it relates to academic performance and well being focus primarily on elementary schools. A study done by Killeen, Evans, and Danko (2003) *Role of Permanent Student Artwork in Student’s Sense of Ownership in an Elementary School*, suggest that displaying student’s artwork within the school fosters a deeper sense of belonging and encourages children to take an active part in their education and fosters a sense of student ownership in the learning process.

Implications of Literature

After having searched through the literature I have found there are many studies which address the issue of visual arts within the school, although primarily within the elementary school. The studies I have found which focus closely to my inquiries on the effects of aesthetic surroundings have provided useful resources, however as they are far and few in between the results are often inconclusive or perhaps it would be too much of a stretch to try and pinpoint a cause and effect essentially making the results co relational.

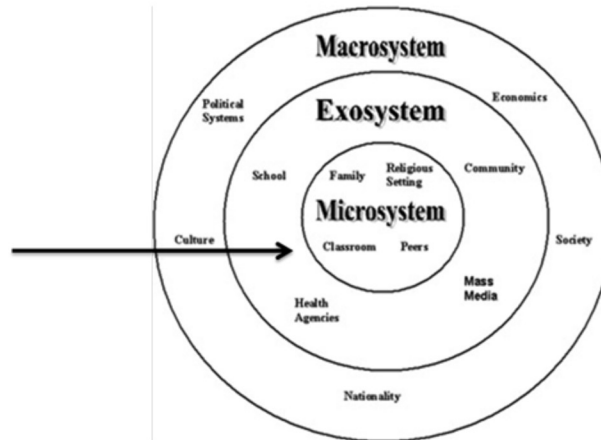
Theoretical Framework

I will discuss the main aspects which make each theory significant to this proposal rather than explaining each level of each theory.

The first theory ,an education theory, and the most prominent in this study, is Bronfenbrenner’s Ecological Systems Theory, which describes the ecological environment as a nested arrangement of structures, each contained within the next. Bronfenbrenner defined the innermost ecological environment, the microsystem, as discussed by (Kumar, O’Malley, & Johnston, 2008) “ as a pattern of activities, roles, and interpersonal relations experienced by the developing persons in a *given setting with particular physical and material characteristics* [italics added]” (p. 3). Essentially the climate educational and social interactions take place is just as important as the activities and experiences that occur within the environment.

In further discussion of Bronfenbrenner's systems it is important to note that this theory is based on the idea of interconnectedness throughout all of the systems which affect the "child" in this case the university student. Students are influenced by the all the many systems which stem outward from the microsystem. The model seen below [Figure 1], shows systems model with an arrow pointing towards the microsystem layer.

Figure 1: Bronfenbrenner's Ecological Systems Theory



The second theory used to further explain why the aesthetic appearance of the educational environment is important, Maslow's Hierarchy of Needs. This psychological theory proposed by Abraham Maslow is often seen in pyramid form to symbolize the progressive nature of humanistic needs and ability to achieve those goals. Maslow has set up a hierarchy of five levels of basic needs. Beyond these needs, higher levels of needs exist. These include needs for understanding, *esthetic appreciation* [italics added] and purely spiritual needs. In the levels of the five basic needs, the person does not feel the second need until the demands of the first have been satisfied or the third until the second has been satisfied, and so on. The aesthetic needs Maslow refers to could be described as an appreciation and search for beauty, balance and form. This understanding that humans need and search for aesthetic appreciations extends the argument for the need of art greatly. Suggesting that in order to obtain self-actualization, as aesthetic needs falls a level below the ultimate human satisfaction, presents the value of art as more than frivolous but essential to the human condition.

Research Design and Methodology

The purpose of this research inquiry can be defined in with three progressive goals; identify key characteristics to evaluate tangible attributes which make a visual art piece "valuable" and thus significant for an academic community, find research and literature which will support an understanding of the value and importance of viewing and purchasing art in a tangible context for a university, and finally developing a measure to discover and recognize how members of the university community perceive the role of the arts in their environment. Within this research proposal the initial investigation begins with understanding all of these aspects defined with the purpose in a more literal way. What role do the visual arts play within a university's center for student life building, where students from every academic background have an opportunity to interact with the art? The aesthetic environment of educational buildings plays an important role in the student's interactions within that environment, thus this proposal will focus on the value the visual arts add to an aesthetic environment as a whole. What makes purchasing art important or valuable?

Literature Sources and Methods for Analyzing the Literature

For this proposed study the majority of the literature used to further understand the proposed questions was found using the University of Maryland library systems Research Port, an online program which provides access to various academic databases with peer reviewed journals, graduate student dissertations, and other forms of information from a myriad of different fields. After narrowing down my search terms I focused on the select articles that were in close context with my interest with the aesthetic environment. Choosing these articles lead me to various other interrelated articles based on the reference sections of the previous articles. Analyzing the literature I made different categories for the literature; the article which focused on the importance of visual arts in academic environments, the role the aesthetic environment has on perceptions and behavior, and how visual artworks play a role in the aesthetic environment.

Study Design

Along with the written research and critical literature analysis I would like to have members of the university community complete an online survey to gauge their perception of the value of the visual arts and their perception of its role within their university community. Understanding the student and faculty perspectives on the universities responsibility to the visual arts and the aesthetic appearance of the student for center life will add a richer balance between discovering and analyzing the benefits the artwork has on the student body and the community's actual attitude to the purchasing and viewing of the artwork.

Participants will be solicited through departmental list serves to fill out the survey through a link which will be provided in the email with a description of the project. Questions will focus on the student's affiliation with the university and with the visual art community. Participants will then be asked about whether or not they feel that it is important to have artwork on display within the center for student life, within other non art affiliated buildings, and if so why or if not why not. Participants will also be asked who should select the art and whose artwork should be chosen, students, professors, non affiliated artists.

And finally participants will be asked whether they believe purchasing art is a necessary expense for a university. This question is pertinent because the trend I predict I will find will be that many may believe it is in fact important to have artwork within the universities buildings and that students should select it, however they may feel that the expense is unnecessary.

This part of the study will essentially benefit to gauge the university community's response to the visual arts as it relates to their environment, which will open the path to offering information to those who may be skeptical as to why the university budget includes art purchasing and how this commitment to cultural excellence benefits them and their peers.

While I do hope to conduct this survey with significant results I do anticipate that I may not be able to get a large enough sample of students and faculty to participate in the survey without some sort of tangible incentive. Other limitations may be difficulty finding stronger researcher more grounded in explicit and tangible results as to the benefits of the visual arts on environments and the people who inhabit them.

Expected Contributions

Since this a proposal for a study there are no concrete findings to report, only expectations of contributions to the general field of study. Based on my inquiry about what benefit the visual arts have for a university community the literature suggest that the role of the arts can be analyzed through a discussion of the contribution of the visual arts as an enhancing feature of the aesthetic environment. Based on analysis of the literature I have found that the condition of the aesthetic environment can play an important role in perceptions of negative or positive emotions, it can also play a part in perceptions of quality of care. The environment the university displays sets the tone and mood for the sort of interactions will occur within a space. Creating an engaging aesthetically pleasing center for student life building will encourage productive and inspiring academic and social interactions.

For a future study I would like to delve deeper into empirically supported measures of how the visual arts can benefit a university community whether on a physical or emotional level. I would like to also focus on the measurable affects of aesthetically pleasing and unpleasing environments can possibly have on people and whether the arts play a significant role in that effect.

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Effective Practices and Principles of an Internal College Readiness Program Based on Literature, School Staff and Student Perceptions: A Mixed Methods Analysis

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Abstract

This triangulated mixed methods study explores the effective elements of college readiness programs by analyzing the existing literature and also school staff and alumni perceptions of their experiences in an internal college readiness program. This study's significance lays in its ability to answer the call for empirical research on the specific factors of these programs that promote successful college access.

While existing studies effectively incorporate either quantitative or qualitative research methods both are somewhat inadequate indicators of effective principles, a combination of the two research methods would provide a more comprehensive explanation of the effective practices and principles of college readiness programs by making note of trends and generalizations as well as an exhaustive knowledge of the participant's perspectives (Creswell & Plano Clark, 2007). For this reason this study will be incorporating a triangulation mixed-methods approach. The school staff perceptions will be collected in qualitative focus group interviews while alumni student perceptions will be collected through a quantitative survey.

The key findings from the literature show that the important components of an internal college readiness program are: academic preparation; the guidance counselor; teacher involvement; parental involvement; and college publicity. Continuing this research agenda, the researchers will gather data on school staff and alumni student perceptions of their experiences in the chosen internal college readiness program: KIPP Pride High, Gaston. In order to create a blue print for successful internal college readiness programs the following recommendations would be valuable: a comparison of two or more internal college readiness programs to discover more essential components; and a study of students who attend a high school qualifying as an internal college readiness program but are also enrolled in an external college readiness program to assess if the access to higher education is heightened for that student.

Introduction

"Low income students who aspire to go to college are frequently overwhelmed by the complexity of college preparation" (De La Rosa & Tierney, 2006, p. 1). Oftentimes low-income students also double as aspiring first generation college students; being first generation college students unfortunately decreases their likelihood of attending college (Engle, 2007). Low-income students who do aspire to go to college are left to rely on their schools to provide resources on the college-going process (Pitre & Pitre, 2009). Unfortunately, the number of schools who have recognized the dependency of their low-income students and have then aligned their school culture and curriculum to reflect the college needs of low-income students is low (Conley, 2007). This mixed methods study aims to add to the body of knowledge that describes the effectiveness of school-based college readiness programs through the analysis of one school's college readiness program. This chapter introduces the problem with the lack of empirical evidence on college readiness programs.

Problem Statement

Having established the importance of college readiness programs for low-income students, empirical evidence that documents the successful elements of college readiness programs in high schools with large numbers of low-income students is lacking in dearth. A proposed study of one repeatedly successful school based college readiness program for low-income students enhances the empirically-based data for current and future college readiness programs for low-income students.

The population affected by the scarcity of empirical evidence of successful college readiness programs is ultimately the low-income students that attend schools with no or ineffective college readiness programs. The students are already disadvantaged because of their low socioeconomic backgrounds and the lack of college resources in the school serves as a further disadvantage. Another population affected by the problem of limited empirical evidence on successful college readiness programs is the community from which low-income students originate. The lack of research on the successful elements of college readiness programs can lead to a lack of information on how to effectively replicate future programs. Without successful college readiness programs, the access to higher education for low-income students may continue to be limited, therefore furthering the cycle of generations without a college education. The community with continuous generation of people without a college education then becomes negatively affected as research shows that people who attend college are more apt to improve their communities (Perna & Swail, 2000; Stern, Dayton & Raby, 2010). The effect that college education has on communities heightens the need for studying and replicating profitable college readiness programs to sustain communities.

Although this is a proposed study of a single case of a reputedly successful internal college readiness program in a high school in Gaston, North Carolina, the issue of the lack of empirically based evidence on the factors that make college readiness programs repeatedly successful is a national problem. The consensus is that information on college readiness programs is unreliable and provides little useful information (Gullat & Jan, 2003; Perna & Swail, 2003; Stern, Dayton & Raby, 2010; Domina, 2010). Gullat and Jan (2003) state that the existing empirical research on college readiness programs more so focuses on the concepts and beliefs about college readiness that guide these programs but not on the actual practices that make them effective or ineffective (Gullat & Jan, 2003).

This focus on the framework and not on the practice is what contributes to the lack of empirical research. Perna and Swail (2003) suggest that future research identify a combination of factors that are most effective in accomplishing the goal of increased access in underrepresented groups. Suggestions for future research pose several questions. For example: Research states that early intervention is best but what grade constitutes early enough intervention? What type of students should these programs consist of? What role does parental involvement play? If parental involvement does play a role how can administrators effectively encourage parental participation?

Purpose Statement and Research Questions

This study aims to add to the existing body of knowledge concerning the effective elements of college readiness programs. The purpose of this inquiry is to explore and understand the factors that contribute to a perpetually successful college readiness program in a high school with high numbers of low-income students based on evidence from existing literature, school staff, and alumni student perceptions. Based on the previously stated problem statement and purpose statement the questions that this research will address are:

Literature Question:

1. What are the components of an internal college readiness program that are most influential for low-income high students pursuing higher education?

Site Question:

2. To what extent do KIPP school staff and alumni perceptions confirm what the literature describes as influential components of internal college readiness programs?

A mixed methods study, which will be explained later in Chapter 3, will be used during this study.

Definition of Terms

The following section will define several of the key terms that this research study uses, for example: college readiness programs; external college readiness programs; internal college readiness programs; and low-income students. These terms are relevant to this research because they are regularly used terms when discussing access to college for underrepresented groups like low-income students. The terms have been defined based on the college readiness literature but have been augmented to fit the specific context of the current study.

College readiness programs. College readiness programs are defined as programs designed to provide disadvantaged students with the opportunity to develop the skills, knowledge, confidence, aspirations, and overall preparedness for college early enough in their schooling to influence their ultimate educational attainment levels (Perna & Swail, 2000). Some of the services provided are information and assistance in college admissions and motivational activities like college mentoring, college visits, advocacy, and academic enrichment including rigorous high school curriculum

and tutoring. According to research (Bergin, Hooks & Bergin, 2007; Engle, 2007) there are endless types of college readiness programs that target low-income, minority, and first generation students but for the purpose of this research, the college readiness programs mentioned will be categorized as either external or internal programs. The research requires that the college readiness programs mentioned be categorized as internal college readiness programs or external college readiness programs because the scope of the study is an internal college readiness program.

External college readiness programs. External programs are college readiness programs sponsored by the federal government, state government, not-for profit organizations, and individual colleges and universities (Perna & Swail, 2000). An important characteristic of these external programs is that although they might take place in school setting or during the school day, their functions are not to affect a school's existing curriculum or teach practices but to instead supplement and extend "a student's weekday curricula and extracurricular experiences" (Gullat & Jan, 2003).

Internal college readiness programs. Internal programs are a regular apparatus of the school in which they exist; therefore, they are implemented, operated, and funded by the school system. While the overall focus of this paper is on an internal college readiness program there will be information provided about external programs, in order to provide a depth of information on the successful factors of college readiness programs.

Low-income students. For the purposes of this paper, low income is defined as usage of free and reduced-price meal benefits for the National School Lunch program provided by the United States Government. In order to qualify for the program the child must come from a family where the income is near or below the national poverty line. This paper is focuses on high schools that have a majority of low-income students; the definition of majority for the purposes of this paper is a school where more than 50% of the students are receiving free or reduced lunch meals.

Scope, Limitations, Delimitations

Scope

The scope of a research study defines where and when the study was conducted and who the subjects were (Sevilla, Ochave, Punsalan, Regala & Uriarte, 2007). For the purposes of this paper, the scope is a single high school setting in Gaston, North Carolina. The high school has over 65% of its students qualifying for free or reduced lunch. The subjects of this case study are the teachers and administrators in the school who are implementing the school's college readiness program and also past student participants.

Limitations

The limitation of a study is the phase or aspect of the investigation which might affect the result adversely but over which the researcher has no control (Sevilla et. al, 2007). Below are the limitations for the study:

Research Design. Interviews limit the ability to generalize about what this study will find as the effective components of college readiness programs. However, the data produced will allow for similar schools with similar characteristics as the KIPP Gaston school to create similar internal college readiness programs. Quantitative surveys limit the depth of information provided on a topic because the survey cannot account for an individual's opinion. However through the use of mixed-methods the researcher hopes to develop rich data that provides a comprehensive look at school based college readiness programs.

Scope. The scope of the study also limits the research finding's ability to be generalized for other schools. This study focuses on one school in one rural town and therefore poses a problem to other schools, who do not share many characteristics with the school in this study. The lack of generalization may make replicating the model found at KIPP difficult for other schools.

Framework. Research studies are shaped by the framework chosen by the researcher and they become the basis of the study. For this reason, the research is also limited to the constraints of the selected framework. The theoretical framework guiding this research is social capital theory. Social capital theory allows the researcher to identify the sources of social capital, which are the resources embedded in one's social networks, resources that can be accessed or mobilized through ties in the networks (Lin, 2005, p. 4). The major drawback with using social capital theory as the framework is that it only looks at one network. In this study, social capital theory will only be looking at the network developed by the internal college readiness program. However, there may be students who are gaining the social capital necessary for college enrollment though outside programs.

Reliance on self-reported information. This study requires that school staff, teachers, and recent graduates of KIPP high school report their experiences in the school based college readiness program. While this study has to rely heavily on self-reported information in order to formulate data, participants might over emphasize both their positive and/or negative experiences and over-emphasis in the data results in research that is plagued with bias. Nevertheless, this study will exercise all measures to reduce participant bias.

Delimitations

The delimitations of a study indicate the variables that are not apart of the study and addresses how the scope of the study will be narrowed (Creswell, 1994). The delimitations here are racial disparities, external college readiness programs, and all high schools as this is a case study of one high school.

Significance of the Study

Studying reputedly successful college readiness programs is a significant topic of investigation for several reasons. The first is that Hill (2008) states that it is significant to study the organization of a school when it comes to facilitating a students transition to college because the actions that the schools take to guide students to college makes a difference on the students postsecondary outcomes. Secondly, there is no empirical evidence on what makes a college readiness program reputedly successful (Gullat & Jan, 2003; Perna & Swail, 2003; Stern, Dayton & Raby, 2010; Domina, 2010). Research (Bergin, Hooks & Bergin, 2007; Gandara and Bial, 2001, as cited in Cabrera, Deil Amen, Prabhu, Terenzini, Lee & Franklin, JR , 2006) state that the lack of program evaluation “sharply limits assessment of these outreach programs’ effectiveness (p. 80). Thirdly, Farmer-Hinton (2008) suggests for more research on internal college readiness programs for underrepresented students as most internal college readiness programs are benefiting affluent and white students. Farmer-Hinton’s claim makes this research significant because it adds to the body knowledge on college access for underrepresented groups like low-income students. A fourth significance of this study is that it has always been the requirement of secondary education institutions to prepare its students for college and this study presents a method for schools to meet this requirement (Barker, Clay & Gratama, 2005).

Over the years, researchers have come up with a list of the benefits of college attendance. The benefits range from enjoyment of the college experience, to economic growth, to increased civic involvement (Perna & Swail, 2000; Stern, Dayton & Raby, 2010). Knowing this, it is important that all efforts be made to gain access for low-income students, who traditionally would be excluded from the college experience. While the federal government has made gains with their college readiness programs, since the implementation of the 1965 Higher Education Act, there is very little empirical evidence about the factors of these programs that provide success. The proposed study on the effective practices and principles of college readiness programs is significant because it is in line with the previous research that calls for empirical research on the specific factors of these programs that promote successful college access.

Review of Literature and Explanation of Conceptual Framework

Literature on Access to Higher Education

Educational opportunity and success are uneven in the United States by income and by race/ethnicity (Swail et al., 2003; Perna, 2006; Radcliffe & Stevens, 2008; Holland & Hinton, 2009). As low income students tend to represent the majority of disadvantaged people in both categories they tend to be the most disadvantaged in the realms of educational opportunity and success (Perna, 2006). The main challenge is for parents and schools to help students create a connection between their desire to go to college and the college entrance preparation process (Radcliffe & Stevens, 2008)

Access to higher education for low-income students is important, according to Swail, Redd and Perna (2003), “because although gaps will always exist in who goes to college and who ultimately succeeds, it still holds true that education has the greatest potential to benefit all” (p.5). In another study, Perna (2006) states that increasing access to college is especially important for underrepresented students who stand at the margin between attending and not attending college. According to Perna (2006), many underrepresented students who could be prospective college students are misinformed about the cost and benefits of a college education.

Access to higher education is also important because of the numerous benefits that are associated with college attendance. For one, the enjoyment of the college experience, that includes the learning environment, participation in athletic, cultural, and social events and overall enhancement of social status. Another benefit is the economic growth associated with having at least a bachelor's degree due to the enhanced productivity of labor resulting from higher levels of educational attainment (Perna & Swail, 2000; Perna, 2006). Perna (2006) also states that guaranteeing that all individuals have the opportunity for college enrollment is a crucial step. The neighborhood that the student originates from and returns to also receives the benefit of economic growth, as there is a decreased dependency on economic welfare/Medicaid programs and lastly, there is an increased civic involvement associated with college attendance that includes increased volunteerism and increased voting rates (Perna & Swail, 2000; Perna, 2006; Stern, Dayton & Raby, 2010).

History of access to higher education in the United States. The G.I. Bill, the Serviceman's Readjustment Act of 1944, was introduced to help military servicemen reintegrate into the economy and society after the war (Swail et. al., 2003). According to Swail, Redd & Perna (2003) the 1960s saw the War on Poverty and two major legislative packages: The Civil Rights Act of 1964 and the Higher Education Act of 1965. These bills established the tenet for future federal involvement in education, which historically had been a state responsibility. The federal government had already laid the groundwork for access to postsecondary education through the G.I. Bill (Swail et. al., 2003), but the legislation of the mid-1960s expanded the federal role through new student financial aid programs and academic support programs, such as the TRIO programs (see below). As President Johnson said upon signing the Higher Education Act of 1965, "We need to do more . . . to extend the opportunity for higher education more broadly among lower and middle income families" (Swail et. al., 2003, p. 9).

The 1970s continued the federal government's expansion into support for educational opportunity, resulting in the Pell Grant. President Nixon announced that the Pell Grant ensured that "no qualified student who wants to go to college should be barred by lack of money" (Swail et. al., 2003, p. 10). Later reauthorizations of the Higher Education Act established more programs, with the greatest expansion of aid coming in 1992 through the introduction of the unsubsidized loan programs (Wolanin, 1998). Federal expansion into education was founded on the generally agreed principle that federal responsibility lay in opening the doors of higher education. A huge expansion of access occurred in the 1990s, driven partially by an economy that needed highly skilled individuals. While throughout our history, the government has intervened at various times to further open access to underrepresented groups (Swail et. al., 2003) the numbers of low-income graduating from higher institutions is still substantially lower than their well-off counterparts (Perna & Swail, 2000).

Several schools have tried to implement their internal college readiness programs. Hill (2008) found that high school organizational characteristics play a role in access to college. While every high school's internal college readiness program is not considered successful Hill (2008) found three ways to categorize the college linking strategies found in high schools that rank from little organization commitment to student outcomes to exceptional organizational commitment to student outcomes. The first is the traditional strategy, providing students with limited college resources; next is the clearinghouse strategy which has fairly adequate college resources; and lastly the brokering strategies which provide an exceptional amount of college planning resources for students and their parents (Hill, 2008).

Literature on External College Readiness Programs

External college readiness programs are sponsored by the federal government, state government, not-for profit organizations, and individual colleges and universities. The key aspect of external college readiness programs is that they are not integrated and operated by the school.

The federal government has been one of the primary leaders in creating and providing funding for these external programs. A prime example of a government funded external college readiness program is the TRIO program, established as part of the original War on Poverty during the Johnson Administration (Pitre & Pitre, 2009). The goal of the TRIO program is to increase equal opportunity for US citizens by providing programs that develop aspirations for higher education and enhance college readiness for students from low-income, first generation college, and ethnic/racial minority groups (Pitre & Pitre 2009). The TRIO initiative includes eight programs targeted to serve and assist low-income individuals, first-generation college students, and individuals with disabilities to progress through the academic pipeline from middle school to post baccalaureate programs (Gullat & Jan, 2003; Perna & Swail, 2000; Pitre & Pitre, 2009). Currently, TRIO programs serve over 850,000 low-income, first-generation students and students with disabilities, from sixth grade through college graduation which amounts to more than 2,800 programs nationally

and a budget of over \$848.1 million for the year of 2009 (Council for Opportunity in Education). Several of the existing TRIO programs are dedicated solely to create access to higher education for traditional high school students: Upward Bound, Upward Bound Math and Science, and Educational Talent Search. (US Department of Education: Office of Post Secondary Education, 2010). While TRIO programs serve to increase the rates of college enrollment amongst underrepresented students TRIO programs are often criticized for practicing reverse discrimination because the eligibility requirements exclude students from dominant ethnic/racial groups or those from high socioeconomic backgrounds (Pitre & Pitre, 2009).

Upward Bound was created in 1964 as apart of Educational Opportunity Act (Gullat & Jan, 2003; Perna & Swail, 2000). As one of the first external programs, Upward Bound works with small groups of students to provide them with college awareness and college preparation (Engle, 2007). These workshops are held after-school, on Saturday and summer courses on college campuses that provide academic instruction (Engle, 2007). The workshop topics cover the wide range of the college going process, one of the topics pertinent to low-income students include financial aid-information, primarily on how to fill out the Free Application for Student Aid (Engle, 2007). As of, Upward Bound served programs with students nationwide (Perna & Swail, 2000). Upward Bound is the most researched TRIO programs and the results on the effectiveness of the program show that while Upward Bound has a positive effect on student college aspirations and overall educational attainment Upward Bound has no effect on academic preparation or a students GPA (Pitre & Pitre, 2009). Council for Opportunity in Education statistics on the 2005 Upward Bound cohort states that 77.3% of all students who participated in Upward Bound programs matriculated to college the fall after graduating. The statistics go on to prove that there is a positive relationship between persistence in Upward Bound and college matriculation as 91.2% of Upward Bound students who participated in the program for three years or longer and 93% who participated through high school graduation enrolled in a postsecondary program immediately following high school.

Talent Search provides participants and their families with information on college admissions, scholarships and financial aid. It came about as apart of the 1965 Higher Education Act and as of 2000, there are 300,000 6th-12th students in the program with 319 sites across the country.

According to the Council for Opportunity in Education TRIO programs are important to low-income students because they are being left behind in the race to a college education. Statistics from the Council for Opportunity in Education show that only 38% of low-income high school seniors go straight to college as compared to 81% of their peers in the highest income quartile. Of those low-income students enrolled in college, low-income students earn bachelor's degrees at a rate that is less than half of that of their high-income peers — 21% as compared with 45% (Council for Opportunity in Education).

Along with the TRIO programs, the federal government has also implemented two grant projects, NEISP and GEAR-UP. NEISP is the National Early Intervention Scholarship Program started in 1992 by federal government offering matching grants to states for providing financial incentives, academic support services and counseling, and college related information to disadvantaged students and their parents (Perna & Swail, 2000). Then in 1998, Congress implemented the Gaining Early Awareness and Readiness for Undergraduate Programs. GEAR -UP was created in an effort to supercede NEISP. This grant was open to all states and partnerships creating a program to increase the number of low-income students who are prepared to enter and succeed in postsecondary education (Perna & Swail, 2000). These partnerships help provide college planning activities and related information to students, typically starting in their in their seventh grade year, and helps build long-term relationships among school districts, colleges, and other community stakeholders (Radcliffe & Stevens, 2008).

Research shows (Pitre & Pitre, 2009) that while TRIO programs have made some gains in increasing college aspirations and access for underrepresented students a major threat to TRIO programs is the lack of funding. According to the Council for Opportunity in Education, while the TRIO programs have proved to be successful, funding for TRIO programs has remained relatively the same over the years. Pitre and Pitre (2009) suggest that while the need for TRIO programs still exists; the lack of funding limits the amount of TRIO participants. To compensate for the limited reach of TRIO programs Pitre and Pitre (2009) suggest that schools, more specifically teachers, counselors and staff, aim to replicate pre-college programs within the schools because “many of the college preparation and transition experiences provided to students served by TRIO Programs can be easily replicated in schools for little to no cost” (p.108).

Literature on Internal College Readiness Programs

As earlier defined, internal college readiness programs are implemented by the school and focus not only on a targeted group but serve as a school-wide effort to increase access to higher education. While these programs are school run they can include outside factors like partnerships with community and university partnerships to ensure graduation, that students are academically prepared for the rigor of college classes, and also that students have equal information about future careers (Martinez & Klopott, 2003; Stern, Dayton & Raby, 2010).

The benefit of internal college readiness programs is the school integration that is provided: external programs are considered fragile if they aren't connected to schools curricula, despite their gains in college enrolment (Holland & Hinton 2009). Also, external programs constantly face the challenge of funds being cut, however if it was an internal program the school would have to provide these funds (Holland & Hinton 2009). Not to mention, college readiness preprograms cannot be the sole responsibility of those who meets with a subset of students, it is dependent of the entire school (Corwin & Tierney, 2007). External programs are good because they offer student-centered work, like individual meetings, focused classes, college related activities, however it is not enough to bring over a cultural change (McClafferty, McDonough & Nunez, 2002). Nevertheless, a negative attribute of these internal programs is that they tend to offer less services, however since it is in a school they are able to offer their receive college guidance and resources to a wider array of students (Domina, 2009; McClafferty, McDonough & Nunez, 2002).

While no universal internal college readiness program has been implemented nationwide, this section contains a review of literature of the most noted design components of these internal programs: academic preparation, the guidance counselor, and creating a college environment.

Academic preparation. Academic preparation is a key factor to access to higher education as the two main academic steps that are critical to college advancement are completing high school courses that are rigorous and taking standardized tests like the PSAT, SAT, ACT and ACT or SAT Subject (McClafferty, McDonough & Nunez, 2002; Savitz-Romer, Jager-Hyman & Coles, 2009). According to Swail, Redd and Perna (2003), the first critical juncture on the road to a bachelor's degree is becoming academically prepared during high school to enroll in college. While academic preparation is noted as the most critical step, low-income students are often unprepared for or discouraged from taking the courses in high school that will academically prepare them for college (McClafferty, McDonough & Nunez 2002; Savitz-Romer, Jager-Hyman & Coles, 2009).

Also, improving student teacher relations, aligning education, implementing academic preparation and strengthening community ties (Martinez & Klopott 2003). Improving student teacher relationships allows for a more personalized learning environment which allow for students and teachers to get to know each other which can ultimately result in teachers being able to plan and carry out lesson plans that cater to the specific needs and culture in the classroom (Martinez & Klopott 2003). Savitz-Romer, Jager-Hyman & Coles, 2009 also suggest incorporating a model of academic support involving "formal and informal strategies that build, strengthen, and promote students command of subject matter and skill development through deliberate activities, structures, policies and expectations" (pg.6).

Another suggestion for improving academic preparation for low-income students is alignment within the schools. Alignment calls for teachers within different grades aligning their coursework so that each grade prepares students for the subsequent grade and that each grade is also building upon the skills taught in previous years (Martinez & Klopott 2003; Savitz-Romer, Jager-Hyman & Coles, 2009)). Alignment also includes the representatives from the university partnership. Any academic support provided by the 13-16 sector should align with the curriculum taught in the school. The 13-16 sector should also be providing academic interventions where they are not only helping students with the academic coursework but also training teachers on how to help students who are struggling with the course material. Lastly, improving community ties is important in academic preparation because it brings relevance to students learning experience, thus engaging students in school while buildings ties to the community.

College guidance counselor. While academic preparedness is the key factor to access, the guidance counselor serves as an equally important factor as they are able to provide options for all students whether in good or bad academic standing. The primary responsibility of the guidance counselor is to provide students with college information and resources (McClafferty, McDonough, & Nunez, 2002). As the key to establishing a college culture within schools, they are creating and implementing the school's normative expectations for student's college destinations, this is especially essential for the students whose families cannot provide them with this information (McClafferty, McDonough, & Nunez, 2002).

They are also responsible for dispensing the information and resources on college to the students in the school. Having this information and resources is important for the students because the college going process is made up of predisposition, search and choice, in order to create this culture students must first be provided with general, in-depth information on college (McClafferty, McDonough, & Nunez, 2002). According to McClafferty, McDonough, & Nunez, (2002), only after they have been provided with enough general information on college and the college process can they make reasonable decisions on the types of college they want to attend, admissions criteria that they do or do not meet, financial issue, and an array of other issue.

However as guidance counselors serve as a key component in college readiness programs, college guidance is often not the single responsibility are the key component, oftentimes college guidance is not the only responsibility. As seen dropout, pregnancy, and gang violence rates continue to be on the rise, the less attention college guidance tends to receive.

Swail, Redd and Perna (2003) present the term “intergenerational” that applies to the effect of a lack of college attendance. In the article he states that when parents do not attend college it creates a cycle of a generation that might not go to college because they do not have their parents as resources to guide them along the college process (Swail et. al., 2003). Muhammad (2008) echoes this issue saying “misinformation in the African American community regarding college costs, access, and the benefits of a college education abound...counseling from a trustworthy, supportive school counselor can make a difference in stemming African American talent loss” (Muhammad, 2008, p. 81).

The necessity of college guidance counselor is especially existent in low socioeconomic communities, which might have the highest number of parents without college degrees (Muhammad, 2008). In these schools it becomes especially important to have a college guidance counselor because it appears that students understanding of their counselors expectations for their future education positively influences college predisposition (Muhammad, 2008).

Creating a college culture in secondary schools. While the guidance counselor does provide for an increase in access, there are schools that do not have this as a resource and therefore a solution to their access problem to create a college climate in their schools. The college culture exists in a school culture that encourages all students to consider college after high school by introducing them to information about higher education opportunities during early adolescence and in high school through formal and informal conversations that specifically pertain to the students current and future lives in an effort to aid them in making an informed decision about their futures (Holland & Hinton, 2009; Radcliffe & Stevens, 2008; McClafferty, McDonough & Nunez, 2002).

The creation of college cultures within the schools in poor communities is important because there are a lack of college educated parents to help guide the students in their journey to higher education (Holland & Hinton, 2009; McClafferty, McDonough & Nunez 2002). Creating a college culture is also important because De La Rosa and Tierney (2006) state that a high schools culture of preparation is a large factor of influence on a students access to college and for low income students, their financial aid related information. Last, research (Jarsky, McDonough & Nunez, 2009 & McClafferty, McDonough & Nunez, 2002; De La Rosa & Tierney, 2006) state that the road to college should not be paved only by the guidance counselor but should instead be a school wide effort. A school wide effort requires that all school personnel provide a consistent message to students that emphasize the support for their quest for a college preparatory K-12 experience.

College/University partnerships. Building this college climate in secondary schools is important because extensive empirical evidence exists on how the high school environments exert powerful influences on student’s college aspirations and preparation (Jarsky, McDonough & Nunez, 2009). The way Jarsky, McDonough & Nunez (2009) suggest to build this college climate is through a partnership with a university. Research has shown that the idea behind University and Urban K-12 school partnerships is to merge the tenets of educational theory into practice. Each institution is thought to benefit: Universities gain information for their research, and/or training sites for their teaching students and schools receive help in instruction and facilitating positive relationships between teaching staff and administrators (Dugery & Knowles, 2003 & Saunders, 2003). However, while the idea behind the partnerships may seem simplistic the actual implementation is not. The research that has been conducted on the implementation of these partnerships state that many fail because of the tumultuous relationships between the University faculty and the K-12 school staff, where faculty administration and the schools are often adversaries (Lieberman, 1986) where the main problem boils down to shock, turf, and communication (Goldring & Sims, 2005).

Parental involvement. Research (Muhammad, 2008; McClafferty, McDonough & Nunez, 2002; Radcliffe & Stephens, 2003), states that family involvement is another major aspect of college culture. According to Perna (2006), parental knowledge and information that promote college enrollment may also be reflected by, and acquired via parental contact with the school about education-related matters. Muhammad (2008) states that for low-income schools, parents should start becoming more knowledgeable, while this is a viable option, a lot of the parents in low socioeconomic environments this might not have access to this information, because they did not attend college (Radcliffe & Stephens, 2003), causing them to feel uncomfortable or even unnecessary in the college going process (McClafferty, McDonough & Nunez, 2002). Schools need to invest in building personal contacts and connections with the student's family by building a welcoming climate for the parents within the school because parental involvement in their child's education promotes college access (Perna, 2006). McClafferty, McDonough & Nunez (2002) suggest schools ask themselves if there are opportunities for parents to visit the school and how do parents know what is happening at the school. Radcliffe and Stephens (2003) also suggest to implementing parental support groups for those parents who did not attend college and therefore have no information to provide for their children.

Teacher involvement. Teachers and principals in this neighborhood also serve as viable contributors to the college culture since they have all attended an institution of higher education (Corwin & Tierney, 2007). Using their own experiences they can build a college climate in these low SES schools. In empowering teachers and administrators to take on this task, they must first be able to recognize their own cultural beliefs that might lead them to have biases over the students that they are teaching then it must be instilled in the staff that college prep is the goal for each student (Martinez & Klopott 2003). The staff also must set clear expectations of the students that they must all attend college because students without clear expectations are denied the support, information and resources necessary for success (McClafferty, McDonough & Nunez 2002). Clear expectations can be set by implementing college based mission statements and implementing constant evaluation of the expectation, by asking questions like are we meeting this expectation and what are the student outcomes (McClafferty, McDonough & Nunez, 2002).

Teachers are also important because they serve as the basis of social support, inside the school, for students looking for assistance in applying to institutions of higher education (Holland & Hinton, 2009). Holland and Hinton (2009) define social support as a core element of college culture that allows for students to foster personalized relationships where frequent communication, academic norms, and the sharing of valuable resources exist. The model of social support that Holland and Hinton (2009) describes is best defined by Savitz-Romer, Jager-Hyman and Coles (2009): "strategies that foster and fortify social networks, school-connectedness, self confidence, and academic motivation through intentional services, behaviors, and expectations" (pg. 6). Research (Holland & Hinton, 2009) argues that this is best done by teachers because they can best understand the students academic potential by developing personal connections allow for students to become more engaged in school. By forming these personal connections teachers should be creating expectations to should always be thinking about college and how to become enrolled (Holland & Hinton, 2009). This falls in line the educational theorist, Nel Noddings, who stressed the importance of care in education. Noddings theorized that students will work harder if the teacher is deemed as caring and trustworthy (Noddings, 1992). This idea of care is what Noddings says is needed in order for schools to evoke positive change.

College publicity. Another important part of the college culture is the college publicity. College publicity allows high school students to benefit from ever-present reminders of college expectations manifested in written and verbal missives and activities designed to highlight the college paths of school staff (McClafferty, McDonough & Nunez, 2002). This can be seen both verbal and non-verbal form of communication. The earlier parts of this review of literature have covered, in depth, examples of verbal communication however; examples of non-verbal communication include college posters, newsletters and newspaper columns (McClafferty, McDonough & Nunez, 2002). De La Rosa and Tierney (2006) suggest that the verbal forms of college publicity, for example newsletter and newspaper columns include data on college achievement, for example: the post secondary destinations, range of SAT and GPA scores, and percentage meeting college admission requirements of recent alumni. Radcliffe and Stephens (2003) report that the key components in building the college culture are access to technology and campus visits. The technology calls for students to have an increased ability to read and write in multimodal and digital forms as well as being able to communicate online are particularly critical skills for today's college-bound students. Campus Visits that include financial aid sessions; a chance to sit in on a college class; and time to write a reflection on the visit is a necessary component

Summary and Implications of the Literature Review

A college education is an individual's most viable asset in today's economy. A college education creates opportunities to earn more money, and help one's community. While the value of a college education has been stated and restated there are still many individuals who do not have a college education because they did not have resources to provide them with access to higher education. However, educators and similarly those with a stake in education have created college readiness programs for underrepresented students like low-income students.

The main source of external college readiness programs for low-income youth are the TRIO programs, which were created as part of the Johnson Administration (Pitre & Pitre, 2009; Swail, Redd & Perna, 2000). TRIO programs provide support to first generation low-income students in order to create opportunities for program participants to succeed in matriculating to college. TRIO programs now serve Currently TRIO programs serve over 850,000 low-income, first-generation students and students with disabilities, from sixth grade through college graduation which amounts to more than 2,800 programs nationally and a budget of over \$848.1 million for the year of 2009 (Council for Opportunity in Education).

While external college readiness programs like TRIO programs have contributed to increasing access to college for low income students the large budget that external programs require is a huge detriment to such programs (Pitre & Pitre, 2009). Pitre and Pitre (2009) suggest that schools incorporate some of the college readiness aspects used in TRIO programs within school since many of the college readiness design factors of TRIO are easily replicated and less financially demanding. Internal based programs also have the benefit of being inside a school, which allows the participant reach of the program to be larger than external programs (Domina, 2009; McClafferty, McDonough & Nunez, 2002).

