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MESSAGE FROM THE EDITOR

USC Upstate is proud to announce the publication of the seventh volume of the USC Upstate Student Research Journal. Our journal provides a glimpse into a few of the many high quality research activities conducted by talented faculty and students at USC Upstate. The Journal is a compilation of outstanding papers from numerous disciplines submitted by undergraduate and graduate students who have been involved in faculty-mentored research, scholarly, or creative activities. Students involved in faculty-mentored extra-curricular projects enter the work-force with an enhanced skill set, including better problem solving, critical thinking, and team-working skills. Since many students who are educated at USC Upstate become employed in the region, support of academic research has a direct and positive impact on the Upstate of South Carolina.

I would like to thank the contributing authors for providing such a rich variety of outstanding articles on a broad range of exciting topics. In addition, I would like to express my extreme gratitude to the journal's Editorial Board (see pages ii and iii to learn more about them). In a world where time is so very limited, their commitment to reviewing article submissions and providing constructive feedback to authors provides invaluable assistance in successfully producing journal volumes and in mentoring students in their writing endeavors. A special thanks to Veronica Quick, Graphic Design Artist in the USC Upstate University Communications Office, for designing the outstanding cover of this volume of the Journal. Thanks also to Les Duggins for taking many of the pictures of campus and our contributing authors. Many thanks to Elaine Marshall, Director of Sponsored Awards, for making the grant writing process at USC Upstate a smooth and often fruitful process. Finally, we would like to take this opportunity to thank Dr. John Masterson, Senior Vice Chancellor for Academic Affairs at USC Upstate, who is dedicated to enhancing faculty and student research efforts at USC Upstate.

If you have any questions or comments about the Journal, or would like to receive a printed copy of the most recent volume of the Journal, please contact Dr. Melissa Pilgrim, (864) 503-5781, mpilgrim@uscupstate.edu. The Journal is also available online at the website: http://www.uscupstate.edu/ResearchJournal.

Enjoy!

Melissa Ann Pilgrim
Editor & Director of Research
Office of Sponsored Awards and Research Support
University of South Carolina Upstate
800 University Way; Spartanburg, SC 29303
THE EDITORIAL BOARD

**DR. MELISSA PILGRIM**  
**EDITOR-IN-CHIEF**

Dr. Pilgrim is an Associate Professor of Biology and the Director of the Center for Research and Scholarship Support. Her primary research focus involves an integrative approach to investigating how ecosystems respond to environmental change (natural and anthropogenic). She uses herpetological systems as her animal models and currently has an army of undergraduate students working with her in a research group called Upstate Herpetology. She has published works in several journals, including the following: *Isotopes in Environmental and Health Studies; OIKOS; Copeia;* and *Southeastern Naturalist.*

**DR. JUNE CARTER**  
**ASSOCIATE EDITOR**

Dr. Carter is a Professor of Spanish and Director of the Center for Teaching Excellence. Her research interests include Latin American narrative and film; Afro-Hispanic literature; Latin American female writers; US Latino/a literature. She has published works in several journals, including the following: *Anuario de Letras; Latin American Literary Review; Caribbean Quarterly; The Rocky Mountain Review; Primal Cabral;* and *Studies in Afri Hispanic Literature.*

**DR. MICHAEL DINGER**  
**ASSOCIATE EDITOR**

Dr. Dinger is an Assistant Professor of Management. His research interests include information security and IT workforce management. He has published his work in several journals, including the following: *MIS Quarterly; Information Systems Research; IEEE Transactions on Engineering Management;* and *Journal of Organizational Computing and Electronic Commerce.*

**DR. LYNETTE GIBSON**  
**ASSOCIATE EDITOR**

Dr. Gibson is an Associate Professor of Nursing and the Director of Research in Nursing at the Mary Black School of Nursing. Her primary research is focused on increasing health equity in ethnic minorities. She is testing the effect of a community-based intervention on screening mammograms by African-American women. She has worked with several undergraduate nursing students in conducting and presenting this research. She was a 2014 *Summer Nursing Research Institute Fellow* at the Institute for Health Equity at the School of Nursing, University of Pennsylvania. She has published articles in *Applied Nursing Research, ABNF Forum, Journal of the National Black Nurses’ Association,* and *Clinical Nurse Specialist™.*
**DR. TINA HERZBERG**  
**ASSOCIATE EDITOR**

Tina Herzberg, Ph.D. is an Associate Professor of Special Education and currently serves as Director of Graduate Programs for the School of Education. Her primary research interests are braille literacy and preparation of tactile materials for students who are visually impaired. Her research began with the exploration of quality in literary braille materials and has now transitioned to exploration of quality in math braille materials. Her work has primarily been published in the international peer-reviewed Journal of Visual Impairment & Blindness. Prior to her arrival at USC Upstate, she served as a general education classroom teacher, an itinerant teacher of students with visual impairment, specialist for a regional service center, and adjunct instructor.

**ELAINE MARSHALL**  
**ASSOCIATE EDITOR**

Elaine Marshall is the Director of Sponsored Awards at USC Upstate. She has been with the University since 1996 and works with all faculty and staff on the Upstate campus who pursue and receive grant funding. Elaine holds a national Certified Research Administrator Designation from the Research Administrators Certification Council. She also has a BA in English and History and a MA in English Literature from Clemson, where she also taught full-time before coming to USC Upstate.

**DR. BEN MONTGOMERY**  
**ASSOCIATE EDITOR**

Dr. Montgomery is an Assistant Professor of Biology. His research focuses on the evolutionary ecology of plant reproduction and plant pollinator interactions. He is currently focused on the partitioning of pollinators among different species of *Silene*, a genus of wildflowers with a wide array of floral traits and multiple pollination syndromes. Dr. Montgomery is also interested in delayed self-pollination as a mechanism that allows for cross pollinations while also providing reproductive assurance. His longer term research interests include competition for pollination between different species and mechanisms for the maintenance of cytoplasmic male sterility (CMS) as well as repercussions of CMS for the maintenance of genetic diversity. He has been working with the Spartanburg Trees Coalition to work toward the eradication of Kudzu in the natural area on the USC Upstate Campus and is the *de facto* curator of the Upstate Herbarium. He has published his work in several journals, including the following: *Biological Invasions, Oecologia, Annals of Botany, American Midland Naturalist, Oikos,* and *Botany.*
**BEST STUDENT PAPER**

Submissions with an undergraduate student as the first author were reviewed and ranked by our Editorial Board. The award program and review rubric are described at: [http://www.uscupstate.edu/researchjournal/](http://www.uscupstate.edu/researchjournal/). The winning submission is marked by a ★ in the Table of Contents.

**SAVE THE DATE!**

**APRIL 17TH, 2015**

**11TH ANNUAL SC UPSTATE RESEARCH SYMPOSIUM**

Many of our journal articles represent expanded projects initially presented by our students as poster or oral presentations at the annual SC Upstate Research Symposium. The symposium is a regional event that provides a forum where both faculty and students from primarily undergraduate institutions can interact to discuss and share information regarding their research, scholarly and/or creative endeavors with each other, local high schools, and a variety of business and community leaders. Please plan on joining us on USC Upstate’s campus for the 11th Annual SC Upstate Research Symposium on April 17th, 2015. To learn more and review past programs see [http://www.uscupstate.edu/symposium/default.aspx?id=12604](http://www.uscupstate.edu/symposium/default.aspx?id=12604).
GRANT WRITING: RECENT BIG WINNERS!

Universities benefit substantially when faculty members are awarded external grant monies for research or service projects. Applying for grant opportunities is a very time consuming and tedious process which often times goes unrewarded since most opportunities are highly competitive with only a small percentage being funded. Grant monies are often used to support student research assistants and thus can have a very positive impact on a student’s academic experience. We would like to congratulate all USC Upstate faculty members who have recently been funded.

ALL GRANT WINNERS (2014)

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<tr>
<th>Name</th>
<th>Project/Program</th>
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<td>Digitization TCN: Collaborative Research: The Key to the Cabinet</td>
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<td>Research Supplements to Promote Diversity - Individualizing Colon Cancer Therapy Using Hybrid RNA and DNA Mol. Signature</td>
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<td>Rudisill, John</td>
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<td>Strengthening USC Upstate By Investing in Student Engagement and Advising Success</td>
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<td>Whittingham, Debra</td>
<td>Teacher Cadet Grant</td>
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TOTAL $1,517,301
Dear USC Upstate, I am not your typical graduate student. But maybe I should be. My daughter is about to finish college. I own my own business. And I look forward to graduating in 2015, just before my 50th birthday. How did I get here, you ask? In 2013, a friend asked me what I thought of USC Upstate’s new master’s program in Informatics.

Well do I remember the sense of accomplishment I felt in completing my B.S., Engineering from USC Columbia some 25 years ago. But when I learned about the graduate Informatics degree program at USC Upstate, that thirst for learning returned to me. I decided that now was a good time to return to school. It wasn’t always so.

For the first part of my career, I worked in the Department of Energy’s Savannah River Project (SRP), conducting training, technical support and computer security. That was the perfect time to start a career in IT support. Famous savants like Steve Jobs and Bill Gates had promised personal computing offered an exciting future. Computer security was a growing concern. I felt privileged to work with creative IT professionals on the SRP. Even then, with their private network of 18,000 PCs and other devices, I could see what an enormous impact the Internet would have on businesses and what I could do with more education.

After leaving SRP, I continued as a PC and network admin at a golf car manufacturer and as a technology specialist serving 13 county school districts in Georgia. Again, it was obvious how crucial it would be to bridge the growing digital divide between technology and non-technical users. As the daughter of a serial entrepreneur and a professional educator, I founded my own technical support and computer consulting business in 1997 in Augusta, Georgia. My vision was and still is to provide a bridge for small businesses faced with a rapidly-changing technology environment because I knew that IT would affect all aspects of how they do business.

In late 2000, I moved home to Union, SC. Even though it was not the wisest decision financially, it was the right thing to do. Without the textile industry to sustain it, Union County struggles to survive. Today, I employ 2 talented IT technicians. Together, we provide much-needed IT expertise to a wide variety of small businesses, non-profits, social agencies, and home users in Union and the Upstate area. For example, we teamed up with the director of the Union County Carnegie Library to use IT to transform library services. As a result, Library Journal magazine named it “2009 Best Small Library in America.”

Daily we are challenged to keep abreast of where our clients need us to be. I immediately and directly apply what I learn in my graduate classes at USC Upstate to support growth in the local Union economy. Through my coursework, I have applied exciting new tools and management strategies typically seen only in corporate-level environments. Dr. Fulbright’s vision for the graduate program, supported by the expertise of the Informatics department faculty, fits perfectly with the vision I have for my business.

My family has been part of the business community of Union for generations. I have a daughter who is a junior at the University of Georgia and another daughter who is a junior in high school. I know that the local economy may necessitate they find their places in the world outside of Union County, but I will continue contributing to the survival of my hometown in the long run. I will support my clients, and I plan to venture into teaching business technology strategies soon. I believe that the business intelligence and innovation concepts I have learned in the Informatics degree program at USC Upstate will be as influential in the future of business as the advent of PCs and Internet were in the early stages of my career.
NON-TRADITIONAL STUDENT SPOTLIGHT: STACEY OLSON

Three years ago, I returned to school to complete my Baccalaureate degree in Experimental Psychology. I realized I would face many challenges as a non-traditional student returning to school at USC Upstate. The commitment I was making would require me to work part-time, attend school full-time, while being a wife, mother of two boys, and overcoming the challenges of having a learning disability (dyslexia). Completing my education, however, has been my desire since high school.

The first time I went to college I allowed life circumstances and my lack of confidence in my ability to achieve academic success keep me from following through with this dream. My mind was set this time as I was accepted to USC Upstate, to do whatever, and take however long it takes to finish my degree. I wrote a note to myself before I started my first class Fall of 2012 and placed it on the wall by my desk to remind myself during times of success, failure, and when I didn’t think I could make it to the end, the note says...

1.) Ask for help
2.) Don’t give up (take the class until you pass it!!)
3.) Failure is not an option.

WHY am I doing this: Every success and every failure on this journey will be something I can share to encourage my own children and the children I hope to work with when I complete my degree. I have to show them that it can be done!! My success and failure in completing my education will be my road map that I can use one day to help guide them toward how to overcome and achieve their own success despite what life has thrown their way.

My first step, in asking for help, was walking through the doors of Student Disability Services the week before classes began Fall of 2012, where I was embraced and welcomed. Dr. Kathy Miller in Student Disability Services offered me suggestions for academic success for a student with dyslexia. Kathy met with me once a week for academic counseling for my first two semesters here at USC Upstate. Each week she taught me how to identify my academic strengths and weaknesses which in turn helped me to learn how to overcome many of the challenges having dyslexia brings to the classroom. Kathy’s support helped me to build on what I can do instead of all of the things I can’t do. Kathy has been a wonderful resource in helping me through this journey of completing my education. My next step was learning how to ask for help from professors. I will never forget my first day of class. I was scared to come back to school after 20 years. After class I worked up the courage to speak with my professor, Dr. Scott Meek. I have always been ashamed of my dyslexia and my school performance. I explained to him that I wanted to do well in his class and that I had failed this class many years ago when I attempted college the first time. His response to me is one that I will never forget, because only one teacher has ever said this to me before: “I am here to help you. Don’t be afraid to ask questions”. In the next class I raised my hand and I said “This might be a stupid question” he stopped me, smiled, and said “There is no such thing as a stupid question”. From that day on, that moment empowered me to ask questions until I understood the answer, in all my classes and in research. Asking these questions has led me to earn Honors in the Phi Chi Honors Society, and Distinction Honors in the Psychology Program.

In the Fall of 2013 in a Psychology Research Methods course with my mentor, Dr. Scott Meek, I began working on a research project examining first impressions and how others come to determine trustworthiness. With each consecutive semester I have had the privilege to learn more about research working as a research assistant with various professors and projects while continuing to build on the Trust Study. In the Spring of 2014, I presented the Trust Study at 13th Annual Georgia Undergraduate Research for Psychology Conference at Kennesaw State University.
University, Georgia; 10th Annual SC Upstate Research Symposium; and University of South Carolina Discovery Day. I have also enjoyed being a teaching assistant for a Research Methods course this semester and sharing my love of research with my peers.

During that time I also learned about the Child Advocacy Studies (CAST) minor and took a position as a student worker in the Center for Child Advocacy Studies that seemed a good fit with my research interest. In this position I began to work with Dr. Lynn McMillan, who is now my second faculty mentor on the Trust Study. My current project addresses trust and childhood trauma which I hope will be selected for funding by the Magellan Scholarship selection committee for the Spring of 2015. In addition, in the Spring of 2015 I plan to present two research projects at the 14th Annual Georgia Undergraduate Research for Psychology Conference 2015 at Kennesaw State University, Georgia; 11th Annual SC Upstate Research Symposium 2015; USC Columbia Discovery Day 2015; Association of Psychological Sciences (APS) Conference 2015, New York city, NY; and Caravel Undergraduate Research and Scholarly Journal Submission.

Through this journey, I have come to realize that conducting research offers me a more informed view than just what I have learned from my own personal experiences and in the classroom. My involvement in research has helped shape me into a more critical thinker. I am very proud of the education I have received from USC Upstate and those who helped and supported me along the way in the Psychology Department. I want to use my life experiences along with my new knowledge and skills to help those who are vulnerable, particularly children who have experienced trauma. My goal following graduation is to become a University of South Carolina Masters of Social Work (MSW) student. My desire as an MSW student is to evolve into a licensed professional in the field of Social Work. I plan to continue to nurture my interest in research along the way and one day obtain my Doctorate of Social Work degree.

ALUMNI SPOTLIGHT: AMANDA COVINGTON

Amanda Covington is from Southern California and moved to South Carolina in 2003 to attend Converse College, receiving a B.A. in history in 2007. She enrolled in USC Upstate a few years later to work towards earning her teaching certificate. Originally attending as a certificate only student, Amanda entered the degree program a semester into her studies and graduated with a B.S. in Secondary Education with an emphasis in biology and as a member of Kappa Delta Pi, an international honor society in education. While attending USC Upstate Amanda enjoyed attending numerous scientific lectures and field outings that were part of the Natural Sciences and Engineering Seminar Series. In addition, she often helped Upstate Herpetology lead community and educational outreach programs. Amanda currently teaches physical science at Chester High School in Chester, SC with ambitions to eventually earn a Master of Science degree in biology, preferably in ecological conservation or a similar field.
**ALUMNI SPOTLIGHT: CHELSEA KROSS**

Chelsea Kross is currently in her first year as a Ph.D. student at the University of Arkansas and completed her M.S. in Biology from Eastern Kentucky University in August 2014. During her second semester at USC Upstate, Chelsea attended a seminar presentation on the conservation of sea otters, which was part of the Natural Sciences and Engineering Seminar Series. Initially, she attended for the sole purpose of earning extra credit in Biology 101, but she became enthralled in how the speaker was using science for conservation and that it was part of his job. And let’s be honest, sea otters were pretty cool. After the presentation she walked straight up to the speaker and asked “how can I do that?” The speaker told her to get involved with undergraduate research and then introduced her to Dr. Melissa Pilgrim. From that moment on, Chelsea immersed herself in research centered on the ecology and conservation of amphibians and reptiles—way cooler animals than sea otters!