The important components of internal college readiness programs are the academic preparation, guidance counselor, and college culture within the school. Academic preparation include rigorous high school classes especially in math and science and also the ability for students to earn college credit while still in high school through either AP classes or dual enrollment in neighboring colleges (De La Rosa & Tierney, 2006; Engle, 2007; Martinez & Klopott, 2003; McClafferty, McDonough & Nunez, 2002, Stern, Dayton & Raby, 2010). The guidance counselor provides the school with the college center, which is the hub for students to access information about college (McClafferty, McDonough, & Nunez, 2002). The guidance counselor is also responsible for hosting school workshops that inform students and parents about the different aspects of the college going process (De La Rosa & Tierney, 2006). Building a college culture within high schools is very important because a schools culture determines the focus of the school (Corwin & Tierney, 2007).

The college culture should include college partnerships, parental involvement, teacher involvement, and college publicity. College partnerships allow for schools to provide their students with first hand accounts on the college experience for example, the rigor of the curriculum, information on how to attain financial aid and also a view on college culture (Jarsky, McDonough & Nunez, 2009). Parental involvement is important because encouragement and support form parents, even from parents who did not attend college, greatly affects a students college going plans (Engle, 2007). It is the responsibility of the school to ensure that parents who did not attend an institution of higher education feel comfortable getting involved with their student's college going process (McClafferty, McDonough & Nunez, 2002). Teachers are also part of the college culture because as individuals who have already graduated from college teachers, alongside the guidance counselors, can provide students with various resources on how to get to college and what to expect once they enroll (Corwin & Tierney, 2007, McClafferty, McDonough & Nunez, 2002). By making teachers apart of the college culture internal college readiness programs can ensure that the entire school is working towards the goal of college access for the students enrolled (Martinez & Klopott, 2003) College publicity is the promotion of college through verbal and non-verbal cues around the school. Examples included in the review of literature are college paraphernalia in the hallways, college visits, and college newsletters (De La Rosa & Tierney, 2006; McClafferty, McDonough & Nunez, 2002; Radcliffe & Stephens, 2003).

Explanation of Conceptual Framework

Social capital theory

The conceptual framework that will guide this study is the social capital theory. Social capital is defined as resources inherent in one's social networks, resources that can be accessed or mobilized through memberships in social networks or other social organizations (Coleman, 1988; Lin, 2005, p. 4; Portes, 1998). An important byproduct of social capital is the potential for information that is engrafted into social relations (Coleman, 1988). The information is produced by actors and shared through social networks.

Actors are agents of social capital and have the ability to distribute and receive social capital. Those agents who distribute social capital, according to Stanton-Salazar (1997, as cited in Gonzalez, Stoner & Jovel, 2001) "provide valued resources and opportunities including emotional support, access to privileged information or knowledge and access to opportunities for college admittance" (Gonzalez, Stoner & Jovel, 2001, p.152)

Forming these networks is important because it is within the networks that the resources for social capital are embedded (Coleman, 1988; Lin, 2005; Portes, 1998). An overall characteristic of all the actors in the network is high levels of motivation and dedication. Using Lin's (2005) definition of mobilized social capital where social capital is defined in terms of its genuine use in the social network the expectation is that "the better the capital used the better the return" (p. 5). Lin's (2005) expectation requires that the actors in the social network are motivated to enter into a social network and dedicated to achieve the overall goal of college access.

Research (Coleman, 1988; Lin, 2005; Portes, 1998) notes that social capital does not exist within the actors or production outputs but is produced through an actor's relationship with others who have certain advantages or high stratification in society or those who facilitate action. Portes (1998) states that the actors in the social network have direct access to the resources available in the network. A key aspect of social capital is that it is not as tangible as physical capital, which is observable in material form (Coleman, 1988). Social Capital can best be measured through access and mobility of the social structure as social capital comes through the changes in the relations among the people that facilitate action (Lin, 2005). This study aims to measure social capital through the access to and availability of relationships between the students and the guidance counselors, teachers and college resources.

Rationale for Use of Social Capital Theory

Using social capital as a theory provides several benefits to the researcher. Firstly, Portes (1998) states that the use of social capital theory illuminates how non-monetary resources can become important sources of power and influence. Using social capital theory allows for the researcher to formulate theoretical propositions for identifying sources and returns on social capital (Lin, 2005). Secondly, social capital theory allows for researchers to categorize social structures and social networks by function (Coleman, 1988). Categorizing by function allows the researcher to assign value to the social capital being produced based on how well the resources assist actors achieve their interests Coleman (1988). Thirdly, because of the categorization of function researchers are better able to account for different outcomes for the actors in the network (Coleman, 1988). Fourthly, for researcher looking to create social capital within organizations social capital theory shows that combining resources produces a difference in behavior and outcomes (Coleman, 1988). Lastly, for researchers looking to examine where in social organization social capital exists, social capital theory allows for the unpacking of the concept to discover what components of the social organization contribute to the value produced (Coleman, 1988; Lin, 2005).

Application to Current Study

Most discussion of social capital theory focuses on the micro-level interaction between a small amount of individuals; however, Lin (2005) asserts that social capital theory can be adapted to represent the social networks in macro level interactions such as associations, communities, and organizations. At the macro level, social capital is seen through social networks with actors who amalgamate their resources so that social capital is seen in the embedded resources of the network provided by actors (Lin, 2005). According to Lin (2005), using social capital at the macro level allows the researcher to analyze the degree of intensity and density of these interactions. Applying Lin's idea to this study, school networks provide the students with social capital when the actors within the school combine their resources and make them available for students and parents.

This theory best fits this research because low-income students are lacking in the social capital necessary to achieve college enrollment (Farmer-Hinton & McCullough, 2008; Cabrera, Deil-Amen, Prabhu, Terenzini, Lee & Franklin Jr,

2006; Gonzalez, Stoner & Jovel, 2001) and this research presents schools as a medium for increasing the social capital for low-income students. Schools are an appropriate medium for increasing student social capital because society on a whole is not producing the same amount of public goods as in the past, which is decreasing the youths social capital; school as social organizations of social capital ensure that students receive some of these public goods the way that they used to (Coleman, 1988). Cabrera, Deil-Amen, Prabhu, Terenzini, Lee and Franklin Jr, (2006) echo the importance of school stating that they can provide the networks necessary to shape college aspirations and overall preparedness. Perna and Titus (2005; as cited in Perna, 2006), states that despite a students original social capital when first entering a school, college acceptance and enrollment can be achieved through resources accessed through social networks in the school they attend. Schools are also an important source of social capital because they exhibit a form of social control to promote compliance for the students (Portes, 1998). Therefore if the norms and goals of the school are to promote college access for its students, then the students in school will gain the resources needed to attain the schools goal.

Another reason why this study is grounded in social capital theory because a key aspect of social capital theory is that it allows the researcher to better articulate the concept of social capital by exploring what components of a social structure best contribute to the social capital that is produced (Coleman, 1988). This aspect speaks to the main purpose of this study which is to decipher which practices and principles of school based college readiness programs are most effective in creating more access to higher education for low-income students. Social capital theory allows the researcher to examine a social structure expected to give students with little to no social capital the resources to expand their social networks and gain social capital.

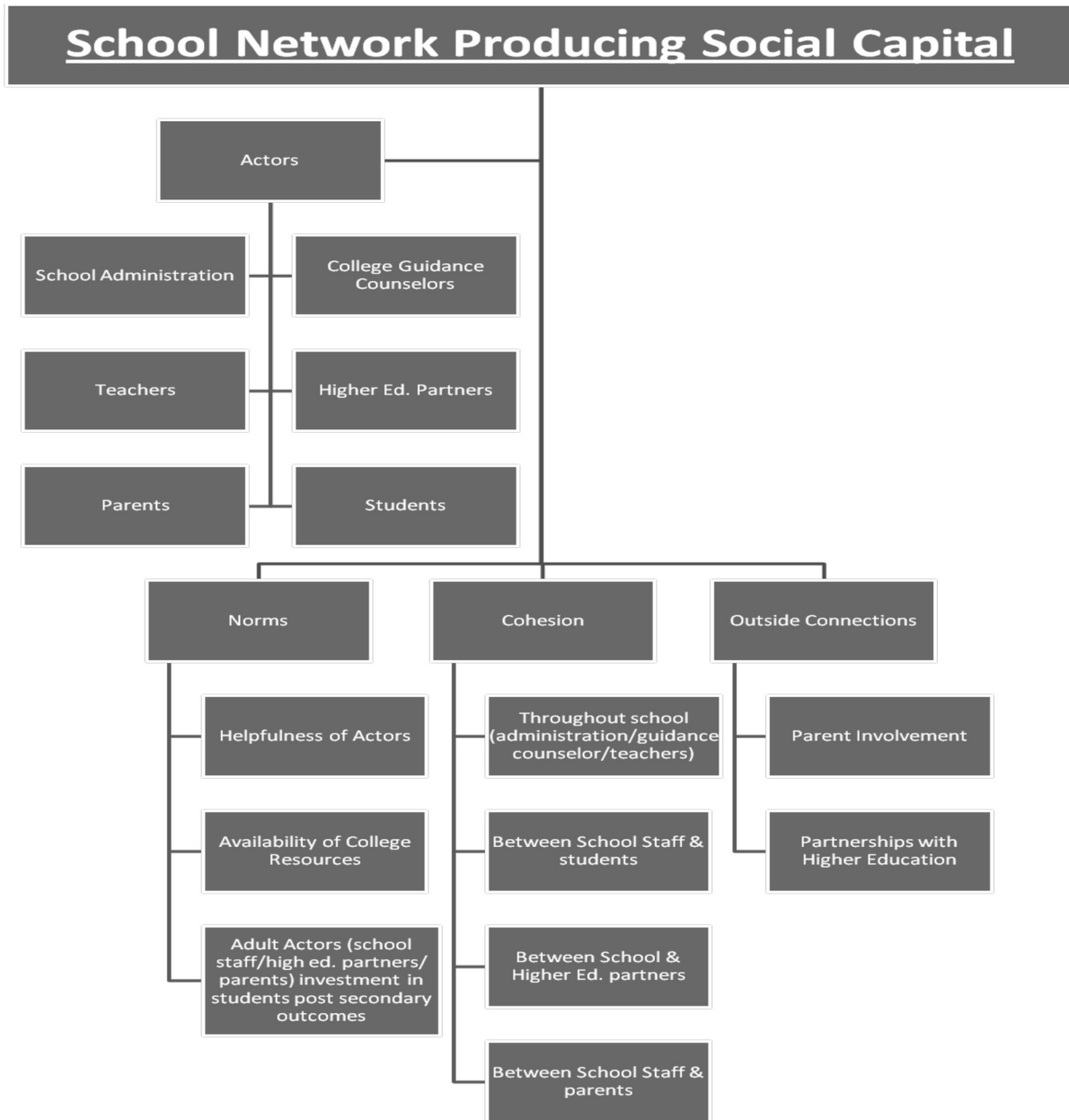
Farmer-Hinton and McCullough (2008), state that through the use of social capital theory students in a school will observe college going as a norm and receive information and resources on how to find, apply, and attend college through their relationships with people around them. Coleman (1988) also speaks about the importance of establishing norms in social capital theory stating that sustaining social capital requires the establishment of norms, as norms exists to limit negative external effects and encourage positive affects. Using social capital theory in this investigation can illuminate how norms can facilitate actions like college attendance and constrain others like dropping out of high school or not attending college. However for norms to be established in the social structure, all the actors within the structure need to be aligned where all the actors are aware of the resources that other actors are providing. Coleman (1988) describes this as a closed social structure and states that the benefit of this structure is that it allows for trustworthiness within the social structure.

Setting clear expectations also plays a part in developing norms. According to Coleman (1988), "if A does something for B and trust B to reciprocate in the future, this establishes an expectation in A and an obligation on the part of B" (pg. S102). Put in the context of this research, A represents the school staff (college guidance counselors and teachers) prepares B, low-income students, for college then A expect B to attend college and B feels obligated to fulfill this expectation. This aligns with the research that calls for schools to set clear expectations of their students in order for them to make college enrollment a reality (McClafferty, McDonough & Nunez, 2000)

Overall, social capital theory allows for the convergence of several different resources and showing that they can be combined to produce different outcomes for individuals. This is the aim of school based college readiness programs to converge the resources offered by guidance counselors, teachers, parents, and university partnerships to increase college enrollment among underrepresented youth. The resources combine to create social capital through the information dispensed to the students. Coleman states "information is the basis for action" (Coleman, 188, p. 104). This statement adds to the significance of the study, as the information provided will allow for the action of access to underrepresented groups.

Proposed model. The proposed model adapts the model of The Dimensions of Social Capital defined by Narayan and Cassidy (2001). While their model adequately presents the model for social capital in international terms, this study adapts the model, along with other research (Coleman, 1988; Gonzalez, Stoner & Jovel, 2001; Lin, 2005; Perna, 2005; Portes, 2003) to relate more to this study of a school college readiness program in particular. Figure 1 illustrates the model chosen for this study.

Figure 1. School Network producing Social Capital



Group characteristics. The actors in this social network are school administration, college guidance counselors, teachers, parents, higher education partners and students. These actors all come together to form a school network that produces social capital.

Interactions. Coleman (1988) states that all social relations and social structures facilitate social capital, knowing this it is important that the actors within the school network are positively interacting with one another to ensure that the social capital necessary to increase low-income student access to college is being produced. In order to produce this necessary type of social capital, Coleman (1988) suggests that the structure of relationships be closed where there is interaction between all of the actors in the network. Such a closed structure interaction is best because it provides the greatest assurance that all actors are working together to accomplish the same goals (Coleman, 1988). Closed structure interactions also ensure that norms developed in social organizations are effective and also that trust is built amongst actors; each of these concepts will be discussed further later (Coleman, 1988). Within these closed structure interactions the principle of “everyday socialibility (Narayan & Cassidy, 2001) should be heavily applied where actors in the structure note the frequency of which they interact with other actors.

Norms. In any organization looking to produce social capital existent and effective norms are important (Coleman, 1988). According to Coleman (1988), in the context of a school organization, norms that help to provide effective rewards for high achievement in a school greatly facilitate the schools task. This relates to research (Martinez & Klopott, 2003; McClafferty, McDonough & Nunez, 2002) that show that in schools norms need to be set for both teachers and students if goals of increased college access are to be met. Farmer-Hinton and McCullough (2008) also agree that students who view college going as a norm and receive the proper information on how to apply and pay for college will then have the social capital necessary to apply this norm to their own lives. While building social capital it is important to note that while norms foster positive outcomes they also limit other outcomes and behaviors because of the high levels of social control (Coleman, 1988; Portes, 1998). Coleman (1988) uses the example of community with effective norms for high achievement amongst its youth might limit the youth from being able to “have a good time” (Coleman, 1988, pg S105). For the context of this study it is important that schools recognize the implications that these limitations have on achieving college access goals.

For this model, the norms that need to become existent and effective are: (1) helpfulness of actors within network; (2) readiness of college resources to actors in network by other actors in network; (3) all actors need to have an interest in student post-secondary outcomes.

Cohesion amongst actors. The cohesion amongst actor’s aspect of a school network is crucial to producing social capital in the student actors because research (McClafferty, McDonough & Nunez, 2002) suggests that all members of the school organization must be actively involved in the college going process in order to have positive impact on the students. Research (Savitz-Romer, Jager-Hyman & Coles, 2009) also states that the social support between actors is what helps to build networks and motivation amongst actors. Furthermore, Savitz-Romer, Jager-Hyman and Coles (2009) suggest cohesion amongst actors is what produces motivation amongst students as they provide the foundation on which students are most likely to benefit from academic support strategies (pg. 6). Portes (1998) also suggests that social networks are not naturally formed and must be constructed through the investment or the networks actors which requires cohesion between participating actors. . As the model suggests there needs to be cohesions amongst school actors; cohesions between the school and the parents; cohesion amongst the school and higher education partners; and cohesion between school staff and students.

Portes (1998) and Coleman (1988) state that the cohesion amongst actors aspect is also important because passing along of information is a byproduct of relationships built within the social organizations producing social capital. The information passed along, according to Coleman (1988) is what is necessary for action, in this case, an increase in the access to higher education for low-income students who were originally lacking in social capital. Therefore, without cohesion between actors the relationships become more fragile and less likely to produce the necessary information.

According to Coleman (1988), the key factors in building cohesion are building trust and obligations between actors. Building trust within social organizations is important because organizations cannot be sustained without them (Coleman, 1988). As stated earlier a main difference between social and physical capital is the ability to see the results, this lack of observable results requires a strong amount of trust if all actors are expected to perform consistently at high levels.

As stated before, “if A does something for B and trust B to reciprocate in the future, this establishes an expectation in A and an obligation on the part of B” (Coleman, 1988, pg S102). This is the tenet that guides this model: each actor does something for another actor and trusts in the future the actor for which the favor has been done will reciprocate in the future. Here it is important to note that in social organizations, like schools, the social capital produced does not primarily benefit those whose efforts are necessary to provide the social capital, however all participants will eventually benefit (Coleman, 1988). For example, within the confines of this study, the actors that are necessary to produce social capital are the school administration team, college guidance counselors, teachers and higher education partners. However, the actors who will receive the highest increase in social capital and the most overall benefits are the students and parents. Nevertheless, the producing actors receive intangible benefits like social support, increase in status within institution, honor, and rewards (Coleman, 1988).

Outside connections. Lin (2005) states that acquiring social networks at the macro-level requires the recruitment of outside actors into the social network. This is where the parental and higher education partner actors come into place. As describe in the literature review parents play a large role in the student’s college going process. The school should actively seek the participation of parents in order to increase the college access for low-income students. However it is important to note while the emotional support that parents can provide is an important factor in students college

going process, it is difficult to measure the importance of the social capital that parents as actors provide (Gonzalez, Stoner & Jovel, 2001). According Gonzalez, Stoner and Gonzalez (2001), because parents of underrepresented students usually have not attended college themselves they depend on others for social capital. Higher education partners also play a large role in college access for the students. For one they can offer opportunities for students to gain college credit while still in school, they can also have school visits where they offer resources to students, parents and teachers about the college going process and experience.

Research Design and Methodology

This chapter outlines the research methodology chosen for this study. Section one restates the purpose of this research and the questions being asked during this inquiry. Section two discusses the selection and rationale for the method design. Section three presents the data sources, data collection and analysis strategies. Lastly, section four addresses how this research minimizes issues of bias and error.

Purpose of Research and Research Questions

As noted in chapter I, this study will address the effective elements of an internal college readiness program. The findings of this research and also the recommendations from the literature will add to the existing body of knowledge concerning the effective elements of internal college readiness programs in schools with a high population of low-income students. Given the purpose of this inquiry, and keeping in mind that in this study the researcher will base any recommendations on both the extant literature and on the local data collected at KIPP High School, both literature based and site based questions are included in the following list of potential research questions:

Literature Based Question:

1. What are the components of the college readiness program that are most influential for low-income high students pursuing higher education?

Site Based Question

2. To what extent do KIPP school staff and alumni perceptions confirm what the literature describes as influential components of internal college readiness programs?

Selection of and Rationale for Design

Selection of research design. The research design chosen for this study is a mixed-methods design. Mixed methods studies combine the qualitative and quantitative approaches into the research methodology and analysis of a single study (Creswell, 1994; Creswell & Plano Clark, 2007; Tashakkori & Teddlie, 1998). More specifically a triangulation mixed methods design will be used, a type of design in which different but complementary data will be collected on the same topic. In this study, focus group interviews will be used to gauge the school staff's perceptions of the important components of an internal college readiness program that will positively influence the college access for low-income students. Concurrent with this data collection, quantitative surveys will be distributed to the students who have graduated from KIPP high school and qualify as low-income, to explore student perceptions of what components of the internal college readiness program most increased their access to college. The reason for collecting both qualitative and quantitative data is to bring together the strengths of both forms of research to corroborate results.

Rationale for the research design. This research aims to detect the successful practices and principles of an effective college readiness program. Similar studies on the effective principles use quantitative methods to measure the overall effectiveness of the program, measuring how many of the students enroll into institutions of higher education after high school, and just listing the practices and principles that these programs incorporate into their program. Another common method is using qualitative methods to gauge students, teachers, and faculty attitudes on the practices that make the program effective. While both research methods are somewhat adequate indicators of effective principles, a combination of the two research methods would provide a more comprehensive explanation of the effective practices and principles of college readiness programs by making note of trends and generalizations as well as an exhaustive knowledge of the participant's perspectives (Creswell & Plano Clark, 2007). For this reason this study will be incorporating a mixed-methods approach. Figure 2 illustrates Creswell and Plano-Clark's (2007) visual of the triangulation method design.

Figure 2. Creswell and Plano-Clark's Visual of the Triangulation Method Design



Site Selection. KIPP Gaston College Preparatory is a free open-enrollment public charter school located in Gaston, North Carolina. Gaston is a low-income rural area in North Carolina located halfway between Newport News, Virginia and Raleigh, North Carolina. **The operating framework of the school is that** “all students, regardless of race or socio-economic background, will achieve at superior levels when taught in a high-quality way” (KIPP Gaston). Not to mention that all students will be expected to graduate from high school and then attend and graduate from the college of their choice (KIPP Gaston).

KIPP High School has an enrollment of approximately 264 students and 62% of which qualify as low – income students indicated by their free or reduced lunch waivers (KIPP Gaston). KIPP Pride High was opened in 2005 and in the spring of 2009 they had a 100% college matriculation rate for their graduating class (KIPP Gaston). Recently the KIPP website was able to report that “100% of KIPP Gaston seniors are headed to college in the fall of 2010--for the second year in a row” (KIPP Gaston).

KIPP Gaston College Preparatory is an ideal setting for conducting this research. KIPP qualifies as a school with a majority of low-income students who are enrolled in a school’s based college readiness program.

Methods for Reviewing and Analyzing the Literature

Using thematic and categorical development and analysis the researcher used the literature to investigate the necessary components of an intern college readiness program. The researcher first sought to understand characteristics of internal college readiness programs. Second, the researcher noted what literature identified as common themes of successful college readiness programs. Lastly, the researcher continued to read other literature on college readiness and classified that literature with the framework previously developed.

The literature selected focused on building a college readiness program in high schools with low-income students. Once it was discovered that necessary components included: college guidance counselors, parental involvement, building a college culture and academic preparation the focus went to finding what the literature revealed about these components and why they were important. Next, the researcher searched for case studies that intertwined all of these components to assess how they did or did not work together.

Once the literature was collected then it was grouped by component (college guidance counselors, parental involvement, building a college culture and academic preparation). Having the literature grouped by components allowed the researcher to assess the features of each component; for example in academically preparing students for college should the responsibility fall completely on teachers or should higher education partners also be responsible.

Role of the Researcher

The proposed role of the researcher is to conduct the qualitative focus group interview with the teachers and college guidance counselor members at KIPP High School, distribute the quantitative surveys to alumni students, and also observe the KIPP high school setting.

Data Collection Strategies and Data Sources

Data Collection Strategies

Strategies for gaining access to research site. As with most research, the researcher is required to gain permission to collect an individual's or site's data (Creswell & Plano Clark, 2007). In order to complete this study the researcher will have to gain access to KIPP high school; this can be done by contacting the superintendent of the district and also the KIPP high school administration.

Focus group interview. "Focus group interviews are groups of people, selected based on their relevance interviewed together, prompting a discussion to explore a topic" (Babbie, 2010, pg. 322-323). For this study two focus group interviews will occur. One will occur with the teacher staff at KIPP high school. Participation in this focus group will be voluntary and the researcher will aim to include teachers from all academic disciplines and grade levels to best assess what is done throughout the school to achieve academic participation and college culture.

The second interview will consist of the college guidance counselors at KIPP high school to assess what counseling sessions consist of between counselors and students and counselors and parents. Also to assess what is being done outside of the classroom to prepare students for college.

Quantitative survey. A quantitative study will be distributed to alumni students to appraise student perceptions of the internal college readiness program. Questionnaires will target alumni student beliefs on each of the components of an internal college readiness program based on the components revealed in the literature. The questionnaire will ask students to rank each component based on what was most relevant to their college matriculation.

Observations. The researcher will conduct unobtrusive research, research that does not affect the research setting (Babbie, 2010), through observations. Observations are important because Corwin and Tierney (2007) state that a school's college culture should be visible upon entrance to the school. Based on Corwin and Tierney's (2007) recommendation the researcher will attempt to observe the internal college readiness program without interacting with the participants.

Data Sources

Data sources are individuals or objects that provide data for analysis (Babbie, 2010). This study will focus on the following data sources:

Teachers. Holland & Hinton, (2009) state that teachers are also important because they serve as the basis of social support, inside the school, for students looking for assistance in applying to institutions of higher education. Teachers are also responsible for providing the students with academically rigorous courses that can better prepare them for college classes. This study recognizes the teacher responsibility in college readiness programs and would therefore propose to hold a focus group interview to determine what efforts are being made by the teachers inside and outside of the classroom to advance the mission of the college readiness program.

School college guidance counselors. The primary responsibility of the guidance counselor is to provide students with college information and resources (McClafferty, McDonough, & Nunez, 2002). Given their responsibility, the researcher in this study will hold an interview with the KIPP college guidance counselor to determine what is being done within the school to provide the students with college information and resources.

Students. The overall research on student experiences in college readiness programs focus on student outcomes from the program, whether or not the students matriculate to institutions of higher education. This study will take a different approach by distributing a quantitative survey aimed at determining the student's views on effective practices and principles of the KIPP college readiness program.

Field Notes. During observations, field notes will be taken while the researcher visits the KIPP high school campus. The researcher will use the field notes taken during different classes, college advising sessions, staff meetings and parent workshops (if available) to analyze how the day to day occurrences in the school compare to the literature's ideas about internal college readiness programs. Observations and field notes also include looking at the decorations throughout the school, school website, and paper publications.

McClafferty, McDonough, & Nunez, (2002) state that setting clear expectations for college attendance in mission statements is another way to establish a college culture within a school. By looking at the website the researcher will be able to determine if the school is setting an expectation for a college culture within the school. Also by evaluating the website, the research can evaluate the context under which words like college are used. This will provide a general sense of the school's belief about college attendance.

Table 1 presents a chart version of the data sources being used in this study:

Data Source	Collection Strategy	Rationale	Anticipated Data
Teachers	Focus Group Interview	Teachers documented experiences in an internal college readiness program are a first hand account on what is going on in the school classroom	Data on how college readiness issues were addressed in classroom.
School college guidance counselor	Focus Group Interview	Can provide first hand account about college culture in school – especially outside of the classroom	Data on how college readiness issues were addressed outside of the program
Students	Quantitative Survey	Can best describe the end results of the program. Can also determine a relations	Data on which aspects of the college readiness had the greatest impact
Filed Notes	Qualitative Observation Analysis	Can describe the schools overall mission to evaluate if in fact school qualifies as an internal college readiness program.	Data on the mission and overall goal of the college readiness program

Data Analysis Strategies

The unit of analysis is the “what or whom being studied” (Babbie, 2010, pg. 98). The unit of analysis for this study is the social network producing social capital for low-income students to increase their access to higher education unit of analysis this investigation asks college guidance counselors, faculty, and students to analyze their experiences in a school-based college readiness program.

Transcription. The qualitative portions of this study, two focus group interviews, will use the actual responses from the teacher and college guidance counselor interviews to formulate the data. Therefore, other interviews will have to be recorded and once they are finished they need to be transcribed. Transcribing the data will best allow the researcher to code the data received in order to analyze what factors the teachers and college guidance counselor recognize as effective principles and factors of the school based college readiness program. The researcher will note what the overall staff defines as a college readiness program and compare their definition to the literature’s definition. The researcher will also listen to their strategies for building a college culture to assess any similarities to the literatures strategies. For example, do they mention college fairs, college visits, and college decorations in the hallway?

Coding. Coding is the process where raw data are transformed and standardized by grouping evidence and labeling ideas so that they reflect broader perspectives (Babbie, 2010; Creswell & Plano Clark, 2007). This is the data analysis strategy that will be used for the observed data. By coding observed data the researcher will be able to label the field notes based on the how it fits each component of an internal college readiness program detailed I the literature. This will give the researcher more background on how the KIPP high school internal college readiness program compares to what the literature describes as an effective college readiness program.

Quantification. Quantification is the process of changing raw data into a numerical format in order for a computer program, the most common method of quantitative analysis, to analyze (Babbie, 2010). The quantitative portion, student surveys, will use multivariate analysis to isolate the relationship between key independent variables, the components of college readiness programs, and the college matriculation outcomes after controlling for other variables, which have yet to be identified.

Ethical Considerations

This research will adhere to Bouma and Ling's (2004) definition of a researcher who is "considerate, does nothing to injure, harm or disturb the participants in research, keeps data collected on individuals and groups secure, accurately record information and reports the findings of the research in a public manner" (p. 203). To ensure the integrity of this study, the researcher will be aware of any unethical practices and adhere to several rules of conduct in order to observe all ethical considerations.

Firstly, all participation will be voluntary and informed (Babbie, 2010). The researcher will ensure this by using a consent form, which will be developed and distributed to all participants prior to any data collection. The surveys that will be distributed by Internet to the graduated students will have a section at the top of the first page that includes a consent clause and requires signatures. The consent form will include (1) a summary of the study; (2) the purpose and objectives of the research; (3) who will have access to the uninterrupted data (research and researcher's advisor); (4) the manner in which results would be reported and distributed; and (5) the information about whom to contact if participants had questions or concerns about the researcher's conduct. Any data from participants who have not filled out and signed consent forms will not be included in this study.

Secondly, all answers will be kept confidential, and anonymous to the researcher's institution and the general public. This will be especially true for the information provided by the students and for the information provided by the teachers and college guidance counselor of the school, measures will be taken to ensure that quotes remain unidentifiable. The research will make efforts to present the findings in a non-threatening manner to the participants and institutions with which the participants are related.

Thirdly, as this is a mixed methods research design that aims to use two data sources to corroborate the findings from the literature there is a possibility that the quantitative and qualitative data sets do not agree (Creswell & Plano Clark, 2007). Creswell and Plano Clark (2007) suggest collecting additional data or even reevaluation however as an ethical consideration the researcher has a responsibility to report all findings.

Lastly, the research will protect all raw data by storing them in a secure location. This information will only be available to the researcher and the researchers' research advisor.

Strategies for Minimizing Bias and Error

Bias, according to Babbie (2010), is the "quality of a measurement that tends to result in a misrepresentation of what is being measured in a particular direction (p. G1). Provided that studies using concurrent mixed methods research are prone to bias (Creswell & Plano Clark, 2007), here are the strategies that the researcher will use to minimize bias and error:

Triangulation. Triangulation is a concept based on the assumption that a mixture of methods would counterbalance any bias from individual research methods, data sources, or researchers, as the researcher is combining different but complementary data on the same topic (Jick, 1979 as cited in Creswell, 1994; Creswell & Plano Clark, 2007). As this study is based on self-reliance data, which is subject to participant bias, a triangulation of research methods serves as a method of reducing bias.

Interview guides. As the interviewer might bring his or her own biases to the research study, the researcher will implement an interview guide documenting the questions and sample probe questions to be asked during the interview. Interview guides are likely to minimize the potential for any such biases (Rodgers, 2007).

Using advisor review. Another strategy for minimizing bias and error in the study will be to have any data to be collected and interpreted checked after collection and interpretation by the researcher's research advisor. This review of data will assure that all ethical concerns were met and that the researcher bias is not present within the study.

Pre-existing notions. It is important that this study not assume that the participants view the practices of the program as successful or even as positive, despite the noted success of the program. In order to maintain a neutral position this study will provide two constants to provide context for the participants to evaluate their experiences; a) their relationship with other program participants (students, teachers, college guidance counselors, etc) and b) the information and college resources they were or were not provided.

Anticipated Limitations of Future Research

Access to Students

One of the main limitations of this study is going to be the collection of data from the students who have already graduated from the KIPP Gaston College Prep. The difficulty arises in finding a method to contact these students and also ensuring that they completely fill out the survey. It is expected that some participants will not return the survey.

Reliance on Self-Reported Information

This study requires that school staff, teachers, and recent graduates of KIPP high school report their experiences in the school based college readiness program. While this study has to rely heavily on self-reported information in order to formulate data, participants might over emphasize both their positive and/or negative experiences and over-emphasis in the data results in research that is plagued with bias. Nevertheless, this study will exercise all measures to reduce participant bias.

Furthermore, this specific research design, data convergence, requires that qualitative and quantitative data sets be converged during interpretation (Creswell & Plano Clark, 2007). This requires that equal weight be placed on data sets from each methodology.

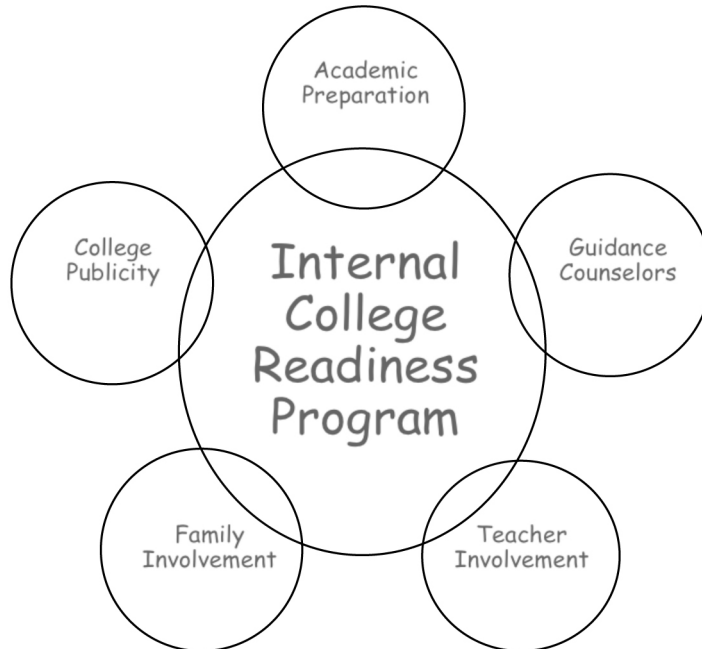
Findings from the Literature, Conclusions and Recommendations

This chapter includes a summary of the study that centers on the initial questions which motivated the study, findings from the literature, conclusions based on the literature, and further research recommendations for further study.

Findings from Literature

After reading a bevy of literature on college readiness programs for low-income students several factors have emerged as being necessary for successful results: academic preparation; guidance counselors; teacher involvement; family involvement and college publicity. Figure 3 presents a comprehensive model of internal college readiness programs.

Figure 3. Comprehensive Model of Internal College Readiness Programs



Finding 1: Academic preparation. Academic preparation is important because if students do not have sufficient grades to enter college they might not apply, or might apply but not meet the academic requirement to gain acceptance. Also academic preparation is important for college persistence as oftentimes student's dropout because they do not feel able to keep up with the rigor of the classes. In order to increase academic preparation guidance counselors should be assisting students with their course selection (Corwin & Tierney, 2007). Teachers can also incorporate college level work in the school curriculum. Schools should also be presenting students to earn college credit while still in high school either through AP classes or with dual enrollment in neighboring colleges. Lastly, for those students who are below school academic requirements, efforts should be made by the school and the student to provide tutoring resources.

Finding 2: College guidance counselors. The College Guidance Counselor main responsibility is to provide students with the resources necessary to learn about, apply to, and enroll in college. This includes setting up a college resource center that can serve as the "hub of college guidance and activities" (Corwin & Tierney, 2007). Guidance counselors should also make sure that teachers and staff are aware of what is going on with the college process so that there is alignment within the entire school. For the students and parents, guidance counselors should be providing workshops that educate on financial aid and other topics that tend to be a barrier on college access for the students in the school. College talk, which is the next factor to be discussed, is also the responsibility of the guidance counselor along with the school administrators.

Finding 3: Teacher involvement. Teacher involvement is important to internal college readiness programs because outside of the academic preparation, teachers also serve as another source of college guidance. As individuals who have the college experience they serve as actors capable of producing social capital necessary. In essence teachers have the ability to act as parental figures for students whose parents have not attended college providing them with the social capital necessary for them to learn about the college experience firsthand (McClafferty, McDonough & Nunez, 2002). As an actor in the network and as a form of social support students should be able to depend on their teachers to not only provide them with academic preparation but also with basic college guidance. This can only be done if there is clear communication and trust between student and teacher (Holland and Hinton, 2009).

Finding 4: Parental involvement. Parental involvement is necessary because it takes school and parental guidance to foster college plans (Holland & Hinton 2009). Low-income students often do not receive this parental involvement because their parents have not attended college and feel as though they cannot be of service to their children (Radcliffe & Stephens, 2003; McClafferty, McDonough & Nunez, 2002). In building a college culture, schools should be presenting a welcoming environment for parents to come in and learn about the college going process alongside their children. Parents should feel welcome to come in ask about what is going on at school and workshops for parents should be held to inform them about the college process (Radcliffe & Stephens, 2003; McClafferty, McDonough & Nunez, 2002).

Finding 5: College Publicity. College publicity is the ever-present reminders in a school about college. Corwin and Tierney (2007) state that a schools culture is present as soon as one steps on the school's campus and can be seen in the hallway decorations and interaction between people in the school. College publicity describes how schools can implement a college culture in their school; consisting of college posters, college newsletters; college decorations in the classrooms; a place in the school where college acceptances are displayed; and having alumni coming back to talk to current students (McClafferty, McDonough & Nunez, 2002; Corwin & Tierney, 2007).

This framework of academic preparation, college guidance counselor, college talk, family involvement, and resources provided will be used to analyze the KIPP schools model of academic preparation for the students in the school. Also the results gathered from the staff and student perceptions will be compared and corroborated with the findings from the literature.

Conclusions

It is the hope of the researcher that the results of this study will serve as a comprehensive examination of a successful internal college readiness programs which will in turn serve as a blue print for other schools with a high population of low-income students looking to increase college access for their students. As this is merely a proposal for a study to be conducted in the future, there has been no data collection to measure student and school staff perceptions of internal college readiness programs; however, conclusions can be drawn on the literature based question.

Literature Based Question. In this study the literature based question is: What are the components of an internal college readiness program that are most influential for low-income high students pursuing higher education? Based on the literature the important components of an internal college readiness program are: academic preparation; the guidance counselor; teacher involvement; parental involvement; and college publicity. These components along with a clear focus of college going, motivated and committed students and adapting to the needs of the school, students and community create a successful internal college readiness program (Perna & Swail, 2006).

The literature also illuminated the importance of embedding these factors in a network producing social capital (Coleman, 1988; Gonzalez, Stoner & Jovel, 2001; Lin, 2005; Perna, 2005; Portes, 2003). Social capital theory allows for the researcher to identify the specific components that produce social capital and interpret which components produce more social capital than the others.

Future Recommendations

In order to create a blue print for successful internal college readiness programs the following recommendations would be valuable:

Comparison of two or more programs. Future research should include a study comparing two reputedly successful internal college readiness program to analyze if there are more essential components. Also comparing programs, especially programs where the low-income student body make-up is different, either by race or geographic location, will allow researchers to determine different need for different types of students.

Combination of Internal and External programs. While this study highlighted some of the benefits of external college readiness program, future research should study students who attend a high school qualifying as an internal college readiness program but are also enrolled in an external college readiness program to assess if the access to higher education is heightened for that student.

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NCLB and Accountability: How Do Testing and Teachers Impact Retention?

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Abstract

This study seeks to uncover the role that high-stakes testing mandated by “No Child Left Behind” legislation and student-teacher ratio has on the retention of the traditional high-school student with an emphasis on the retention disparity between minority students and their White peers. This empirical, quantitative analysis uses school level data from the Common Core of Data. This data set was used to observe national trends between minority students and their White counterparts because minority students are generally the group plagued by underachievement and high dropout rates. Given the already expansive body of work surrounding what we refer to as the achievement gap, which can include issues of achievement ranging from grades to standardized test scores and even the issue of retention rates which this study focuses on, this study seeks to approach the issue from a different direction with a broader data set. Analyses showed that for minority male students (Black and Hispanic) a lower-student teacher ratio greatly contributed to their retention yet conversely White females’ retention seemed to be somewhat unaffected by student-teacher ratio fluctuations and high-stakes testing. Therefore, this study suggests that although student-teacher ratio and testing do have an impact on retention, this impact is primarily only for minority students, impacting minority males at the highest level.