As part of Upstate Herpetology, an undergraduate research group mentored by Dr. Pilgrim lab, Chelsea was able to participate in a wide variety of research that ranged from performing frog call surveys for the North American Amphibian Monitoring Program to determining use of an abandoned homestead by herpetofauna. She also expanded her research experience by completing small mammal and water quality research with Drs. Jon Storm and Jack Turner, respectively. Research became such an important part of her life as an undergraduate that she decided to continue her studies and go to graduate school. Chelsea continued to attend each semester’s seminar series, eventually meeting her future Master’s program advisor, Dr. Stephen Richter when he spoke to the USC Upstate campus her junior year.

In her time as an undergraduate student, Chelsea was awarded two research assistantships and a teaching assistantship, which helped prepare her for the requirements of graduate school. In addition, she presented her research at annual South Carolina Upstate Research Symposia (2009, 2010, 2011, and 2012) and the 2012 Joint Meeting of Ichthyologists and Herpetologists in Minneapolis, MN. Attending professional conferences allowed her to meet other researchers in her field and expand her professional network, which allowed her to meet her future Ph.D. advisor, Dr. J.D. Willson, as an undergraduate! The opportunities she had at USC Upstate enabled her to successfully reach her goals of attending graduate school. “I am so grateful for the opportunities and connections that were given to me by USC Upstate, the Division of Natural Sciences and Engineering, and Dr. Melissa Pilgrim. Thank you!” Once she completes graduate school, she plans to become an assistant professor in wildlife ecology or a conservation biologist/educator, and get the next generation interested in wildlife conservation.

**ALUMNI SPOTLIGHT: CHELSEA ZIMMERMAN**

Chelsea Zimmerman graduated from USC Upstate in 2012 with a Bachelor of Arts in English and Women’s & Gender Studies minor. Upon taking WGST 101, Chelsea was so enamored with the field that she completed the minor in two semesters, with the help of a non-scheduled section of Feminist Theory and Methods in Fall 2012. Chelsea was a recipient of the LIFE scholarship each semester during her Upstate attendance, as well as the Nancy P. Moore scholarship in 2012. A member of Gamma Beta Phi Academic Honor Society, Chelsea was...
named to the undergraduate Dean’s List consistently throughout her Upstate career, while simultaneously working as a tutor in the USC Upstate Writing Center and running her own business, Flightless Bird Photography.

Since graduating from Upstate, Chelsea has continued to grow her photography business and has also presented her independent research at the Southeastern Women’s Studies Association conference in Greensboro, NC in March 2013. She has settled in Boone, NC after being accepted as a fully funded graduate student at Appalachian State University and is currently working towards her Masters of Arts in English with a certificate in Women’s Studies, while working as a consultant in the App State Writing Center.

After earning her master’s degree, Chelsea will continue her studies in a PhD program in hopes of becoming a professor of English literature. Chelsea is grateful for the wonderful English faculty at USC Upstate for providing her with the tools necessary to succeed in graduate studies. She credits Dr. Esther Godfrey with igniting her passion for Romantic and Victorian literature as well as feminist literary theory – obsessions that have carried throughout her undergraduate and graduate studies and will continue as inspiration in her future years as a student and teacher of English literature. Chelsea is also grateful to Dr. Lisa Johnson and the Center for Women’s and Gender Studies at USC Upstate for teaching her the importance of feminism as a unifying movement for equality. Chelsea hopes that she, too, will someday positively impact the lives of her students, sparking a passion for learning while altering their perception of the world around them.
**Impact of Nocturnal Temperature Variation on the Calling Activity of Anaxyrus fowleri, Hyla chrysoscelis, and Hyla cinerea**

**JARAD COCHRAN** is a senior at USC Upstate pursuing a Bachelor of Science degree in Biology. His undergraduate research in amphibians began in spring of 2013 where he became a student volunteer for the North American Amphibian Monitoring Program (NAAMP) in the Piedmont region of South Carolina. In the spring of 2014, Jarad received a research assistantship under the supervision of Dr. Melissa Pilgrim and transitioned to the lead volunteer for the NAAMP in the Piedmont region. As lead volunteer, he records 120 wetlands annually and organizes the data collected by the NAAMP group. He is also continuing the research begun by other Upstate students where they utilize automated recording systems (ARSs) to record frog calls in four different wetlands. At the 2014 USC Upstate Research Symposium, Jarad presented a poster on the effects of temperature variation on the frog calling activity collected by the ARSs. In addition to his research activities, Jarad is a Chemistry, Biology, and History tutor at USC Upstate and a Supplemental Instructor for Upstate’s Chemistry 111 course.

**ADRIAN HAYES** graduated from USC Upstate with a B.S. in Biology in the fall of 2012. She is currently working at USC Upstate as an administrative assistant for the Sponsored Awards and Research Support Office. Before graduating, Adrian served as a Supplemental Instructor for Introductory Biology courses and was an active undergraduate researcher. Her research experiences started during the summer of 2011 in Dr. Turner’s Watershed Ecology Lab where she conducted water quality analyses evaluating the abundance of fecal coliforms in local water sources. In the spring of 2012, she received a research assistantship under the supervision of Dr. Pilgrim and served as the lead

**ABSTRACT.** Temperature influences anuran calling activity and the Piedmont region experiences large changes in diurnal versus nocturnal temperatures most months of the year. We conducted a study that investigated the magnitude of temperature change at four Piedmont wetlands from sunset to 01:00 and how temperature changes impacted calling activity of Anaxyrus fowleri, Hyla chrysoscelis, and Hyla cinerea inhabiting the wetlands. We also evaluated if the relationship between anuran calling activity and temperature at the four focal wetlands was similar to the association between temperature and anuran calling activity across the Piedmont region. We used Automated Recording Systems (ARSs) at the four focal wetlands to obtain air temperatures and sound files (for conducting call surveys that allowed assessment of calling activity). We utilized temperature and call survey data from our 2008-2013 North American Amphibian Monitoring Program (NAAMP) data set to expand our work across the Piedmont Region. Analysis of Variance indicated that average temperatures at 0:45 were significantly lower than average temperatures at 21:15 at the four focal wetlands. The decrease in air temperature appeared to be biologically relevant, as it was associated with a decrease in calling activity of each species. Trends in our focal wetlands data set paralleled trends in our regional data set; in both sets of data, calling activity of the three species peaked at the highest recorded temperatures. Our next step is to increase the complexity of our statistical analyses to examine how multiple variables interact to affect calling activities of our focal species.
student volunteer for North American Amphibian Monitoring Program initiatives in the piedmont region of South Carolina. Adrian competed for and was awarded a Magellan Scholar grant to support her research investigating anuran bioacoustics during the summer of 2012. Adrian has presented her research at local, regional and international scientific meetings, as well to community members during outreach programs. The research presented in this volume highlights some of the work she completed with support from the Magellan Scholar program.

**Elliott Gibbs** graduated from USC Upstate with a B.S. in Biology in the spring of 2014. He is currently working as a Production Chemist with New Life Chemical & Equipment, Inc. Elliott’s undergraduate research experiences began with work studying urban predator ecology under the supervision of Dr. Jon Storm; in fact, his poster presentation of the urban predator project received the best student poster award at the 9th Annual SC Upstate Research Symposium. Elliott was also interested in amphibian biology and became an official volunteer for the North American Amphibian Monitoring Program under the supervision of Dr. Melissa Pilgrim. He received a Magellan Scholar grant to study anuran bioacoustics during the summer of 2012; a portion of this research is the focus of the current journal article. In addition to his research activities, Elliott was an active member of the USC Upstate Chemistry Club and a Supplemental Instructor for Introductory Biology courses.