Introduction

Problem Statement

Education is often considered to be the impetus by which societies are able to change, however within the last decade the United States of America has managed to fall behind other industrialized countries in terms of graduation rates and overall education of American students. This issue is particularly relevant for members of minority communities who seem to become victims of the achievement gap that is present in American education. Since minorities seem to achieve at a lower rate than their peers, it forces the researcher to question why and more importantly how this is able to persist in a democracy where all are perceived to have equal access to upward mobility. Therefore, since education is flawed in America, it allows for a wide breadth of analysis and for the purposes of this study, the ideas of retention and teacher impact will be reviewed.

Purpose of Study and Research Question

This study aims to contribute to the body of literature about the current graduation rate problem and also education inequalities as a whole. The chosen analysis hopes to uncover the impact that student-teacher ratio and testing have on the retention of high-school students. The research question that seeks to expose this impact, if any is as follows: What impact, if any, do high-stakes testing and student-teacher ratio have on the retention of minority students in traditional high schools?

Significance of Research

Given the importance of education for upward mobility, the issue of retention is both timely and relevant. If students make the decision to drop out of school there is a whole host of issues and at the forefront given the recession is the economic strife that accompanies persons who fail to reach the higher echelons of education. This is not to say that without an education one cannot be successful but more so a statement of the general consequences for not pursuing education.

Summary of Analytical Framework

The analytical framework in this study serves as my mode of analysis and the way that I chose to approach the issue of retention. The factors listed are all pieces of the much larger issue of retention disparities.

Race and gender. For the purposes of this study, race and gender qualify as “minority status” and thus serve as the indicators of how much these two factors impact the retention rate of the traditional high-school students. These factors were reported by school officials, nationally.

“No Child Left Behind” Testing. Although the data set chosen for this study does not offer actual test scores, it does possess the years before and after this legislation was put into place which in effect offers the information that lends itself for analysis. By seeing how retention changes, or does not change, one can attempt to deduce that perhaps this testing may have had some form of impact especially given the debate over high-stakes testing which will be discussed further in Chapter Two.

Student-Teacher Ratio. Student-teacher ratio is the amount of students to teacher in the classroom. For example, 15 students in a class with one teacher will provide a student-teacher ratio of 15: 1.

Retention Rate. The retention rate is the rate at which students are retained throughout high-school which means the rate at which they progress from the 9th grade and get promoted to the next. Retention was used as the “achievement” measure because graduation rates have some skepticism about proper calculation and also due to limits of the data set. This issue will be discussed in further detail in Chapter Three.

Analysis and Discussion of the Literature and Presentation of Analytic Framework

“No Child Left Behind”

“These reforms express my deep belief in our public schools and their mission to build the mind and character of every child, from every background, in every part of America.” This statement was made by President George W. Bush in January of 2001. Bush made the announcement of *No Child Left Behind*, which will herein be referred to as NCLB, only three days after taking office because he felt that “too many of our neediest children are being left behind.” As a result of this sentiment, President Bush called for solutions based on accountability (school not necessarily student), choice and flexibility in Federal education programs.

All of the information relevant to this study is paraphrased and taken from the Department of Education’s section of the website devoted to NCLB and thus allows for a fairly simple analysis of what exactly NCLB is. This legislation requires that states set annual objectives in order to demonstrate progress for the next year and to show that they are making strides to close the achievement gap between minority students and their White peers. These objectives are required to take into account socio-economic factors. The goal of NCLB is that *all* high school students regardless of any socioeconomic status, achieve proficient levels of knowledge by 2014. Although this goal is a rather large one, it is indeed necessary for the promotion of the democracy known as the United States in which all people are able to have viable voice in the country. Without an education, some voices are being silenced because they lack the literacy to process the world that surrounds them which is extremely unfortunate and frankly undemocratic.

NCLB requires high schools to report graduation data which is part of a school’s yearly objectives. As a result of this, some states have decided that exit exams may assist with fulfilling all of the requirements of NCLB because that helps with the graduation rate reporting, adequate yearly progress reporting and the annual testing requirement.

The Problem with Testing

By implementing tests that can restrict students from being able to graduate one would presume that this would simply further contribute to students deciding to drop out from high-school. “Critics see it as fundamentally unfair to deny diplomas to students who have successfully completed thirteen years of schooling. They also see it as cold-hearted, considering that possessing a high school diploma is an important predictor of future life outcomes.” (Cameron and Heckman 1993) According to Cameron and Heckman, although there are so called high school diploma equivalents such as the ORE, there is still no real substitute for the diploma because there are still differences in wages and hours of work or even in terms of post certification education and other training decisions. According to these economists, a high school diploma is essential in order to live the best life possible or at least better than those who do not possess the diploma. Therefore the exit exams that essentially guard the pathway to

this upward mobility are thought of as extremely unfair and thus many people have an issue with state's interpretations of NCLB.

“Even some proponents of exit exams agree that they would lead to fewer students graduating. They argue that the tests are necessary in order to assure that high school diplomas are meaningful.” (Greene Winters 2004) The assumption is that exit exams measure proficient levels of knowledge and if students do not possess this after 13 years of schooling then they should not be granted a diploma anyway because the diploma will no longer be a measure of academic achievement because one does not necessarily have to be capable academically to obtain one. However, given this idea one may beg the question of whether or not these tests really assess proficient levels of knowledge. If they do indeed assess proficiency then how is it that students in Florida were able to be accepted into college and the military but could not pass their exit exams and thus could not progress to what is the next step of their lives. (Steinback) The more interesting part about the Florida bit is that for both the military and college, there are tests that are in place for students to demonstrate their intellectual ability. Therefore, what is so different between the exit exam that supposedly assesses proficiency and standardized test such as the SAT which demonstrates college preparedness? One would think that if a student was extended admission to a college or university that they would have proficient levels of knowledge but according to these exit exams they do not.

Amrein and Berliner (2002) have already examined whether states that adopted exit exams have seen increased dropout rates, decreased graduation rates, or increased percentages of students pursuing a GED. They found that 66% of states that implemented high school exit exams were negatively impacted by tests because of movement toward less desirable outcomes. However, some question the validity of this study due to methodological issues (Greene Winter 2004).

One issue is that they compared the graduation rates to national averages instead of simply states without exit exams which would have offered a clearer, more accurate distinction. Also, their measure failed to control for the magnitude of the changes in graduation rates, dropout rates, and rates at which students seek GEDs. As a result of these discrepancies, Greene and Winter (2004) decided to conduct their own study to determine if exit exams impact graduation rates and they found that exit exams have no effect. However, they admit that further research needs to be conducted to determine the validity of their study also.

Accountability According to Chicago?

Chicago, like many urban school districts, is plagued with academic underachievement. With high crime rates, poverty, and low education levels of many parents the education system in urban (and rural) communities face challenges that other areas of the country do not have to be concerned with. As a result of failing to educate many students adequately, Chicago decided to partner with Bill and Melinda Gates to create the Chicago High School Redesign Initiative which broke down their large high school into smaller learning communities. Most students who attended these schools were from impoverished communities in which they failed to excel academically. By breaking these large schools into smaller ones, positive outcomes were observed. Of particular concern was the observation of the difference in student-teacher relationships, which may seem minor but that are a major part of the educational experience.

“Almost all of the classrooms contained concrete evidence of generally positive and mutually respectful student-teacher relationships. For example, many of the teachers we observed expressed concern about students' well-being.” (Stevens, Spote, Stoelinga, Bolz 2008) This welcoming and warm environment can greatly impact the way a student approaches the knowledge that a teacher is attempting to impart. This reminds us of the accountability idea explained in Chapter I because these students may feel as if they owe something to the teachers to strive academically because these instructors are verbalizing that they see these young people as an investment and that they care about their well-being. “In response to a student's question about why he had to complete a homework assignment, another teacher replied, “Because I care about you.”” (Stevens, Spote, Stoelinga, Bolz 2008) This difference in teacher attitude, and the student's presumed understanding that instructors actually care about them being a success in life or not is critical to a student being engaged in their education. Therefore, the work being done in Chicago forces one to consider all of the things that impact education and all of the potential reform measures, if it as simple as saying “I care” as a teacher then perhaps policymakers should consider teacher *investment* more.

Summary and Implications of the Literature

After considering the literature, two major issues seem to be rather prominent: a) is high-stakes testing really a reason for students to drop-out and thus lower the retention rate of the school? b) are students more engaged in smaller schools and will that cause them to be retained at a higher rate? Since none of the literature offers a definitive answer for the national population, this study hopes to offer more information that can contribute to the discourse surrounding this issue.

Research Design and Methodology

Purpose of Study and Research Questions

As aforementioned in Chapter I this study aims to contribute to the body of literature about the current graduation rate problem and also education inequalities as a whole. The chosen analysis hopes to uncover the impact that student-teacher ratio and testing have on the retention of high-school students. The research question that seeks to expose this impact, if any is as follows: What impact, if any, do high-stakes testing and student-teacher ratio have on the retention of minority students in traditional high schools?

Data Collection and Data Sources

Data was used from the Public Secondary School Universe Survey Data from the Common Core of Data offered by the National Center for Education Statistics. School level data was used because it offers a different level analysis than the district level data that is also provided.

Data Analysis Strategies

The analysis was a linear regression using the formula: $n_{12th(year\ x)}/n_{9th(year\ x)}$. Data were adjusted as necessary and these adjustments will be discussed in greater detail in the next section.

Strategies for Minimizing Bias and Error

Traditional Public High-Schools only. This study focused only on traditional high schools so in STATA parameters were set to eliminate all schools that extended past the 9th through the 12th grade. For example, some schools went from grades 5 to 12 but those were not of interest for this particular analysis. By eliminating these other schools the study is more generalizable for national standards.

Student-Teacher ratio. In the data set there were some schools who reported 0 teachers for the school which obviously cannot be the case. Therefore, the data was adjusted to only include schools that had at least one full time teacher equivalent per every 100 students present in the school. By adjusting for this, many schools that falsely report information were eliminated.

Ethnic group of study. In order for the ethnic group of study to be included, at least 20 students had to be enrolled at the school for them to be included in the analysis. This adjusted for demographic changes in the community that may have taken place in which a situation occurred where for example only one African American student was in ninth grade and then in subsequent years you have 30 African American students. This gives a false retention rate so by adjusting for at least 20 students of the ethnic group, this helped to reduce issues and false readings.

Ethical Considerations

Given the sensitive nature of discussing minority status and the way that impacts the way minorities interact with their surroundings, there are a lot of assumptions and generalizations made about how both testing and student-teacher ratio impact minority student's retention. Therefore, it must be stated that not *all* minorities fit the conclusions that will be mentioned. Aside from this, all information is school reported and thus according to the National Center for Education Statistics, did not harm any student or participant while collecting demographic data.

Limitations of the Study

School reported information. Since this data was provided by schools, there is a fairly wide margin for error because of falsehoods reported by schools. As of right now, there is no other way to retrieve data so this is the standard limitation that a researcher incurs as a result of human error.

Retention instead of graduation rates. Of vast importance is the fact that retention rates were calculated and not graduation rates. Since this data set does not offer information on the number of diplomas granted, the study is confined to the data that is offered which is the amount of students in each grade each year. Due to the fact that this is not necessarily a study of graduation rates, some may argue that it does not have much bearing on the graduation rate issue. However, it does shed some light on the drop-out problem which certifies that it is still valid.

Same year data. The formula presented earlier in this chapter uses the same year of students. This is a major risk when it comes to making this study generalizable but it had to be done in order to maintain the integrity of the research question.

Findings, Conclusions and Recommendations for Future Research

Findings

Findings of this study are represented in Appendix A. Be advised that this is a graph that represents the general trend represented in the data that answer the research question. Additional data are available upon request if you contact bharrison@nea.org

Conclusions

From the data presented in Appendix A we are able to see that minorities are indeed impacted by student-teacher ratio but not necessarily high-stakes testing. Since the retention rates are fairly similar in both 1999 and 2007, it seems that that may not be a factor in retention rate fluctuations however there could always be other reasons for a retention rate remaining fairly consistent.

Perhaps the most interesting observation that can be made from looking at this data is the fact that Black males seem to be so impacted by the student-teacher ratios. Their female counterparts are pretty consistent in the year 2007. It is also interesting that Hispanic males and females are very similar to Black males in that when classes exceed 41 students per every 1 teacher their retention is drastically reduced. Once again, other factors must contribute to this because perhaps many of these overcrowded classrooms may be in impoverished communities in which educational outcomes are impacted anyway.

Recommendations for Future Research

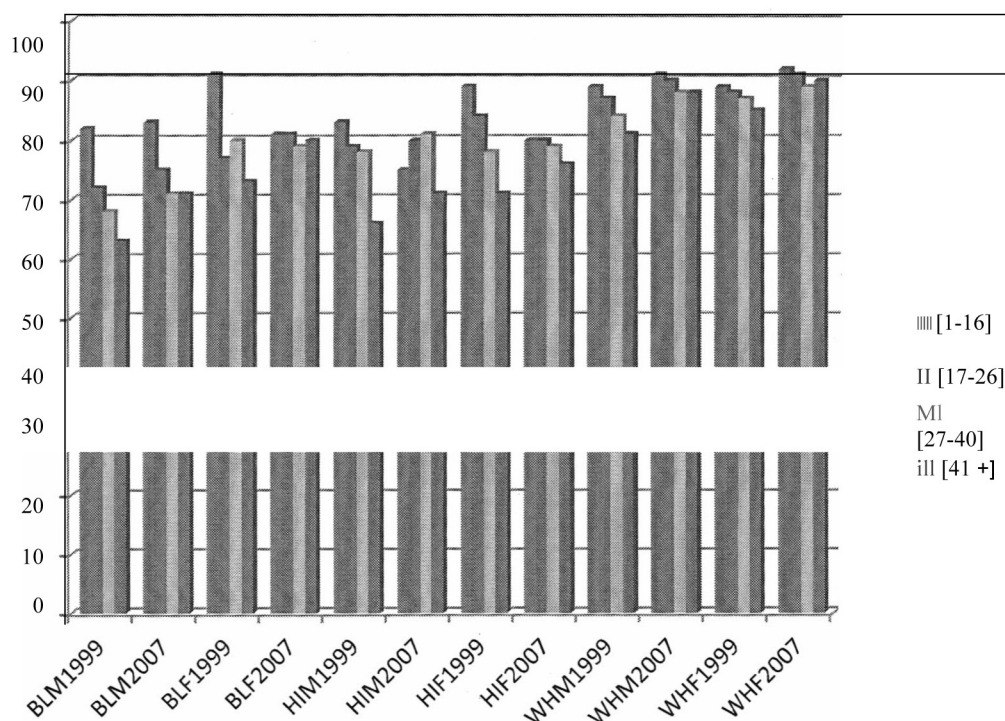
After carefully reviewing the findings and realizing that this issue primarily impacts members of the minority community, I have determine three primary recommendations for future research which are as follows:

Geo-coding and mapping the areas with the lowest retention. By actually seeing where the areas in need are, programs can be constructed and implemented to address the problem in the communities. This could make the study useful for policymakers and those in charge of state legislation, particularly because of the educational implications of a community that lacks education. Rarely do policymakers want to have areas of their communities that are crumbling. It eventually costs taxpayers dollars that could be spent on other things.

Merge findings with census data to control for various neighborhood indicators. Indicators such as crime, socioeconomic status, general income of the area and even average education level obtained by members of the community offers a great deal of context for issues in education. This additional analysis would provide the context in which more conclusions could be drawn about what causes retention rates to fluctuate.

Determine the impact that school finance has on retention rates. Students feel invested in if their teachers say they *care* about them and express that they believe in them. It would be interesting to see if the same could be observed for when students feel financially invested. If they have new buildings, up to date books and the most recent technology, will students have a higher retention rate?

Appendix A



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Note: More citations will be added as this study progresses. This is merely the first phase of the project and thus a longer reference list will be offered when the study is more comprehensive.

Delineating the Differences in Veterinary Treatment between Domestic Companion Pets and Production Animals in the United States: Implications for Policy

DeKarra Johnson

Mentor: McNair Staff

Abstract

People's attitudes toward animals impact the quality of veterinary treatment provided for domestic companion animals and production animals. The value of certain animal species in society is dependent on how humans can relate to and benefit from animals. In the United States, some domestic animals such as dogs and cats are held in high-esteem and are given near-human status. On the other hand, domestic animals like cattle and swine, which are primarily used as food sources, are given the status of inanimate objects to be treated as property. As a result, the allocation of resources, including capital and labor, is not proportionally distributed between companion animal medicine and production animal medicine. There are negative consequences of this uneven distribution that threaten the security of the United States' food supply and human health. The spread of foodborne illnesses and antibiotic-resistant pathogens can be linked to weak food safety and antibiotic regulations for production animals. Such weaknesses enable diseased animals to enter the food supply contaminating millions of pounds of animal byproducts consumed by companion animals and humans. By understanding what factors influence people to continue providing inferior veterinary treatment to the production animals they depend on for subsistence, scholars and practitioners in the field of animal husbandry can create new and effective strategies that encourage sympathy toward production animal wellness for the sake of human wellness. Building upon a completed review of the literature, research addressing the aforementioned issues will be developed and implemented to satisfy requirements in the McNair Scholars Program.

The Effects of Brain Drain on Haiti

Whitney Joseph

Mentor:

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Abstract

This study was conducted in the form of a historical analysis to understand and determine the various ways that human capital flight, better known as brain drain, has impacted Haiti and how occurrences such as political events, have influenced brain drain in return. The first research question seeks to identify determinants in Haiti that contribute to brain drain. An analysis shows that the three main contributors are the economy, healthcare, and education. The economy is a major factor because of the mishandling and insufficient availability of funding to provide and maintain job prospects. It also affects healthcare and education because Haiti is not financially stable and the country does not have enough fiscal capital to apportion to those systems. Healthcare is a contributing factor to brain drain because the pay to healthcare professionals such as doctors and nurses, who are lacking in accessibility, is lower than in other countries. Another contributor to brain drain is education because the education system is weak and not only do few individuals acquire a post-secondary education, there are few opportunities to advance in specialized fields of interest and conduct meaningful research. Also, the country does not have enough money to provide upgraded, recent resources and materials needed for research and studies.

Brain drain has impacted political development because there are not enough policies to address many of the issues faced by Haiti, while economic development has been effected because the output of human capital is not enough to sustain the lost capital from highly-skilled emigrants. The development of education has been impacted by brain drain in the same way that education has influenced brain drain through the absence and lack of necessary educational resources, which is a result of the very low funding allocated to post-secondary education. The lack of job and career opportunities, as well as opportunities to advance in education, motivates Haiti's educated professionals to leave the country.

The presidential reign of Francois Duvalier was imperative in influencing the brain drain epidemic that plagues Haiti because many Haitians emigrated to places such as the Dominican Republic, the United States, Canada, and Cuba. The reasons behind the emigration were as a result of many changing policies and rules that were enforced that placed many people's lives in jeopardy. In fear, numerous Haitians left the country for better career and lifestyle opportunities abroad and the number of documented Haitians that have left the country has continued to increase annually.

Introduction

Human capital flight, more commonly referred to as 'brain drain', has continued to have significant negative effect on the development of the Republic of Haiti. It is a predicament that has been researched at numerous times and in numerous ways, with several common definitions. According to Viem Kwok and Hayne Leland, brain drain "...commonly used to describe one of the most sensitive areas in the transfer of technology [that] refers to skilled professionals who leave their native lands in order to seek more promising opportunities elsewhere" (Kwok and Leland 1982). Robert L. Barker, author of *The Social Work Dictionary*, defined brain drain as "A nation's or institution's loss of scientific, technical, or leadership talent when these people relocate. This is a problem in developing countries, which use their limited resources to educate citizens only to see them migrate to nations that offer higher salaries or other desirable conditions" (Barker 2003), while Allan G. Johnson, author of the second edition of *The Blackwell Dictionary of Sociology*, labels brain drain as "...a situation that occurs when talented highly skilled people migrate from one place to another, especially in search of advanced education and employment. It often occurs when young people migrate from Third World countries to Europe or the United States" (Johnson 2000). The International Physicians for the Prevention of Nuclear War (IPPNW) simply defines the brain drain situation as the "permanent [or long-term] migration of [a] skilled group of [a] population from one country to another" (International Physicians for the Prevention of Nuclear War).

When brain drain occurs, individuals with expertise and talent in a variety of disciplines depart from where they live and migrate elsewhere. The reasoning may vary anywhere from poor living conditions and lack of employment opportunities to war and political instability. As a result of this emigration, the region where these adept, educated individuals come from is left educationally and economically deprived. The region that experiences this drain in talent loses resources that it needs to adequately sustain itself. Brain drain can be a serious predicament depending on the country that one is referring to, the population, the number of educated individuals that leave, and the fluctuation in the magnitude of how many people leave annually.

Knowing the gravity of the brain drain situation in Haiti is important largely due to the fact that it is a developing country. Although it appears that there is no universal definition for brain drain, the term generally refers to low or even mid-income countries that are not industrialized. Some developing countries are referred to as Least Developed Countries (LDCs). The UN distinguishes LDCs as low-income countries; that have weak human resources on nutrition, health, education, and adult literacy; are economically vulnerable in terms of instability of agricultural production, instability of the exportation of goods and services, the economic importance of non-traditional activities, concentration of merchandise exportation, impediment of economic smallness, and the percentage of the population displaced by natural disasters (UN OHRLLS 2003).

Trends in migration are not a new occurrence for Haiti. Large migration patterns began in the 1960s with the Duvalier regime that began with Francois Duvalier and continued in the 1970s in Cuba. Since these times, more Haitians have emigrated to countries such as the United States, Canada, Cuba, and France. In the U.S. there are continuous discussions about the large clusters of Haitians in cities such as Boston, New York and its metropolitan area, Miami and Fort Lauderdale.

Purpose of the Study

The purpose of this research study is to analyze human capital flight, or brain drain, within the Haitian Republic. There are differences of opinion in how scholars define and measure brain drain, or aspects of brain drain. I will be analyzing the internal potential causes of migration including natural disasters, political turmoil, and the education systems. My goal is to see if it is possible to pinpoint brain drain to one event or multiple events. I want to know how brain drain affects Haiti because of the perceived negative effects that occur as a result. I will seek to answer three questions within this study: (1) what are the internal factors that contribute to brain drain from Haiti, (2) how has brain drain impacted the overall political, economic and educational development of Haiti, and (3) how important were political events (e.g., removal of Jean-Bertrand Aristide, Papa Doc and Baby Doc Duvalier) in influencing brain drain?

In addition to these research questions, I am considering the philosophical question of how developed countries such as the United States fit into the issue of brain drain with their implemented programs to attract skilled workers from other regions, especially developing countries. In considering this, I believe this mentality is imperialistic in the sense that it allows countries like the U.S and the European Union (EU) to obtain control over less powerful countries. Others believe that the idea to take and utilize the most educated individuals for the benefit of their work is a good economic western thought. The question that will be answered in this instance is whether brain drain is the result of practical economics, of people trying to make a better living abroad due to circumstances such as corruption and poor management, or if Haitian migrants should remain in Haiti to work in institutions such as college, and banks.

Significance of Research

The significance of this research is to provide an in-depth understanding of how natural and political events can affect or motivate brain drain. An increased understanding may lead to the discovery of possible constructive solutions or preventative measures to curtail the negative effects of brain drain in Haiti. The impact of brain drain on Haiti is of particular importance now because Haiti cannot afford to lose any more valuable resources, especially human capital, since the tragic January earthquake.

Delimitation

The main delimitation that I faced in conducting this research has been the fact that my research is not empirical. My research is based on secondary research, on other individuals' research and work. Another delimitation I have faced is finding consistent, concrete, reliable data on Haiti that I can. Nevertheless this is an important topic because the problems experienced by Haitians are ongoing and further research will investigate causes of brain drain and its impact on Haiti. The research is relative to the overall development of Haiti because it is a variable in Haiti's development.

Definitions Related to Research

As previously mentioned, brain drain or human capital flight occurs when many of the proficient, educated individuals who leave the country, often in search of better living opportunities, do not return. As a result, their communities and country are left deprived of quality workers needed to improve conditions and the community is left at a disadvantage for which it must struggle to find a replacement or solution for the absent, but necessary work. International migration, the global movement of people between different countries, is a significant component of brain drain. Depending on the economy and population of a certain country, the magnitude of external international migration from a given country can be quite devastating. Another integral part of brain drain, or human capital flight, is human capital. Human capital is “the measure of the economic value of an employee’s skill set [that] builds on the basic production input of labor measure where all labor is thought to be equal. The concept of human capital recognized that not all labor is equal and that the quality of employees can be improved by investing in them. The education, experience and abilities of an employee have an economic value for employers and for the economy as a whole” (Edralin). The Concise Encyclopedia of Economics defines human capital as “expenditures on education, training, medical care, and so on as investments in human capital” (Becker 2008). It is important because a viable country is not possible if there are no human resources.

Section 1 of this paper is an introduction that includes definitions of relevant terms and states the purpose of the paper and the significance of the research. Section 2 provides a literature review that summarizes sources read in reference to the research. Section 3 explains the research design and the methodology used in the study. Section 4 summarizes the paper through findings, conclusions, and recommendations for future research.

Literature Review

The overall topic investigated is the impact of brain drain on Haiti by investigating the contributors of brain drain, its impact on political, economic, and educational development, and the value of political events in inciting brain drain, through a historical perspective. As a result, included are the summaries of some of the sources that were found in relation to the research and brain drain. Most of them are research or working papers specifically about the impact of brain drain on various regions, measures, such as income, or institutions, such as education systems.

Brain drain and human capital formation in developing countries: winners and losers

In this paper, Beine, Docquier, and Rapoport (2008) define brain drain as the “international transfer of resources in the form of human capital and mainly applies to the migration of relatively highly educated individuals from developing countries” (631). The study looks at the theoretical and empirical framework of brain drain and summarizes migration data gathered from a dataset created by Docquier and Marfouk (2008). The theoretical framework involves the influence and option of education as a factor to human capital, the effect of migration, and the proportion of educated people before and after migration, while the empirical framework considers variables such as the level of human capital before migration, the degree of skilled migration at the start of the migration period, and population density in 1990, the starting year of the study.

In terms of results, the study looks at econometric issues that include variables of life expectancy at birth, total country population, racial tensions, emigrants living in countries that are part of the Organization for Economic Co-Operation and Development (OECD) before the observed time period, and the gross domestic product (GDP) of countries that were a source of migration (639). Cross-sectional results, or results that span various countries, show that source countries care more about the individuals who remain in the country after receiving an education. Those countries that lose human capital from brain drain significantly lose more than those countries that obtain a slight gain from human capital. However, the research reveals that brain drain can have beneficial effects on developing countries that have a large enough population, such as China, India and Brazil, so as to offset/minimize the impact that the brain drain will have. Overall, the gains numerically outweigh the losses and as a whole, developing countries seem to expand their human capital (648). The significance of this document to my research is that the results found for Haiti showed that the country had a negative effect. It proves that between 1990 and 2000, brain drain had a negative effect on Haiti.

International migration by education attainment, 1990–2000

Docquier and Marfouk, along with Beine (2008), sought to address the issue of an absence of an organized, observational evaluation on the intensity of brain drain by creating a construct a worldwide database on international movement by educational achievement. They essentially argue that admission into schools in countries of origin would improve if more individuals go back to school in their native country, the chances of migration increase the anticipated return of human capital. They also note that “quality-selective” immigration policies were used to choose the individuals desired in the work force. The study calculates emigration rates and stocks by the level of education acquired in countries of origin in 1990 and 2000, using data sources such as censuses, microcensuses, register data. The findings of the study reveal that emigration stocks are larger in regions such as Europe and parts of Asia and are concentrated in regions such as the United States. The highest emigration rates are found in regions such as Central America, Africa, and the Caribbean.

Educated migrants: is there brain waste?

The research completed by Ozden seeks to analytically address the issue of why some talented immigrants, especially those that come from Latin American, Eastern Europe, and East Asian countries, find it difficult to obtain a skilled job in their area of expertise. Several variables such as money spent on post-secondary education, education taught in English, GDP, the distance between native countries and the U.S, and openness of U.S immigration policies to certain countries, and the level of difficulty encountered when migrating based on level of education (227).

Some individual factors that affect why people migrate are whether they should migrate, their financial ability to migrate and whether a person is prepared and content with living away from home, while country or communal factors that affect why people migrate are support or social networks. Some discrimination towards migrants is based on skill or education level, which is the case with OECD countries. Several predictions are provided for why occurrences such as ease of migration happen the way they do, where higher skilled migrants have more difficulty. Ease of migration is an important factor that is encountered when considering the jobs migrants receive when they arrive in their destination country.

Data from Docquier and Marfouk (2006) as well as U.S. Census data is used to conduct the research, of which there were over 200,000 observations included in the dataset. Occupations were divided and labeled as “high skilled, which incorporated individuals such as scientists, accountants, engineers, and teachers with at least a full college education, or low skilled, which categorized individuals who obtained less than a full college education and included technicians, police, waiters, and drivers (232).

A graph from Docquier and Marfouk’s (2006) research shows that in 2000, Mexico has the highest migration rate to the U.S, followed by the Philippines. Haiti’s migration rate to the U.S is significantly higher than the rates for migration to other parts of the world. Another graph obtained from Docquier and Marfouk’s (2006) data shows that for many countries, the share of emigrants that go to the U.S is higher than the EU-15. However, this does not include Mexico, whose share of highly skilled emigrants to the EU-15 is over three times that for the U.S. In terms of Haiti, the focus point of this research, the share of highly skilled emigrants that go to the EU-15 is higher at 46%, while the percentage for the U.S is 38%.

A table obtained from the World Bank on tertiary education shows that enrollment in post secondary education in Haiti is almost nonexistent compared to an approximate low portion of Haitian immigrants who have a post-secondary degree when they arrive to the United States. The last table used in this research compares the stock of migrants in the U.S and the European Union with a primary, secondary or tertiary education. Although the number of migrants with a tertiary education increased from 1990 to 2000, the number was higher for the United States.

The researchers calculated the proportion of migrants who had skilled jobs and a tertiary education and data shows that in general, Latin Americans are the least likely to find skilled jobs. Two types of variables, quality variables that explain why the equal levels of education are weighed differently in the U.S., and selection variables that explain the differences in abilities of migrants from different countries (237). From various calculations and graphing, the results show that the distance between the native country and the U.S., the English language, and money spent towards tertiary education seem to be important factors that have a positive and strong effect on the chances of educated migrants acquiring a skilled job. Educated migrants who come from countries where English is a commonly spoken language and where much of the money and resources are spent on post-secondary education, work more efficiently in the U.S. In turn, this becomes a significant reason to why migrants from certain geographical areas find it easy or more challenging to find skilled work when they migrate to the United States.

Brain drain and inequality across nations

In this research paper Docquier (2006) seeks to answer the question of whether brain drain is a constructive event or a when considering its ... on developing countries. He focuses on two aspects of migration that call attention to the emanation of brain drain on developing countries and the contradicting views and ideas of skilled migration as something that is quite advantageous, although it deprives countries of essential human capital. The purpose of this paper is to provide a better understanding and portrayal of brain drain and a survey of empirical and theoretical studies on brain drain (3) with the intent to offer policy recommendations that will benefit the impoverished people of developing nations, through the use of macroeconometric studies.

A common problem found in relation to brain drain is that accurate data on migration is unreliable and there is often a lack of information on the education level attained by immigrants. Docquier and Marfouk (2006) expanded on the brain drain research conducted by William J. Carrington and Enrica Detragiache by creating an international data set on skilled migration. One finding revealed that although larger countries have more people that emigrate, emigration rates are highest for middle class countries. The European Union plays a significant role in international migration because numerous individuals travel there from African countries and many of these countries are developing countries that are left at a disadvantage and cannot afford to lose these migrants. The data shows that there is a strong relationship between human capital and the output gained for every worker in the labor market in the sense that as human capital is reduced numerically, more workers have lower levels of education. There is research that shows that brain drain can be a positive occurrence when the human capital gained is greater than the human capital that was lost.

It was concluded from the research that the positive effects of brain drain can have a significant impact and may create an increase in human capital. The best possible skilled emigration rate necessary to create a gain in human capital differs depending on the country in question and factors including "population size, political environment, education policy, level of development, etc" (23), but on average a rate of five to ten percent is needed for a gain to be present. Obtaining human capital gain from international migration is possible if quality-selective immigration policies that do so are created and are affixed with motivators that influence people to return to their home countries and enforce international participation. Docquier seems to suggest that taxing individuals based on level of education would be a useful tool in increasing brain gain. He states that more empirical research and data such as surveys are important and necessary to create policies to combat brain drain.

An analysis of the cause and effect of the brain drain in Zimbabwe

This study, which was a conducted as a collective effort between the Scientific and Industrial Research and Development Centre (SIRDC) and the National Economic and Consultative Forum (NECF), was directed by C.J. Chetsanga. It was conducted to identify and understand the status of the brain drain epidemic that is occurring in Zimbabwe, the reasons to determine the best possible solutions to resolving this issue. The purpose of the study was to "establish the trend, rate, and level of brain drain in Zimbabwe" while investigating the events that motivate professionals to leave the country or desire to return to the country. This study is important because understanding the causes and effects of brain drain in Zimbabwe will allow policy-makers to brainstorm and create policies and programs that will combat this phenomenon and reduce its severe negative impact. The relevance of this to my research is that Haiti, like Zimbabwe, is a developing country that has and continued to suffer in many similar ways.

The data collected regarding brain drain observed trends from 1990 to and incorporated visits to South Africa, Botswana, Canada, the United States, and the United Kingdom, the most common emigration destinations for Zimbabwean individuals. In order to fully grasp the impact of brain drain researchers gathered demographic info on variables such as socioeconomic status, gender, age, profession, and skills. An important part of the research took into account three types of brain drain: (1) primary external brain drain, where professionals leave their native country for overseas host countries, (2) secondary external brain drain, where professionals leave their native country for other countries in the same geographic region, and (3) internal brain drain, where individuals work in occupations outside of their field of expertise or move from public to private sectors.

Researchers studied socioeconomic statuses, determining the causes of these conditions, and then created questionnaires that were distributed to individual Zimbabwean people who had lived outside of the country for more than six months, private institutions and non-governmental organizations (NGOs), 13 universities and colleges, and public sector organizations including ministries. They also conducted group discussions, brainstorming sessions, and interviews in the United States, the United Kingdom, Botswana, and South Africa. These are the places that most Zimbabweans are documented to migrate to after leaving their home country.

There were several important findings that appeared from the conduction of the study. Some of the findings include the fact that most of the educated people who have left Zimbabwe have been teachers and nurses because of budget cuts to education and healthcare and most of the questionnaire participants received Baccalaureate degrees. The largest motivator for leaving Zimbabwe seemed to revolve around issues within the labor force, while the most common reasons for leaving included low salaries, exchange rate, and greater career opportunities. A majority of them had intentions to eventually return to Zimbabwe or had a desire to do so. Age played an important part in their decision as those who were middle aged were more uncertain as to whether they would or had a desire to return because they had families, while younger and older respondents showed more of an intent and desire to return.

Several conclusions were made based on the aforementioned findings as well as the research and information gathered from the study. The researchers arrived at the conclusions that Zimbabweans are unjustly discriminated against when they leave their home country in search of better opportunities and that placing more legal concerns on this issue may not be very beneficial. Although teaching and nursing are the two areas that are most affected by the Zimbabwean brain drain, another factor is, brain drain is still a significant issue for professions where the small number of skilled professionals leaving are those who have the most skills and knowledge in their respective fields of expertise. Many of the proposed recommendations given in the report were in relation to policies that could potentially reduce the extensive brain drain in Zimbabwe such as ...

International migration, remittances and labor supply: the case of the republic of Haiti.

Jadotte (2006) first makes note of early migration patterns in waves—the first wave involving migration from Haiti to Cuba and the Dominican Republic in the early 1900s, and the second wave including emigration during the Francois Duvalier regime of the 1960s. He refers to the fact that the aggregate monetary income for remittances in 2007 was about \$1,200 billion dollars, establishing and confirming the fact that remittances are of large significance to the Haitian economy. The issue faced in this paper is that there is little substantial information on the tenor and evaluation of the ramifications of international migration and remittances on Haiti's economy. The importance of remittances comes from the fact that they increase the quality of life of the recipients by allowing them to use the money for purposes such as food, education and healthcare and they contribute to the increase in capital of the inherited country. However, some downsides are that they can reduce women's income in the remittance-receiving households and it can have an affect on how working people behave because they may become idle or dependent on the remittances (5).

Jadotte conducted an analysis of international migration by looking at the number of relatives in a household that live abroad and of remittances by looking at whether households receive remittances. He used a Haitian Living Conditions Survey (HLCS) administered to about 7,200 homes with questions that focus on relatives of the household that do not live in Haiti and whether the household obtains remittances (7). Over 25 percent of households receive remittances, some of which count for a significant source of income. It seems that regardless of income, the percentage of household individuals with a post-secondary education is below one percent. However, in terms of migration, there is a positive correlation between income and the level of migration in addition to the percentage of those who receive remittances. Approximately two percent of people who live in houses with migrant relatives abroad have a post-secondary education and the same applies for houses that collect remittances.

The results of the analysis show the chances of migration are not significantly affected by education level and are lower in farming- or fishing-involved households. Yet, chances are higher in semi-urban and rural areas and are positively affected by households with livestock and landholding. Most Haitians who migrate out of Haiti move primarily to the U.S., the Dominican Republic, and Canada.

Predicting risk factors associated with forced migration: an early warning model of Haitian flight

Shellman and Stewart collaborated in an attempt to build an “early-warning model of Haitian flight” based on the prediction of five main risk factors: (1) government and rebel behavior toward each other (2) the Haitian economy-inflation (3) the U.S. economy-inflation (4) U.S. wages, and (5) U.S. foreign policy action toward Haiti. Another key factor taken into consideration was Haitian migration to the U.S. This research is important because knowledge and prediction of potential risk factors would allow policy-makers to plan for tragic events. The study was conducted longitudinally with a focus on weekly migration patterns, which was beneficial in examining migration by allowing for numerous observations, providing a better interpretation of what causes migration, and “providing more useful predictions for policy-makers”.

The authors argue that “migration is a function of various domestic and international political, economic, and cultural factors” (Shellman and Stewart 2007). Economic and foreign policy measures were added to the models of the changes in government and rebel behavior toward each other because of the argument that a poor economy influences the behaviors of both. Shellman and Stewart essentially theorize that U.S interaction and foreign policy will influence government and rebel behavior and decisions, although the influence could possibly be positive or negative. It is theorized that violent and hostile behaviors motivate people to leave their native country.

Weekly data from the U.S Coast Guard on the capture of illegal Haitian immigrants travelling by boat, from 1994 to 2004, was used in place of the absence and unavailability of annual Haitian migration and refugee data. Shellman and Stewart use various methods to validate their data. Economic data was computed with the use of Consumer Price Indexes for Haiti and the U.S., and wages for the U.S. were calculated for its economic observance.

The results show that inflation has a negative effect on rebels, who react more violently, and no effect on the government, which is also the case with behaviors in foreign policy; in terms of the rebel-government relationship, high interaction results in less hostility while low interaction increases hostility; the Haitian government is more hostile to the rebels when inflation and U.S. foreign policy are considered. Adverse U.S. foreign policies, rather than reciprocal foreign policies, toward Haiti galvanize migration for refuge to the U.S.

Haiti Asks Expat Professionals to Return and Help

Written four months after the tragic earthquake that plagued Port-au-Prince, the capital of Haiti, and surrounding areas, the article addresses the concerns and efforts of government minister Edwin Paraison in stimulating Haitian emigrants in host countries such as France to return to Haiti to aid in the reconstruction of Haiti. His goal was to “promote the government’s mobilization plan to entice professionals back, with offers of good salaries, housing, and transportation.” The return of Haitian professionals would make a positive difference in advancing reconstruction efforts and a slight remedy in Haiti’s brain drain. McKenzie states that the UN and the Haitian government are working together to provide incentives such as payment to attract professionals to help. Watching as their colleagues leave to work in Haiti would inspire more Haitian professionals to provide personal aid.

Research Questions and Methodology

Purpose of Study and Research Questions

As mentioned before, the problem with brain drain is that many of the proficient, educated individuals who leave the country, often in search of better living opportunities, do not return. As a result, their communities and country are left deprived of quality workers needed to improve conditions and the community is left at a disadvantage for which it must struggle to find a replacement or solution for the absent, but necessary work. Thus, the purpose of this study is to examine and determine how brain drain impacts Haiti by identifying the factors within Haiti that influence brain drain, how brain drain has affected politics, economics and education, and how relative political events have stimulated Haiti’s brain drain.

Data Collection and Sources

The primary method used to collect data and analyze the literature was the use of the Google search engine, which included the Google Scholar and Google Books sections, was initially used as a resource to find articles, papers and general information on brain drain. This proved to be quite useful as numerous relative sources were found from the websites of important organizations such as the World Bank, the International Monetary Fund, and the United Nations. These sites were directly searched for sources and available statistical data tables on migration and remittances. The University of Maryland library research port was used to locate books and online databases, including General/Multi-disciplinary databases such as Academic Premier, EBSCO and JSTOR. Various search terms or phrases used to locate desired sources were “brain drain,” “human capital,” “human capital flight,” “migration,” and “Haiti”. U.S. Census Data was searched, but no pertinent data was found. No relevant statistical information could be found from the Haitian Institute of Statistics and Informatics, an agency under the Ministry of Economy and Finance. Little information was found from the website of the Haitian Embassy.

Data Analysis Strategies

The analysis for each of the three research questions was similarly conducted. For the first research question, the three main areas of focus were economic, healthcare and education. As a result, readings on brain drain in reference to these topics from government, organizational, or institutional websites were given precedence in terms of importance, especially those sources with information or data specific to Haiti. The relationship of the readings to each other, as well as the similarities and differences in the findings of the readings, were considered to give an idea of how the economy, healthcare, and education in Haiti have or may influence the magnitude of the brain drain that has been experienced in the country for years. Various readings note that the effect of the economy on brain drain is a major reason for the migration of skilled individuals because of the lack of sufficient job or career opportunities available.

The same method that was used to analyze the internal factors was also used to analyze

Earlier this year in January, Haiti suffered from a tragic 7.0 magnitude earthquake, which further exacerbated the poverty-stricken developing country. As a result of this earthquake, a suggestion was made that some of the literature analyzed should involve the relationship between brain drain and natural disasters, particularly because of the 2004 Tsunami that wreaked havoc and destruction on several countries in the Indian Ocean.

Timelines of historical events in Haiti were reviewed from various websites to ensure that the information and dates were reliable. Viewing timelines would aid in the identification of political events that may have impacted brain drain in Haiti. In terms of political events that were analyzed, the research focuses on the forced removal of the former president of Haiti Jean-Bertrand Aristide and the Duvalier regime that occurred under the rule of former President Francois Duvalier, followed by his son Jean-Claude Duvalier. The readings regarding these two events explained what happened, although not specifically in terms of brain drain. However, in analyzing these events, consideration was given to what occurred during those presidencies and how, given the research, reading and analyses done, they affected brain drain.

Strategies for Minimizing Bias and Error

To ensure that the research remained as objective as possible, precedence on references was given to scholarly papers and articles that were written by researchers or that were sponsored by organizations such as the World Bank and the International Monetary Fund; these organizations specialized in and continue to do research on brain drain. Secondary Preference was given to by the Verifying information that is commonly repeated in multiple sources and relying on research papers and relevant studies to ensure that information from secondary sources is accurate. Multiple databases were used , with the application of various search methods, to find desired information and data.

Ethical Considerations

There were no ethical considerations of concern with this research because it was written from a historical perspective and did not involve the thoughts and opinions of participants.

Limitations

As previously stated, a major limitation to this research was the lack of reliable information that was available regarding migration in Haiti, especially in terms of statistics. This is a general problem that arises when attempting to collect quantitative data on migration.

Findings, Conclusions and Recommendations for Future Research

Findings and Conclusions

Brain drain is a topic of which there are many conflicting views on the costs and benefits, even though most researchers agree that it does more harm than good. Its global impact influences many aspects of society and vice versa. In Haiti, although many factors influence brain drain, the economy, healthcare and education seems to have the most significant role in how brain drain has and continues to develop.

Research Question 1: What are the internal factors that contribute to brain drain from Haiti?

The largest factor that influences brain drain is the economy, followed by two other imperative factors that were focus points in this research, healthcare and education. In a world propelled by globalization where many societies are capitalistic, having an economy that can actively compete in the global market through the importation and exportation of goods is imperative. Much of the economic hardship that Haiti has experienced has been as a result of misuse and corruption of funding by the government and elites. This has created an inability for the country to use and allocate its finances to important systems such as the workforce, education and healthcare. Professionals such as doctors, nurses, teachers, engineers, and architects do not receive reputable wages in comparison to other countries. The results of several studies show that brain drain has a negative impact on Haiti and that if not for remittances, money returned to Haitian citizens from friends and family in the Haitian Diaspora, the condition of Haiti's economy would be abominable.

Migration to countries such as the United States has continually increased at least over the past 20 years. In addition to the state of the economy, the deprivation of adequate healthcare in a country where there is no universal healthcare for its occupants is another reason that skilled migrants are leaving Haiti to live elsewhere. The opportunities to excel and advance in specialized fields appear to be few and far between. The occurrence of the January 12 earthquake brought to the world's attention the fact that Haiti does not have enough doctors, nurses, hospitals, resources and medicine to treat many of the ill people who need aid.

Education is the third main contributor of brain drain because, as with the previous determinants, the education system is poorly constructed and implemented. Since there is not enough money to sufficiently fund education, most students who receive an education do so through private schools. Very little money is allocated to higher education and as such, many individuals who receive or seek to receive a tertiary education emigrate to countries such as the Dominican Republic, the United States, Cuba, Canada and France.

Research Question 2: How has brain drain impacted the overall political, economic and educational development of Haiti?

Just as the economy, healthcare and education have had an influence on Haiti, the reverse can be said for brain drain and the political, economic and educational development in Haiti. In terms of political development, it does not seem that policies are being placed to resolve the brain drain issue in Haiti and retain the country's educated professionals. There are no policies or strategies in place for Haiti to well-adapt itself to environmental changes. It is not prepared to handle natural disasters such as hurricanes, which are common in the country between June and November, or earthquakes, which do not occur as commonly. In addition, if more highly-skilled workers are leaving, they cannot offer input for policies needed to improve conditions within the country and that will foster more career and job opportunities.

Political development is relevant to economic development because the approval of the distribution of resources comes from the political leaders such as government officials. It has been shown that if there are more educated emigrants than educated workers who stay in their home country, the country will suffer a brain gain. However, if the opposite is true and there are more educated natives who remain in Haiti, the country is likely to experience a brain gain in human capital. When highly-skilled professionals leave Haiti, the output of capital that goes into the workforce is lost, which leads to a decreasing functional economy.

In the same way that education contributes to brain drain, brain drain impacts the development of the education system because there are not enough teachers and the wages for teachers is not very substantial. Furthermore, since it is not economically possible to invest highly in education, the education system remains as is and is not likely to improve unless economic conditions improve and more money is allocated to the education system as a whole. There are few, if any, prospects for those obtaining a post-secondary education to research fields of interest and updated resources and materials are not as readily available as they may be in other countries.

Research Question 3: How important were political events (e.g., removal of Jean-Bertrand Aristide, Papa Doc and Baby Doc Duvalier) in influencing brain drain?

Politics have been a major factor in the emergence and continuation of brain drain in Haiti and they have been very important in the influence and development of brain drain in the country. The expulsion of Jean-Bertrand Aristide may have been of some importance in the influence of brain drain in Haiti because it may have shown that there was a weak governmental structure since there was so much interference and involvement by the U.S in Haitian affairs.

The presidency of Francois “Papa Doc” Duvalier had the most significant impact on brain drain because of ongoing corruption and homicides ordered by him. Various books and articles written on show that as a result of actions taken and policies implemented during his presidency, numerous individuals fled Haiti in fear of their lives and the deterioration of their quality of life should they stay.

Recommendations for Future Research

In continuation of this study, it is recommended that a mixed methods empirical research study be conducted to not only provide a more concrete, accurate perspective and understanding of the actual impact of brain drain on Haiti, but to also provide valuable insight that would benefit policy-makers in creating a system or policies that would reduce and combat Haiti’s brain drain.

The methods for this would include the distribution of surveys or questionnaires and a conduction of individual interviews and focus group interviews of people who are contributing factors to the brain drain phenomenon in Haiti, or in other words, Haitian professionals that were born in Haiti and received a post-secondary education there. Conducting this additional research would not only provide a more concrete, accurate perspective and understanding of the actual impact of brain drain on Haiti, but it may also provide valuable insight that would benefit policy-makers in creating a system or policies that would reduce and combat Haiti’s brain drain.

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Appendix

Haiti Country Profile 1990-2010

Country	Variable	1990	1995	2000	2005	2010
Haiti	Estimated number of international migrants at mid-year	19084	22203	25832	30054	34966
Haiti	Estimated number of refugees at mid-year	0	0	0	0	1
Haiti	Population at mid-year (thousands)	7108	7861	8648	9410	10188
Haiti	Estimated number of female migrants at mid-year	8478	9599	11168	12993	15116
Haiti	Estimated number of male migrants at mid-year	10606	12604	14664	17061	19850
Haiti	International migrants as a percentage of the population	0.3	0.3	0.3	0.3	0.3
Haiti	Female migrants as percentage of all international migrants	44.4	43.2	43.2	43.2	43.2
Haiti	Refugees as a percentage of international migrants	0	0	0	0	0
Country	Variable	1990-1995	1995-2000	2000-2005	2005-2010	
Haiti	Annual rate of change of the migrant stock (%)	3	3	3	3	

Source: *International Migrant Stock: The 2008 Revision Population database*. Department of Economic and Social Affairs, Population Division.

Exploring the Genetic Basis of Root Mucilage in Cowpea (*Vigna unguiculata* (L.) Walp.)

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Mentors:

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Introduction

Cowpea (*Vigna unguiculata* (L.) Walp.) is a member of the legume family, Fabaceae. Cowpea varieties are vital agricultural crops in arid and semi-arid environments in Africa, Asia, India, and Central America. Cowpea sold in the United States is commonly known as black eyed peas. Breeding for specific cowpea varieties depends on environmental conditions where phenotypic traits may relate to drought tolerance, and resistance to fungal and bacterial pathogens, aphids, nematodes, viruses, and many others. The agricultural production of a variety with desirable traits is an important economic consideration that ultimately determines yield and quality of a harvest.

The cowpea genome research group at the University of California Riverside recently developed a high density single nucleotide polymorphism (SNP) genetic linkage map (Muchero et al. 2009) and coupled this genetic map to a 1 OX-coverage physical map of the cowpea genome. These new genome resources together with knowledge of synteny between the genomes of cowpea and fully sequenced reference legumes soybean (*Glycine max* (L.) Merr.) and *Medicago truncatula*, have been utilized to genetically and physically map phenotypic traits. One of the most visually striking of these mapped traits is the production of a high amount of root mucilage.

Root mucilage is of importance to plant-microbe interactions in the rhizosphere of cowpea and other legumes, and may hinder the uptake of aluminum from the soil (Knee et al. 2001). A region of the cowpea genome bearing a major gene controlling root mucilage has been identified using a recombinant inbred line mapping population. Within this region, several candidate genes exist that may also be responsible in seed mucilage production in *G. max* and *Arabidopsis* (Li et. al 2009).

The objectives of this study include phenotyping diverse germplasm for the mucilage trait, testing one or more candidate genes for polymorphisms, and the chemical quantitation and characterization of root mucilage. Phenotypes of several hundred cowpea germplasm accessions were compared to their existing SNP haplotypes spanning the region of interest to categorize haplotypes containing different alleles for the root mucilage trait. The gene sequences of different alleles for two candidate genes were determined for comparison between lines. Root mucilage will eventually be analyzed for protein and carbohydrate content and specifically for arabinogalactans and proteins (Moody et al. 1988).

Results

Phenotyping Diverse Germplasm

The phenotyping of 373 cowpea lines from the UCR germplasm collection revealed only one additional line that produces high amounts of root mucilage (UCR3944), numerous lines that have a moderate amount of mucilage, and an abundance of lines that have low mucilage. Phenotypic scoring for the mucilage trait lead to the desire to genotype lines that exhibit the characteristic of high mucilage (UCR232) and low mucilage (CB- 27). The mucilage trait is also evident in near isogenic lines derived from these parents, exhibiting high mucilage (BB-33) and low mucilage (BB-3).

Genetic Inquiry

The genotyping of these lines has lead to the discovery of polymorphism within a region marked by a SNP in a gene annotated as phenazine biosynthesis. Within this region, there are other genes with potential involvement in mucilage production. These candidate genes are annotated as extracellular dermal glycoprotein (EDGP), and transparent testa S (TIS), based on synteny between cowpea and annotations from *G. max* and *Arabidopsis*. Inquiry into the DNA sequences for these candidate genes began with oligonucleotide design. Primers were designed based on the partial sequences available for these genes from cowpea. Two sets of PCR primers were chosen for each candidate gene. The starting and ending base of each set were different between the two sets of primers for each gene. An initial polymerase

chain reaction was run at 53°C with only the near isogenic lines, and produced multiple bands. A second run of polymerase chain reaction included the near isogenic lines and the parents, was run at 56°C and produced prominent amplicons of the desired base lengths: 500 bases for TIS, and SOD bases for EDGP. The second set of primers for each gene produced fewer and cleaner bands. The product of polymerase chain reaction from these desired lanes was subject to an E-Gel apparatus, which allowed the extraction of the bands of interest from the E-Gel. The products of interest were run on a 1 % Agarose gel in 0.5 TBE buffer, to determine the accuracy of the bands but a problem occurred with the gel. The products were run again with a new gel and provided quality results. These products were submitted for Sanger Dideoxy Sequencing.

Chemical Analysis

Cowpea seeds were germinated on glass microfiber discs in petri dishes for the collection for root mucilage for chemical analysis. After 3 days the rootlets of the seedlings grew in a random fashion and were re-orientated for the rootlet to grow parallel with the filter paper. After 2-3 days the seedlings continued to grow upwards toward the condensation on the roof of the petri dish, and subsequently dried out and died. Arabidopsis mutants were germinated on glass microfiber filter paper discs and the rootlets grew into the filter paper, inhibiting the visual observation of root mucilage.

Discussion

Considerations for future work

The phenotyping diverse germplasm revealed one additional line with this rare trait of copious root mucilage and this line should be genotyped for comparison to the polymorphism observed between UCR232 and CB27. The sequencing data obtained for the candidate genes did not reveal any polymorphisms between the parents or the near isogenic lines, and deriving additional sequence data from these genes may help to determine whether these genes play a role in determining the phenotype. The portion of the project pertaining to the chemical analysis of root mucilage did not proceed very far. After the cowpea seeds dried out the consensus was to germinate sterile seeds in petri dishes with the glass fiber discs on both the bottom and the top of seeds, allowing the root mucilage to potentially adhere to both the top and bottom discs, as well as providing adequate water in the germination process. The problem with the Arabidopsis seeds germinating into the glass fiber may be overcome by germination on a water agar solution, allowing for the visually observation of root mucilage.

Genomics assisted plant breeding

The use of genomic resources, genetic tools, and principally the application of molecular biology to plant breeding has provided monumental achievements in terms of valuable crop selection. The applicability and use of a phenotype with a copious amount of root mucilage may be revealed in the future. With plant breeders and farmers facing unpredictable environmental changes, a diversity of cowpea varieties is an invaluable resource. The use of marker assisted breeding programs in agriculture production may help solve some of the most problematic causes of plant mortality.

Experimental Procedures

Phenotypic Scoring for Mucilage Trait

A random sample of 373 cowpea lines from the germplasm were germinated in a plastic pouch that contains a paper wick that allows for visual observation of root growth without disrupting the seedlings. Rootlets were stored upright in folders, in the greenhouse, and observed after 4 days with an approximate length of 4-5 cm. Rootlets were scored with observable criteria including high mucilage, some mucilage, and low mucilage.

Genetic Inquiry

The DNA from recombinant inbred lines Big Buff and CB-27 and near isogenic lines BB-3 and BB-33 have previously been extracted from leaf tissue. The concentration of DNA in these samples was estimated via a nanodrop spectrophotometer. Primers were designed based on gene sequences of genes annotated as Transparent Testa 8 (TT8) and Extracellular Dermal Glycoprotein (EDGP) from *G. max*, derived from syntenic relationships between *V. unguiculata* and *G. max*.

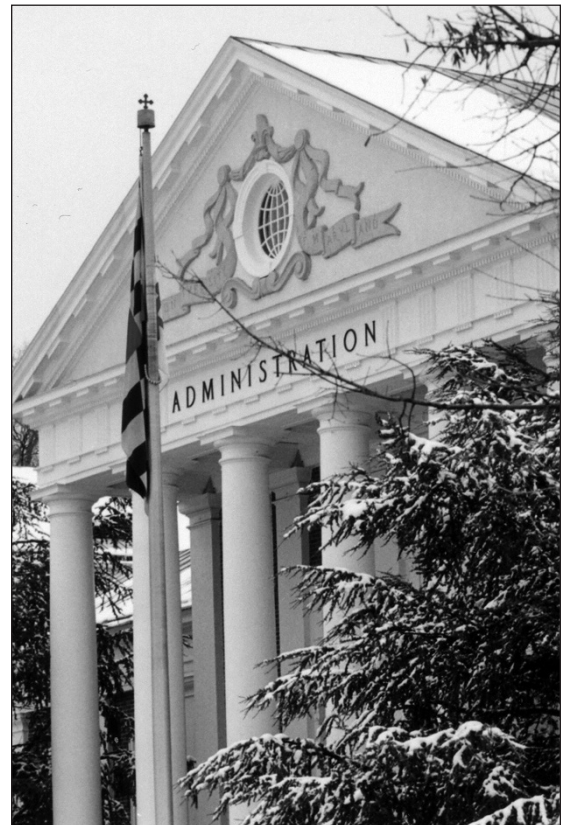
Chemical Analysis of Mucilage

Cowpea seeds were surface sterilized with 1 % EtOH for 1 min, 6% Bleach (v/v) for 10 min, with 3x 10 min sequential washes, and antibiotics chloramphenicol (60j.Jg/ml), streptomycin (100 j.Jg/ml), cefotaxime (100 j.Jg/ml), and ampicilin (100 j.Jg/ml), at 24°C for 24 hours on a rotary shaker and subsequently washes 2 times for 10-15 min each. Glass-fibre filter discs were sterilized in commercial bleach for 5 min and washed with ultra purified sterilized water. Cowpea seeds were germinated on Whatman Glass Microfiber filter papers (GF/A, 125mm diameter) in petri dishes and placed in an incubator. At the onset of germination, the seedlings roots were growing upwards and were reoriented for the roots to grow parallel with the filter paper for mucilage adherence. After 4 days the roots had continued to grow upwards towards the condensation and inherently dried out. Experiment was repeated with a glass fibre disc on both the bottom and the top of the seeds in the petri dishes. Seeds were also grown in modified pouches with the paper wick removed and the glass fiber discs stapled to the holding fold at the top of the paper wick insert.

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Does Parental Sexual Behavior Influence “Parental Fitness” and Child Custody Determinations?

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Abstract

Family Law typically promotes a nuclear family model and rules against parents who exhibit alternative sexual practices. The family court system uses the “best interest of the child” standard to guide custody decisions but the standard is vague so judges may consider nearly any kind of evidence or insert personal biases. This study examines the relationship between parental sexuality and child custody determinations, and specifically focuses on homosexual and sex worker parents. The courts and legislation have a tendency to rule against gay and lesbian parents in custody cases because there is fear that the children will grow up to be homosexual or experience social stigma. Sex worker mothers are at risk of losing their children to the State because there is concern that the children will lack morals and decency. Studies show virtually no difference between the children of homosexual parents or legal sex worker parents compared to normative heterosexual parents, so the arguments used to limit parental involvement in custody cases often lack merit. The current legislation and custody process does not solely focus on the best interests of the children involved, but instead impose moral biases and stereotypes on parents’ lifestyles. The study explores previous research and cases to examine the patterns concerning child custody and non-nuclear family models. The study will follow a mixed-methods approach to measure social workers’ attitudes and approaches to child custody decisions, and will also document sex worker parents’ experiences and difficulties regarding their occupations as sex workers and roles as parents.

Introduction

Family law and policies are preoccupied with nuclear family models, which have implications in child custody determinations. Child custody cases involving parents who practice alternative sexual behaviors are treated skeptically by the law. Gay and sex worker parents are at risk of losing their children because their sexual lifestyles do not conform to societal expectations. The legislation and social work policies rely heavily on moral judgments and stereotypes instead of actual research to determine the placement of children. Through this study, the researcher hopes to influence and contribute to legislation that truly addresses the needs and best interests of children instead of judging nonconforming parents.

Purpose of Research

The purpose of this study is to examine how parental sexual behavior impacts perceptions of “parental fitness” and child custody determinations. The study focuses specifically on Lesbian, Gay, Bisexual, and Transgender (LGBT) parents and sex worker parents.

Significance of the Research

This research is significant because child custody decisions are highly influenced by moral judgments and presumptions of social workers, judges, and legislators. The moral judgments and prejudices of policies and laws do not truly address the best interests of children, but instead punishes parents who practice alternative sexual behaviors. The courts often limit the parental involvement of LGBT and sex worker parents at the expense of the children; in some cases parents’ actual parenting skills and love for their children do not outweigh the moral prejudices of the law. As a result, children are taken away from their homes and placed in foster care or with extended family because of their parents’ perceived sexual promiscuity or deviance.

Research Questions

- How does parental sexual behavior impact child welfare and child custody determinations?
- What are the practices and attitudes of social workers towards sex worker parents?

Analysis of the Literature

Background

The courts are often called on to render decisions affecting family structure and the living arrangements of individual family members. Judges are often required to determine custody rights on the basis of the lifestyles and values of the individuals involved (Lewin, 1981). Family law is preoccupied with the symbolism of “normal” family life, which typically involves a nuclear family or a married heterosexual couple living with their biological children (Schulenberg, 1999). The court’s presumption of what constitutes a normal family has implications in child custody determinations; child custody cases involving gay parents are treated as special cases and skeptically by the law even though more than twenty percent of lesbians and ten percent of gay men have children (Henry, 1977). There is also a tendency for courts and social workers to rule against single mothers who work in the sex industry because single motherhood and sex work does not fit into the nuclear family model (Roberts, 1995).

Best Interests of the Child Standard

The family court system uses the “best interest of the child” and “least detrimental alternative” conceptual models to guide their child custody decisions. The “best interests of the child” is the common legal test for custody decisions in all states and generally favors the custody arrangement that best fulfills the needs of the specific children involved (Herman, 1997). The “least detrimental alternative” acknowledges the limitations of the courts and experts in determining what is truly best for a child, so instead it determines the parent’s capacities relative to a child’s needs and tries to find the least harmful solution (Tye, 2003). The judicial system continues to attempt to fill the needs of children and their best interests, but also continues to promote the concept of normalcy and nuclear families.

There are several factors involved in the “best interests” determination such as:

- the child’s emotional, mental, and social needs, bond between parent and child, parent’s ability to provide a stable home environment, and parent’s moral fitness (Vujovic, 2004). The vague standard of the “best interests” doctrine forms the basis for custody and judges to consider nearly any kind of evidence in deciding which parent should have custody of the child, which can interfere in objective determinations (Lewin, 1981). The courts have been consistent in their concern that awarding custody to a homosexual parent would not serve the best interests of the child; many lesbian, bisexual, gay, and transgendered biological and de facto parents have been denied custody in favor of heterosexual parents or third parties such as grandparents (Latham, 2005). The hint or stigma of living an “alternative lifestyle” makes someone liable to a decision based on prejudice rather than on the best interests of the child (Henry, 1977).

Applications of the Best Interest of the Child Standard

The controversial per se rule is used by a few states to determine the “best interests” of children in custody decisions. The per se rule dictates that all parents in a particular category are unfit and it is always best to remove the child from those parents’ custody (Shapiro, 1996). In some jurisdictions, a parent’s homosexuality is a per se reason for denying custody and creates the irrefutable presumption that a homosexual is unfit for parenthood (Latham, 2005). The evidence of a parent’s homosexual conduct is enough for a court to disqualify him from being granted custody; a court applying a per se standard is not required to consider any other factors and may deny custody based on sexual orientation alone (Huff, 2001). In 1995, the Supreme Court of Virginia ruled that a lesbian is per se an unfit parent because of her “felonious sexual conduct [which is] inherently in lesbianism” and that exposure to homosexuality is likely to cause children harm in the future (Brunner, 1999). Although the per se rule is unpopular, many states apply the presumption of harm approach when they decide custody cases involving homosexual parents which is essentially the per se rule in disguise (Allen & Burrell, 1996). The per se and presumption of harm approaches are based on stereotypes of homosexuality with little regard for the actual best interests of the children involved (Brunner, 1999).

The nexus test is a standard that most states have adopted, and it assesses a person’s parental fitness on an individual case-by-case basis. Under nexus tests, only the aspects of a person’s background that have a direct connection to the ability to parent or potentially harm a child are relevant to the court’s determination about custody (Tye, 2003). The courts require evidence that the parent’s homosexuality has an adverse effect on the specific child; if the parent’s

homosexuality has no adverse impact on the child, then it is irrelevant in a custody case (Shapiro, 1996). The nexus approach prevents the courts from using the fact that a parent's lifestyle is outside the societal mainstream as a basis for decision in custody determinations (Latham, 2005). The District of Columbia is the only jurisdiction using a nexus test that statutorily forbids the use of a parent's sexual orientation as the sole basis for denying custody; and in other jurisdictions, sexual orientation is increasingly considered irrelevant to custody and visitation disputes (Vujovic, 2004). The courts will only deny custody because of a parent's sexual orientation if a connection can be shown between parental sexual orientation and harm on the child (Patterson & Redding, 1996).

Parental Fitness

Parental fitness is at the center of child custody determinations, and the idea of a "fit parent" is grounded in the conventional notions of heterosexual marriage and selfless mothers as the legal foundations of society (Schulenberg, 1999). Social workers often make decisions regarding the fitness of a parent and follow a ten-part model for conducting parental fitness evaluations in custody cases, which includes: family history, educational history, occupational history, marital history, substance abuse history, and criminal history (Herman, 1997). A parent's sexual orientation may be an issue in custody cases because the American legal system has not accepted the notion that a good parent may also be homosexual or promiscuous (Hitchens, 1980). Many homosexual parents worked hard to conceal their sexual orientation from their children and families out of fear they would lose custody, but since the late 1960's, more gay parents have been unwilling to keep their sexual preference secret or to concede their parental rights (Hitchens, 1980). Society's assumptions and prejudices regarding homosexuality and the proper way to raise children are reflected in the laws and court decisions; it is widely presumed that a heterosexual home environment is unquestionably better for a child than a homosexual home environment in terms of role modeling and moral development (Hitchens, 1980). The courts should not find a distinction between homosexual and heterosexual parenting because homosexual parents relate to their children as parents, not as homosexuals (Richman, 2002).

A mother's sexuality may be an issue in custody cases because there are concerns about single sex workers' ability to be fit parents. Society's assumptions and prejudices regarding sex workers and the proper way to raise children are reflected in the laws and court decisions. It is widely presumed that mothers in the sex industry are "unfit" to raise children and that their lifestyles are harmful for children's moral development (Murphy, 1998). The courts are concerned about the effect a parent's sexual conduct may have on a child's development because the child may develop a standard of morality not generally accepted by society (Huff, 2001). The legal system is not concerned with a mother's relationship with her children but focuses on her sexual behavior, which may not necessarily affect them.

The criminal law influences courts' perceptions of socially acceptable behavior and parental fitness, and mothers involved in the criminal justice system are deemed unfit parents. The law helps shape the way society perceives women's proper roles as selfless, asexual mothers who should devote their lives to child rearing (Roberts, 1995). Modern law categorizes female prostitutes by their sexual conduct and makes their involvement in sex work the central component of their identity (Sanchez, 1997). Sex worker mothers deviate from society's ideal of motherhood and are often treated harshly by the criminal

justice system; criminal law consistently punishes women who deviate from what the law perceives as their "natural capacity to nurture and protect" (Murphy, 1998). Women who are arrested for prostitution and processed in the criminal justice system often lack resources and alternatives to put their life as prostitutes behind them (Arnold, 2000). Society and the justice system do not view mothers in the sex industry as victims or individuals but rather as petty criminals, the kind of people that destabilize and destroy communities (Jacobs, 1999). Prostitution-involved women are rarely recognized as maternal figures and "true mothers" by society, and are at high-risk of child custody disputes (Dalla, 2004).

Sex work

Economic vulnerability forces some women into sex work because the sex industry is seen as one of the few alternatives available to women with limited education and opportunities (Rornero-Daza, 2003). The term "sex worker" relates to the provision of sexual favors as a career path that is "more or less freely chosen by individuals who see it as a possibility for quick monetary profit" (Rornero-Daza, 2003). The majority of women in the sex industry freely decide to be involved and have control over whether and when they stop; many chose to stay in the industry as a resistance to poverty and potential unemployment (Romero-Daza, 2003; Surratt & Inciardi, 2010). A high number of

female sex workers especially prostitutes have children, and studies have found that prostitutes with children experience greater financial need and incentive for working to provide for their children (Sloss & Harper, 2004).

The common idea of sex workers conjures the image of a woman walking the streets, but there are several different types of sex workers ranging from exotic dancers to phone-sex operators (Arnold, 2000). There are also various types of prostitution which include call girls, escorts, brothel workers, pornographic actors, massage parlor workers, and street walkers. Call girls are able to charge high prices for their services, work in private settings, and are afforded higher status than other types of sex workers (Romero-Daza, 2003). Street prostitutes or “streetwalkers” are often viewed as the bottom of the sex work hierarchy by both insiders and outsiders to the sex industry (Romero-Daza, 2003). Street-level sex work is considered the most dangerous and least glamorous form of prostitution; street workers’ living situations are characterized by high rates of housing instability, significant financial difficulties, and violence (Bletzer, 2005; Sloss & Harper, 2004).

Moral Fitness and Custody Decisions

Courts consider factors like the parent’s “moral fitness” in custody decisions, which opens the door to the consideration of a parent’s sexual orientation. For child custody determinations where one parent is accused of immoral conduct, case law requires evidence of an adverse effect on the child as a result of the sexual or “immoral” conduct to justify an award of custody to one parent over another (Brunner, 1999). Custody guidelines often attempt to legally and discursively control and inhibit alternate sexualities, and judges may even deny custody to a gay or lesbian parent and define his sexual identity as deviant (Richman, 2002). Homosexuals’ sexual conduct and orientation are often viewed as immoral so individuals assume that the placement of children with homosexual parents will cause moral harm (Shapiro, 1996). The courts are concerned about the effect a parent’s sexual conduct may have on a child’s development because the child may develop a standard of morality not generally accepted by society (Huff, 2001; Hyde, 1991). The fact that many states have statutes that prohibit homosexual activity through sodomy laws makes homosexual parents’ criminals and perceived as incapable of setting a good example for children (Huff, 2001; Patterson & Redding, 1996).

A parent’s sexual behavior or promiscuity impacts the Courts’ opinions of the parent’s “moral fitness” in custody decisions. Legal sex work (exotic dancer, pornographic actress, etc) and illegal sex work (prostitution) are viewed as immoral because of the perception that workers engage in risky behavior such as unprotected sex, drug use, and violence (Weitzer, 2009). There is concern that sex workers will expose their children to unsafe situations and cause them to develop a lack of morality (Bletzer, 2005; Hyde, 1991). Studies have shown that prostitute mothers rarely entertain clients in their residence while their children are home, and that few daughters follow their mothers’ footsteps into the sex industry (Bletzer, 2005). Social workers and courts can use sex worker mothers’ sexual or “immoral” conduct to justify an award of one parent over another or removing children from the home because of the potential adverse effects on children (Brunner, 1999).

Child Custody Concerns

A major concern of the court is that both lesbians and gay men will produce homosexual children. Psychologist and founder of the Family Institute, Paul Cameron claimed that “homosexuality is contagious and the children will follow in their parents’ footsteps,” which implies that it is important that custody is not granted to gay men and lesbians (1998). There is fear that homosexuality will “spread” and cause a decrease in morals and procreation, which would change the social fabric of the country. The American Psychological Association and the National Association of Social Workers contend that homosexuality is not more prevalent among children with a homosexual parent than those with heterosexual parents (Cameron, 1998). Research shows that most homosexuals are children of conventionally heterosexual parents; 92% of young adults who grew up with two lesbian parents identify as heterosexual, and 90% of adult sons raised by gay fathers identify as heterosexual (Latham, 2005; Schulenberg, 1999). The assertion of the court that homosexual parents should be denied custody because they raise homosexual children is prejudicial and unsupported by research.

The most common concern raised by opponents of homosexual parenting is society’s lack of acceptance of alternative families, including homosexual parents and children. There is fear that the children of gay and lesbian parents will experience stigma, ridicule, and embarrassment by their peers and the community (Latham, 2005; Patterson & Redding, 1996; Schulenberg, 1999). The children may experience child-peer rejection and strained social relationships because of the parents’ sexual identities (Hitchens, 1980; Patterson & Redding, 1996). The courts often assume that

granting custody to homosexual parents is not in the “best interests” of the child because of societal disapproval and potential rejection of them.

The general concern about the societal treatment of lesbians and gay men does not justify custody decisions limiting the rights of homosexual parents. It is unconstitutional to deny parent custody of his or her child based on the possibility of social stigmatization or societal disapproval (Huff, 2001; Shapiro, 1996). In *Palmore v. Sidotl*, the Supreme Court held that although the constitution cannot control prejudices, it cannot tolerate or encourage them either (Latham, 2005). The court can only conclude stigma justifies a denial of custody, if there is evidence of a connection between the stigmas the child experiences and some harm to child (Shapiro, 1996). The stigma and potential ridicule may be overstated because research indicates that the children of homosexuals feel no less accepted than those of heterosexuals (Latham, 2005). Psychologists have also found no difference in comparative studies with regard to the quality of children’s friendships or social competence, and found the children to have similar ratings of popularity among other children (Latham, 2005).

There is considerable societal disapproval and stigma regarding sex worker mothers, which causes concern that children of sex workers will experience the same disapproval and prejudice as their parents. Professional promiscuity on the part of females is a “striking deviation from what a large segment of the society declares to be acceptable sexual performance,” which causes disapproval and negative views towards prostitution (Jackman, 1963). Women in the sex industry often hide their sex work because of stigmatization and fear of the consequences of being discovered such as losing custody of their children (Bletzer, 2005). The stigma and fear of discovery associated with sex work also prevents mothers from accessing needed services such as drug rehabilitation or legal protection from abusive partners and child custody hearings (Sloss & Harper, 2004). The courts and laws are more likely to limit sex worker mothers’ parental rights than offer resources and support (Sloss & Harper, 2004).

There is a myth that homosexual parents, especially gay men will molest their children so it is best to remove the children from their homes. Some individuals have argued that homosexuals are predisposed to child molestation and that most pedophiles consider themselves gay (Baldwin, 2001; Brunner, 1999; Huff, 2001). There is a belief that the gay community targets children for their sexual pleasure because the homosexual

lifestyle is a youth-oriented culture (Baldwin, 2001). The idea that people associate pedophilia with homosexuality denotes that homosexuality is viewed as immoral and as a sexual sickness (Latham, 2005). Some courts believe that denying custody is necessary to shield children from the risk of sexual molestation because children living with lesbian or gay parents are more likely to be sexually abused by the parent or the parent’s friends (Patterson & Redding, 1996; Walker, 1999). In 1976, in the *Matter of J. S. & C.*, an expert testified that the gay father’s visitation should be limited once his sons hit puberty because they would be subject to either “his overt or covert homosexual seduction” (Patterson & Redding, 1996). In general, the overwhelming majority of child abuse cases can be characterized as heterosexual in nature with an adult male abusing a young female (Patterson & Redding, 1996). Only about 14% of molestation cases involve homosexual men, while 82% of adult offenders are “heterosexual partners of a close relative of the child” and 74% of boys abused by an adult male are victims of “someone in a heterosexual relationship with the child’s mother” (Latham, 2005). The issue of child molestation is a serious and genuine concern but there is no evidence that homosexual parents are the majority of the perpetrators or more likely to offend.

A major concern of the courts is that sex workers will expose their children to domestic violence and sexual abuse because of their lifestyles. Women in the sex industry often experienced abuse and neglect in home environments as well as sexual and physical abuse as children. Some psychologists believe that sex workers’ daughters are more likely to be sexually abused because of their mothers’ history of abuse and the possibility of entertaining clients in their homes (Dalla, 2003; Weitzer, 2009). Studies show that many sex workers especially street-level prostitutes and exotic dancers characterize their relationships with male partners as “severely abusive;” women in prostitution are the frequent victims of violence at the hands of their partners and strangers (Bletzer, 2005, Romero-Daza, 2003). Children are often exposed to physical violence in their homes which can lead to emotional and psychological damage that causes poor relationships and low self-esteem as adolescents and adults (Bletzer, 2005). Social workers and judges are likely to remove children from the homes of sex workers because they are concerned they will be exposed to physical violence or sexual abuse even though studies show these issues are also prevalent in non-sex worker homes.

There is a belief that children in the custody of gay or lesbian parents are more vulnerable to behavior problems and mental breakdown (Patterson & Redding, 1996). Research indicates there is not any difference in the development, mental health, or general psychological stability of a child parented by homosexuals and one parented by heterosexuals; in fact children of homosexuals have been found to exhibit “impressive psychological strength” (Latham, 2005). The

American Psychological Association (APA) acknowledged that research findings suggest that the well-being of children is unrelated to parental sexual orientation and that children of homosexual parents are as likely to flourish as those of heterosexual parents (Patterson & Redding, 1996; Tye, 2003). Gay and lesbian parents are as likely as heterosexual parents to provide home environments that support positive developmental outcomes among children living in them (Patterson & Redding, 1996). As long as a parent can provide a nurturing home environment and demonstrate good parenting skills then psychosocial development of children will not be compromised (Brunner, 1999). Children of gay and lesbian parents are often described as more tolerant of diversity, more nurturing toward younger children, and better communicators than their counterparts (Kunin, 1998; Latham, 2005). Children's optimal development is influenced more by the nature of the relationships and interactions within the family than by the particular structural form it takes (Latham, 2005).

Another issue concerning custody cases is that some courts still assume that lesbian and gay men are mentally ill and therefore unfit to be parents (Patterson & Redding, 1996). The DSM originally designated any non-normative sexual behavior such as sadism, masochism, fetishes, and homosexuality as mental illnesses (Ault & Brzuzy, 2009). The DSM designation of homosexuality as an illness resulted in oppressive outcomes for gay, lesbian, and bisexual people such as limited custody and visitation rights (Silverstein, 2009). In the late 1960s and early 1970s, activists, social workers, psychologists, and psychiatrists pressured APA to eliminate homosexuality from its list of mental disorders, which lead to the APA removing it from the DSM in 1973 (Ault & Brzuzy, 2009). The idea that gay parents are unfit because of mental illness can be criticized on the grounds that atypical gender development or non-heterosexuality is neither illnesses nor disabilities (Patterson, 2009). The APA and other professional organizations such as the American Bar Association and the National Association of Social Workers have adopted policies that oppose discrimination based on sexual orientation and supports granting child custody to homosexual parents (Patterson & Redding, 1996).