**Dr. Melissa Pilgrim** is Director of Research and an Associate Professor of Biology at USC Upstate. She joined the faculty at USC Upstate in the Fall of 2006. Her primary research focus involves an integrative approach to investigating how ecosystems respond to environmental change (natural and anthropogenic). Her research program integrates field ecology, biogeochemistry (e.g., stable isotopes), and ecophysiology. She earned her Ph.D. from the University of Arkansas in 2005 and transitioned to a post-doctoral research position at the University of Georgia’s Savannah River Ecology Laboratory (SREL). Many of her current research initiatives still involve collaborations with SREL faculty and students. In addition, she has an army of undergraduate students working with her in an undergraduate research group called Upstate Herpetology. Her publications range from book chapters in Herpetology volumes to scholarly articles in isotope, ecological, and herpetological journals. She currently serves on the Editorial Board for Herpetologica, as a Council Member of the South Carolina Academy of Science, and as the Upstate Regional Coordinator for the North American Amphibian Monitoring Program.
Impact of nocturnal temperature variation on the calling activity of *Anaxyrus fowleri*, *Hyla chrysoscelis*, and *Hyla cinerea*

1. Introduction

Anurans (i.e., frogs and toads) often experience extreme population fluctuations [1]-[2]. However, several recent changes in anuran population dynamics (e.g., shifting breeding seasons and susceptibility to disease) have been linked to range reductions and loss of species [3]-[7]. Anuran population decline is occurring globally [7]-[9], and the scientific community has responded by developing programs to inventory and monitor anuran occurrence across large spatial scales [10]-[11]. We participate in one such program, the North American Amphibian Monitoring Program (NAAMP), managed by the United States Geological Survey (USGS). The NAAMP established standardized call survey protocols designed to maximize detection of anuran species across large regions of North America [12]. Although the protocol appears adequate for detecting certain species, recent studies demonstrated that the NAAMP call survey parameters may underestimate occurrence of anurans in some areas [13]-[14]. For example, [15] found that decreases in calling activity of *Anaxyrus fowleri* (Fowler’s Toad), *Hyla chrysoscelis* (Cope’s Gray Treefrog), and *Hyla cinerea* (Green treefrog) from sunset to one in the morning (the timeframe specified by the NAAMP for conducting call surveys) increased the sampling effort necessary to detect the anurans in the Piedmont region of South Carolina.

Temperature influences anuran calling activity [12], [14], [16] and the Piedmont region experiences large changes in diurnal versus nocturnal temperatures most months of the year. Thus, we suspected that the reduction in calling activity documented by [15] may also be associated with decreasing temperatures through the timeframe allowed for completing anuran call surveys. Several studies support the idea that thermal influences may outweigh temporal influences on anuran calling activity [17]-[18]. Thus, the major goal of our current study was to investigate the association between temperature and calling activity of *A. fowleri*, *H. chrysoscelis*, and *H. cinerea*. Our specific objectives were to (1) evaluate the magnitude of temperature decline from sunset to one in the morning at the four wetlands that were the focus of the [15] study, (2) determine if the average temperature at sunset was significantly higher than the average temperature at one in the morning at the four wetlands, (3) investigate if decreases in temperatures were associated with decreases in calling activity of *A. fowleri*, *H. chrysoscelis*, and *H. cinerea* at the four wetlands, and (4) ascertain if the relationship between calling activity and temperature at the four focal wetlands was similar to the association between temperature and calling activity across the Piedmont region of South Carolina.

2. Materials & Methods

Assessing Objectives 1-3

Evaluating Temperature Change at the Four Focal Wetlands

As part of our ongoing work [15], we have automated recording systems (ARSs) at four wetlands (named Cleveland, Ludwick, Patterson, and Scotsgrove) in Spartanburg County. We programmed the ARSs to record air temperature at the 15, 30, and 45 minute mark of each hour. To evaluate the magnitude that temperatures changed at our study wetlands, we exported the ARS temperature files from the 21:15, 21:45, 22:15, 22:45, 23:15, 23:45, 00:15, and 00:45 time periods from May 13th – June 17th, 2012 into EXCEL (Version 15) for data management and analysis. Please note that the May and June dates overlapped with the NAAMP Sampling Window 3 for the Piedmont region of South Carolina and corresponded to the dates of the (15) study. We visually inspected trends in temperature change through time for each wetland by plotting time against average temperature at each time during the 35 day study period. We used Analysis of Variance (ANOVA) to determine if the average temperature at 21:15 was
significantly higher than the average temperature at 0:45 at each wetland.

**Evaluating the Association between Temperature and Anuran Calling Activity at the Four Focal Wetlands**

We completed anuran call surveys by listening to five-minute ARS sound files recorded at the 21:30, 22:30, 23:30 and 0:30 time periods from May 13th to June 17th, 2012. Each time we heard *A. fowleri*, *H. chrysoscelis*, and *H. cinerea* calling in the sound files, we recorded the species as present. If the species was not heard, we recorded the species as absent. For each species, we calculated its frequency of occurrence in call surveys by dividing the number of surveys with the species calling by the total number of surveys (n=35 at each time period at each wetland). To assess the degree that frequency of occurrence was associated with temperature at the survey times, we calculated the average temperature at each time period that call surveys were completed (see Table 1). We then plotted the frequency that each species was detected in our surveys against the four temperature readings associated with the call survey times.

**Assessing Objective 4**

**Evaluating the relationship between temperature and calling activity of *A. fowleri*, *H. chrysoscelis*, and *H. cinerea* across the Piedmont region of SC**

Using anuran call survey data collected during 2008 – 2013 as part of the NAAMP program (see Ferguson and Pilgrim [19] for call survey protocol), we evaluated the relationship between air temperatures and the presence of *A. fowleri*, *H. chrysoscelis*, and *H. cinerea* in call surveys of wetlands spanning seven counties in the Piedmont region of SC. Specifically, for wetlands where the three focal species were detected, we calculated the average air temperature associated with the call survey detections and the average air temperature associated with call surveys that indicated the species was not detected. We then graphed the relationship among call survey month, average air temperatures when the species was detected, and average air temperatures when not detected.

### 3. Results

**Objective 1-3**

On average, air temperature at each of the four wetlands decreased through time (Figure 1). Analysis of Variance indicated that the average temperature at 0:45 was significantly lower than the average temperature at 21:15 for each of the wetlands (Table 1). Thus, we documented a statistically significant decrease in air temperature through the night at wetlands across Spartanburg County. In addition, the decrease in average air temperature at each time period (Table 2) appeared to be biologically relevant, as it was associated with a decrease in the calling activity of each species (Figures 2-4).

**Objective 4**

Of our three focal species, *H. chrysoscelis* was the most widely distributed in the Piedmont of SC, as the species was detected at 107 of the 110 wetlands we sampled as part of the NAAMP. The other two focal species occurred in at least 75% of the sampled wetlands (i.e., 94 of the 110 wetlands for *A. fowleri* and 83 of the 110 wetlands for *H. cinerea*). Not surprisingly, temperatures across the Piedmont region of SC increased as our sampling dates progressed.
from winter to summer (see Figures 5-7). With the exception of February, the average monthly temperatures when *A. fowleri* was present in call surveys was equal to or higher than average monthly temperatures when the species was absent in call surveys (Figure 5). The average monthly temperatures when *H. chrysoscelis* was detected in call surveys tended to be higher or equal to the average monthly temperatures for when the species was absent from call surveys (Figure 6). The average monthly temperatures when *H. cinerea* was detected in call surveys also tended to be higher than or equal to the average monthly temperatures for when the species was absent in call surveys (Figure 7).

4. Conclusions

As suspected, air temperatures significantly decreased from sunset to one in the morning at our study wetlands with ARSs. In addition, we demonstrated that decreases in temperatures were associated with decreases in calling activity of *A. fowleri*, *H. chrysoscelis*, and *H. cinerea* at the four wetlands. The patterns in calling activity at the four wetlands paralleled the patterns in calling activity at the wetlands surveyed as part of our participation in the NAAMP. In both sets of data, calling activity of the three species peaked at the highest recorded temperatures. Interestingly, the highest recorded temperatures with anuran calling activity at the four wetlands in Spartanburg County were lower than the highest recorded temperatures with anuran calling activity in the regional data set. The regional data set encompassed five years, while the work in Spartanburg County was completed in 2012. In the future, we plan to assess annual variation in calling activity across the region.

Our overall results were not surprising, as previous research has demonstrated temperature impacts both anuran calling activity [12] and the quantitative characteristics of anuran vocalizations [20]. The three focal species are late season breeders in our region. In addition, the three species predominantly call from above the water (i.e., the treefrogs) or at the land-water interface (i.e., the toads) [21]; thus, it made sense that as air temperatures dropped, their calling activity dropped. Our study represented the first look at thermal impacts on anuran calling activity at our study wetlands with ARSs and at our NAAMP wetlands.

Our next step is to increase the complexity of our statistical analyses (e.g., use logistic regression analyses) in a way that allows us to examine how multiple variables (i.e., time of night, temperature, wetland, and year) interact to affect calling activities of our focal species. In addition, we hope our results help the USGS refine the NAAMP survey protocols for our region. One possible solution is to relax the protocol requirement that the ten survey stops along a route must be completed sequentially through the night. For example, maybe volunteers could alternate the direction the routes are completed so that the stops will be taken in the 10 to 1 direction occasionally instead of always in the 1 to 10 direction.

5. Acknowledgements

We would like to thank Jennifer Holleman, Peter Lembcke and Chelsea Kross, for assistance in the field at the four wetlands with Automated Recording Systems. We are grateful to the Spartanburg Area Conservancy and their land owner partners for granting us access to the study wetlands with Automated Recording Systems. In addition, we would like to thank the army of NAAMP volunteers that have contributed to our regional database.
6. References


7. Figures & Tables

Figure 1. Average air temperatures decreased through time at the study wetlands (N = 35 nights at each time at each wetland; averages are presented ± 1 SE).