Mothers in the sex industry are viewed as psychologically and physically unhealthy because they are seen as mentally unstable and HIV/AIDS risks. Studies show that street prostitutes are more likely than non-prostitutes and indoor sex workers to exhibit psychological disorders and engage in extensive high-risk sex behaviors with

numerous partners, which increase their vulnerability to HIV (Bletzer, 2005, Surratt & Inciardi, 2010). The psychological impact on a child living with a mentally unstable parent or an HIV infected parent can cause the child to have poor self-esteem and high rates of depression; society's fear of the HIV and mental illness could manifest itself in an avoidance of contact with the child by his peers (Bletzer, 2005). Although the literature shows the mental health and HIV disparities among street-level prostitutes, there is no convincing evidence of poorer physical or mental health, lower self-esteem, or impaired social relationships among other sex workers (Bletzer, 2005). Studies show that mothers in the sex industry often practice safe sex and are not infected by HIV/AIDS at higher rates than other women, so the mental and physical health arguments are less relevant in custody decisions (Bletzer, 2005).

There is an assumption that all sex workers are addicted to drugs and alcohol, which causes them to neglect and abuse their children. Studies show that many street-level prostitutes use drugs especially crack cocaine as a coping strategy for limited opportunities and daily stress (Bletzer, 2005). Some prostitutes admit to using drugs and alcohol while pregnant, which contributes to Fetal Alcohol Syndrome and birth defects; these babies are usually removed from the mother's custody by the State immediately after birth, while the mothers are charged with child endangerment (Bletzer, 2005). The children of addicts and alcoholics often follow their parents' footsteps because of a genetic predisposition towards addiction, social learning, or efforts to cope with painful realities; the courts and social workers try to prevent the cycle of drug addiction, alcoholism, and neglect by removing children from the custody of addicted mothers (Bletzer, 2005). Although the literature documents the prevalence of drug use among street-level prostitutes and the effects of addiction on children, there is little evidence of the drug use of mothers in other parts of the sex industry such as call girls and escorts (Bletzer, 2005).

Sex worker parents and foster care

For many poor women, single mothers, and sex workers, the battle to retain custody of their children is not with the judicial system but with the State. State statutes do not explicitly impose particular standards of behavior, but authorize child protective agencies and courts to intervene and remove a child if the child is neglected, abused, or in imminent danger of abuse (Murphy 1998). Mothers tend to be the focus of the state's intervention in cases of allegations of child abuse and neglect because they are often the custodians and caretakers of children (Murphy, 1998). The statutes' goal is supposedly child protection but the language of the law permits intervention on the basis of the mother's conduct rather than harm to the child (Murphy, 1998). Child Protective Service workers make discretionary

judgments about bad mothering; conversations with social workers often reveal deep biases about bad mothering based on race, class, poverty, and occupation (Murphy, 1998). The failure of parents to support their children emotionally and financially as well as provide moral guidance falls within most states' definitions of child neglect and are reasons for child removal regardless of the stability or love of the home (Murphy, 1998).

The state's removal of children from the homes of sex workers has major implications on the mental health and future outcomes of children. There is a perception that prostitution is a victimless crime but "the [true] victims are the children of the women who are left with no active parental involvement" (Arnold, 2000). Most prostitutes have children but do not live with them because they are placed in foster care, or live with their fathers or extended family members (Dalla, 2000). The children's removal from the home is typically the result of maternal alcoholism, drug addiction, imprisonment, or domestic violence regardless of whether or not she engaged in sex work (Bletzer, 2005). In other cases, sex workers are viewed as unfit mothers and lose their children because they raise them in the context of prostitution (Pheterson, 1993).

Foster care is meant to be a temporary arrangement, but children stay in care for an average of two years and have limited contact with their birth parents (Doyle, 2007). Foster children often experience inadequacies in state care including poor-quality caregivers, sexual and physical abuse, neglect, and constant shifts of placements (Mendes, 2006). The conditions in the foster care system are sometimes worse than the conditions in the sex workers' homes, and the children have to deal with feelings of inadequacy and depression for being separated from their mothers (Mendes, 2006). Foster children are typically released from the state between 16 and 18 years old, and face difficulties in accessing education, employment, and housing opportunities (Mendes, 2006). These young adults are at higher risk for drug and alcohol abuse, depression, teen pregnancy, high school drop out and imprisonment than their counterparts (Mendes, 2006).

Theoretical Frameworks

The criminal law shapes the way we perceive ourselves and others, and legal rules reward conduct that fulfills a woman's maternal role and punishes conduct that conflicts with mothering (Roberts, 1995). Society defines women as mothers or potential mothers, which determines her social identity (Roberts, 1995). The social construction of what constitutes a good mother and what constitutes a bad mother facilitates its control of women because women who fail to meet the ideal of motherhood are deemed as deviant or criminal (Roberts 1995). The State stigmatizes unwed and "unfit" mothers for violating the dominating norm; the criminal justice system punishes female defendants according to the extent to which their acts deviate from appropriate female behavior (Roberts, 1995). Mothers who commit crimes or immoral behavior such as sex work and prostitution are bad mothers who do not deserve the courts' mercy or custody of their children. Sex workers who are able to provide safe and loving homes for their children should be allowed to retain custody of their children regardless of their sexual behavior if it has no adverse effect on the children.

Parents should be judged based on their parenting skills and bonds with their children instead of their sexual orientation. The categories "lesbian mother" and "gay father" are conceptually flawed because they imply that a parent's sexual orientation is the decisive characteristic of his or her parenting (Stacey, 2010). The idea that children need both a mother and a father is flawed, and has inflamed culture wars over divorce, single parenthood, and gay parenting (Stacey, 2010). Social science studies have not found that families headed by married, biological parents are best for children compared to all other forms of families (Stacey, 2010).

The justice system and social workers, or "Petty Bureaucrats" are deciding children's placements and futures based on their own moral values and biases without truly addressing the "best interests" of children. The most important characteristics of parents are the ability to provide a stable and nurturing home environment that will promote positive psychosocial development in children.

Research Design and Methodology

This study will follow a mixed-methods approach and triangulation design, in which the researcher will collect quantitative and qualitative data simultaneously. The quantitative component will include online surveys of social workers to measure their attitudes and approaches to child custody and parental fitness decisions. The qualitative component will include interviews of sex worker parents to learn about their experiences regarding their occupations as sex workers and roles as parents.

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A Comparison of the Inhibition of Nucleocytoplasmic Trafficking by Viral Effectors from Cardioviruses and Rhinoviruses

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Abstract

Cardioviruses and *Enteroviruses* of the *Picornaviridae* family exhibit similar infections. Viruses from the two genera inhibit nuclear import/export through the nuclear pore complex (NPC), a channel between the cytoplasm and nucleus. However, the diseases caused by viruses within these two genera vary in severity. *Encephalomyocarditis virus* (EMCV), a cardiovirus, uses a small potent protein called Leader (L) to inhibit trafficking through the NPC, thereby causing encephalitis in pigs and other animals. Human rhinovirus (HRV), an enterovirus, uses a protease, 2A, to inhibit trafficking through the nuclear pore and infection is associated with the common cold. It is unknown why cardioviruses and enteroviruses cause diseases of varying severity. In addition, little information is known about whether the mechanism of these viruses' toxic proteins in inhibiting nuclear transport through the NPC, may correlate with the severity variation of the disease phenotypes of these viruses. To test this, we would compare the rates of nuclear efflux by three different *Cardioviruses* and three serotypes of HRV. Molecular techniques would be used to clone and express recombinant L proteins of the cardioviruses. Both nuclear efflux and nuclear import assays would be performed using recombinant green fluorescent protein (GFP) to track infection in HeLa cells for the effects of either L protein or 2A protease. This is done to determine the extent of inhibition of nuclear trafficking at the NPC. Knowledge of the kinetics between cardioviruses and HRV could hint at the different pathogenicities of these viruses. Also, it could add to our understanding of whether the genotype of a virus can infer the phenotype of the disease it causes.

Introduction

Picomaviruses are small, non-enveloped, positive-sensed single-stranded RNA viruses (Gustin & Samow, 2002). The genome is approximately 7500 nucleotides long and is packaged in an icosahedral capsid (Lin, et al., 2009). The RNA viruses, within the *Picornaviridae* family, cause different diseases of varying pathogenicity. Of the enteroviruses, poliovirus causes flaccid paralysis while the human rhinovirus causes the common cold and can exacerbate asthma. On the other hand, viruses of the *Cardiovirus* genus such as *Encephalomyocarditis virus* (EMCV) have been shown to be associated with outbreaks of myocarditis and encephalitis in pigs, non-human primates and other mammals (Oberste, et al., 2009). Also in the *Cardiovirus* genus, Theiler's murine encephalomyelitis virus (TMEV), has a neurovirulent strain and a persistent strain (thought to cause multiple sclerosis in mice) while saffold virus (SAFV) is asymptomatic in humans (Sato, Tanaka, Hasanovic, & Tsunoda) (Zoll, et al., 2009). Upon infection of cells, viral proteins of picomaviruses are recruited to aid and facilitate in viral replication, transcription and translation, as well as, evading the host cell immune response. One way by which picomaviruses shut-off host cellular processes is by inhibiting trafficking through the nuclear pore complex (NPC) (Porter & Palmenberg, 2009). The NPC is a large multi-subunit complex of approximately ~60,000 kDa that is comprised of 30 different proteins called nucleoporins (Nups) (Fontoura, Faria, & Nussenzveig, 2005). It is an aqueous pore within the nuclear envelope that allows the transport of molecules between the nucleus and cytoplasm (Lin, et al., 2009) (Sorokin, Kim, & Ovchinnikov, 2007). Small molecules, such as water and ions are transported by diffusion through the NPC, but it acts as a barrier to macromolecules such as DNA, RNA and proteins (Lin, et al., 2009).

In transporting macromolecules, each cargo needs to bear a recognition signal, either a nuclear localization sequence (NLS) for importing to the nucleus or a nuclear export sequence (NES) for exporting to the cytoplasm (Terry & Wentz, 2009). Transport receptors called karyopherins associate with cargos containing either an NLS or NES (Lin, et al., 2009). The karyopherins dock the cargos at different Nups as they travel through the NPC (Fontoura, et al., 2005). Active trafficking through the NPC is mediated by a GTPase, Ran, which aids in the

dissociation and association of karyopherins and their cargos (Lin, et al., 2009). During infection by some viruses, the activities of the Nups are disrupted by viral proteins (Porter & Palmenberg, 2009).

Inhibition of active trafficking at the NPC can prevent nuclear import of antiviral signals, cellular signals that are necessary for cellular gene expression and activation of innate immunity pathways (Porter & Palmenberg, 2009).

The genera of the *Picornaviridae* family appear to use different mechanisms to achieve nuclear transport blockage at the NPC. The enteroviruses (e.g. poliovirus and human rhinovirus, HRV) use an encoded 2A protease to cleave nucleoporins. On the other hand, the cardiomyoviruses (e.g. Encephalomyocarditis virus (EMCV), and Theiler's Murine Encephalitis Virus (TMEV)) lack a 2A-like protease. Instead they encode a leader (L) protein which is used to regulate nuclear trafficking (Porter & Palmenberg, 2009). In EMCV, it has been shown that the presence of L causes phosphorylation of the nucleoporins. L, in EMCV, is thought to bind to Ran thereby inhibiting import of signal molecules and export of cellular mRNA through the NPC (Porter, Bochkov, Albee, Wiese, & Palmenberg, 2006).

In this research, we proposed to clone and express EMCV, TMEV, saffold (SaN) L protein and determine if TMEV and SaN, like EMCV disrupt the NPC by phosphorylation of the Nups. Alongside this, we proposed to compare the rates at which the cardiomyoviruses (TMEV, EMCV and SaN) and rhinovirus inhibit nuclear import and enable nuclear efflux at the NPC. We propose that the cardiomyoviruses (EMCV, TMEV and SaN) and the rhinoviruses will target and inhibit nuclear import into the NPC with different kinetics. Our hypothesis was that the difference in kinetics of these viruses in the disruption of nuclear import, contributes to the different disease phenotypes and the severity of the diseases caused by these picornaviruses. Knowledge of the kinetics of these viruses is significant as it could help to shed light on the varying disease severities of these picornaviruses.

Results

GST was amplified and digested, as well as viral L in pTriEx 1.1 vectors. Undigested pTriEx 1.1 was used as a control in the digestion of viral vectors in pTriEx 1.1. Colonies were gotten for both transformed recombinant EMCV L as well as recombinant TMEV L, however a diagnostic digest using an enzyme called Dra 1 showed that the viral L vectors did not contain the GST insert. GST-GFPNLs was purified with high purity. Most of the recombinant GFPNLs appeared to be present in the eluted protein fraction. Both the SDS-PAGE gel and the Western blot (incubated with GST antibody) showed the presence of purified GST-GFPNLs in the eluted portion of the purification process. GST-EMCV L was also purified however with ~40% purity and some GST truncations. Both the SDS-PAGE gel and the Western blot (incubated with GST antibody) showed the presence of GST-EMCV-L in the eluted fraction of the purification process.

GST-EMCV L is shown to be active as an upward mobility shift (as indicated by the red box) is observed. Phosphorylation of the Nups is indicated in a Western blot by an upward mobility shift. Similar upward mobility shifts were not seen in reactions with either GST or cytosol only. The control (reaction containing GST-EMCV L provided by 1. Ciomperlik) appeared not to show an upward mobility shift.

Discussion

For this project, we postulated that cardiomyoviruses and rhinoviruses would inhibit nuclear trafficking through the NPC at different rates, and that this difference in inhibition could elucidate on the varying disease severities of these viruses. Previous work in the lab had shown that recombinant EMCV L phosphorylates nucleoporins, thereby preventing interaction with karyopherins that bind cargo NLSs and inhibiting import into the NPC (Porter & Palmenberg, 2009). It is unknown whether TMEV L and SafV L block import in a similar manner. To determine if TMEV L and SafV L phosphorylates nucleoporins like EMCV L, we needed to clone and express C-terminal GST-tagged viral L proteins for TMEV L and SafV L. The position of a GST tag can affect the activity of a protein. It has been shown previously that a GST tag at the N-terminus region of TMEV L and SafV L renders the L proteins inactive (Basta et. al, unpublished data).

Therefore to compare the L activities of EMCV, TMEV and SafV, GST needed to be positioned at the C-terminus end of the L proteins of the three cardiomyoviruses.

A few colonies of *E. coli* transformed with the ligation reactions that grew on ampicillin plates but diagnostic digests of the bacterial DNA plasmid showed that there were no GST insert in the plasmid. A number of possible explanations could be derived for the inefficient ligation of GST to the viral L vectors. One possible explanation is that the enzymes (Bsu361 and XhoI) used to digest the insert and vector did not digest the insert properly. Also, the

insert to vector ratio during ligation reaction may be too low and would need to be increased for more effective ligation reactions. Nevertheless, new primers have been designed to amplify GST from another plasmid for cloning into the viral L vectors. In addition, recombinant GFP_{NLS} was purified with high purity. To test its activity, a nuclear import assay was performed. However, during a test nuclear import assay, there was little to no green fluorescence in the nuclei of HeLa cells incubated with just GFP_{NLS}. However, under ultraviolet (UV) light, green fluorescence was observed indicating that the protein was active in emitting green light. Previous nuclear import assay with recombinant GFP_{NLS} and EMCV L using digitonized HeLa cell and *Xenopus laevis* oocytes cytosol had been successful. Similar experiments had not been done using HeLa cell cytosol. Our preliminary test nuclear import assay suggest that HeLa cell cytosol was not sufficient in supplying cellular factors needed for import of GFP_{NLS} into the nuclei to show nuclear import inhibition. Porter et al proposed that possibility of EMCV L interacting with a cellular factor in the cytosol to induce phosphorylation of the Nups and that active transport through the NPC required factors in the cytosol (2009). A nuclear efflux assay was considered for an alternative method to test GFP_{NLS} import to the nuclei and be further used for the comparison of the nuclear trafficking inhibition by recombinant EMCV L and HRV-16. Similar to the problem associated with the nuclear import assay, nuclear efflux assay using HeLa cell cytosol was difficult. Optimization the nuclear efflux assay or using *Xenopus* cytosol would need to be looked at for future directions.

In continuation of the project, recombinant EMCV L with the GST tag on the N-terminus region was made to perform the nuclear import and export assay. Protein purification of the recombinant EMCV L showed that it was ~40% pure with some GST truncations. The activity of the purified recombinant EMCV L was tested using a phosphorylation assay showing a slight upward mobility shift of Nup 62 from HeLa cells. GST and cytosol incubated HeLa cell extract did not show the same mobility shift. This result is concurrent with previous studies that show that EMCV L phosphorylates Nup 62 (Porter & Palmenberg, 2009). Although, EMCV-L was shown to be active signified by the upward mobility shift, the control did not show similar result. One possible reason could be that the EMCV - L used as the control might not have been active. However, the electrophoresis of the SDS-PAGE gel shown needed to run longer in order clearly show mobility shift of the phosphorylation of Nup 62 by recombinant EMCV L.

In conclusion, recombinant EMCV L and GFP_{NLS} was successfully purified and optimization has begun for the nuclear import and nuclear efflux assays. Further work with this project would be effectively clone and express recombinant EMCV L, TMEV L and SaN L with the GST tag on the C-terminus region. The next step would be to perform a nuclear import assay using digitonized HeLa and *Xenopus* cytosol to assess the inhibition of nuclear transport through the NPC by the three coronavirus L and HRV-16 2A. Conclusions drawn from the experiment would help enlighten our understanding of the varying disease severities of these picornaviruses.

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Understanding the Abscisic Acid Pathway Using Guard Cell Specific Genes and the Anti-Aging Drug Spermidine

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Abstract

Plants must respond to environmental stress including drought and harsh winters. Overcoming these stresses depend heavily on timing of stomatal closure and seed germination. My research focused on both chemical and genetic aspects involved in the abscisic acid pathway that controls both stomatal closures in leaves and seed germination in *Arabidopsis thaliana*. My first study focused on recognizing specific proteins involved in the abscisic acid pathway for stomatal guard cell closure. Given specific promoters for their respective proteins, it is possible to determine whether or not proteins are guard cell specific. Gateway™ technology utilizes a series of reactions to create a clone containing a promoter of interest called an expression vector. By injecting this vector directly into the leaf of *Arabidopsis*, the plant will use the promoter to create the guard cell specific protein. The second study examined the effect of the anti-aging drug Spermidine on seed sensitivity to abscisic acid concentration during seed germination. By varying the concentration of Spermidine and abscisic acid exposure to seeds then observing the number of surviving seeds, the effects of Spermidine on seed germination can be measured. Spermidine is expected to reduce seed sensitivity to abscisic acid leading to increased seed germination.

Introduction

Plants must respond to environmental stresses such as droughts and harsh winters. Each year billions of dollars are lost due to drought and winter. The National Weather Service reports that drought alone cost the U.S. over \$61.6 billion. Making plants that are better suited for combating these disasters has become a major area of concern. There are ways to do just that. Overcoming these stresses depend heavily on timing of stomatal closure and seed germination.

Stomata are microscopic pores on the bottom surface of leaves. Two guard cells make up the pores which control gas exchange for the plant during photosynthesis (Pei et al., 1998; Hugouvieux et al., 2001). As gases are being exchanged water escapes. This becomes a great problem for plants during drought. Opening stomatal pores contribute to 95 percent of total water lost from the plant. By genetically controlling when stomata open and close, a plant can conserve the precious water it needs to survive when water becomes scarce.

The anti-aging drug Spermidine controls many cellular processes to slow the aging process down in organisms. In plants seed germination is slowed keeping the seeds alive during the winter. This is critical for long, harsh winters during which, seeds die before the rains and rising temperatures permit optimal growth. By controlling when a seed germinates, a seed can endure the winter long enough for those favorable conditions to arrive in the spring. Greater understanding of these processes will give plants necessary tools for coping with intense weather conditions.

Common to these seemingly unrelated events are their signaling mechanisms, the abscisic acid (ABA) pathway. My research focused on both chemical and genetic aspects involved in the ABA pathway. Despite ABA's role in stomatal movements, genetic components of the humidity signaling cascade remain largely unknown. Thus, my first study focused on the genetic aspect by identifying regulatory regions in guard cell preferential genes. These genes are responsible for stomatal guard cell closure involved in the ABA pathway. Controlling when the gene is expressed means finding the promoter. So developing a faster method to identify the region in the promoter specifically that encodes functionality is of the greatest importance. Guard cells use a complex signaling network to create a "graded binary" output that can readily be observed under the microscope: stomatal 'opening' or 'closing'. The study of guard cell signaling provides insights into how the many cellular processes assemble together to create a quantifiable single

cell output (Kwak et al., 2008), allowing quantitative dissection of the functions of individual genes and proteins within signaling cascades.

Despite its role in stomatal movements, molecular components of the humidity signaling cascade also remain largely unknown. Humidity is an environmental stimulus that regulates stomatal movements. Stomatal closure occurs very rapidly in response to a reduction in relative humidity in the atmosphere. So when the air has very little moisture, stomata close.

Genomic techniques have been developed and adapted to *Arabidopsis thaliana* guard cell signal transduction studies in humidity. This allows for molecular genetic, cell biological, biophysical, physiological, and functional genomic analyses of single cell signaling responses (Pei et al., 1997; Pei et al., 1998; Allen et al., 1999; Wang et al., 2001; Hosy et al., 2003; Leonhardt et al., 2004) in *Arabidopsis*. *Arabidopsis* provides a model for understanding stomatal closure and seed germination. It is a small plant, allowing it to be used in vitro, meaning in controlled conditions. It has a short life cycle for quick growth. Thousands of seeds can be collected from a single plant. Its small genome was sequenced and annotated. Exchanging DNA between it and bacteria is relatively simple. This all contributes to the abundance of genetic and genomics tools available for plant experimentation. Recently, most biochemical, genetic and molecular studies on plant hormone action and biosynthesis have been carried out in the model plant *Arabidopsis thaliana* for its simplicity of genome, short reproductive cycle, small plant size and great amount of information available on its metabolic pathways and signaling (Tassoni, et al., 2000).

Being targets of early signaling branches, ion channels provide effective functional signaling and quantitative analysis points to identify and characterize upstream regulators and identify the intermediate targets and signaling branches that are affected either directly or indirectly by these regulators. Regulatory factors that control ABA response have been identified by genetic, biochemical, and pharmacological/cell biological approaches (reviewed by Rock, 2000; Finkelstein and Rock, 2002). As mentioned previously, identifying the region in the promoter specifically that encodes functionality is necessary. Biochemical approaches have uncovered a variety of gene promoter elements such as kinases, kinase inhibitors, phosphatases, phospholipases, and transcription factors that correlate with the ABA response (Finkelstein et al., 2002). Having identified a series of transcriptional activators and their target genes, it should be possible to dissect the signaling pathway involved in the ABA activation of these [promoter elements] (Finkelstein et al., 2002).

ABA mutant phenotypes may be tissue specific and subtle (Finkelstein et al., 2001). Given tissue specific promoters, it is possible to determine whether or not the genes activated are guard cell specific using Gateway™ technology. Gateway™ technology utilizes a series of reactions to create a clone containing a promoter of interest called an expression vector. By injecting this vector directly into the leaf of *Arabidopsis*, the plant will use the promoter to activate the promoter elements in guard cells specifically.

Recall that plants must respond to both drought and harsh winters. Surviving harsh winters depends on timing of seed germination. The second study examined the effect of Spermidine on seed sensitivity to ABA concentration during seed germination.

ABA is required for plant adaptation to environmental stress by affecting different plant tissues, developmental stages, and physiological processes. These include changes in seed dormancy and germination (Leung and Giraudat, 1998). Spd allows for inhibition of the phase transitions from embryonic to germinative growth and from vegetative to reproductive growth (Leung and Giraudat, 1998; Rock, 2000; Rohde et al., 2000b). Thus, seed germination is slowed keeping the seeds alive during the winter.

The study examined the effect of Spermidine on seed sensitivity to ABA concentration during seed germination. Although endogenous ABA [produced by the plant] is essential for the induction of dormancy and the germination of mature *Arabidopsis*, the seed can be suppressed by as little as 3 μ M exogenous ABA (Finkelstein et al., 2001). Genetic studies in *Arabidopsis* demonstrated that the first major ABA accumulation phase is maternally derived and immediately precedes the maturation phase of seeds (Karssen et al., 1983). The second major ABA accumulation in wild-type *Arabidopsis* seed depends on synthesis in the embryo itself (Karssen et al., 1983). Although the embryonic ABA accumulates to only one-third the level accumulated at 10 days after pollination, it is essential for the induction of dormancy, which is maintained despite a substantial decrease in ABA by seed maturity (Finkelstein et al., 2001). The ABA content of a wild-type mature dry seed is only 1.4-fold that of the peak ABA level in a nondormant ABA-deficient mutant, suggesting that endogenous ABA is not the only signal for dormancy maintenance in mature seed. Despite the strong evidence for a fundamental role of ABA in regulating dormancy, this is a complex trait controlled by many factors (Finkelstein et al., 2001). Seed maturation begins when developing embryos cease cell division and

start growing and is correlated with an increase in seed ABA content, consistent with the fact that ABA can induce the expression of a cyclindependent kinase inhibitor (ICK1) (Wang et al., 1998) that would lead to cell cycle arrest at the G1/S transition (Finkelstein et al., 2000) stopping seed germination.

By varying the concentration of Spermidine and abscisic acid exposure to seeds then observing the number of surviving seeds, the effects of Spermidine on seed germination can be measured. Spermidine interacts with macromolecules like DNA, RNA, acid phospholipids and proteins (Tassoni et al., 2000). In plants, they have been implicated in a large range of growth and developmental processes including germination of seeds and response to environmental stresses (Buuren et al., 2000).

Based on the results of a similar study, the authors suggest that Spd may prevent chilling injury during harsh winters in squash by a mechanism involving protection of membrane lipids. Chilling injury is thought to involve alteration of membrane structure. Raison and Lyons proposed that the primary event causing chilling injury is a phase transition in the molecular ordering of membrane lipids. The membrane phase transition would have many deleterious effects on the tissues, including increases in membrane permeability and alteration of the activity of membrane proteins. All the results support the view that Spd and may inhibit chilling injury by slowing [lipid disfigurement] in *Arabidopsis* (Bouchereau et al., 1999).

Spermidine is expected to reduce seed sensitivity to abscisic acid leading to increased seed germination. At [0.5 mM] concentration, 100 % of seeds germinate (data not shown) to clearly demonstrate that several plants responded to low temperature acclimation with a uniform and substantial increases in Spd (Tassoni et al., 2000). An inhibition of the seed germination percentage was also observed [when too much Spd is added] (Bouchereau).

Methods for Determining Guard Cell Specific Genes

Stock and working solution preparation

The primers were obtained and prepared by adding necessary amounts of water. Afterwards, each solution was mixed using Vortex and spun using a bench top centrifuge. The working solutions were prepared by adding 5 uL of the primer solution to 45 uL of water into a 1.5 mL Eppendorf centrifuge tube. These solutions were also mixed and spun. They were then placed in ice.

Genomic DNA preparation

To prepare genomic DNA, 2 *Arabidopsis* leaves were cut and placed into 1.5 mL microcentrifuge tubes. This was repeated 20 times. Added to each tube was 100 uL of Edward's buffer. Using a pestle, the leaves were ground. The mixtures were centrifuged for 15 minutes at 14,000 rpms. The supernatant was transferred to new tubes. Then added to the solution was 450 uL of isopropanol to precipitate the mixture. It was inverted 5 to 10 times, then left to incubate at room temperature for 15 minutes. Afterwards, the mixtures were centrifuged for 15 minutes at 14,000 rpms. The precipitate was removed, resuspended, then centrifuged at 14,000 rpms for only 5 minutes. The DNA now could be resolubilized and separated by adding 100 uL of autoclaved water. Then the precipitate was resuspended using the pestle. The DNA was then incubated in the shaker for 15 minutes at 60°C. The DNA was resuspended without the pestle and centrifuged at 14,000 rpms for 15 minutes. The supernatant, now containing the DNA, was extracted and stored at -20°C.

Amplified promoters using PCR for GoTaq enzyme

First, the substances were thawed, mixed, and spun except for the enzymes obtained. The GoTaq solution was prepared as follows. It included 5 uL of buffer solution, 14 uL of autoclaved water, 1 uL of reverse and forward primers, 2 uL of dNTP, 1 uL of MgCl₂, 0.5 uL of gDNA and 0.5 uL of polymerase. PCR tubes were obtained and solutions were transferred to the tubes. The PCR was run using the following settings. First, 95°C for 2 minutes, 95°C for 20 seconds, 55°C for 20 seconds, 72°C where time depends on length of primer (1 minute per kb), 72°C for 5 minutes, and 4°C infinitely.

Agarose gel electrophoresis preparation

The gel was prepared by adding 30 mL of TAE per 0.3g of agarose into a 500 mL Erlenmeyer flask. The solution can only be dissolved by heat. Thus, the solution was placed into the microwave for 1 minute. The solution was then cooled by transferring it several times between a 250 mL Erlenmeyer flask. Then, 0.3 uL of Ethidium Bromide was

added to the smaller flask per 30mL of solution. The solution was swirled and then poured into the electrophoresis tray. It took approximately 15 minutes to polymerize.

Agarose gel electrophoresis

The GoTaq solutions were each placed into a well. Then, 6 uL of Ladders was added to the last well. It was used as a reference for size of DNA fragments. Then, the gel was run at 135 Volts until the fragments migrated to approximately two-thirds of the gel. Then using Quantity One: Gel Doc XR™ program, pictures were taken for length confirmation. If a positive match, then the promoters of interest were amplified using KOD. If not, the process was repeated to confirm the negative result from the GoTaq enzyme.

Amplified promoters using PCR for KOD enzyme

First, the substances were thawed, mixed, and spun except for the enzymes obtained. The KOD solution was prepared as follows. It included 5 uL of buffer solution, 32.5 uL of autoclaved water, 1.5 uL of reverse and forward primers, 5 uL of dNTP, 3 uL of MgSO₄, 0.5 uL of gDNA and 1 uL of polymerase. PCR tubes were obtained and solutions were transferred to the tubes. The PCR was run using the following settings. First, 95°C for 2 minutes, 95°C for 20 seconds, 55°C for 20 seconds, 70°C where time depends on length of primer (25 seconds per kb), 70°C for 5 minutes, and 4°C infinitely.

Agarose gel electrophoresis

The gel was prepared in the same way as previously described. Before being added to the wells, one-fifth of KOD's volume in 6X Sample Buffer dye was added to each PCR tube. There was excess amount of KOD solutions so each was divided into two electrophoresis wells. After adding the KOD solutions, 6 uL of Ladders was added to the final well. Then, the gel was run at 135 Volts until the fragments migrated to approximately two-thirds of the gel. Then using Quantity One: Gel Doc XR™ program, pictures were taken for length confirmation. If the lengths were correct, then the DNA would be extracted. If there was a negative result, the amount of GoTaq enzyme cycles was reduced to 10, purified, and then amplified using the KOD enzyme.

PCR purification

The PCR product was obtained and transferred to 1.5 mL microcentrifuge tubes. Added to the product was 62.5 uL of Binding solution I. This was then transferred to a separation column and centrifuged for 1 minute at 14,000 rpms. The flowthrough was discarded, then 500 uL of wash was added. The mixture was then centrifuged for 30 seconds at 14,000 rpms. The flowthrough was discarded and then the DNA was washed again. The residual wash was then removed via centrifugation for 1 minute at 14,000 rpms. The DNA was then eluted by adding 35 uL of water to the membrane, letting it incubate for 2 minutes, then centrifuging again for 1 minute at 14,000 rpms.

DNA Extraction

The promoter sequences were extracted from the gel using extraction pipette tips on an UV emitting table. It was important to expose the DNA for a very brief period of time due to sensitivity. Each piece of gel is equivalent to 45 uL. Using the Gel Extraction Kit, triple the volume of gel extracted is necessary to dissolve the gel. Thus, 270 uL of the Extraction Buffer was added to both 45 uL pieces of gel in a 1.5 mL Eppendorf tube. The extracted DNA was heated for 1 minute at 60°C to melt in the Thermo Mixer™. The mixture was transferred to the extraction column and centrifuged for 30s at 8,000 rpms. The liquid collected at the bottom, flowthrough, was then discarded. The DNA was then washed with 500 uL using the WN buffer by centrifuging for 30s at 8,000 rpms. After discarding the flowthrough, the DNA was washed again using 700 uL of WS buffer by centrifuging for 30s at 8,000 rpms. The flowthrough was discarded. Then excess wash was removed by centrifuging for 2 minutes at 14,000 rpms. To collect the DNA, it was eluted for 1 minute at 14,000 rpms using 20 uL of autoclaved water. The DNA was then placed at -20°C for storage.

BP reaction for genetic recombination

Using 3 uL of the eluted DNA, it was added to 1 uL of pDONR/ZEO and 0.5 uL of BP Clonase II. It was then left to incubate for at least 30 minutes at room temperature.

DNA Transformation

After incubation, 1 uL of the recombinant was added to another tube. TOP10 bacteria was obtained from the -80°C freezer and placed into ice for melting. Then, approximately 50 uL of TOP10 bacteria was added to the BP recombinant. It was kept on ice for 5 minutes. Then it was heat shocked by being placed in 42°C water for 30 seconds. Then it was placed back into ice for 5 minutes, forming the entry clones.

Grew Entry Clones

The following procedures occurred in sterile conditions. After the BP recombinant was chilled, 300 uL of LB media was added to it. The mixture incubated at 37°C in the shaker for approximately 1 hour.

Plated Entry Clones with Zeocin

To isolate the clones, the mixture was centrifuged for 1 minute at 8,000 rpms. The clones were then resuspended using the pipette. They were added to the Zeocin plate and spread using a curved glass rod under sterile conditions. The colonies of bacteria were grown over night in a 37°C incubator.

Growth of entry clone minicultures

The following procedures occurred under sterile conditions. Zeocin was vortexed and spun, then 2.5 uL was added to 5 mL of LB media. Pipette tips were used to collect samples from individual colonies from the Entry clone plate. The tips were then dropped into tubes containing the Zeocin and media. The tubes were then placed in a 37°C shaker over night.

Plasmid separation

Colonies were obtained and pelleted by centrifugation for 1 minute at 14,000 rpms. The supernatant was discarded. The rest of the bacteria was extracted by repeating the previous steps until 5 mL of the media was discarded. Then Plasmid Miniprep kit was obtained. MX1 buffer kept at 4°C was removed from the fridge, and then 200 uL was added to the Entry clone colonies. The mixture was vortexed until the colonies were resuspended. The bacterial clones were lysed, or broken, by adding 250 uL of MX2 buffer to each and inverted 5 times. The plasmids were isolated afterwards by quickly adding 350 uL of MX3 buffer to each colony. The plasmids were then inverted about 20 times. The plasmids were centrifuged for 10 minutes at 14,000 rpms. The supernatant was then transferred to separation and collection tubes. The mixture was centrifuged for 30 seconds at 8,000 rpms afterwards. The liquid flowthrough was discarded. Added to the tube was 500 uL of WN buffer I. It was then centrifuged afterwards for 30 seconds at 8,000 rpms. The flowthrough was discarded and 700 uL of WS buffer II to wash the plasmids and prevent the DNA from being eluted. The mixture was centrifuged for 30 seconds at 8,000 rpms. The flowthrough was discarded, but to rid the solution of remainder buffer, the mixture was centrifuged for an additional 2 minutes at 14,000 rpms. The flowthrough was discarded and the separating tube was then placed into an 1.5 mL microcentrifuge tube. To elute the plasmid, 50 uL of autoclaved water was added directly to the membrane of the tube. Finally, the solution was centrifuged for 1 minute at 10,000 rpms and the plasmids of the entry clones were placed in -20°C for storage.

Creation of Destination Vector

The plasmids PMDC107, PMDC110, and PMDC111 were transformed with DB3.1 bacteria to become destination vectors. The vectors were then grown and plated on a Kanomycin and Chloramphenicol plate. The colonies were extracted, then grown in a Kanomycin solution. Once grown, the vector colonies had their DNA extracted and gel electrophoresed to confirm the size. For the electrophoresis, 5 uL of the plasmid, 1 uL of dye, and 2 uL of autoclaved. The procedures were all similar to previously described methods for promoter transformation, entry clone growth, plating, and DNA extraction.

Splice destination vector plasmids

In order to check the plasmids' sequence, they were spliced using SmaI and XhoI restriction enzymes. All the destination vector plasmids were obtained and two sets of reactions were set up. One set for the SmaI and the other for XhoI. Each received 5 uL of the plasmid, 1 uL of the respective enzyme, 1 uL of the respective buffer, and 3 uL of water. The reactions were left to incubate for 1 hour at 37°C. Afterwards, 2 uL of dye was added to each reaction. The mixtures were then run under electrophoresis.

LR Reaction

The LR reaction combines entry clones with destination vectors using the following combination. Added first was 1.5 uL of the entry clone followed by 1.5 uL of the destination vector. Then, 1 uL of Tris buffer was added and finally 0.5 uL of LR Clonase II. The reaction was left to incubate at 37°C for an hour.

Electric Shock Transformation

TOP10 bacteria was obtained and 50 uL of the bacteria was used to transform 1 uL of the expression vector. The recombinant was then placed in an electroschock cuvette and shocked at “E. Coli1” setting until beeps signaling transfer occurs.

Expression Vector Growth

After transformation, 300 uL of LB medium was added to the vector and left to incubate in the shaker at 37°C for an hour. Once grown, the vector is then plated on kanomycin plates to grow the colonies. Both occur in sterile conditions.

Expression Vector Miniculture Growth

The following procedures are similar to those previously mentioned. The minicultures were obtained and left to grow over night.

Expression Vector Plasmid Extraction and Transformation

The following methods are similar to those mentioned earlier. First the expression vector was extracted. Then the plasmids were amplified using the GoTaq enzyme. Once a correct affirmation was received, the plasmids were transformed with Agrobacteria and plated.

Injected Arabidopsis and Nicotiana for guard cell expression

A single *Arabidopsis* specimen and 16 tobacco plants were obtained and labeled “1 through 15” and one “Full Length.” Then 15 spliced sequence and 1 full length sequence bacterial recombinants were obtained. Using a p1000 Pipettman, 0.5 mL of the recombinants were each transferred to 2 mL Eppendorf tubes. Using 1 mL syringes, the bacterial recombinants were injected into the underside of 2 leaves per plant.

Methods for Determining Spermidine Concentration

Prepare 500 mL of 1/2 MS plus agar media

To prepare the media, 1.1 grams of MS salts and 0.25 grams of MES was measured and poured into a 500 mL plastic beaker. Then added 400 mL of distilled water and mixed the solution. Then the pH was adjusted by adding KOH until it was between 5.6 and 5.8. Then more water was added to reach a total volume of 500 mL. The solution was then poured into a separate bottle containing 4 grams of agar. After preparing, the solution was then autoclaved.

Sterilize seeds

Wild-type Colombia O seeds were obtained and placed into a 1.5 mL tube. The seeds were then treated with 0.05% SDS and placed on a rotator for 8 minutes. The SDS was discarded and the seeds were washed 3 times with 100% ethanol. They were then left to dry on autoclaved Whattman paper under sterile conditions.

Prepare plates

The plates were prepared using the concentrations as shown in Table 2.

Table 2. Plate Preparation Concentrations. The concentrations of Spd and ABA were added as volumes indicated in each box.

Plate Preparation Concentrations				
*Volume in uL	0 uM ABA	0.5 uM_ABA	1 uM ABA	2 uM ABA
0 mM Spd	0	12.5	25	50
	0	0	0	0
0.5 mM Spd	0	12.5	25	50
	125	125	125	125
1 mM Spd	0	12.5	25	50
	250	250	250	250

Each box represents one plate. The top number represents volume of ABA and the bottom represents volume of Spd both in uL.

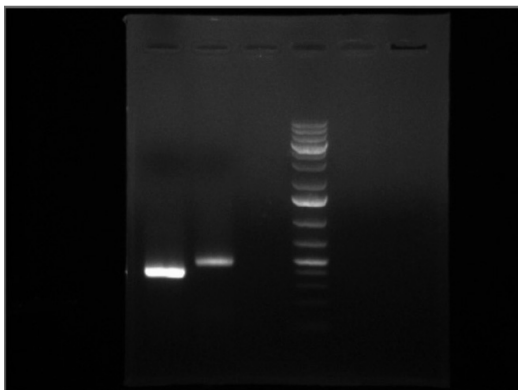
Count seeds

A digital microscope was used to count the seeds. The seeds were classified into three groups. Stage 1 is a seed that failed to germinate. Stage 2 is a seed that began germination, characterized by the root breaking the seed coat. Stage 3 is a seed that has grown into a seedling and begins photosynthesizing.

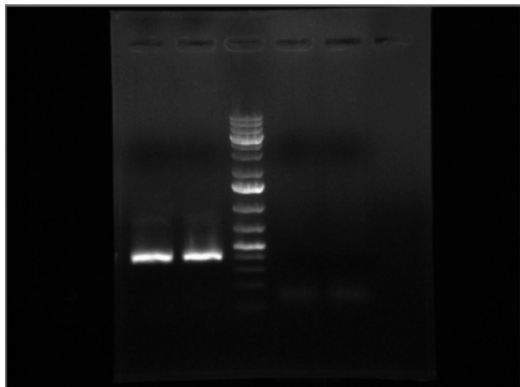
Results for Determining Guard Cell Specific Genes

The first set of reaction set out to amplify promoters At4g24510 and At1g78530 using the GoTaq enzyme to check the functionality of the primers. Successfully amplifying the promoter region shown in fig1, then allows for amplification using the KOD enzyme necessary for cloning and DNA extraction. Receiving a positive result, as shown in fig2, the promoter At4g24510 could undergo the BP reaction, transformation, plating, and extraction. The promoter was unsuccessfully amplified so it had to undergo reduced GoTaq cycles to obtain pure strands of DNA, purify it, then amplify again using the KOD enzyme.

Figure 1.

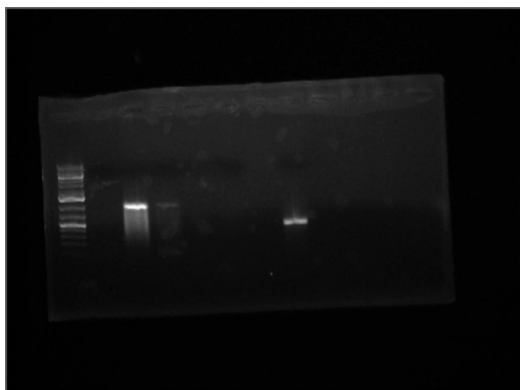


2010-06-03 - gotaq - 144 145 - 156 157. The promoters At4g24510 and At1g78530 and At1g78530 were successfully amplified using the GoTaq enzyme.

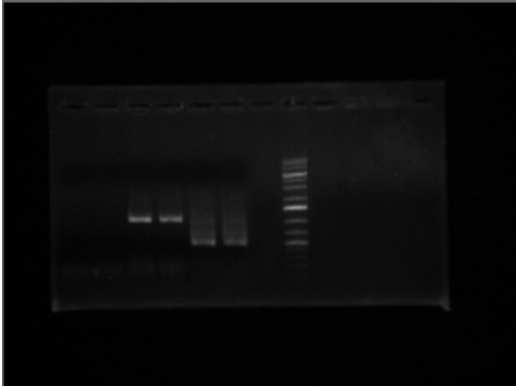
Figure 2.

2010-06-03 - kod - 144 145 - 156 157. The promoter At4g24510 was successfully amplified using the KOD enzyme. The promoter At1g78530 was unsuccessfully amplified.

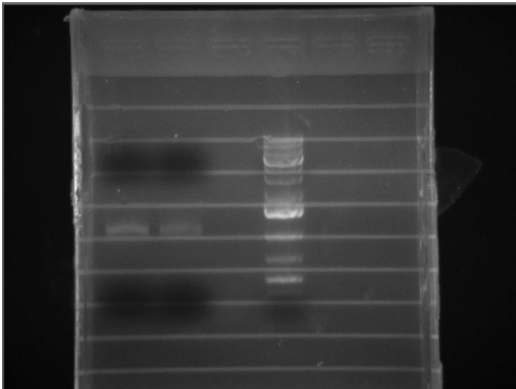
The primers for promoters At1g10060, At1g04800, At1g78530, At1g33811, At5g16240, At1g79770, and At5g19580 were checked. As shown in fig3, only 3 promoters were successfully amplified so they could then be amplified using the KOD enzyme. The others had to be redone to check for mistakes. However, fig4 shows that only promoters At1g04800 and At1g78530 were successfully amplified using the KOD enzyme, but At1g10060 was not. Thus, At1g10060 was amplified under the reduced GoTaq cycles, purified, then amplified again using the KOD enzyme seen in fig5.

Figure 3.

2010-06-09 - gotaq - 126 127 - 134 135 - 138 139 - 140 141 - 160 161 - 162 163 - 156 157. The promoters At1g10060, At1g04800, and At1g78530 were successfully amplified using the GoTaq enzyme, but promoters At1g33811, At5g16240, At1g79770, and At5g19580 were not.

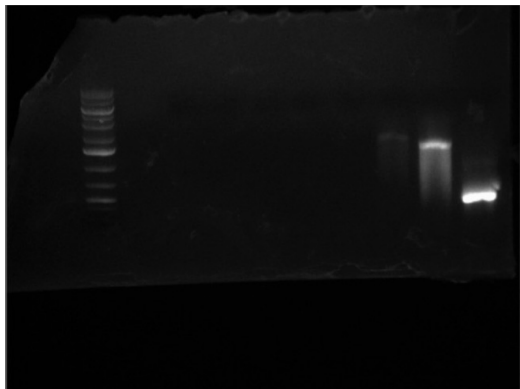
Figure 4.

2010-06-10 - kod - 138 139 - 140 141 - 156 157. Promoters At1g04800 and At1g78530 were successfully amplified using the KOD enzyme, but At1g10060 was not.

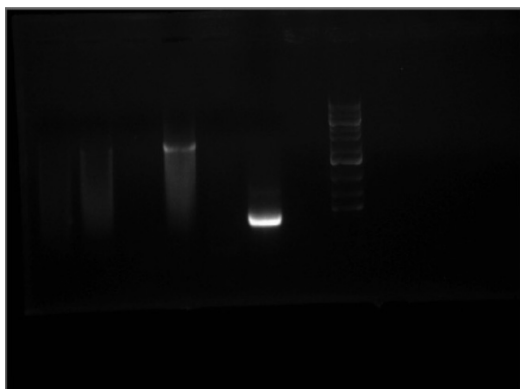
Figure 5.

2010-06-16 - kod - 138 - 139. The promoter At1g10060 was successfully amplified by using the GoTaq enzyme for only 10 cycles, purified, then amplified using the KOD enzyme.

The next set of promoters to be amplified were At1g08810, At3g62820, At5g25840, At5g55620, At3g55500, At2g20875, and At2g21140. The primers that worked were for promoters At1g08810 and At3g62820, fig6. Those were then amplified using the KOD enzyme, but failed. Sown in fig7, the promoter At2g20875 was successfully amplified using the GoTaq enzyme for 10 cycles, purified, then run using KOD enzyme, but At5g25840, At5g55620, At3g55500 and At2g21140 were not and cloning ceased. Only promoters At1g08810 and At3g62820 were successfully amplified using the KOD enzyme, fig8, so they could undergo the BP reaction, transformation, plating, and extraction. The promoters At1g08810 and At3g62820 were amplified successfully under reduced GoTaq cycles having failed KOD amplification, fig 9, so cloning continued. However, promoters At5g55620 and At2g20875 were still unsuccessfully amplified and cloning ceased.

Figure 6.

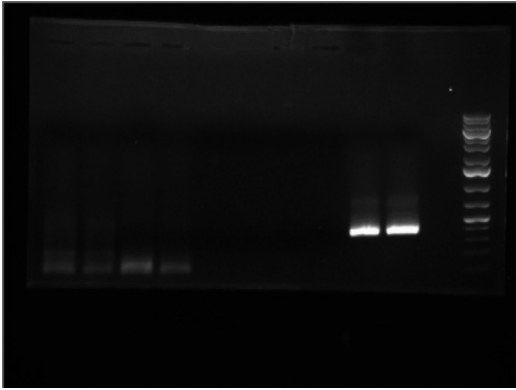
2010-06-23 – gotaq – 124 125 – 128 129 – 130 131 – 132 133 – 136 137 – 142 143 – 146 147. The promoters At1g08810 and At3g62820 were successfully amplified using the GoTaq enzyme. The promoters At5g25840, At5g55620, At3g55500, At2g20875, and At2g21140 were not.

Figure 7.

2010-06-28 – gotaq – 130 131 – 132 133 – 136 137 – 142 143 – 146 147 – ctrl 144 145. The promoter At2g20875 successfully amplified using the GoTaq enzyme for 10 cycles, purified, then run using KOD enzyme, but At5g25840, At5g55620, At3g55500 and At2g21140 were not.

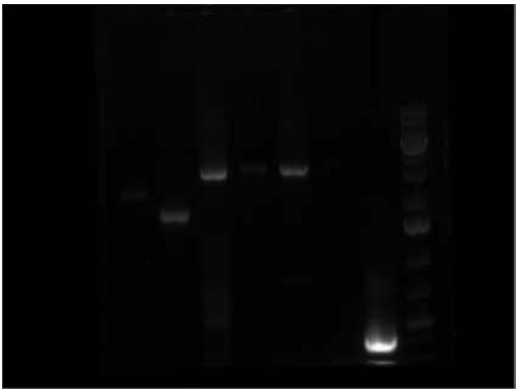
Figure 8.

2010-06-28 – kod – 124 125 – 128 129 – ctrl 144 145. The promoters At1g08810 and At3g62820 were successfully amplified using the KOD enzyme.

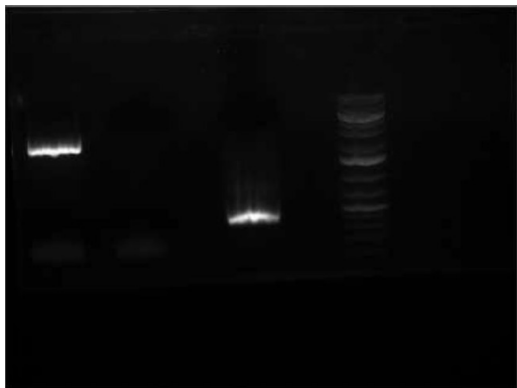
Figure 9.

2010-06-30 - kod - 124 125 - 128 129 - 132 133 - 142 143 - ctrl 144 145. The promoters At1g08810 and At3g62820 were successfully amplified using the GoTaq enzyme for 10 cycles, purified, then run using KOD enzyme, but At5g55620 and At2g20875 were not.

The primers for promoters At2g04570, At2g21590, At2g46720, At3g23840, At1g75880, and At1g62400 were next to be checked. Shown in fig10, promoters At2g04570, At2g21590, At2g46720, At3g23840, At1g75880, were successfully amplified using the GoTaq enzyme, but At1g62400 was not. Since none of the promoters that worked using the KOD enzyme, fig 12, they all were run using reduced GoTaq cycles. Shown in fig11, fig12, and fig13, the promoters At5g55620 and At2g21590 were successfully amplified using reduced GoTaq enzyme cycles and cloning for promoters At2g20875, At2g04570, At2g21590, At2g46720, At3g23840, At1g75880, and At1g62400 ceased.

Figure 10.

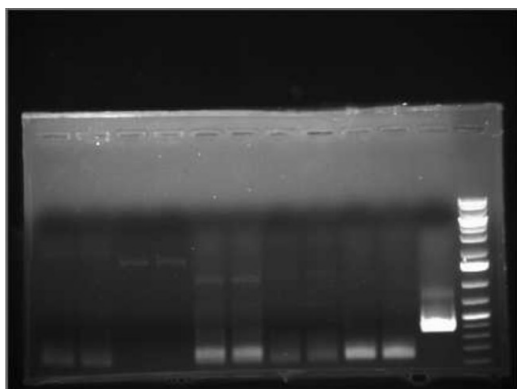
2010-07-13 - gotaq - 148 149 - 150 151 - 152 153 - 154 155 - 164 165 - 158 159 - ctrl 144 145. The promoters At2g04570, At2g21590, At2g46720, At3g23840, At1g75880, were successfully amplified using the GoTaq enzyme, but At1g62400 was not.

Figure 11.

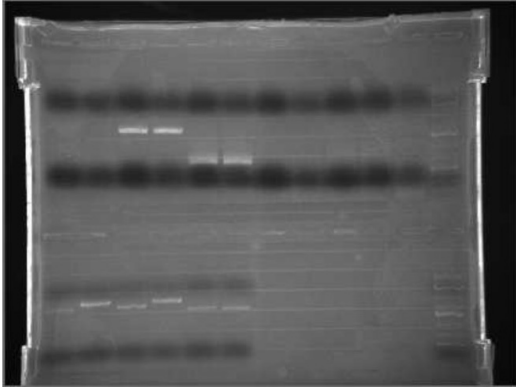
2010-07-13 - kod - 132 133 - 142 143 - ctrl 144 145. The promoter At5g55620 was successfully amplified using the GoTaq enzyme for 10 cycles, purified, then run using KOD enzyme, but At2g20875 was not.

Figure 12.

2010-07-13 - kod - 148 149 - 150 151 - 152 153 - 154 155 - 164 165 - ctrl 144 145. The promoters At2g04570, At2g21590, At2g46720, At3g23840, At1g75880, and At1g62400 were unsuccessfully amplified using the KOD enzyme.

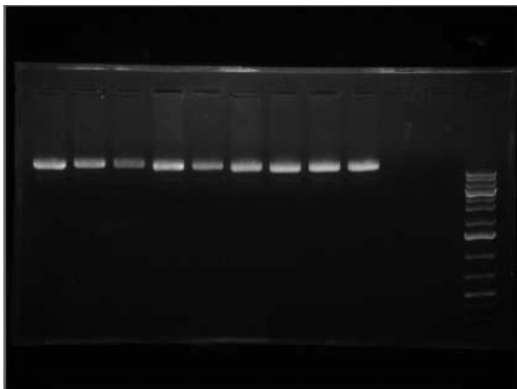
Figure 13.

2010-07-21 - kod - 148 149 - 150 151 - 152 153 - 154 155 - 164 165 - ctrl 144 145. Promoters At2g04570, At2g21590, At2g46720, At3g23840, At1g75880, and At1g62400 were inefficiently amplified using the GoTaq enzyme for 10 cycles, purified, then run using KOD enzyme.

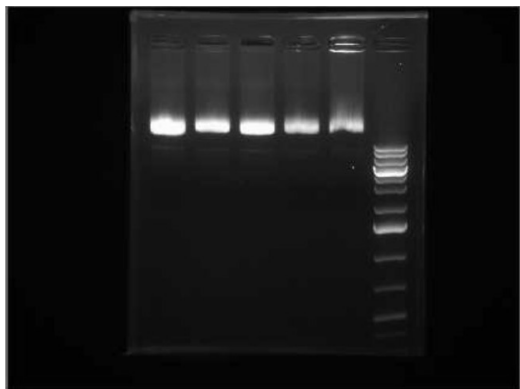
Figure 14.

2010-07-23 - kod - 148 149 - 150 151 - 152 153 - 154 155 - 164 165 - ctrl 144 145 and plasmids. Shown at the top, the promoter At2g21590 was successfully amplified using the GoTaq enzyme for 10 cycles, purified, then run using KOD enzyme, but At2g04570, At2g46720, At3g23840, At1g75880, and At1g62400 were not. Shown on the bottom, the entry clone plasmids pDPE001, pDPE002, pDPE003, pDPE004, pDPE005, and pDPE006 were successfully extracted.

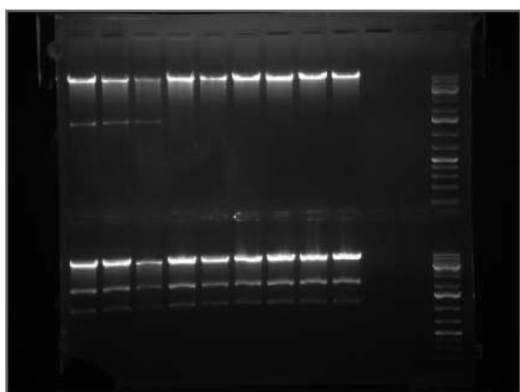
The promoters At4g24510, At1g04800, At1g78530, At1g10060, At1g08810, At3g62820 were successfully converted into entry clones corresponding to the names pDPE001-6 shown in fig14. These were then sent to have their DNA checked for any mistakes. Only pDPE001-4 were correct. These could then be made into expression vectors, but first the Destination vectors had to be made. Destination vectors named pDPD001-3 were made combining DB3.1 and PMDC107, PMDC110, and PMDC111 shown in fig15 and fig16. They were then checked for correctness by splicing. Shown in fig17 and fig 18 the destination vectors worked, but only with the XhoI restriction enzyme to splice them. It was only necessary to choose one destination vector to make the expression vectors, so pDPD001 was chosen. So pDPD001 was used for pDPE001-4 to make the expression vectors pDPX001-4 successfully, fig19. All of the results are summarized and explained in Table1.

Figure 15.

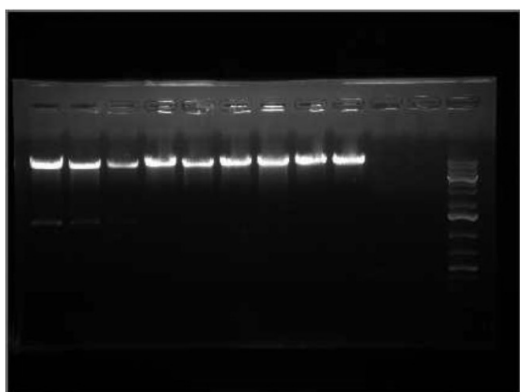
2010-07-29 - pDPD001-3, A-C. The destination vector plasmids pDPD001-3, A-C were successfully extracted, but were not concentrated enough.

Figure 16.

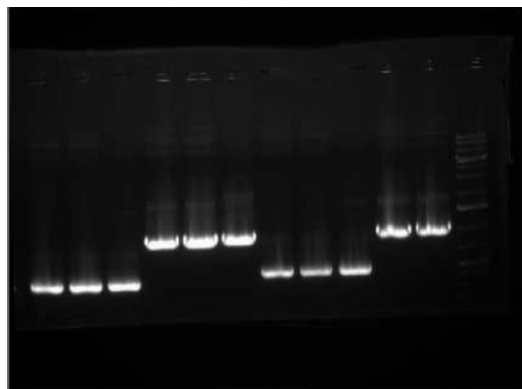
2010-07-30 - pDPD001-3, A-C. The destination vector plasmids pDPD001-3, A-C were concentrated producing bright bands.

Figure 17.

2010-08-04 - pDPD001-3, A-C XhoI and SmaI. Shown at the top, the restriction enzyme SmaI failed to splice the destination vectors pDPD001-3, A-C. Shown at the bottom, the restriction enzyme XhoI successfully spliced the destination vectors pDPD001-3, A-C.

Figure 18.

2010-08-06 - pDPD001-3, A-C SmaI. SmaI insufficiently spliced the destination vectors pDPD001-3, A-C.

Figure 19.

2010-08-19 - pDPX001-4, A-B. The plasmids for expression vectors pDPX001-4, A-B were successfully extracted.

Table 1.

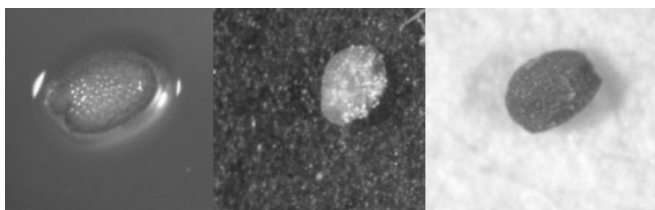
Preliminary Results for Guard Cell Preferential Genes				
Protein	AGI number	Primer F	Primer R	Results
GDSL-motif lipase family protein	At1g33811	126	127	Primers Don't Work
Expressed protein	At5g25840	130	131	Primers Don't Work
Acyl ACP (acyl carrier protein) desaturase	At5g16240	134	135	Primers Don't Work
Expansin (EXP6)	At3g55500	136	137	Primers Don't Work
Hydroxyproline rich protein	At2g21140	146	147	Primers Don't Work
Expressed protein	At1g79770	160	161	Primers Don't Work
Putative protein	At5g19580	162	163	Primers Don't Work
Expressed protein	At5g55620	132	133	Being Sequenced
EPF1	At2g20875	142	143	Being Sequenced
MYB60	At1g08810	124	125	Wrong Sequence
Pectin esterase homolog	At3g62820	128	129	Wrong Sequence
Branched chain amino acid transamidase (BCAT1)	At1g10060	138	139	Agrobacterium Transformation
Glycine rich protein	At1g04800	140	141	Agrobacterium Transformation
CER2	At4g24510	144	145	Agrobacterium Transformation
Receptor protein kinase, putative	At1g78530	156	157	Agrobacterium Transformation

Preliminary Results for Guard Cell Preferential Genes. The promoters that did not continue with cloning are in the “primers don’t work” column. The promoters awaiting DNA sequence confirmation are categorized as “being sequenced.” The promoters that had incorrect DNA sequences were categorized as “wrong sequence.” The promoters that were converted into expression vectors and awaiting to be transferred into plants for analysis are categorized as “agrobacterium transformation.”

Preliminary Results for Determining Spermidine Concentration

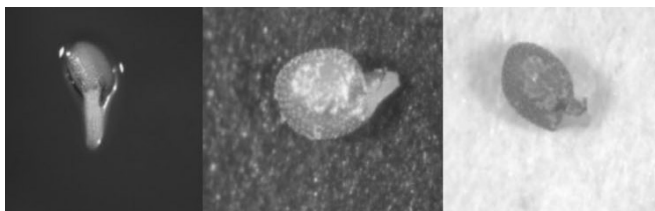
After counting the three stages of seeds, fig20, fig21, and fig22, the percentages of surviving seeds were counted for the various Spd and ABA concentrations. Fig23 shows that as the percentage of surviving seeds for all Spd concentrations decreased as the concentration of ABA increased. However, when seeds were treated using 0.5 mM Spd, over 85 percent of the seeds survived initially. For those treated with 0 mM Spd, 70 percent of the seeds survived initially. For those treated with 0 mM Spd, only 60 percent of the seeds survived initially.

Fig20.



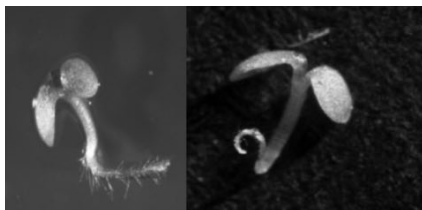
Stage 1 seeds. These seeds failed to germinate.

Fig21.

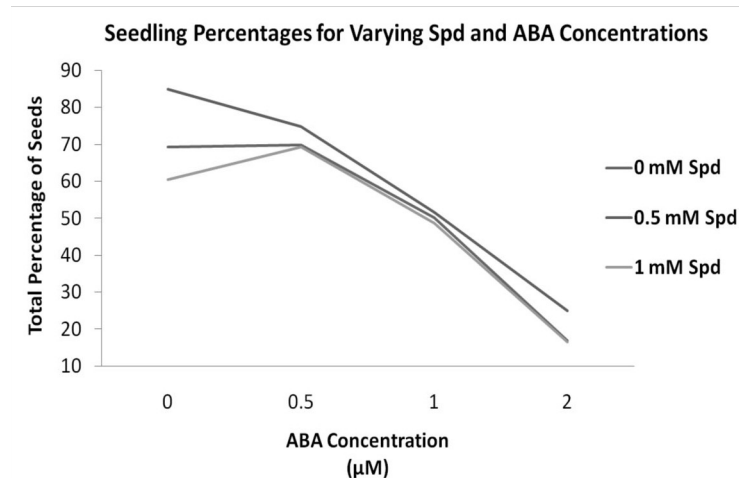


Stage 2 seeds. These seeds germinated, which is shown via the root breaking the seed coat.

Fig22.



Stage 3 seeds. These seeds have matured into seedlings that undergo photosynthesis.

Figure 23.

Seedling Percentages for Varying Spd and ABA concentrations.

For seeds that were treated under 0 mM concentration of Spd, as ABA concentration increased, the seeds's survival dropped from 70 to 17 percent. For seeds that were treated under 0 mM concentration of Spd, as ABA concentration increased, the seeds's survival dropped from 85 to 25 percent. For seeds that were treated under 1 mM concentration of Spd, as ABA concentration increased, the seeds's survival dropped from 60 to 16 percent.

Discussion

My research is still ongoing, so I will discuss future research aspirations. Having transformed the expression vectors into *Agrobacteria*, the next aspect of my research is to determine the guard-cell specificity of the promoter sequences. Thus, I must perform GUS reporter assays and identify regulatory regions in the promoters to determine gene expression patterns in plants.

Although there has been little data collected regarding Spermidine concentrations, some conclusions can still be drawn. The data does support my hypothesis that Spd will increase seed viability. By successfully inhibiting the phase transitions from embryonic to germinative growth, Spd was able to keep the seeds alive. Data showed that in the presence of Spd the percentage of surviving seeds greatly increased. Spd concentration of 0.5 mM worked the best under changing conditions, setting a standard for future studies using Spd concentration. However, too much Spd added to seeds was toxic to seeds. Data also showed that in excess ABA and Spd concentrations, seeds do not germinate. This finding supports previous research that the ABA pathway is far too overpowering and complex for drugs to fully prevent. However, the use of Spd will be able to significantly cut the number of dying seeds. Thus, Spd had to be kept under 1 mM concentration. In the future it is necessary to first replicate these findings. Afterwards, the concentrations of Spd can be more actively studied for determining the best concentration of Spd to use.

Conclusion

By finding the genes responsible for stomatal guard cell closure involved in the ABA pathway it will be possible to control when stomata open and close. Plants will be able to better regulate gas exchange processes that contribute to the 95 percent of water loss in plants. Having the ability to stop the single most destructive process detrimental to plant survival will allow even common plants to withstand the driest of droughts. Being able to develop a faster method for identifying regions in the promoter that encodes functionality is crucial for accelerating the progress of this important study.

Chemically, inhibiting phase transitions from embryonic to germinative growth using Spd gives the new ability to manipulate seed germination. By having a standard for the treatment of seeds using Spd, complete seed germination control is possible in the near future. Thus, seeds can be treated to endure the coldest and harshest of winters long enough for favorable growing conditions in the spring.

Combining both the genetic and chemical aspects of the ABA pathway which is responsible for plants' response to environmental stress is necessary to even begin to comprehend this process. By further understanding these two seemingly unrelated responses involving stomatal closure and seed germination provides further insight into the still largely unknown Abscisic Acid signaling pathway to make plants impervious to environmental disasters. Thus, plants necessary for all peoples across the world to survive and thrive on will be accessible to all creating much a greener place for us to live.

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Decline and Disparities in Mammography Use Trends by Socioeconomic Status and Race/Ethnicity¹

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Abstract

The second leading cause of death in women in the United States is breast cancer. While it remains the most common type of cancer in women, early detection through mammography screening has been used to combat and treat breast cancer. But after the 2000, the rates of mammography have been declining. The purpose of this study is to examine whether or not the decline has continued and whether all racial/ethnic and socioeconomic groups experienced the same rate of decline. The study further explores the reasons why there are greater decline rates and breast cancer disparities among African American women, and women with lower income and education. Data from the National Health Interview Survey (2003 to 2005) and the Behavioral Risk Factor Surveillance System (2002 to 2004) were used to calculate the percent decline for the total population and by race/ethnicity and socioeconomic status. Mammography rates declined between 2003–2005 (NHIS) and 2002–2004 (BRFSS). Data from both the NHIS and BRFSS show a greater rate of decline for African American women, and women with lower income and education. An expert sampling method is used to recruit participants to explore their views on the reasons why breast cancer disparities existed among African American women, women with lower income, and women with lower education. These results differ from previous studies which examined broader time interval (2000 to 2005). Further research is recommended to explore whether the rates of decline have continued, the impact of the decline in mammography rates on breast cancer incidence, mortality, and stage of diagnosis, as well as the underlying reasons for the observed decline in mammography rates and for disparities in the rates of decline.

Background/Introduction

Breast cancer is the most common type of cancer in women throughout the United States and is also the second leading cause of death in women today (Kim & Jang, 2008). According to the National Cancer Institute's Surveillance, Epidemiology, and End Results Cancer Statistics Review (2008), the age-adjusted death rate for breast cancer was 24.5 per 100,000 women per year during 2002–2006 in the United States (Homer et al., 2008). About 40,170 women are estimated to die from breast cancer in 2009 (Homer et al., 2008). Mammography can detect breast cancer at an earlier stage when treatment is more effective (Makuc, Breen, & Freid, 1999). Mammography screening detects about 90 percent of breast cancer even before it can be felt or show any symptoms (American Cancer Society [ACS], 2008). Therefore, the key to treat breast cancer certainly is early detection. Not only does mammography save women's lives by improving their treatment options and their chances for successful treatment, but most importantly, it improves their chances of survival (ACS, 2008). Mammography screening has been one of the important keys to combating and surviving breast cancer.

In the American Cancer Society's "Breast Cancer Facts & Figures 2007–2008" Report (2008), race/ethnicity, socioeconomic status, stage at diagnosis, and age at diagnosis greatly influence breast cancer survival (ACS, 2008). Women who have less than a high school education and have no health insurance coverage are the least likely to have had a recent mammogram (ACS, 2008). This may contribute to the later discovery of breast cancer, making their chances of survival less likely. Similarly, African American patients who are more likely to be of lower socioeconomic status compared to White American patients are also less likely to have had a recent mammogram. African American women are more likely to die from breast cancer at every age, according to the American Cancer Society's report (ACS, 2008). The survival differences between White American and African American breast cancer patients suggest that

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these differences may be attributed in part to racial disparities regarding in mammography screening (Chagpar, Polk, & McMasters, 2008).

The percentage of all women ages 40 and older who reported having had a mammogram within the past two years increased dramatically between 1987 and 2000, from 29% to 70% (Breen & Kessler, 1994). This increase in the use of mammography over time has had a profound effect on the incidence and mortality rate of this disease. It made early detection more common and helped to reduce mortality of breast cancer (Breen et al., 2007). Earlier this decade, the American Cancer Society observed that after the rapid increases, the rate had stabilized between 2000 and 2003. However, recent data from the National Health Interview Survey (NHIS) suggested that there was a decline in mammography use for all women ages 40 and over between 2003 and 2005, from 70% in 2003 to 66% in 2005 (ACS, 2008).

Nancy Breen's "Reported Drop in Mammography: Is this Cause for Concern?" article (2007) reported a decline in the use of mammography from 70% to 67% using 2000 and 2005 NHIS data (Breen et al., 2007). Although they found that rates were lower in 2005 than in 2000 for nearly all of the different groups of women, they found that a "significant decline was observed among white women, women with higher educational attainment" and also "the largest significant declines were among women who traditionally have used mammography at high rates, including women with higher incomes" (Breen et al., 2007). A similar study using 2000 and 2005 NHIS data, "Racial Trends in Mammography Rates: a Population-Based Study" (2008), also reported the decline in all groups of women, but further stated that the decline only reached statistical significance in the White American population (Chagpar, Polk, & McMasters, 2008). Although this report reported that rates of mammography were declining in all groups, it further stated that there is a greater rate of decline among White American populations and declared that "race is not a significant independent predictor of mammography rates in each year" (Chagpar, Polk, & McMasters, 2008). This study will further explore the results and conclusions from these previous studies using data from the NHIS and BRFSS.

Research Questions

The purpose of this study is to analyze trends of mammography use, using a more precise time interval of two-years (2003-2005 NHIS and 2002-2004 BRFSS), among women ages 40 and over by race/ethnicity and socioeconomic status in the United States in order to examine whether all racial/ethnic and socioeconomic groups experienced the same rate of decline. Furthermore, this study is conducted to examine the possible reasons affecting the greater rates of decline and breast cancer disparities among African American women, and women with lower income and education and to compile information in order to carry out further research.

According to the NHIS, there has been a decline in mammography rates for women ages 40 years and over, regardless of socioeconomic status and race/ethnicity. The questions are: 1. Has there continued to be a decline in mammography rates? 2. Has the rate of decline varied by family income, education, or race/ethnicity? 3. Do data from the Behavioral Risk Factor Surveillance System (BRFSS) show similar patterns to data from the NHIS? 4. Why are there greater decline rates and breast cancer disparities among African American women, and women with lower income and education?

Definitions

Age-adjusted rate. Age-adjusted is defined as "weighted average of the age-specific rates, where the weights are the proportions of persons in the corresponding age groups of a standard population" (United States National Institutes of Health, 2008).

Behavioral Risk Factor Surveillance System (BRFSS). This data system is a state-based system of telephone health surveys that collects information on health risk behaviors, preventive health practices, and health care access primarily related to chronic disease and injury. It was established in 1984 by the Centers for Disease Control and Prevention (Centers for Disease Control and Prevention, 2008).

Breast cancer disparities. This concept is defined as the differences in the incidence, mortality, and survival rate that existed among specific population groups (ACS, 2008).

Healthy People 2010. The national disease prevention and health promotion agenda was released by the Department of Health and Human Services in 2000 in order to provide a framework for prevention for the Nation. The national health objectives are designed to identify the most significant preventable threats to health and to establish national goals to reduce these health threats (U.S. Department of Health and Human Services [USDHHS], 2000).

Mammogram. Mammogram is defined as “a low-dose x-ray procedure that allows visualization of the internal structure of the breast.” On average, mammography will detect about 90% of breast cancers in women without symptoms (ACS, 2008).

National Health Interview Survey (NHIS). This data system is a primary source of health information on the civilian, noninstitutionalized population in the United States. It is conducted by the Centers for Disease Control and Prevention (CDC) and was designed specifically to produce national estimates. An annual survey is administered in person by Census Bureau interviewers. Information is gathered on health knowledge, attitudes, and practices for various population groups, including those defined by age, sex, race, family income, geographic region, and place of residence (Breen & Kessler, 1994).

Surveillance, Epidemiology, and End Results (SEER). This data system is sponsored by the National Cancer Institute (NCI) to provide an authoritative source of information on cancer incidence and survival in the United States (Horner et al., 2008).

Socioeconomic Status (SES). This term is defined as “a combined measure of income, education, and access to health care” (Merriam-Webster Online Dictionary, 2009).

Study Design/Sampling

In order to explore the research questions, 1. Has there continued to be a decline in mammography rates? 2. Has the rate of decline varied by family income, education, or race/ethnicity? 3. Do data from the Behavioral Risk Factor Surveillance System (BRFSS) show similar patterns to data from the NHIS?, data from the NHIS and the BRFSS were used to examine trends and patterns in the recent mammography use. And lastly in order to explore the research question 4. Why are there greater decline rates and breast cancer disparities among African American women, and women with lower income and education?, expert sampling method will be used to gather a sample of people with known or demonstrable experience and expertise in the field of breast cancer disparities.

Each year the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC) conducts the NHIS. It has been conducted every year since 1957 to collect data using national population-based face-to-face survey in order to represent the American civilian noninstitutionalized population (NCHS, 2006). Nationally, approximately 400 interviewers were trained about basic interviewing procedures and concepts and procedures unique to the NHIS. The NHIS is conducted using computer-assisted personal interviewing or CAPI. This method presents the questionnaire on computer screens to each interviewer, guides them through it and allows them to enter survey responses directly into the computer. The CAPI program system also automatically routes the interviewer to appropriate questions based on answers to previous questions of the interviewees (NCHS, 2006). Not only does the CAPI program determine if the selected response is consistent with other data collected during the interview, but it also saves the time required for transferring and processing data and it makes sure the accurate flow of the questionnaire (NCHS, 2006). The interviewers are directed under health survey supervisors in the United States Census Bureau Regional Offices to interview about 35,000 adults. Response rates for the questions fielded in the cancer module are in the range of 80% (NCHS, 2006). These adult female respondents ages 40 years old and over were asked questions regarding the use and the timing of their most recent mammogram (Appendix A). The first question was “Have you ever had a mammogram?” and if women responded “Yes,” the second question was then asked: “When did you have your last mammogram?” (Appendix A). The most recent data available for mammography use for women ages 40 and over receiving it within two years is from the year of 2005. The data from 2003 to 2005 were used for this study.

Another data source that was used to examine trends and patterns in the recent use of mammography is the CDC’s BRFSS data. Unlike NHIS data which represent the entire United States and is administered in person, BRFSS is administered through telephones and questions regarding mammography use were not administered to women in all states (CDC, 2008). Randomly selected from the telephone directory, one adult age 18 or older in each household was interviewed about their health risk behaviors, preventive health practices, and health care access primarily related to chronic disease and injury (CDC, 2008). Breast cancer-related questions are included in the women’s health section, which is conducted differently each year and in each state (CDC, 2008). In Module 9: Women’s Health section, their first question started with a brief description of a mammogram, “A mammogram is an x-ray of each breast to look for breast cancer,” and then it asked “Have you ever had a mammogram?” (Appendix B). If women answer “Yes,” then the second question about “How long has it been since you had your last mammogram?” was asked (Appendix B). The

data for women ages 40 and over who have had a mammogram within the past two year from the year 2002, 2004, and 2006 were used for this study.

In order to examine the trends from the two data sources to answer the research questions, the percent change formula was used to calculate the percent decline of the 2003–2005 NHIS data and the 2002–2004 BRFSS data.

The formula is:

$$\text{Percent Change} = \frac{(V_{\text{past}} - V_{\text{present}})}{V_{\text{past}}} \times 100$$

$$V_{\text{past}} = \text{past or present value}$$

$$V_{\text{present}} = \text{present or future value}$$

The percent change from one period to another is calculated using value at beginning of period subtracted by value at end of period, and then divided it by value at beginning of period, and finally multiplies by 100. For example, to find the percent decline for all women ages 40 and over receiving mammography within the past two years from 2003 to 2005 from the NHIS data, it is calculated as follows:

$$\frac{(70\% - 67\%)}{70\%} \times 100. \text{After the result of the percent decline comes out to be } 4.2857\%,$$

the result is rounded to one place decimal, 4.3%. This method is also repeated to calculate all of the percentages of the percent decline in the categories of race/ethnicity, family income level, and educational level in both NHIS data and BRFSS data. The percent change formula is a useful indicator to look at how much this rate is declining in this area.

Finally, in order to explore the research question 4. Why are there greater decline rates and breast cancer disparities among African American women, and women with lower income and education?, expert sampling method will be used to gather a sample of people with known or demonstrable experience and expertise in the field of breast cancer disparities. The focus group of about 10 to 20 participants is consisted of persons with acknowledged experience and insight in the field of breast cancer disparities. The recruitment method for this study is to send out invitation letters and/or emails to university professors whose interest is the field of public health, specifically in breast cancer. Snowball sampling method will also be used for this study because participant recruitment will also be based upon referral from prior participants, asking them to recommend others they know who also meet the criteria. The invitation can also be sent to breast cancer program managers in governmental agencies and in non-profit organizations, such as Department of Health and Human Services Office of Women's Health and American Cancer Society. The panel discussion allow these participants to discuss their views on the reasons why they believe that there are greater decline rates and breast cancer disparities among African American women, women with lower income and education during two discussion sessions. Informed consent will be given to each participant prior to the first sessions. The sessions will be transcribed, tape-recorded, and videotaped to make sure all the information is collected from the participants. Moderator will lead and stimulate given discussion questions and encourage participants to give their input and suggestions about the topic.

Data Plan

After collecting information from the two data sources, NHIS and BRFSS, the percent decline is calculated in Microsoft Office Excel 2007 and entered into the spread sheet. The calculation is conducted three times to ensure a high level of data accuracy. This procedure significantly reduces entry errors.

For the second part of this research study, I plan to use MAXQDA 2007 Software to organize the discussion during the sessions into theme. MAXQDA is one the most advanced software programs for both qualitative and quantitative research. This software program will be used for computer-assisted qualitative data and text analysis part of this research study. The research study will be reviewed by other research professionals before conclusion is made about the study. And finally, the identified themes from this study will be helpful for further research when conducting questionnaire survey study with a more general population.

Results

Table I.