**Table 1.** ANOVA indicated average temperatures at 21:25 were significantly higher than average temperatures at 0:45 (df = 1, 68 for all analyses).

<table>
<thead>
<tr>
<th>Wetland</th>
<th>Temp @ 21:15</th>
<th>Temp @ 0:45</th>
<th>F</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleveland</td>
<td>20.7°C</td>
<td>18.5°C</td>
<td>17.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Ludwick</td>
<td>20.3°C</td>
<td>18.2°C</td>
<td>16.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Patterson</td>
<td>21.1°C</td>
<td>18.4°C</td>
<td>26.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Scotsgrove</td>
<td>19.4°C</td>
<td>16.3°C</td>
<td>26.3</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Table 2.** Summary of average temperatures at temperature recordings 21:30, 22:30, 23:30, and 0:30.

<table>
<thead>
<tr>
<th>Wetland</th>
<th>21:30</th>
<th>22:30</th>
<th>23:30</th>
<th>0:30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleveland</td>
<td>20.4°C</td>
<td>19.5°C</td>
<td>18.9°C</td>
<td>18.4°C</td>
</tr>
<tr>
<td>Ludwick</td>
<td>20.0°C</td>
<td>19.3°C</td>
<td>18.7°C</td>
<td>18.2°C</td>
</tr>
<tr>
<td>Patterson</td>
<td>20.8°C</td>
<td>19.7°C</td>
<td>18.9°C</td>
<td>18.3°C</td>
</tr>
<tr>
<td>Scotsgrove</td>
<td>19.0°C</td>
<td>17.6°C</td>
<td>16.9°C</td>
<td>16.3°C</td>
</tr>
</tbody>
</table>

**Figure 2.** The effect of temperature on calling frequency of *Anaxyrus fowleri*. (Average temperatures at each Temperature Reading for each wetland can be found in Table 2).

**Figure 3.** The effect of temperature on calling frequency of *Hyla chrysoscelis*. (Average temperatures at each Temperature Reading for each wetland can be found in Table 2).

**Figure 4.** The effect of temperature on calling frequency of *Hyla cinerea*. (Average temperatures at each Temperature Reading for each wetland can be found in Table 2).

**Figure 5.** Comparison of average temperatures when *A. fowleri* were calling to average temperatures when *A. fowleri* were not calling at NAAMP wetlands (averages are presented ± 1 SE).
Figure 6. Comparison of average temperatures when *H. chrysoscelis* were calling to average temperatures when *H. chrysoscelis* were not calling at NAAMP wetlands. (averages are presented ± 1 SE).

Figure 7. Comparison of average temperatures when *H. cinerea* were calling to average temperatures when *H. cinerea* were not calling at NAAMP wetlands. (averages are presented ± 1 SE).
Gender, Ethnicity, and Dialect Language in the Southern Classroom: Two Observations with Comparisons

**ABSTRACT.** This article investigates the classroom as a microcosm of society and seeks to observe sociolinguistic patterns and usages occurring in two Upstate South Carolina high school classes. The hypothesis of the paper before observing was that students would speak informally with one another in non-standard ways but code-switch to a more formal register in the classroom. I also hypothesized that teachers would expect more formal speech in the classroom, and that students who speak with marked speech dialects would have a harder time in the classroom. While my original hypotheses have been called into question, I have discovered some interesting findings including gender differences and the heterosexual marketplace being played out in the classroom, an alarmingly low number of minority groups in the class, and evidence which makes me suspect self-fulfilling prophecies are working against minority students.

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1. Introduction

The classroom is an environment in which students and teachers spend much of their time. Students speak in a certain way in the classroom and so do teachers. How do teachers speak to students, and how do students speak to teachers? Who decides which language will be used in the classroom and what are the consequences for those students who do not comply or conform? What factors come into play when one looks at the linguistics used in the classroom and the prejudice or discrimination that may develop whether intentionally or unintentionally? Is gender a factor? Is ethnicity a factor? This work represents a preliminary look into a very broad range of topics. Future iterations of this research will focus on discrete elements within this scope.

As an aspiring teacher, I will use this paper to explore the classroom as a social environment and will observe what happens sociolinguistically. I will be looking for examples of code-switching and will look to see if students follow stereotyped interactional models. I will be looking to observe speech patterns and types that are prevalent. I will also be looking for ways that gender is defined and differences between genders. I want to see how the way one speaks effects one’s education, and I want to see if teachers treat students differently based upon their linguistic orientation.

Before I entered the classroom I hypothesized that students would speak informally with one another in non-standard ways but -switch to a more formal register in the classroom. I also hypothesized that teachers would expect more formal speech in the classroom, and that those who speak with marked speech dialects would have a harder time in the classroom. I also hypothesized that girls in the classroom would speak and act differently than boys because of the expectations placed upon them by the heterosexual marketplace, a term I will define later.

2. Other’s Research

In preparation for my classroom observations I explored the topics hypothesized above. According to Sociolinguistic researcher, [1], code-switching can be observed when people mix forms from two or more dialects in a single conversation. Two types of code-switching occur in the classroom, situational and metaphorical. Situational code-switching is “when code-switching is constrained by the social context”; metaphorical code-switching is “when code-switching is used as a sociolinguistic resource, rather than just to respond to context” [2]. Educationally speaking researchers have traditionally examined two codes. The “elaborated code” is comprised of standard syntax and complex sentence structure and is traditionally associated with the middle and upper classes. The “restricted code” generally reflects short, simple phrases that are often left unfinished. Utterances following this code demonstrate less adherence to standard conventions and are often associated with individuals from lower socioeconomic class backgrounds [3].

With regard to expectations, [2] discusses the concept of self-fulfilling prophecies. A self-fulfilling prophecy is one that “causes itself to become true. The term is often used in education to suggest that high teacher expectations for a particular student lead to success for that student” [2]. Schools often fail non-standard speakers by assuming they are unable to perform complex work or think abstractly because of the patterns of the code they employ. While ethnicity is not a direct correlate with elaborated or restricted codes, racial or ethnic stereotyping may contribute to expectations many teachers and even some students may use as a basis for their prophecies. It should be noted here that self-fulfilling prophecies may work in both directions. Students who employ standard language structures and portray confidence with academic endeavors may garner positive prophecies while others with equal intelligence but different backgrounds may be told they are unlikely to succeed [4]. One source indicated
"several studies of students from the Caribbean detail the difficulties they encounter at school for reasons of linguistic and cultural contrasts" [5]. [6] stated that the expectations of term teachers explain the inferences made by teachers about the potential of student achievement may be influenced by a variety of elements like student aptitude, IQ test scores, information given by a students’ former teachers, and the family background of the student. They pointed out that these inferences "may shape teachers’ perceptions of students before they enter the classroom" [6]. Self-fulfilling prophecy also affects the self-perception of students. I hypothesize that the absence in this class of more African-Americans, Hispanics and other groups who have been labeled with marked non-standard speech patterns is the result of negatively oriented self-fulfilling prophecies.

[2] points out that in middle school students “develop sharply defined ways of being” because of “age-specific focus” and “the typical intensity of adolescent expression and the number of hours that students spend together” so that a “heterosexual market” is established. He also states that “students presumably use language features to show where they fit in with respect to the communities of practice active in their schools” [2]. [7], a sociolinguist renowned for her work on language and gender, observed that everyone has access to gendered performances but that these performances have constraints on who can do them without being punished by society. She goes on to note that this is the point at which gender and sex merge as society seeks to match behaviors with sex assignments that are biologically based. Students have been a part of the school system for most of their lives, and [7] further observes that boys and girls up to middle school age have simply thought of themselves as different from each other but in the heterosexual market they come to view themselves as cooperative groupings. Eckert further states that in several ways, schools also recreate the gender order, and schools, because they are major locations for socializing, are foundational to the building of gender constructs [7]. Since I am observing the high school classroom, gender can be expected to play a significant role in discussion and other interactions.

Teachers in the classroom effect the way students learn and they often are the deciding factor in whether a student continues his or her education. [8] makes four astute observations about teachers in today’s schools:

1) The workforce is predominantly white while student population is much more diverse.
2) White teachers often have only limited interaction with diverse populations outside of the schools where they teach.
3) They often have lower expectation for diverse students than for their white counterparts
4) They are largely ineffective in assisting students bridge cultural gaps between school and home

Teacher education is vital to creating a classroom that is unified in its diversity that is environmentally hospitable to equality despite gender or ethnicity, etc. [9] quoting from Lippi-Green says that “discrimination based on dialect remains ‘so commonly accepted, so widely perceived as appropriate, that it must be seen as the last back door to discrimination.” This linguistic subjection tenet is an issue that goes beyond the lines of class and ethnicity [9]. He argues that truth and equity should be the chief concerns of public education about language. Many challenges must be overcome for dialect diversity and respect to occur. One of the ways that this can come about is through the creation of language and dialect awareness programs that will bring awareness and consideration of diversity in language [9].