Comparison of Mammography Rates Among Women Ages 40 and Over by Race/Ethnicity, Family income level, and Educational level: The 2000, 2003 and 2005 National Health Interview Surveys

Category	2000	2003	2005	Percent Decline 2003-2005
Women receiving a mammogram during the past 2 years (ages 40 and over)	70%	70%	67%	4.3%
Race/Ethnicity				
African American	68%	70%	64%	8.6%
White American	71%	70%	67%	4.3%
Family income level				
Poor	55%	55%	48%	12.7%
Near poor	57%	60%	55%	8.3%
Middle/High income	76%	74%	72%	2.7%
Educational level				
Less than high school	57%	58%	54%	6.9%
High school graduate	69%	67%	64%	4.5%
At least some college	76%	75%	72%	4.0%

Source: National Health Interview Survey, CDC, NCHS (NCHS, 2006)



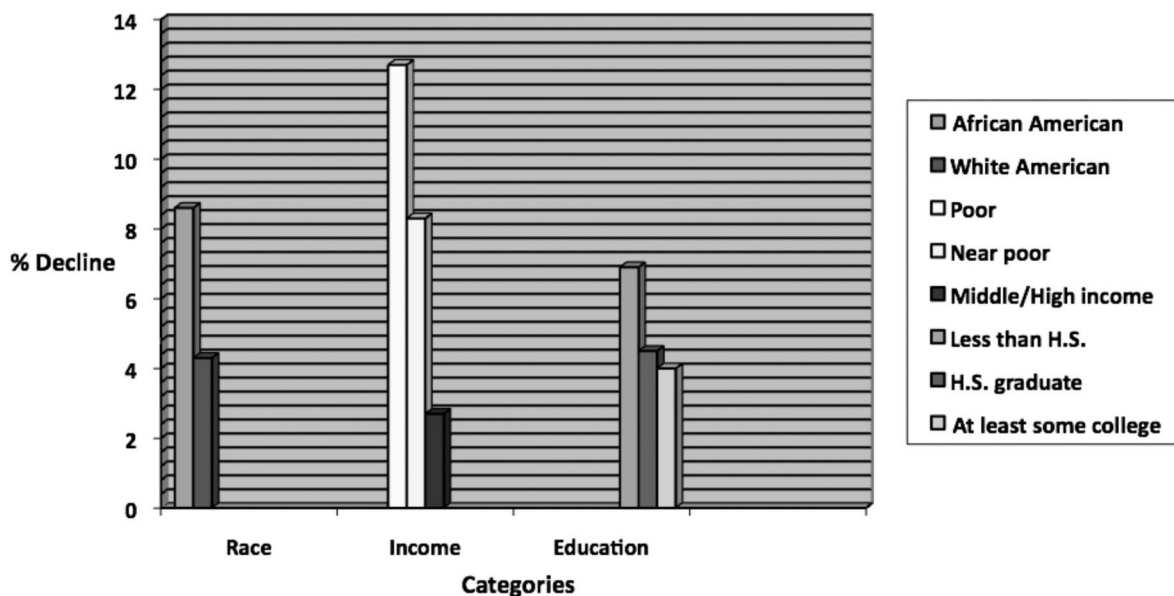
Table II.

Comparison of Mammography Rates Among Women Ages 40 and over by Race/Ethnicity, Family income level, and Educational level: The 2000, 2002, 2004, and 2006 Behavioral Factor Risk Surveillance System

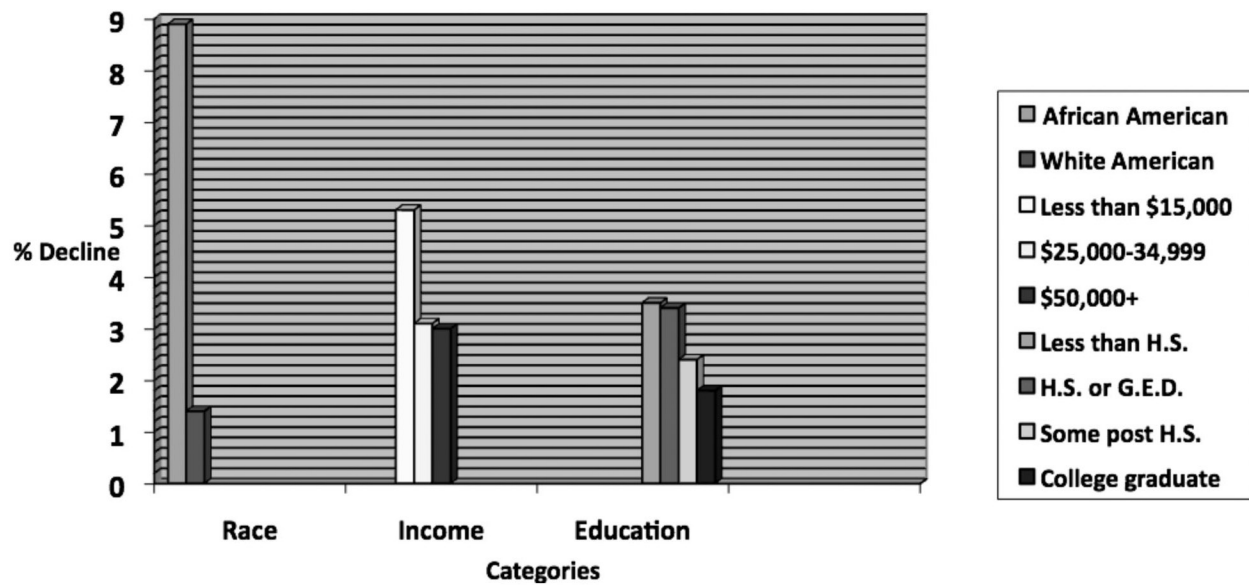
Category	2000	2002	2004	2006	Percent Decline 2002-2004
Women receiving a mammogram during the past 2 years (ages 40 years and over)	76.1%	76.1%	74.9%	76.5%	1.6%
Race/Ethnicity					
African American only	80.2%	82.8%	75.4%	80.1%	8.9%
White American only	76.4%	76.2%	75.1%	77.0%	1.4%
Income					
Less than \$ 15,000	65.4%	66.3%	62.8%	64.7%	5.3%
\$25,000-34,999	76.5%	76.5%	74.1%	73.6%	3.1%
\$50,000+	83.4%	82.7%	80.2%	81.7%	3.0%
Education					
Less than H.S.	67.7%	65.8%	63.5%	66.0%	3.5%
H.S. or G.E.D	75.3%	75.7%	73.1%	74.6%	3.4%
Some post H.S.	78.5%	77.8%	75.9%	77.1%	2.4%
College graduate	82.4%	81.4%	79.9%	81.3%	1.8%

Source: Behavioral Risk Factor Surveillance System, CDC (CDC, 2008)

Percent Decline in Mammography Rates: The 2003 and 2005 National Health Interview Surveys



Percent Decline in Mammography Rates: The 2002 and 2004 Behavioral Risk Factor Surveillance System



Overall, mammography rates declined during 2003 to 2005 according to the National Health Interview Survey and during 2002 to 2004 according to the Behavioral Risk Factor Surveillance System. According to the NHIS, the rate of having had a mammogram declined 4.3%, from 70% in 2003 to 67% in 2005. According to the BRFSS, the rate of having had a mammogram also declined 1.6%, from 76.1% in 2002 to 74.9% in 2004.

While a downward trend in mammography screening was seen in all women, there was a more significant rate of decline for certain groups based on race/ethnicity, family income level, and education level (Table I and II). Both NHIS and BRFSS data show a greater rate of decline for African American women, women with lower income, and women with lower education. In these years, both surveys suggest that African American women, women with lower income level, and women with lower education level were less likely than White women, women with higher income level, and women with higher education level to report having had a mammogram within the past two years. For example, the percent decline for African American women was 8.6% compared to 4.3% for White American women based on the NHIS 2003–2005 data. Similarly to the 2002–2004 BRFSS data, the percent decline for African American women was 8.9% while it was only 1.4% for White American women. Disparities also existed in various family income level and education level groups as well. In the NHIS data, the percent decline percentages decrease as we move from “Poor” to “Near Poor” to “Middle/High income” in the family income level category with 12.7%, 8.3%, and 2.7%, respectively. The percent decline percentages also decrease as we move from “Less than high school” to “High school graduate” to finally “At least some college” in the educational level category with 6.9%, 4.5%, and 4.0%, respectively. In the BRFSS data, the percent decline percentages decrease as we move from “Less than \$15,000” to “\$25,000–34,999” to “\$50,000” in the income level category with 5.3%, 3.1, and 3.0%, respectively. And finally, the percent decline also decrease as we move from “Less than High School” to “High School or G.E.D.” to “Some post High School” to “College graduate” with 3.5%, 3.4%, 2.4%, and 1.8%, respectively. Data from the BRFSS from 2002–2004 show similar patterns as data from the NHIS 2003–2005 regarding a decline for all women ages 40 and over and a greater rate of decline for African American women, women with lower income level, and women with lower education level.

The third finding is that BRFSS data show no further decline during 2004 to 2006 in mammography rates in all women ages 40 and over receiving mammography within the past two years. From 2004 to 2006, the percentage increased from 74.9% to 76.5%. The rates also increase for all three categories: race/ethnicity, income level, and education level. Unfortunately, public data are not yet available from more recent NHIS.

The fourth finding is that access to care, usual source of care, and strong correlations of poverty status and education to race and ethnicity could be factors affecting the breast cancer disparities in African American women, women with

lower income, and women with lower education, according to the pilot testing of the research study. A pilot study was conducted as an interview with one of the breast cancer program manager at a non-profit agency. The method of this pilot study was to send an invitational email to a non-profit organization expert from the American Cancer Society, asking to schedule a phone interview for a class research study. Not only were breast cancer disparities questions asked during the interview, but there were also questions regarding the referral to other experts in the field and helpful suggestions for writing future questionnaire survey questions. Based on the pilot testing with my interviewee, the feedback allowed me to add some changes to the research study's instruments. The advice was to conduct further research about Medical Expenditure Survey Panel (MESP) and determine whether or not some of their surveys can be used as a model for my future study survey questions.

Discussion

The percentage of women ages 40 and over having had a mammogram within the past two years increased from 29% in 1987 to 70% in 2000 (ACS, 2008). Although mammography screening across racial groups and socioeconomic statuses increased from 1987 to 2000, a decline after 2000 in the mammography rate has been noted in national studies.

Examining the differences in the period of 5 years, Breen et al. (2007) and Chagpar, Polk, & McMasters (2008) found that there was only a significant decline among White American women, women with higher education, and women with higher income. In contrast, when this study examined the trends of mammography rate for women ages 40 and over from 2003 to 2005 and from 2002 to 2004, the two-year time period indicated a greater rate of decline for African American women, women with lower education, and women with lower income. Now another question is raised: what was happening between 2003 and 2005 that did not show in the longer period between 2000 and 2005?

However, despite the contrasting findings, it is obvious that mammography rates for women ages 40 and over are not consistent with the Healthy People 2010 goal of 70% (USDHHS, 2000). Although it is not significantly different, it may indicate to us that we might be going in the opposite direction of our nation's goal. This should alarm us and should call for continued monitoring of trends in incidence, screening, mortality, and their underlying factors.

While closely examining the reasons why there was a decline in mammography use for all women ages 40 and over in the United States, and examining whether the decline continues, some literature suggests possible reasons for the decline in mammography use. The drop in rates may be caused by factors, including an increase in the number of women who do not have health insurance, higher health care costs, lower belief in the effectiveness of mammograms, reduced perceived risk because of reported decrease in mortality from breast cancer, and a lack of promotion of mammography (Campbell et al., 2009). Other reasons from the Institute of Medicine (IOM) include low reimbursements by insurers, rising malpractice law suits against radiologists who read mammograms, and fewer radiologists choosing to specialize in breast imaging (Campbell et al., 2009).

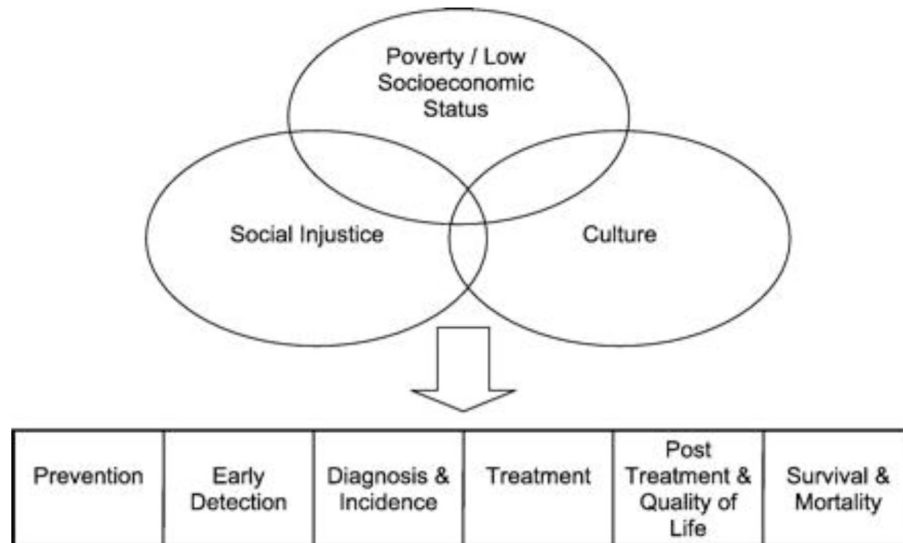
After attempting to examine the reasons why there are greater decline rates and breast cancer disparities among African American women, and women with lower income and education, the pilot study result suggests that access to care and having a usual source of care highly influenced whether or not women receive regular mammography screening. There are also strong correlations of poverty status and education when compared to race and ethnicity. African American women are more likely to be in the lower socioeconomic status and this relates to whether or not they are able to afford insurance or even if their insurance plan covers preventative care, such as mammography screening. All these factors not only relate to each other, but they also have an effect on mammography rate and breast cancer disparities. More research has to be conducted in order to further our understanding about the reasons why these factors still existed.

Some strengths of this research study are that the method of expert sampling provides experts' opinion and the use of national surveys. The advantage of having experts as the samples is that the credibility is already established and I am not on my own trying to defend my decisions. I have someone to back me up on what I try to argue or come up with. The other strength is that because NHIS and BRFSS are collected by a federal government agency, these data sources are highly reliable and are not subjective to any bias. While there are several strengths in this research study, there is also a weakness in using expert sampling as a method in this study. The weakness is that even though the samples are experts in the field, there is still a possibility that they could be wrong. This is why further research involving a more general population needed to be conducted to add more evidence to the research study.

I want to conduct further research in the future using Drs. Freeman and Chu's Social Determinants of Health Disparities in Cancer theoretical framework to guide the course of my study. I will guide my research study based

on three major social determinants of low socioeconomic status: poverty, culture, and social injustice. These three determinants will help guide me when further exploring my research question of why disparities in mammography rates existed among racial minority and low socioeconomic population. The Institute of Medicine (IOM) published a review explaining how Freeman and Chu's model is a model in which health care disparities arise. It is the overlap of three major factors: economic, social, and cultural factors (Ward et al, 2004).

Figure: Social determinants of health disparities in cancer (Freeman and Chu) (Ward et al, 2004).



First, poverty or low socioeconomic status factors influence cancer risk factors, such as tobacco use, poor nutrition, and physical inactivity. Income, education, and health insurance coverage play important roles because they largely influence people's level of resources, information, and knowledge (Ward et al, 2004). Second, cultural factors include learned beliefs, values, traditions, and behaviors that are common to a particular social group (Ward et al, 2004). They are the accepted social norms within that particular group that largely influence people's behaviors and attitudes. For example, some groups that believe in alternative forms of healing as opposed to modern medicine may be less likely to get a regular breast cancer screening or a mammogram (Ward et al, 2004). Third, social injustice also influences the interactions between patients and physicians, according to the IOM. The unfair treatment of an individual or group based on race or socioeconomic status may determine the quality of health care that one receives (Ward et al, 2004). The three major factors, poverty or low socioeconomic status, social injustice, and culture, all influence access to health care, such as appropriate prevention, early detection, diagnosis and incidence, treatment, post treatment and quality of life, and survival or mortality (Ward et al, 2004). This framework will be useful in guiding the future research.

For the follow-up study methods, I plan to do one or more of the following: 1. Examine more recent NHIS data to see if there continues to be a decline over time (the BRRSS data suggested that it was only a short-term decline), 2. Examine breast cancer incidence and mortality trends to see whether the decline in mammography resulted in lower breast cancer incidence and/or higher breast cancer mortality and/or later average stage at diagnosis, 3. Examine changes in health insurance coverage overall and for mammography, and 4. Conduct in-depth interviews with several key informants, including breast cancer program managers, to find out why they think there was a decline in mammography rates.

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Appendices

Appendix A: Mammography Questions from 2005 National Health Interview Surveys

Have you EVER HAD a mammogram?

1. Yes
2. No
7. Refused
9. Do not know

When did you have your MOST RECENT mammogram

1. A year ago or less
2. More than 1 year but not more than 2 years
3. More than 2 years but not more than 3 years
4. More than 3 years but not more than 4 years
5. Over 5 years ago
7. Refused
9. Do not know

Appendix B: Mammography Questions from 2004 and 2002 Behavioral Risk Factor Surveillance System

A mammogram is an x-ray of the breast to look for cancer. Have you ever had a mammogram?

1. Yes
2. No
7. Don't know/ Not sure
9. Refused

How long has it been since you had your last mammogram?

Read only if necessary:

1. Within the past year (anytime less than 12 months ago)
2. Within the past 2 years (1 year but less than 2 years ago)
3. Within the past 3 years (2 years but less than 3 years ago)
4. Within the past 5 years (3 years but less than 5 years ago)
5. 5 or more years ago

Do not read:

7. Don't know/Not sure
 9. Refused
-

Does Situation Type Moderate the Relationship Between Maternal Attention-Deficit/Hyperactivity Disorder (ADHD) Symptoms and Observed Parenting?

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Abstract

Previous research has found associations between parental attention-deficit/hyperactivity disorder (ADHD) symptoms and maladaptive parenting. In contrast, some suggest a “similarity-fit hypothesis,” in which equal levels of ADHD symptoms between parents and children may be associated with a shared behavioral tempo, which may result in a better “fit.” However, this theory has only been tested in a free-play situation (Psychogiou et al., 2008a). This study tested the “similarity-fit hypothesis” using two samples of children with ADHD and their mothers across two tasks to examine the extent situational context is associated with ineffective parenting. Mother-child dyads were observed in an unstructured free-play task and a structured homework task in two studies of parent-child interactions consisting of a total of 175 elementary-aged children with DSM-IV ADHD. A significant main effect for situation type on positive parenting and ineffective commands was found in Study 2. Mothers displayed higher rates of positive parenting and ineffective commands in the homework task compared to the free-play task. A trend-level interaction (Situation Type x Maternal ADHD symptoms) was found in Study 1. Probing the interaction revealed that higher levels of maternal ADHD symptoms predicted higher levels of ineffective commands in the homework task, but not in the free-play task. Although, our results were both consistent and inconsistent with the literature examining families where ADHD is present in children and parents, our study’s findings may contribute to the limited literature using observational measures to examine associations between maternal ADHD symptoms and parenting. Our results suggest the challenging nature of the structured homework task may tax a mother’s core symptoms of ADHD, which contrasts with the “similarity-fit hypothesis.” Further research testing the “similarity-fit hypothesis” is needed to determine the extent situational context impacts the relationship between maternal ADHD symptoms and parenting.

Keywords: Attention-deficit/hyperactivity disorder, observed parenting, parental ADHD

Introduction

Attention deficit/hyperactivity disorder (ADHD) has an estimated prevalence of 3-16% among school-aged youth (Brown et al., 2001; Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition – Text Revision (DSM-IV-TR); 2000; Faraone, Sergeant, Gillberg, & Biederman, 2003; Froehlich et al., 2007; Goldman, Genel, Bezman, & Slanetz, 1998; Lavigne, LeBailly, Hopkins, Gouze, & Binns, 2009; Polanczyk, de Lima, Horta, Biederman, & Rohde, 2007). DSM-IV-TR criteria for ADHD includes developmentally incongruent symptoms of symptoms of hyperactivity, impulsivity, and inattention present before age 7, coupled with impairment in functioning spanned across multiple settings, such as school, home, and work (DSM-IV-TR, 2000). One significant area of impairment for children with ADHD is negative parent-child interactions, including higher rates of maternal criticism and child deviant behavior and noncompliance, when compared to families of children without ADHD (Barkley, Anastopoulos, Guevremont, & Fletcher, 1992; Cunningham & Barkley, 1979; DuPaul, McGoey, Eckert, & VanBrakle, 2001; Mash & Johnston, 1982; Psychogiou, Daley, Thompson, & Sonuga-Barke, 2007b). These negative factors associated with families of children with ADHD highlight the significance of studying this population.

ADHD is also a highly heritable disorder, with a heritability rate estimated to be .76 (Faraone et al., 2005). Along with its high heritability rate, ADHD is a chronic disorder that persists well into adulthood, despite changes in symptom manifestation (Barkley, Fischer, Smallish, & Fletcher, 2002; Faraone et al., 2000, 2005). The ADHD diagnosis alone has also been found to increase the risk of ADHD in one’s own child (Biederman, Faraone, & Monuteaux, 2002). These

factors suggest that many families have both parents and children with ADHD. Consequently, maladaptive parenting is expected considering adults, especially mothers, with ADHD have significant difficulties with planning, remaining on task, attending to uninteresting tasks, and restlessness. These difficulties may be especially apparent in highly demanding situations, such as helping their child with homework (Prince & Wilens, 2000; Weiss, Hechtman, & Weiss, 2000).

Several studies provide support for an association between parental ADHD symptoms and reported maladaptive parenting. Banks, Ninowski, Mash and Semple (2008) found that mothers with higher ADHD symptoms reported less parenting efficacy (i.e., one's perception of their effectiveness as a parent), more parenting dissatisfaction, and more laxness and overreactivity towards their children. Even prenatally, mothers with higher ADHD symptoms reported having less positive expectations for their children, were less positive when evaluating their future parenting behaviors, and attended their prenatal checkups less regularly (Ninowski, Mash & Benzies, 2007). Chronis-Tuscano et al. (2008) found that for mothers of children with ADHD, mothers with higher ADHD symptoms reported lower levels of involvement and less positive parenting. In another study, mothers with a diagnosis of ADHD reported less monitoring of their child's behavior and less consistency in parenting and discipline, and had lower quality responses in a computerized problem solving task than mothers without ADHD (Murray & Johnston, 2006). Additionally, exposure to parental ADHD has been associated with more parent-reported family conflict and less family cohesion (Biederman et al., 2002). Psychogiou, Daley, Thompson, & Sonuga-Barke (2008b) also found a positive correlation between maternal ADHD symptoms and self-reported personal distress in parenting situations (e.g., "I tend to lose control during my child's emergencies") as measured on a subscale of the Interpersonal Reactivity Index (IRI) modified for parenting (Davis, 1983). In sum, there is considerable evidence that higher maternal ADHD symptoms are associated with maladaptive parenting (Banks et al., 2008; Biederman et al., 2002; Chronis-Tuscano et al., 2008; Murray & Johnston, 2006; Ninowski et al., 2007; Psychogiou et al., 2008a, 2008b, 2007a).

Studies that were not limited to parent self-report and included observations of parent-child interactions for families of children with ADHD have also found associations between higher parental ADHD symptoms and maladaptive parenting. In a study of children diagnosed with DSM-IV ADHD, less observed positive parenting and more commands given without an opportunity for a child to comply were related to higher levels of maternal symptoms of ADHD during a structured homework task (Chronis-Tuscano et al., 2008). In addition, maternal ADHD symptoms were positively correlated with negative parenting in a less structured free-play task in the same study (Chronis-Tuscano et al., 2008). In another observational study, Psychogiou, Daley, Thompson, and Sonuga-Barke (2008a) found a positive correlation between maternal ADHD symptoms and observed negative parenting, such as negative expressed emotion and negative communication, in a community sample of children.

In contrast, some claim there may be positive benefits for families in which both parent and child have higher ADHD symptoms. Psychogiou et al. (2008a) suggested a "similarity-fit hypothesis," in which elevated ADHD symptoms in mothers may be associated with increased understanding of their child's behavior and a shared behavioral tempo between the mothers and children which results in a better "fit." The "fit" is best, according to Psychogiou et al. (2008a), when both parent and child have equal levels of ADHD symptoms, either high or low. In a 2008 study by Psychogiou and colleagues, they found higher levels of self-reported positive involvement in families where both mothers and children had higher ADHD symptoms compared to families that were "mismatched" (i.e., lower maternal ADHD symptoms and higher child ADHD symptoms or vice versa). However, in a related study, when self-reported findings were tested observationally, maternal ADHD symptoms and observed positive and negative parenting were positively correlated in a 10-minute free-play at the child's home. In addition, a further test of the "similarity-fit hypothesis" was applied for fathers. Fathers with higher levels of ADHD symptoms reported more negative parenting, specifically poor monitoring, inconsistent discipline, and physical punishment (Psychogiou, Daley, Thompson, & Sonuga-Barke, 2007a). Thus, although there is modest yet mixed support for Psychogiou's "similarity-fit hypothesis" in mothers, there does not seem to be any empirical support for the "similarity-fit hypothesis" in fathers.

There are several possible reasons for these mixed findings regarding the "similarity-fit hypothesis." For instance, the two Psychogiou et al. studies (2007a, 2008a) that found support for the "similarity-fit hypothesis" did not focus on children diagnosed with ADHD based on DSM-IV-TR criteria. That is, the community samples in Psychogiou et al. (2008a) were entirely absent of diagnoses of ADHD and instead continuous levels of ADHD symptoms were examined in mothers and children. This is in contrast to Chronis-Tuscano et al. (2008) and Murray and Johnston (2006) where stringent criteria was applied in assuring a child diagnosis of ADHD. Thus, the Chronis-Tuscano et al. (2008) and Murray and Johnston (2006) studies better captured inherently impaired children with ADHD. Second, parenting observations in the Psychogiou et al. (2008a) study were conducted in the homes of the children in a 10-minute

free-play task. In contrast, in the Chronis-Tuscano et al. (2008) study, two tasks of varying structure (and thus different parenting demands) were incorporated in the research design. Third, two different coding systems were employed to code the observations in the Psychogiou et al. (2008a) and Chronis-Tuscano et al. (2008) observational studies, which also may account for differences in results. Fourth, symptoms of parental ADHD were assessed using different measures: the 93-item Conners Adult ADHD Rating Scale (CAARS) in Chronis-Tuscano et al. (2008) and the 18-item Adult ADHD Rating Scale (AARS) for mothers and fathers in the Psychogiou and colleagues studies (2008a, 2007a). Thus, the differences in measures alone may substantially account for discrepancies in findings for the association between maternal ADHD symptoms and parenting.

We tested the “similarity-fit hypothesis” suggested by Psychogiou et al. (2008a) in two samples. Specifically, we examined the differential associations between maternal ADHD symptomatology and observed parenting based on the amount of structure the parenting task requires. We hypothesized that structured situations (i.e., homework task) may be more difficult for a parent with higher symptoms of ADHD because structured tasks may tax their difficulties with sustained attention, planning, and organization. Research questions addressed in this study are:

First, are maternal ADHD symptoms associated with observed ineffective parenting? We expected, based on existing literature reviewed herein, that maternal ADHD symptoms would be associated with higher levels of observed negative parenting, higher levels of ineffective commands (e.g., those without an opportunity to comply), and lower levels of positive parenting (Chronis-Tuscano et al., 2008).

The second research question addresses whether the situational context is related to ineffective parenting. There is some evidence to suggest more generally that context does play a role in evoking negative parenting behaviors including less sensitivity in attempts to control child behavior, less involvement, less responsiveness, and less positive affect, notably in clean-up and problem solving situations, when compared to play situations (Deault, 2010; Johnston et al., 2002; Seipp & Johnston, 2005; Tripp, Schaughency, Langlands, Mouat, 2007). In Danforth and colleagues’ (1991) review of observational studies of parent-child interactions, overall variations in parenting were noted between structured tasks and unstructured play situations. Specifically, in structured tasks, more verbal exchanges and negativity from parents are found in observations of children with higher levels of hyperactivity. With that said, we hypothesized that mothers of children with ADHD would display greater parenting deficits, as measured by less effective commands, more negative parenting, and less positive parenting in a structured homework situation relative to an unstructured free-play situation.

Finally, and perhaps most importantly, we examined whether the associations between maternal ADHD symptoms and observed ineffective parenting vary by situation. It may be the case that mothers with ADHD will demonstrate greater parenting deficits in structured, relative to unstructured or free-play situations, because these high-demand tasks tax the core symptoms of ADHD for parent and child. Therefore, we hypothesized that mothers with higher levels of ADHD symptoms who have children with ADHD will exude greater parenting deficits in structured, relative to unstructured, situations. The findings of this study could benefit existing literature on families of children with ADHD, and may clarify inconsistencies in support of or against the “similarity-fit hypothesis.”

Methods

Participants

Our analyses were based on data drawn from two samples:

Study 1. The first study examined parent-child interactions for families of children with DSM-IV-TR ADHD. Seventy mother-child dyads were recruited from the Washington, D. C. metropolitan area. In order to be included in the study, children (1) had to meet full DSM-IV diagnostic criteria for an ADHD diagnosis based on parent and teacher behavior and symptom rating scales and structured interviews with parents; (2) had an estimated IQ above 70; (3) were between the ages of 6 and 10; and (4) resided with their biological mothers. More than half of the children (65.5%) in Study 1 were taking stimulant medications. However, to capture children’s uninhibited behavior, children were rated and observed while they were unmedicated.

Given the high heritability rate associated with ADHD (.76; Faraone et al., 2005), we expected mothers in this study to display ADHD symptomatology. However, no ADHD symptom cutoff was required for mothers. Additionally, we excluded mothers who were taking stimulant medication and for the presence of any Axis 1 disorder in mothers other than ADHD.

Eighty-three percent of observed parent-child interactions were included in our Study 1 analyses. Due to technical difficulties (i.e., recording errors), 17% of observed parent-child interactions were not included in our analyses.

Study 2. The second study is a study of 105 families of children with DSM-IV-TR ADHD with mothers with at least mildly elevated depressive symptoms (Beck Depression Inventory BDI-II) score ≥ 10 . Participants were also recruited from the Washington, D.C. metropolitan area. Children in Study 2 had to meet the same inclusion criteria as Study 1, with the exception of age. Children in Study 2 were between the ages of 6 and 12.

Similar to Study 1, more than half of the children in Study 2 were medicated (57.7%). However, children in Study 2 remained on their typical stable doses of medication for parent-child observations, due to changes in ethical standards. Parents were asked to rate their children's behavior on questionnaires based on their children's behavior when unmedicated.

Mothers were not selected for their ADHD symptomatology in either study. However, due to the high heritability, we expected that mothers of children with DSM-IV diagnosed ADHD would be likely to have higher levels of ADHD symptoms themselves. Regarding psychological co-morbidity, mothers in Study 2 were included if they had other psychological disorders that did not necessitate urgent treatment (thus, mothers with substance abuse, psychosis, or bipolar disorder were excluded).

Fifty-nine percent of observed parent-child interactions were included in our Study 2 analyses ($N = 62$). Forty-one percent of the observed interactions were not included, some due to recording errors and some due to the fact that coding is still in progress.

Procedures

Mothers of children with ADHD who expressed interest in participating in either study were deemed eligible from a telephone screen. Eligible participants were invited to attend a study visit that included a diagnostic assessment of child ADHD and observed parent-child interactions. All study procedures were approved by the university Institutional Review Board and all mothers provided their written informed consent. Mothers in both studies completed an adult rating scale of their own ADHD symptoms (CAARS). Participants were paid for their participation in the studies.

Parent-child interactions were completed in a room equipped with a one-way mirror for the researcher's viewing and video recording. For the 5-minute free-play task, mothers were instructed to follow their child's lead and play with the child's choice of toys provided (i.e., cars, Jenga). Following the free-play task, the parent and child engaged in a 10-minute "homework" task that consisted of a grade-appropriate math worksheet. Parents were instructed to provide as much assistance as needed for their child to complete the worksheet.

Measures

Conners Adult ADHD Rating Scale (CAARS). The CAARS is a reliable and valid 93-item measure of adult ADHD (Conners et al., 1999; Erhardt, Epstein, Conners, Parker, & Sitarenios, 1999). The CAARS includes items assessing hyperactivity, impulsivity, and inattention. Adults rate symptoms as happening "Not at all, never" to "Very much, very frequently" on a 4-point scale. It is an excellent self-report assessment tool of adult ADHD symptoms based on its good psychometric properties and inclusion of normative data.

Dyadic Parent-Child Interaction Coding System (DPICS). The observed parent-child interactions were coded using the Dyadic Parent-Child Interaction Coding System – Third Edition (DPICS-III). A composite of "positive parenting" (DPICS-PP) was calculated based on total frequency of praise and positive touch (i.e., gentle positive physical contact). A composite of "negative parenting" (DPICS-NP) was calculated based on total frequency of negative talk (including negatively worded commands and critical statements) and negative touch (i.e., physical restraint or redirection). The total frequency of "No Opportunity for Child to Comply" (DPICS-NOC; i.e., vague commands or commands given without an opportunity to comply within a five-second interval) was also calculated. These three categories of parenting were selected for their ability to quantify ineffective parenting (higher levels of negative parenting and ineffective commands and lower levels of positive parenting) and for their theoretical and empirical associations with parental ADHD. DPICS frequencies were pro-rated to account for the fact that parent-child interactions were observed for different amounts of time in the two situations (free-play: 5 minutes, homework: 10 minutes); play frequencies were doubled to allow for comparison.

DPICS training consisted of manual review, completion of the DPICS workbook (Eyberg, Duke, McDiarmid, Boggs, & Robinson, 2004), and group practice with sample parent-child interaction videos. Eight undergraduate coders were trained until they achieved 80% reliability on a criterion video. Ongoing weekly face-to-face meetings for coding practice and discussion were conducted to ensure coder reliability. Agreement between coders was assessed

throughout the studies based on periodic reliability checks. Thirty to 50 percent of the videos were coded by two raters for inter-rater reliability. Inter-observer reliability coefficients were 0.89 for DPICS-PP, 0.83 for DPICS-NP, and 0.86 DPICS-NOC in Study 1.

Results

Data Analysis

To examine the main aims of the study, analyses were conducted using generalized estimating equations (GEE) to examine main and interaction effects for each sample. GEE was appropriate for our studies based on its ability to account for nested and discrete data, such as parenting behaviors in two different situations, and subject-specific data, such as maternal ADHD symptoms (Ballinger, 2004; Zeger et al., 1988).

In each analysis, we first examined if the situation type and maternal ADHD symptoms each independently predicted our dependent variables (DPICS-NP, DPICS-NOC, and DPICS-PP), using an alpha level of $p < .05$. To examine if situation type moderated the relationship between maternal ADHD symptoms and observed parenting deficits, we examined the interaction of maternal ADHD symptoms and situation type in predicting observed parenting. Post-hoc testing was conducted to examine simple slopes and regions of significance when a significant interaction was found.

Generalized Estimating Equations

Positive Parenting

Study 1. There were no significant main effects for situation type or maternal ADHD symptoms or the interaction on DPICS-PP in Study 1 (Table 4).

Study 2. There was a main effect for situation type on DPICS-PP in Study 2. Mothers displayed more positive parenting in the homework task, relative to the free-play task (Table 4). There was no significant main effect for maternal ADHD symptoms on DPICS-PP, nor was there a significant situation type x maternal ADHD symptoms interaction.

Negative Parenting

Study 1. There were no significant main effects for situation type or maternal ADHD symptoms or the interaction on DPICS-NP in Study 1 (Table 5).

Study 2. There were no significant main effects for situation type or maternal ADHD symptoms or the interaction on DPICS-NP in Study 2 (Table 5).

Commands Without an Opportunity to Comply

Study 1. There was no significant main effect for situation type or maternal ADHD symptoms on DPICS-NOC; however, there was a trend-level interaction (Situation Type x Maternal ADHD symptoms) (Table 6). Probing the interaction revealed that a higher level of maternal ADHD symptoms (1 SD above the mean CAARS score compared to 1 SD below the mean) significantly predicted a higher level of ineffective commands in homework ($\beta = 0.20$, $SE = 0.82$, $p = .015$), but not in free-play ($\beta = -0.64$, $SE = 0.12$, $p = .581$).

Study 2. There was a main effect for situation type on DPICS-NOC in Study 2. Mothers displayed higher levels of DPICS-NOC in homework relative to the free-play situation (Table 6). There was no significant main effect for maternal ADHD symptoms on DPICS-NOC, nor was there a significant situation type x maternal ADHD symptom interaction.

Discussion

This study examined the independent and interactive relationships between situation type and maternal ADHD symptoms with observed parenting for parents of children with ADHD. No main effects for maternal ADHD symptoms were found for predicting ineffective parenting across the two situations. Although the absence of a main effect does not support existing literature suggesting parenting deficits associated with maternal ADHD symptoms, the current study was limited by the use of only a maternal self-report questionnaire of ADHD symptoms. Thus, commensurate with past studies finding an association between maternal ADHD symptoms and ineffective parenting, future research should incorporate clinical interviewing and attempt to attain samples of mothers diagnosed with ADHD and those presenting with clinical impairment related to ADHD symptoms. Predicting parenting *across* the two situations varying in structure may also have limited results for the main effect of maternal ADHD symptoms, however this was necessary given our interest in examining the interaction of maternal ADHD symptoms and situation type on parenting deficits.

Our results of more positive parenting in the homework task compared to the free-play task in Study 2 were also inconsistent with the literature typically finding more negative parenting in structured situations, particularly for children with ADHD. Future studies with larger samples should examine the influence of additional variables that may impact the parent-child interaction in families with children and adults with higher ADHD symptoms, such as child characteristics, medication status, and parental mental health (e.g., depressive symptoms) to help elucidate this finding. Future studies should also examine observed parenting in other structured parenting situations that are relevant such as clean-up.

Situation type was also significantly associated with ineffective commands in one of the two studies. Mothers of children with ADHD displaying more ineffective commands in structured situations compared to free-play is more consistent with the literature and supports the presence of situational differences in parenting (Danforth et al., 1991; Deault, 2001). Our findings suggest that mothers of children with DSM-IV ADHD direct their child's behavior ineffectively (i.e., repeating commands and issuing vague commands) in structured homework situations, relative to unstructured free-play situations.

We obtained preliminary support for the situation type moderating the relationship between maternal ADHD symptoms and parenting deficits, with a higher level of maternal ADHD symptoms predicting a higher level of ineffective commands in the structured homework task, but not in the unstructured free-play task. This finding suggests that structured situations may stress a mother's own attention problems in her interactions with her child with ADHD. This finding is contrary to the similarity-fit hypothesis, which suggests that there are parenting benefits when both a parent and child have higher levels of ADHD symptoms.

Overall, results were not consistent across the two studies. This may be due to numerous dissimilarities between samples. The two samples differed primarily in two ways: 1) children's medication status for observations and 2) the inclusion criteria for mothers. Previous research notes that parents of children who take medication for ADHD display higher rates of positive parenting (Danforth et al., 1991) which may have impacted our findings for Study 2. Unfortunately, our study lacked sufficient power to control for child's medication status. Depression is one of the most common comorbidities in adult women with ADHD and is very common among mothers of children with ADHD (Biederman et al., 1992, 1993, 2008; Chronis et al., 2003; Murphy & Barkley, 1996) and in Study 2 mothers had to have a BDI-II score ≥ 10 . However, controlling for maternal depression would have also significantly reduced our power for all analyses. In addition, past research has suggested that controlling for highly collinear variables, in this case depression, would remove the variance for our construct of interest, maternal ADHD symptoms (Miller & Chapman, 2001). Future studies with larger samples would allow for a thorough examination of the direct and interactive effects of maternal depression and ADHD.

This study highlights the importance of assessment of ADHD within families given the potential adverse developmental trajectories for children with ADHD. When parents and children share ADHD symptomatology, one's home environment may become disrupted and disorganized; thus, exacerbating the risk of negative outcomes for children with ADHD. In addition, the clinical literature could clearly benefit from more research on complex families in which both parent and child have ADHD. Additional research exploring these issues could have an impact for clinicians and therapists in practice and could inform efforts to treat these complex families.

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Table 1*Sample Characteristics* (n = 175)

Variable	Study 1 (n = 70)		Study 2 (n = 105)	
	M (SD)	% (n)	M (SD)	% (n)
Child characteristics				
Age (years)	8.06 (1.2)		8.79 (2.08)	
Sex (male)		71 (50)		67.3 (70)
Race/ethnicity				
Caucasian		36.2 (25)		39.8 (41)
African-American		40.6 (28)		30.1 (31)
Hispanic or Latino		4.3 (3)		4.9 (5)
Native American		1.4 (1)		--
Asian		--		1.0 (1)
Bi-racial		7.2 (5)		20.4 (21)
Other		1.4 (1)		3.9 (4)
Refused		8.7 (6)		--
ADHD Diagnosis				
Combined type		78.9 (55)		74.3 (78)
Inattentive type		15.5 (11)		22.9 (24)
Hyperactive/impulsive type		5.6 (4)		1.9 (2)
Not otherwise specified		--		1.0 (1)
Comorbidity				
Oppositional defiant disorder		47.9 (34)		28.6 (30)
Conduct disorder		19.7 (14)		19.0 (20)
Medication status				
On medication		65.8 (46)		57.7 (60)
Not on medication		34.2 (24)		42.3 (44)
Mother characteristics				
Age	38.60 (6.1)		39.95 (7.35)	
Average education level	3 ⁺ years of college, but did not receive a degree		3 ⁺ years of college, but did not receive degree	
Race/ethnicity				
Caucasian		45.6 (34)		51.9 (54)
African-American		45.6 (34)		28.8 (30)
Hispanic or Latino		7.4 (5)		3.8 (4)
Native American		--		1.0 (1)
Asian		--		1.9 (2)
Bi-racial		--		7.7 (8)
Other		1.5 (1)		4.8 (5)
BDI-II	9.01 (8.59)		22.73 (10.31)	

WISC Wechsler Intelligence Scale for Children, 4th ed., *DBD* Disruptive Behavior Disorders rating scale, *ADHD* Attention Deficit/Hyperactivity Disorder, *ODD* Oppositional Defiant Disorder, *CD* Conduct Disorder, *BDI-II* Beck Depression Inventory

Table 2

Maternal ADHD Symptoms

	Study 1		Study 2	
	M	SD	M	SD
CAARS (Sum of item responses)				
DSM-IV Inattention	7.30	5.53	9.90	6.09
DSM-IV Hyperactive	6.25	4.50	8.42	5.29
DSM-ADHD Total	13.55	9.23	18.31	10.15
Inattention/memory	11.06	6.57	14.36	7.84
Hyperactivity/restlessness	9.13	5.79	12.07	7.09
Impulsive/emotional	8.72	5.32	13.10	5.97
Self-concept	5.32	3.91	8.74	4.42

CAARS individual item scale, 0=Not at all, 1=Just a little, 2=Pretty much, 3=Very much
 DSM-IV Diagnostic and statistical manual, fourth edition, ADHD attention-deficit/hyperactivity disorder,
 CAARS Conners adult ADHD rating scale

Table 3

Frequencies of Outcome Variables by Situation

Situation	Study 1			Study 2		
	PP	NP	NOC	PP	NP	NOC
Play	9.98 (7.50) N = 57	8.61 (8.96) N = 57	6.85 (7.42) N = 54	3.20 (4.17) N = 62	5.10 (6.70) N = 61	6.23 (6.51) N = 62
Homework	6.21 (8.09) N = 61	5.57 (4.34) N = 57	7.20 (6.12) N = 57	7.69 (9.46) N = 61	7.22 (6.80) N = 61	12.46 (12.30) N = 61

PP Positive parenting; NP Negative parenting; NOC No Opportunity for Child to Comply

Table 4

DPICS-PP

Situation	Study 1			Study 2		
	β	SE	p	β	SE	p
Situation	-1.00	1.29	.441	2.45	1.03	.018**
Maternal ADHD	-0.02	0.07	.769	0.07	0.06	.294
Situation Type x Maternal ADHD	-0.06	0.07	.350	-0.01	0.05	.777

Beta (β) and standard error (SE) statistics using Type III sum of squares approach, two-tailed tests. DPICS-PP dyadic parent-child interaction coding system-positive parenting

** $p < .05$

Table 5*DPICS-NP*

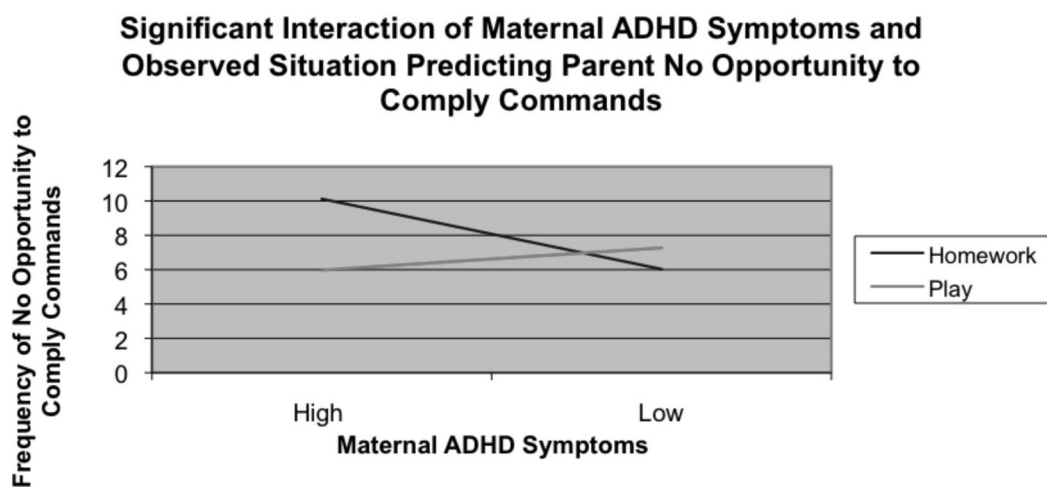
	Study 1			Study 2		
	β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>
Situation	-0.85	1.00	.394	1.13	0.80	.159
Maternal ADHD	0.11	0.09	.217	0.04	0.07	.597
Situation Type x Maternal ADHD	-0.03	0.07	.658	-0.01	0.04	.859

Beta (β) and standard error (SE) statistics using the Type III sum of squares approach, two-tailed tests. *DPICS-NP* dyadic parent-child interaction coding system-negative parenting

Table 6*DPICS-NOC*

	Study 1			Study 2		
	β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>
Situation	-1.71	1.31	.193	3.84	1.25	.002**
Maternal ADHD	0.07	0.07	.321	0.15	0.11	.163
Situation Type x Maternal ADHD	0.13	0.07	.071*	-0.04	0.06	.508

Beta (β) and standard error (SE) statistics using the Type III sum of squares approach, two-tailed tests. *DPICS-NOC* dyadic parent-child interaction coding system-no opportunity to comply

* $p < .10$ ** $p < .05$ **Figure 1.**

Maternal ADHD Symptoms x Observed Situation Predicting Parent No Opportunity to Comply Commands.

Zipf's Law and Its Correlation to the GDP of Nations

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Abstract

This study looks at power laws, specifically Zipf's law and Pareto distributions, previously used to describe city size distribution, income distribution within firms, and word distribution within languages and documents among other things, and Gibrat's law describing growth rate. This study seeks to discover if Zipf's law can also be used to model the distribution of GDP's worldwide using Gibrat's law as a justification. The simplest method to determine Zipf's law's applicability, and the one used in this study, was to create a log log plot, plotting rank versus size of the GDPs. Using that plot, Zipf's law was verified through two criteria. First the plot must appear linear and second it must have a slope of -1 . For the purpose of this study, the data looked at was for all countries and then countries split into categories of emerging economies and advanced economies for the years 2005, 2006, 2007, and 2008. The results of this study showed that all countries and countries with emerging economies did not appear linear on the log log plot while advanced economies appeared linear with a slope roughly $-.70$, suggesting that GDP distribution of advanced economies instead follow a Pareto distribution. Advanced economies also showed a significantly smaller variation in growth rates over the four years as implied by Gibrat's law. This was used as a possible explanation for the distribution discovered.

Introduction

Problem Statement

Today, countries interact constantly with one another sending products and services around the world. Despite these international dealings there still remains a disconnect between the wealthiest and the poorest countries. Some countries seem to have entirely successful and large economies while it seems as though other nations flounder and can barely sustain their populations. A few countries experience extreme wealth while others survive with extreme poverty. Although this may not be a problem for countries with large economies, smaller economies and limited resources pose a significant dilemma for others.

The implications of the massive variance between economies are numerous and go beyond the national level. Haddad, et. al. (2003) noted that malnutrition reduction rates within a country followed closely with both household income and national levels. Filmer and Pritchett (1999) indicated by their study that income per capita and inequality of income distribution, among other factors, explain ninety-five percent of cross-national variations in mortality. Others have found that foreign trade, investment, and debt dependency, all interconnected factors in GDP, negatively affect infant mortality rates (Shen & Williamson, 2004). With this in mind, the problem thus emerges to explain and possibly try to mitigate the differences between the very wealthy countries and the much poorer countries.

Purpose of Study and Research Questions

With the significant impact that a country's economy size and strength has on its population, understanding the phenomena that leads to the size dispersion becomes essential. One method used to understand interaction of variables is through mathematical modeling. Interestingly some models seem to fit for a variety of phenomena spanning diverse fields. In particular, Zipf's law, a power law, has become one of the most striking empirical facts in the social sciences and economics (Gabaix, 1999). Zipf's law has been found to be related to other known power laws that show up in as varied fields as the distribution of biological genera and species by Willis, size of cities by Auerbach, distribution of income by Pareto, and word usage frequencies by Zipf (Hill). Looking at the economic implications of previous research, the purpose of this project is to apply Zipf's law to the gross domestic product of nations in order to create a theoretical framework for the apparently vast differences between the few largest economies and the many smaller ones. From this the single research question used in this study follows: Can Zipf's law be used to model the rank and size of the gross domestic product of countries?

The remainder of this paper is organized as follows. Chapter II gives a background including definitions of key terms and the research plan. Chapter III shows the results of the research, particularly through the use of graphs demonstrating the data. Finally, Chapter IV gives a summary of the conclusions and suggestions for future research.

Background and Research Plan

Background

Zipf's Law. One of the most prominent regularities throughout the social science disciplines is that of Zipf's law for cities (Axtell and Florida, 2006). It says that the size distribution of cities within most countries seemingly fits a power law. Written mathematically, this means that "the probability that the size of a city is greater than some S is proportional to $1/S$: $P(\text{size} > S) = \alpha/S^\xi$, with $\xi \approx 1$ " (Gabaix, 1999). If cities are ranked by size, creating a plot of the log of the size compared to the log of the rank, one would get a plot closely resembling a straight line with a slope of exactly -1 (Axtell and Florida, 2006). This law does not follow for some countries with unique social structures, such as China or the former USSR, but for other developed countries Zipf's law well approximates city size distribution (Marsili and Zhang, 1998). Although Zipf's law is most commonly used in reference to the rank and size of cities, its applications fall under a vast range of areas. In confirming Zipf's law's appearance within data, there are two necessary parts. First, evidence of the existence of a power law must be shown and second, the power law must have an exponent of -1 (Gabaix, 1999)

Zipf's law is so astounding because it seems collectively society organizes itself to follow this incredibly simple distribution law without the expressed desires of authorities (Marsili and Zhang, 1998).

Zipf's distribution essentially describes other phenomena including that of the distribution of firm sizes (Axtell and Florida, 2006).

In income distribution. Pareto in the late 19th century, described personal income as following a power law with an exponent of about 1.5, although after looking at several countries in 1922 Gini showed that income distributions can be estimated by power laws but with varying exponents (Okuyama, et. al., 1999). The Pareto distribution frequently referred to as the 80-20 law, suggests that approximately twenty percent of the population controls eighty percent of the wealth (Földvári, 2009). The Pareto distribution is often used to approximate Zipf's law (Meintanis, 2009).

Gibrat's law. Gibrat's law says that the mean and variance of the growth rate of an item are independent of its size (Hansberg, 2006). Gibrat's law has been studied in relation to areas such as financial returns, firms, and city sizes (González-Val & Sanso-Navarro, 2010).

Gibrat's law, or the law of proportionate effect as originally named by Robert Gibrat in 1931, is used to describe surprisingly non-random and extremely complex distributions (Eeckhout, 2004). Gabaix (1999) described an interaction between Zipf's law and Gibrat's law necessary in understanding distributions of gross domestic products used in this study.

Data Collection and Research Plan

Data Collection. For the purposes of this study, the data used will be gathered from the International Monetary Fund's World Economic Outlook Databases (World Economic and Financial Surveys, 2010). More specifically, the data used will be the gross domestic product of all 183 members of the International Monetary Fund from the years 2005 to 2008. The gross domestic product will be measured in terms of current prices in United States dollars.

This specific data was used for four main reasons. First of all, the International Monetary Fund had the most reliable and up to date data available during the time the research was completed. The database used is created biannually, beginning in January and June and appearing in publications in the following April and September.

Secondly, the data from the IMF from the years 2005 through 2008 was used for its completeness. The IMF provided data on all 183 countries counted within its membership for these years, with the exception of Turkmenistan in 2008 and estimates for a few countries. In the years preceding 2004, the gross domestic product numbers for multiple countries was incomplete and in the years after 2008 much more of the data were estimates done by the IMF.

Thirdly, the richness of the WEO database provided optimal data. The database provided not only the gross domestic products of the 183 countries but also provided further information about individual countries economies, specifically if the country had an emerging or advanced economy which proved beneficial in this study.

Finally, the data used was measured in terms of current prices and in United States dollars to provide a constant unit of measurement for the data. Using any variation would provide data that would not accurately provide growth rates and unison between countries necessary to properly analyze the data.

Research Plan. According to Gabaix (1999), to visualize Zipf's law, one orders the items being used, in this case countries, by rank (United States having the largest GDP has a rank of 1, Japan with the second largest GDP has a rank of 2, etc.). Next a graph is drawn with the log of the rank on one axis and the log of the GDP on the other. If Zipf's law follows, a straight line will appear. Furthermore the line will have a slope of -1.

In Gabaix's theoretical framework for explaining Zipf's law for cities, he uses a fixed number of items growing stochastically. Then assuming that for a particular range of sizes, the items follow Gibrat's law as defined above, he concludes that those particular items, in a steady state, will have a distribution that can be described by Zipf's law, including the power exponent of -1 (Gabaix, 1999).

With this in mind, the research plan was to follow a set of distinct steps for three different categories of data. First, the growth rates for each country were calculated individually. Secondly, the mean growth rate and standard deviation for the data were calculated in order to see if Gibrat's law holds for the data. Next the data were modeled by plotting the rank versus the GDP of the countries. This allowed for a visualization of the extreme gap and the obvious preponderance of data at the lower end of the scale. After this a second plot was created, plotting the log of the rank versus the log of each country's GDP in an attempt to visualize the linear behavior of the data consistent with a power law. If the data appeared linear, then the final step was to determine the power exponent by looking at the slope of the graph. If the slope is indeed -1, then Zipf's law is confirmed for the data.

After this procedure was done for all countries, the countries were split into two categories by their economies, advanced and emerging. The previous listed steps were repeated on each of these categories of data.

Results

All Economies

The International Monetary Fund provided information on a total of 183 countries. For the year 2008, information on Turkmenistan was not available. For each of the years, 2005 through 2008, the mean growth rate and the standard deviation from the mean are shown in the chart in Table 1.

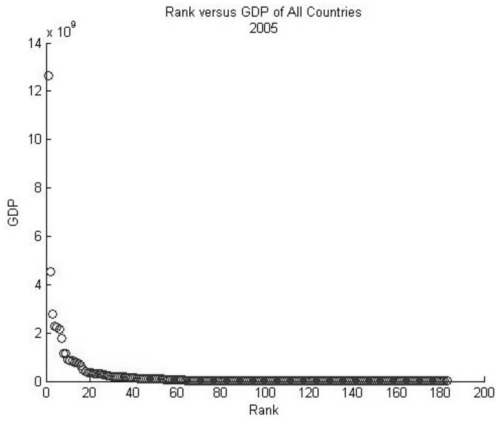
Table 1.

Years	Mean	Standard Deviation
2005 to 2006	0.140173176	0.098320774
2006 to 2007	0.183983363	0.092242753
2007 to 2008	0.176523999	0.090028962
2005 to 2008	0.605920054	0.362929085

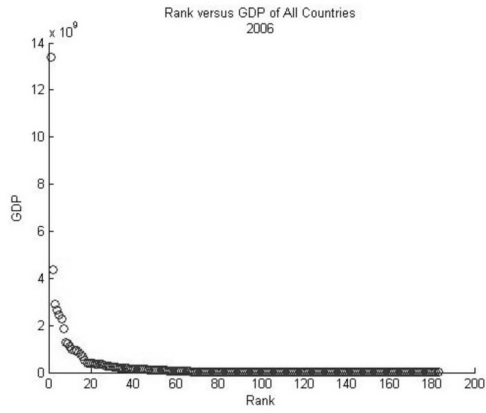
Next, the data from each of the four years was simply plotted on the graphs in Figure 1. Each of the GDPs from all 183 countries, with the exception of Turkmenistan in 2008, are plotted on the graphs. The clear separation among GDPs can be seen in these graphs. The number of small GDPs is obviously much more heavily weighted than the number of higher GDPs.

Figure 1.

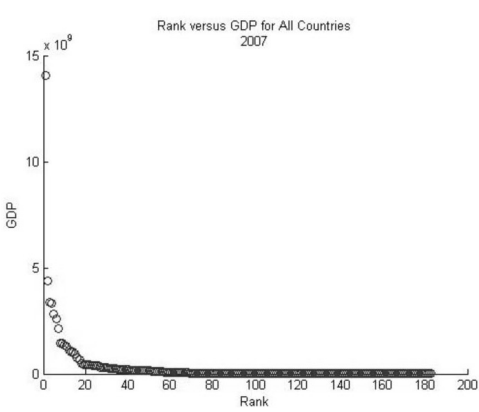
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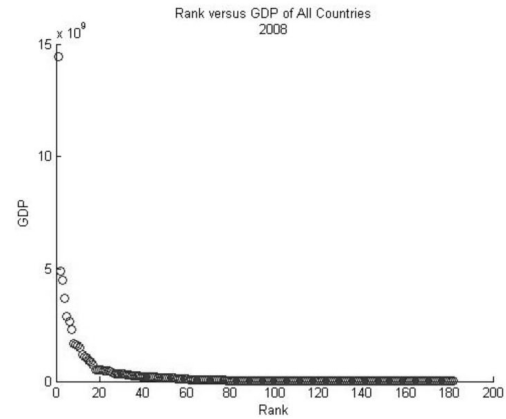
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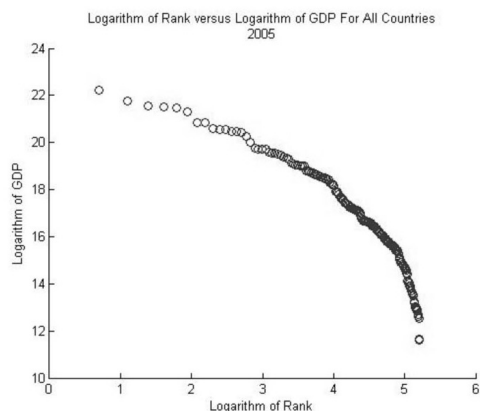
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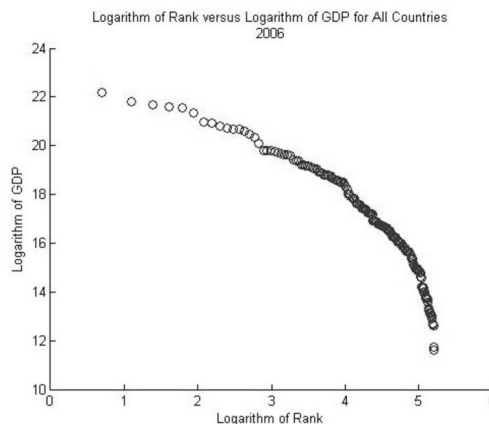
The next step in the research process was to graph the logs of rank versus the log of the GDPs for each of the 183 countries. The graphs created are shown in Figure 2. Clearly it can be seen immediately that these do not create a roughly linear graph, immediately exposing the absence of Zipf's law among all countries. Instead of a linear graph, the points create a distinctly concave down plot. Therefore the step of finding the slope and the power exponent is not necessary as neither Zipf's, nor the other power laws clearly apply.

Figure 2.

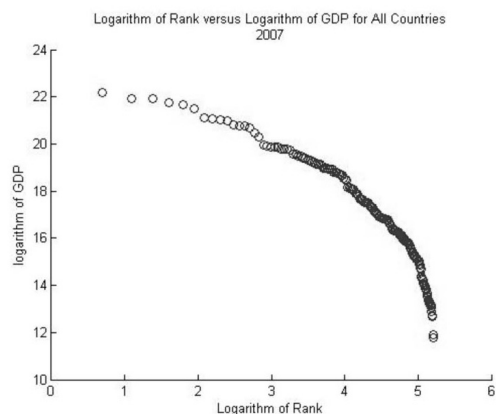
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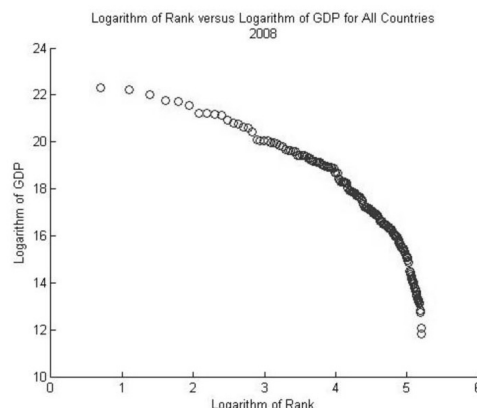
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Advanced Economies

According to the International Monetary Fund there are a total of thirty-three countries whose economies are seen as advanced. In continuing with the process used for all countries, the growth rates were calculated. Then, the average growth rate and the standard deviation from that growth rate were also calculated. The results from this calculation are shown in Table 2.

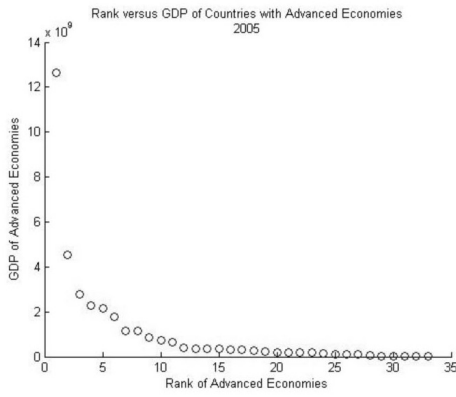
Table 2.

Years	Mean	Standard Deviation
2005 to 2006	0.045913326	0.07467498
2006 to 2007	0.15663896	0.062061399
2007 to 2008	0.090671167	0.088404904
2005 to 2008	0.360524724	0.192071891

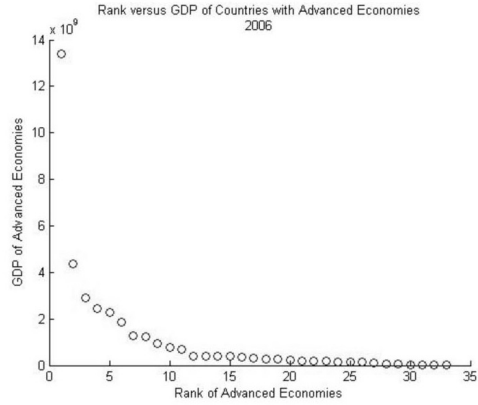
Next, as was previously done, the data from the thirty-three countries considered to have advanced economies by the International Monetary Fund were plotted and can be seen in Figure 3. Clearly among advanced countries as well, the graphs are much more heavily weighted in the tail end of the graph. With far fewer countries in this sample, each plotted point can be seen individually far more distinctly

Figure 3.

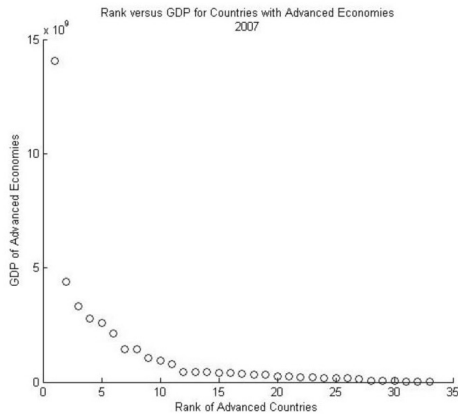
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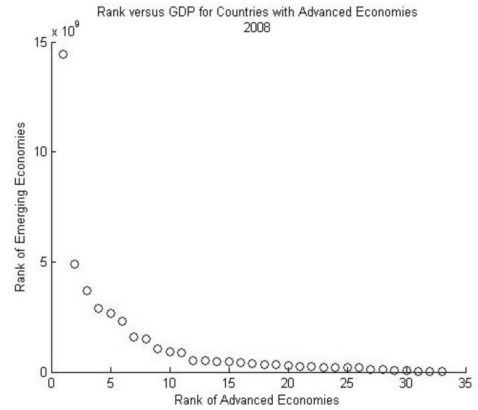
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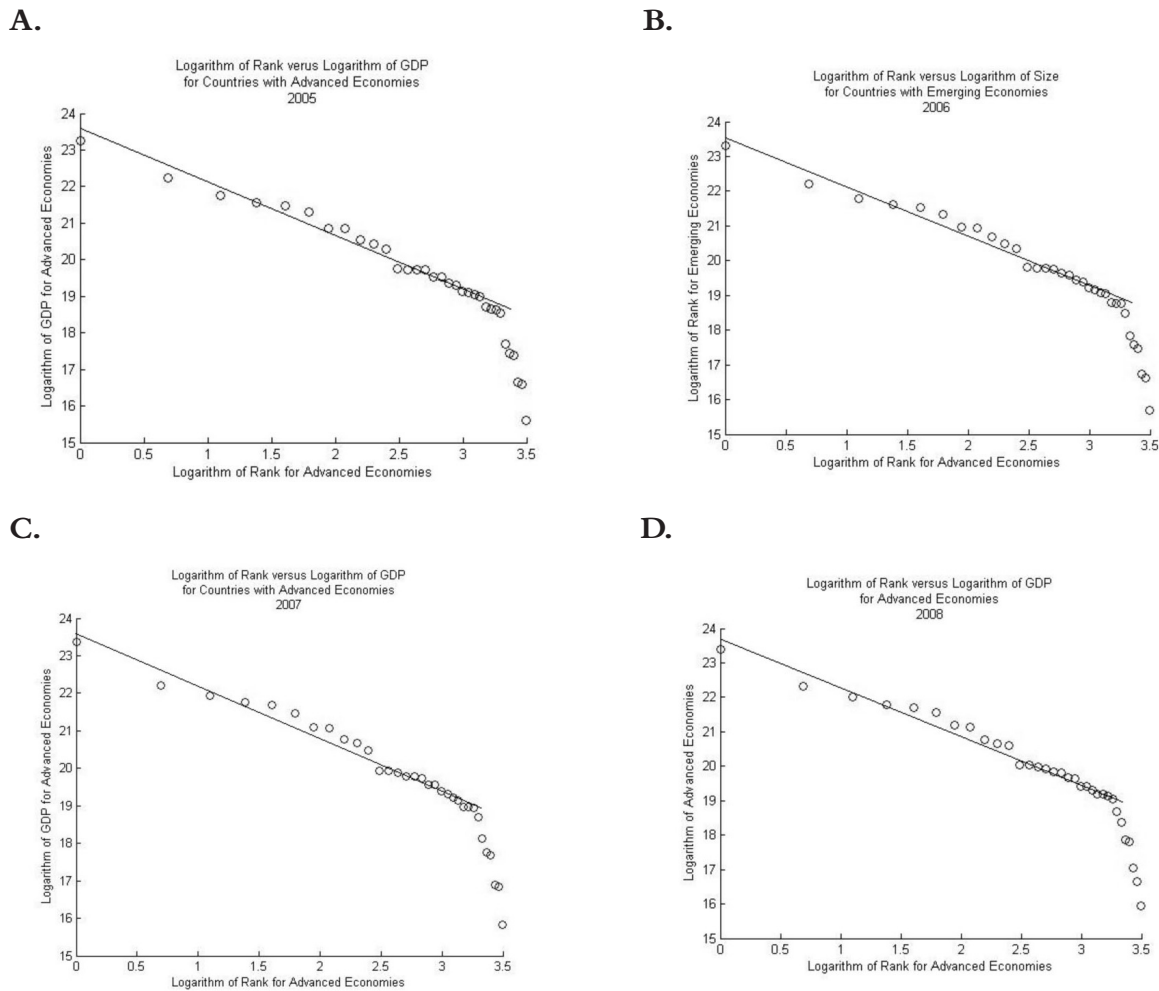


D.



The third step in the process is to plot the logs of each of the ranks versus the logs of each of the GDPs for countries with advanced economies. The graphs are shown in Figure 4 with several fascinating things appearing. First of all, unlike the graphs of all the countries, the graphs of advanced economies do have a relatively linear distribution. On each of the graphs, the only exceptions to this linear design on the six lowest ranked countries. On each of the graphs, a line was placed approximating the linearity of the top ranked twenty-seven advanced countries.

Figure 4.



With the linearity established for the logarithm plots of the advanced economies, the final step in the process is to find the slope of these lines and thus establishing the power exponent. For the year 2005, the exponent was determined to be -0.689737 , for 2006 the exponent was determined to be -0.696829 , for 2007, -0.714123 , and for 2008, -0.72272 .

Emerging Economies

Finally, after following the research steps for all countries and countries with advanced economies, the procedure was repeated a third time, using this time instead the remaining 150 countries with emerging economies as established by the International Monetary Fund. Once again, the growth rates were determined for each of the countries and then the mean and standard deviation of the growth rates over each year were determined. These results are displayed in Table 3.

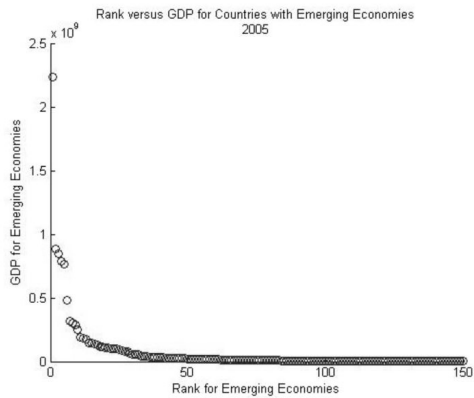
Table 3.

Years	Mean	Standard Deviation
2005 to 2006	0.15458278	0.10097654
2006 to 2007	0.18999925	0.096767624
2007 to 2008	0.19553834	0.113245655
2005 to 2008	0.66.0269356	0.368742368

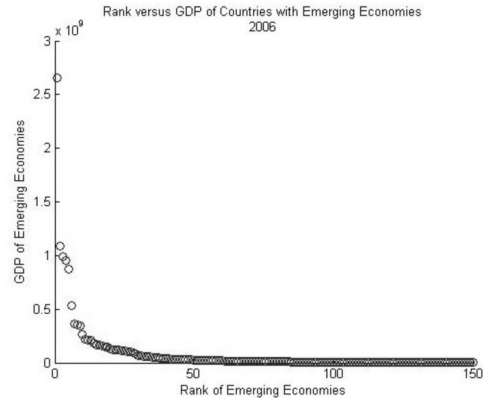
Next, as before the rank versus GDP for the 150 countries with emerging economies in order to display once again the much more heavily weighted lower end. Turkmenistan's economy fell into this section and so for the year 2008, only 149 countries' GDPs are plotted. These plots can be seen in Figure 5.

Figure 5.

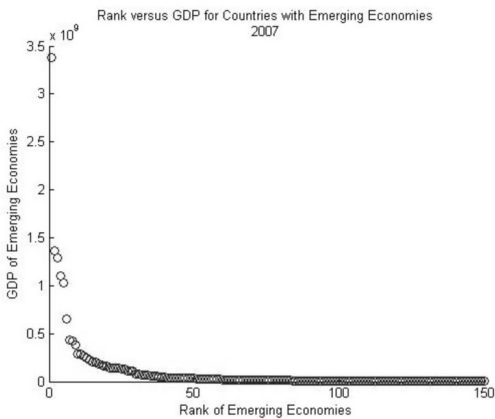
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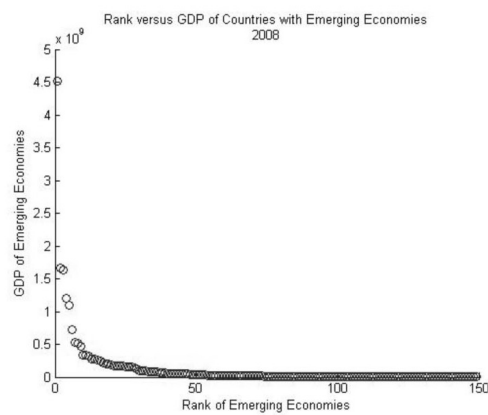
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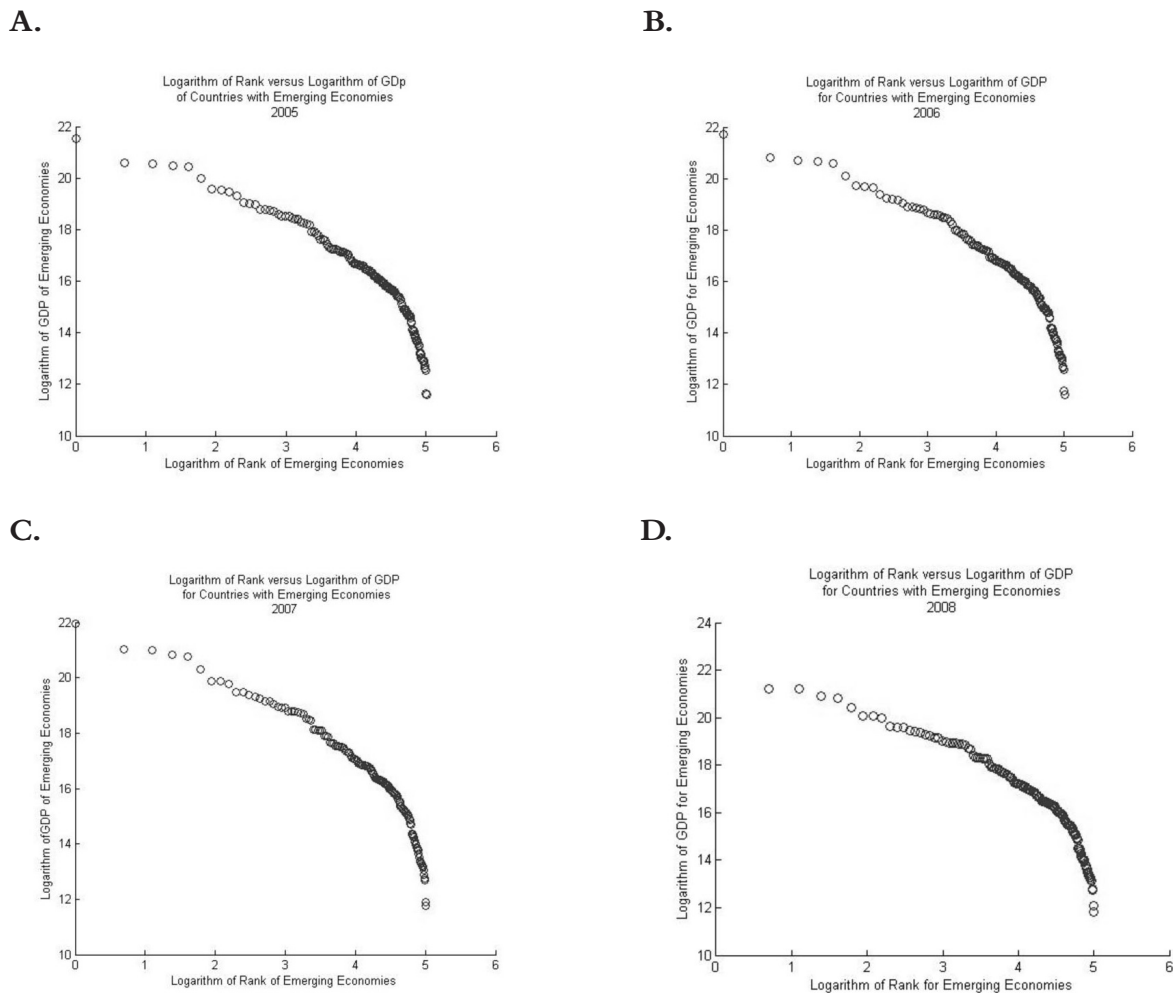


D.



The next step, as was done for all countries and for countries with advanced economies, is to plot the logs of the ranks versus the logs of the GDPs of countries with emerging economies. These can be seen in Figure 6. As with the log plots of all countries, there is clearly once again not a linear distribution. Once again the graphs form a concave down distribution instead.

Figure 6.



Conclusions and Future Research

All Economies

In looking at the data shown in Figure 2, we can see that the log-log graphs for each of the four years for all economies all followed a similar pattern. In each of the four graphs, the data formed a roughly concave down pattern. As was mentioned previously in the results section, this means that all countries do not follow a power law and therefore the second step of determining the slope is not necessary to establish Zipf’s law.

Although the explanation for this is not clear, a possible preliminary finding can be seen in Table 1. The standard deviation in growth rates among the 183 countries ranges between nine and ten percent between each pair of years from 2005 to 2008. Over the four year span the standard deviation was as high as 37 percent. Because of time constraints, it is difficult to determine whether this deviation is due to economy size. For this reason, it is quite clear that Gibrat’s law also cannot be verified.

Advanced Economies

For advanced economies the results were somewhat different. In graphing the log of the rank versus the log of the GDP for each of the four years, a relatively linear pattern emerged. In each of the four graphs, all except approximately the lowest ranked six GDPs fell roughly on the same line. From this a power law was established. After the line estimating the data was added, the slopes for each of the four years were determined to be approximately between -0.70 and -0.72. Since the slope deviates significantly from -1.0, the conclusion based on this data is that the distribution of advanced economies does not follow Zipf’s law but instead follows a Pareto distribution allowing for the variation in the power exponent. It is unclear why the lowest ranked economies seem to fall off the line.

A possible explanation for the Pareto distribution can be seen in Table 2. The standard deviation of growth rates between each pair of year ranges between approximately 7.5 and 9 percent while the standard deviation across all four years was approximately 19 percent, considerably lower than that of all economies. Time constraints on the project make it difficult to determine whether this deviation is independent of size making it unclear whether Gibrat's law was verified.

Emerging Economies

The log-log plots for GDPs from countries with emerging economies showed results very similar to those of all countries. Each of the four graphs showed a clearly concave down pattern and therefore does not represent a power law. Because of this, Zipf's law clearly does not apply to countries with emerging economies, making finding the slope irrelevant.

In looking at the growth rates as shown in Table 3, it can be seen that the standard deviation between each pair of years ranges roughly between 10 and 11.3 percent and nearly 37 percent across all four years. This is nearly double the standard deviation between growth rates of advanced economies suggesting a possible explanation for why neither Zipf's law, nor any other power law is demonstrated through the distribution of GDPs among emerging economies. Although the large deviation exists, because of time constraints it is difficult to determine whether this deviation is related to size. Although this deviation suggests this data does not follow Gibrat's law, it is not clear whether this is in fact the case.

Future Research

Several avenues exist to expand upon this research and upon the knowledge concerning power laws, and in particular Zipf's law. First, since the GDP of neither all economies nor emerging economies followed a power law, finding a model to describe these phenomena could prove valuable in understanding what causes this distribution. Secondly, since no clear cause for the power law distribution of advanced economies emerged, future research with fewer time constraints could be designed in order to determine two things, if the growth rates are independent of size as in Gibrat's law and as proposed by Gabaix (1999) and if not, what causes these economies to follow this pattern. A theoretical design could provide answers that this research was not able to provide. Finally, research can be done to continually expand upon the number of known distributions for which Zipf's law accurately models.

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