Some researchers have pointed out that students who speak with minority dialects have difficult experiences because the English linguistic features used in the classroom are different from the features used at home. It is especially difficult for AAE-speaking students because AAE (African American English) is closer to SE (Standard English) than it is distant. [10] claims that “without explicit guidance and instruction, learners may have difficulty recognizing which
linguistic forms are common to both SE and AAE and which forms are unique." They also cite that “others have argued that the cause is not dialect differences in students but rather teachers' lack of knowledge about dialect and their negative attitudes that interfere with student learning”[10].

3. Research & Observation

For this study, first, during the spring semester of 2014, I went to Boiling Springs High School in Boiling Springs, SC and observed a creative writing elective class at the high school level. I wrote a paper and spoke at a conference about the findings of that initial observation. Following that observation, I went to Chapman High School in Inman, SC during the autumn semester of 2014 and observed both a high school creative writing elective class and an English III CP (College Prep) class. I wanted to develop further and solidify the findings of the first semester. I also wanted to see if any observable difference could be noted between the two schools. I hypothesized that there would be some marked differences demographically between the two schools. I must note that Chapman High School and Boiling Springs High School are neighboring districts in Spartanburg County, SC.

The creative writing class at Boiling Springs High School contains fourteen students. Immediately upon entering the classroom I noticed an overwhelming majority of white students, only two black students, and no observable other ethnic students. Twelve students are white; two students are black. The gender mix is relatively even. Six students are male; eight students are female. Five of the males are white; one is black. Seven of the girls are white; one is black. I noticed none of the students are Hispanic or of any other traditionally marked ethnicity. The teacher of the class is a white male approximately fifty years old.

The creative writing class at Chapman High School is comprised of only six students. Five of the students are white and one student is black. Five of the students are female and one is male. The English III CP class contains twenty-seven students with only two black students, two mixed students, two Latino students. The rest of the class is white. The teacher of these classes is a white twenty-eight year old male.

I observed the use of elaborated and restricted codes in the classroom at Boiling Springs. I also paid close attention to gender differences and ethnic differences in students’ speech. Finally, I attempted to observe teacher-student and student-student interactions before and after class to see if any parties switch codes during the less formal times between class sessions.

During my first three observations at Boiling Springs, I noticed that the predominant speech style is Standard American English [See Figure 1]. This surprised me because I expected the Southern dialect to be more prevalent. The students’ use of Standard American English shows that they are more inclined to use elaborated code rather than restricted code. While my limited time in the classroom has not yet afforded me the opportunity to converse with students about their backgrounds, it seems highly likely that the lack of those who speak with more restricted code could be a result of self-fulfilling prophecy. In other words because “creative writing” class has more of a Standard American English connotation, students who use non-standard or restricted code will be less likely to choose this elective class. Also, in the three visits I have
been able to make so far, I have not observed any code-switching before or after class. It is possible that students switch into the restricted code in the halls, but at least to this point, I have observed only elaborated code use in the classroom, before, during, and after class.

I observed some degree of informality in the Boiling Springs classroom. For example, I noticed that none of the students say “sir” to the teacher, although they do refer to him by “Mr.” plus his family name. They also used words like “yep” to him. This suggests that the students use informal forms of address, at least with this particular teacher. Beyond this, however the speech the students use seems very standard and quite formal although the atmosphere the teacher creates is fairly relaxed.

In terms of gender I have noticed the male students tend to be more assertive toward each other and the girls in the class than the female students are (See Figure 2). One of the girls made a comment about the poem being kind of a metaphor and a boy responded emphatically and rudely, “It IS a big metaphor.” Another of the girls speaks softly and shyly and looks down a lot as she makes comments in the class. In one of my observation times the students presented a piece of their writing in front of the class. I looked for usages of restricted and elaborated code, and gender differences in their presentations. Across the board, all of the females in the class tended to use upward speech in the classroom—ending sentences with rising intonation in the manner traditionally used for questions, but now associated with middle class feminine language. Further, females showed more enthusiasm and emotion in their writing and reading. One girl even cried while reading her story. Males in my class observation tended to have more assertive speech and often interrupted others. This behavior applied not only to the students but to the teacher as well. Male students’ writing also tended to be darker and less emotional as they shared mostly nightmare and horror stories. The females in the class outnumber males, yet the males dominate the conversations and often interrupt both the females in the class and each other.

In the English III class at Chapman High, I noticed that the girls in the classroom did most of their conversation with a neighbor one-on-one, while boys tended to give input, interjections aloud for the whole class to hear. During a game [in which I paused tallying input, interjections, questions, interruptions], the first few groups to go were all male. Girls seemed to talk during class just as much as the boys, yet it was more conversational and relational whereas the boys’ talking was more dominant and to the group. The “Class Clowns” are all male students. The male students definitely dominated the class. Some exceptions were those male students who were quiet.

At Boiling Springs High, the class speaks in what might be loosely termed casual Standard American English [essentially the elaborated code without rigid structure]. Sometimes I picked up on vestiges of the restricted code like *g-droppin’,* Southern pronunciation of vowels like *pipe* sounding like *pahp,* and African American English pronunciation of some words *career* sounding like *cah-ruhr.* Surprising to me is the fact that the teacher employs the most non-standard features. He often uses the informal *ya’ll* and he drops many more word final “g’s than the students do.

At Chapman High School, the teacher uses good Standard American English in his lesson presentation. More of the students however use a stronger Southern American English and African American Vernacular English. I would say that the students at Chapman have less Standard American English use than does Boiling Springs High School students that I observed.
4. Summary & Conclusion

Based on my observations, the students in the Boiling Springs elective class all exhibit a high degree of proficiency in the elaborated code that is Standard American English. I also found that, on the surface, it appears that the teacher may be attempting to lower the formality level of the classroom by using a more casual style with his g-dropping and frequent use of dialectal forms such as "ya'll."

My preliminary observation is that the students may not be totally comfortable with this, but this is an area for further research. The elaborated code of the students is far more prevalent than the restricted code in this classroom, although a limited amount of restricted code does come out at times when the students are relaxed. Finally I noticed a strong difference between the genders in the class, with males being more assertive and dominating the speaking and using more stereotypically masculine content to write about and the females being more supportive, emotional and choosing more stereotypically feminine content to write about.

The heterosexual marketplace is in full force by the time students take this course [mostly 11th and 12th grade] and my observations support the research which suggests gender differences in language production will be strong at this age.

The observations conducted at Chapman High School produced similar findings. While students spoke with more restricted code in the classroom than at Boiling Springs, the males seemed to dominate in Mr. Timmons' classroom.

Since the classroom as a sociolinguistic environment may be a considered a microcosm for society as a whole, I hope, as a future teacher, to have some impact on changing the perpetuation of these negative roles, like self-fulfilling prophecies and gender inequality by creating an equal environment and by bringing about awareness in my fellow teachers with regard to inequalities and stereotypes that should not persist in a democratic nation. I hope that in working within my small sphere of influence I can help bring change to our society as a whole.

5. References

Dashing Through Novels: A Comparison/Contrast Content Analysis on the Use of Punctuation in Rowling’s *Harry Potter*

**Abstract.** This paper examines the use of the dash in comparison to other punctuation marks using six sample passages from the first and last novels of J. K. Rowling’s *Harry Potter* series: *Harry Potter and the Sorcerer’s Stone* and *Harry Potter and the Deathly Hallows*. Furthermore, Rowling’s style as a writer was analyzed based on a comparison/contrast between the two novels using the selected passages. The study was conducted using content analysis on six emotive, or highly emotional, passages of roughly equal length from the beginning, middle, and ending sections of both novels. The two novels were analyzed by comparing/contrasting the two beginning passages to each other, the two middle passages to each other, and the two end passages to each other. The results of this analysis indicated that Rowling has not changed her writing style much over the ten year period between these novels’ publication dates. The results on the larger scale indicated that Rowling regularly employs the dash in place of four more traditional punctuation marks to add emotive effect and that this often leads to run-on sentences.

**Yvonne Kao** attends USC Upstate and is working towards a double major in Communications and English, along with a minor in Creative Writing. In the Fall of 2013, Yvonne had the opportunity to intern with the Marketing Department at Chapman Cultural Center. During this time, she wrote four personality profiles that were published in *The Spartanburg Herald Journal*. She also worked with the Music Foundation and currently works there part-time as a Music Library Assistant. In the same semester, she met Dr. Marlow, her current research mentor, while taking his Advanced English Grammar course. In the Spring of 2014, she presented her research at the Tenth Annual SC Upstate Research Symposium. Yvonne writes creatively as well, and two of her fictional short stories have been published in the USC Upstate’s *Writers INC: Student Literary Journal*. Yvonne also holds a Bachelor’s degree in Music Performance from Furman University.

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1. Introduction

“A dash is quite a dramatic punctuation mark,” [1]. Without punctuation distinctions in tone nuance and meaning would be difficult even the grammatical construction of our sentences would be greatly impacted. Yet, in the literary world, punctuation is often downplayed unless one is exploring the work of E. E. Cummings [2]. This paper begins to address this issue through close examination of punctuation elements in J. K. Rowling’s internationally famous Harry Potter book series. In her novels, Rowling uses a punctuation mark known as the dash frequently and for a variety of purposes. In addition to its own syntactical functions, the dash is often used in place of other punctuation marks. The purpose of this study is to compare and contrast how the dash is used in the first and last books of the series (i.e., *Harry Potter and the Sorcerer’s Stone* and *Harry Potter and the Deathly Hallows*, respectively), using emotive sample passages from Rowling’s novels, and to see if there is any significant change in her writing style spanning this series of seven novels. Rowling often uses the dash in emotive contexts, that is, in instances of heightened emotion, such as excitement, anger, agitation, and fear. Grammatically, this can lead to run-on sentences. The more dashes in a sentence, the more likely it is to be a run-on sentence.

Traditionally, the dash has two official functions: 1) Interruptions within a sentence and 2) Appositives. In its first function, the dash is generally used to call attention to, or set off, any interrupting structures [3]. In other words, the dash can be used to indicate an abrupt break in thought [4]. For the second function, the appositive signalers, *namely, that is*, and *in other words*, can be preceded by either a comma or a dash. Also, using this type of construction, the dash and the colon are frequently interchangeable. In her audio podcast, *Dashes Versus Colons*, [1] states, “The difference between a colon and a dash is pretty subtle: they can both serve to introduce a related element after the sentence, but a dash is stronger and more informal than a colon.” The dash gives the appositive more emphasis.

In both *Harry Potter and the Sorcerer’s Stone* and *Harry Potter and the Deathly Hallows*, Rowling makes frequent use the dash in place of other, more traditional, alternatives, particularly when the characters are in emotive states—that is, she uses the dash as a substitute for other punctuation marks to achieve more emphasis when the characters are in a state of heightened emotion. This substitution usage has myriad effects. For instance, while this increased usage of the dash arrests the attention or indicates an interruption in thought, the oversaturation results in a large number of run-on sentences. Run-on sentences are independent clauses that have been joined without proper punctuation and conjunction [5]. Another potential downfall of writing emotively is sentence fragments. In another audio podcast, *Sentence Fragments*, [6] gives a valid reason why fragments are generally unacceptable:

[You can’t magically make any set of words a sentence by starting with a capital letter and ending with a period (or an exclamation point). In the most basic form, a complete sentence must have a subject and a verb.

A lack of either subject or verb is typically classified as a sentence fragment. Again, this phenomenon occurs, occasionally, whenever Rowling substitutes the dash for a more traditional punctuation mark, although fragments also occur sometimes in sentences with traditional punctuation simply due to the heightened emotion of the passage itself, without any appearance from the dash.

2. Methods

For the purpose of this study, a total of six sample passages, ranging between approximately 300-350 words each, were chosen from the chapters towards the beginning, the middle, and the ending of both *Harry Potter and the Sorcerer’s Stone*, book one of the series,
and *Harry Potter and the Deathly Hallows*, book seven and last of the series. Each passage was chosen for its emotive content.

The first part of the analysis was conducted by comparing/contrasting the two sample passages from the beginning of both novels to each other, the two middle sample passages to each other, and the two ending sample passages to each other. This comparison/contrast involved tallying the total number of each relevant punctuation mark: the dash, the comma, the period, the colon, and the ellipsis, as well as tallying the total number of sentence types: complete, run-on, and fragment, both with dashes and without dashes (i.e., using traditional punctuation marks only).

In the second part of the analysis, the total number of dashes in each example was tallied, and then each dash was classified according to which traditional punctuation mark it appears to be replacing. The dash was used as an interchangeable substitute in various contexts for four different types of punctuation: the comma, the period, the colon, and the ellipsis. The tallying process was then repeated with these four traditional punctuation marks. Finally, each sentence was examined in terms of independent clause and the grammaticality of the joining of multiple clause sentences, or lack thereof. Each sentence was categorized as being a traditional complete sentence, a run-on sentence, or a sentence fragment.

The results of the analysis are shown in the Tables and Figures section below. Each sample passage can be found in the Appendix.

### 3. Results & Discussion

Each of the six sample passages had ten or more dashes, used in at least three different ways. This does not indicate much in the way of stylistic changes in writing. However, in book one, *Harry Potter and the Sorcerer’s Stone*, the most frequent dash substitution was for the comma, followed closely by the period. Conversely, in book seven, *Harry Potter and the Deathly Hallows*, the most frequent dash substitution was for the ellipsis, followed not-so-closely by the comma, perhaps indicating a subtle shift in clause construction preference on the author’s part.

#### Table 1 Findings

The findings in Table 1 indicate fairly similar results in terms of marks of punctuation distribution and resulting sentence types. Both Sample 1 passages had the same number of dashes, and there were only two more run-on sentences in Book 1 Sample 1 than in Book 7 Sample 1. On this point, Rowling has not changed her writing style much, if at all. The main thing to note with these results would be that while Rowling did not decrease her usage of the dash throughout the ten-year publication gap between novels, she seems to have become more consummiate with its usage. Table 1 shows that Book 1 Sample 1 had four complete sentences with dashes, while Book 7 Sample 1 had eight. As the number of run-on sentences decreased from book one to book seven, this does not support the hypothesis that using the dash leads to run-ons.

#### Table 2 Findings

The findings in Table 2 do not reveal a great deal of difference between book one and book seven, either. These two samples were drawn from the general middle area of each novel, and again, like the Sample 1 passages, both of these passages’ results appear rather similar. Eleven dashes were found in Book 1 Sample 2, and ten were found in Book 7 Sample 2. Without knowing what the dashes substitutions functions are, there is not much more information that can be ascertained. Syntactically, the book one excerpt had a total of three run-on sentences, two of which used dashes, compared to the book seven excerpt, which only had
one run-on, which did, in fact, have at least one dash. Structurally speaking, the two passages do not differ much, corroborating the theory that Rowling did not alter her writing style over the course of the series.

Table 3 Findings

Finally, as for the findings in Table 3, which show the comparison/contrasted between the Sample 3 passages from the two novels’ endings, the only truly notable difference was that there were five more dashes in Book 7 Sample 3 than in Book 1 Sample 3. However, eighteen dashes is the record holder compared all of the other passages, which contained 10-13 dashes. That means a lot more substitutions, and yet the results do not indicate a drastic increase in run-on sentences. In fact, there were more run-on sentences, both with and without dashes, in the book one excerpt. Another fact that is of interest is that the number of traditionally used periods drops by nine from book one’s sample to book seven’s. With this in mind, it can be inferred that Rowling uses the dash in a much more grammatically correct fashion in Book 7 Sample 3. While these findings refute the hypothesis that increased dash usage leads to an increased number of run-on sentences, it is worth marking that Rowling is continuing her style of using dashes as substitutions for more traditional marks of punctuation while also producing fewer run-on sentences.

Book 1 to Book 7 Compare/Contrast

Tables 4 and 5 compare/contrast the punctuation types and substitutions between books one and seven. The results in Table 4 reveal that there were a total of thirty-five dash substitutions in all three book one sample passages: thirteen for the comma, twelve for the period, three for the colon, and seven for the ellipsis. In comparison, Table 5 shows that there were even more dash substitutions in the book seven sample passages: thirty-nine. Yet despite fourteen of these substitutions being for the comma—more than in book one—this type of substitution falls in a poor second place to the twenty-one dash substitutions for the ellipsis. There were a mere three substitutions for the period, and only one for the colon, in this novel. This shows a subtle, yet apparent shift in Rowling’s writing style, namely that in the seventh book, there are far more dash substitutions for the ellipsis and not nearly as many for the period. What makes these findings important is that Tables 6 and 7 discuss the resulting sentence types with and without dashes.

Concerning the sentence types in the book one excerpts, Table 6 shows that whenever Rowling used a dash, the resulting sentence had an almost 50:50 tendency of being either a run-on or a complete sentence, whereas when she used traditional punctuation only, the ratio of complete-to-run-on sentences was more like 25:1. Comparatively, Table 7 shows more than a 3:1 ratio of complete sentences to run-on sentences whenever Rowling used a dash. Also, when she used traditional punctuation only in the book seven excerpts, the ratio of complete-to-run-on sentences was 56:0. This shows possible development as a writer, especially since prior findings revealed that Rowling used more dashes in the book seven excerpts. Furthermore, the results for determining sentence types with and without dashes in the six sample passages show an overall decrease in the number of run-on sentences from book one to book seven. Table 6 shows a total of eleven run-on sentences from the book one passages, while Table 7 shows only five. As for sentence fragments, the difference falls not in the number so much as distinction between using dashes and using traditional punctuation only. There were no fragments with dashes in the book one passages, although there were a total of seven fragments, all of which used traditional punctuation only. According to Table 7, there were a total of nine sentence fragments, four of which had dashes, while the remaining five did not.
In the *Harry Potter and the Deathly Hallows* excerpts, the dashes seem most used for parenthetical statements, interruptions, and false starts for purpose of repetition. There were far more dash substitutions for the ellipsis than any other substitution. Yet in *Harry Potter and the Sorcerer’s Stone*, there were almost twice as many dash substitutions for commas as for ellipses. Line 7 of Book 1 Sample 3 shows this comma substitution clearly, “But, Harry — what if You-Know-Who’s with him?” [7]. Rowling uses the dash here instead of the comma after a direct address to show the speaker’s hesitation. But a comma would be the traditional usage. Lines 25-27 of Book 1 Sample 3 show a similar substitution for the period:

He put the bottle down and walked forward; he braced himself, saw the black flames licking his body, but couldn’t feel them — for a moment he could see nothing but dark fire — then he was on the other side, in the last chamber [7].

Both dashes in this example could be replaced with periods—which would also have prevented this sentence from becoming a run-on. Nevertheless, it shows how the dash can be used to replace the traditional use of the period, thereby indicating in this particular usage a greater continuity of thought.

Seven situations which would traditionally take ellipses were found in the book one excerpts. One such instance occurs in Line 2 of Book 1 Sample 1:

“You don’t mean — you *can’t* mean the people who live *here*?” [7].

But another notable cross-usage of Rowling’s was her usage of the dash as an ellipsis, to signify hesitation. An example of this was found in Line 20 of Book 1 Sample 1:

“You think it — wise — to trust Hagrid with something as important as this?” [7]. In this example, both dashes would traditionally be ellipses, instead, to show hesitation before and after the dash-enclosed word.

This dash-substituted-for-an-ellipsis proved to be much more prolific in the book seven excerpts. Lines 1-2 of Book 7 Sample 2 clearly show this marked increase for using the dash to act as an ellipsis: “How — how dare you?” said Lupin. “This is not about a desire for — for danger or personal glory — how dare you suggest such a —” [8]. Incidentally, this sentence is also a case of the dash leading to being a run-on sentence. However, stylistically it is more important to note that of the four dashes in this example, three of them function as ellipses. The first two dashes, both of which function as ellipses, are used as false starts for the purpose of repetition. The fourth dash leads to an interruption, another finding that is consistent with how Rowling uses the dash in *Harry Potter and the Deathly Hallows*.

Throughout all three of the book one excerpts, only three dashes of the thirty-five dashes appeared in structures that would traditionally use a colon, making this the least substituted mark. This is apparent in Lines 9-10 of Sample 2:

The sun shone brightly on a stack of cauldrons outside the nearest shop. Cauldrons — All Sizes — Copper, Brass, Pewter, Silver — Self-Stirring — Collapsible, said a sign hanging over them [7].

In this example, a color traditionally belongs after “Cauldrons — All Sizes” to show the start of a list of properties pertaining to the cauldrons of all sizes. It is replaced with a dash, instead. The scarcity of this type of substitution is reflected in the fact that only one actual colon appears in all of the three passages. Incongruously, none of the dashes found in the three excerpts from book one follow the traditionally accepted use of the dash. Tables 4 and 5 show how many times the dash was used in place of other punctuation marks.

There was some concern that using the dash would lead to an increase in the number of run-on sentences. The final part of the study involved tallying up the number of run-on sentences and the number of complete sentences that occurred when a sentence contained a dash versus when a sentence used traditional punctuation only.

In book one, there was a nearly equal number of traditional sentences and run-on sentences as a result of using the dash to show a character’s highly emotional state, as shown in Line 59 of Book 1 Sample 2, “He does tend to — what was that?” [7]. According to the results
shown in Table 6, when the sentence contained at least one dash, the number of run-on sentences compared to the number of complete sentences was nearly equal. Yet when Rowling used traditional punctuation only, there was a 25:1 ratio of complete sentences to run-on sentences. This suggests there is a positive correlation between using the dash as a substitute punctuation mark and run-on sentences. Comparatively, when the sentences contained only traditional punctuation, only two run-on sentences appeared in the three passages examined here. Therefore, the use of the dash correlates with a drastic increase of run-on sentences. One of the most notable examples of this can be found in Sample 2, Lines 3-5:

The brick he had touched quivered — it wriggled — in the middle, a small hole appeared — it grew wider and wider — a second later they were facing an archway large enough even for Hagrid, an archway onto a cobbled street that twisted and turned out of sight [7].

There are no fewer than four dashes in this run-on sentence, and each dash could be replaced with a period, signifying a complete sentence. Technically, this single run-on sentence is a complete sentence four times over. The dashes lead to a very convoluted statement, perhaps as Rowling’s attempt to make the reader feel the stress of the character’s situation. The run-on with the most amount of substitutions was in Lines 13-14 of Book 1 Sample 3: “Me!” said Hermione. “Books! And cleverness! There are more important things — friendship and bravery and — oh Harry — be careful!” [7]. In this example, there were three dashes, and each dash could be substituted for a different punctuation mark: the colon, the ellipsis, and the comma, respectively. As the sentence is a run-on, this again shows how using the dash can lead to run-on sentences.

This tendency does not change overmuch from book one to book seven. Yes, there were fewer run-on sentences on the whole in the collective book seven passages, but the five existing run-on sentences all had dashes, again suggesting a positive correlation between using the dash and run-on sentences. Perhaps the most pertinent example of this can be found in Line 10 of Book 7 Sample 3: “I — I come with a warning — no, a request — please —” [8]. While short, this is undoubtedly a run-on sentence—with a startling total of four dashes, two of which function as ellipses and two of which function as periods. Moreover, this occurs near the end of the novel, and therefore the end of the series. In ten years of writing the Harry Potter book series, Rowling did not deviate from substituting the dash for more traditional punctuation marks whilst conveying characters in emotive contexts.

4. Conclusion

In conclusion, Rowling uses the dash in place of a variety of more traditional punctuation marks when she wishes to portray characters in a heightened state of emotion. This study has shown that the dash can be used interchangeably with at least four other types of punctuation marks, but conscientious authors should be aware and wary of potential drawbacks. The use of the dash, for example, leads to run-on sentences nearly as often as it does to traditional sentences. Yet within these sample passages, the dash supersedes its normal lexical and syntactical boundaries, in what appears to be an evolution of this adaptable punctuation mark. The dash, in other words, is one of the most versatile marks of punctuation, as shown multiple times in Rowling’s novels, Harry Potter and the Sorcerer’s Stone and Harry Potter and the Deathly Hallows. Further studies might explore the effect, in terms of individual emotional outcome, that each dash substitution has on readers of Rowling’s text and whether this emotion is actually heightened by the use of the dash, in place of the more traditional punctuation marks. Additionally, in the samples excerpted for this study, a large majority of the dashes appear within dialogue as opposed to setting and description. Examining the context in which dashes appear is also worthy of investigation.
5. Acknowledgements

I would like to thank Dr. D. Marlow for sticking with me and guiding me through this project.

6. References


7. Tables & Figures

Table 1. Beginning : Beginning

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Table 1. Beginning : Traditional

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Table 2. Middle : Middle

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| Sentence Types:         | Book 1 Sample 2 | Book 7 Sample 2 |
| With Dash(es)           | (C)             | (R)             |
| (C)                     | 2               | 1               |
| (R)                     | 12              | 19              |

Table 3. Ending : Ending

| Punctuation Type:       | Book 1 Sample 3 | Book 7 Sample 3 |
| Substitution &          |                 |                 |
| Traditional Usage       |                 |                 |
| Dash                    | 13              | 18              |
| Comma                   | 24              | 23              |
| Period                  | 25              | 16              |
| Colon                   | 0               | 1               |
| Ellipsis                | 0               | 3               |

| Sentence Types:         | Book 1 Sample 3 | Book 7 Sample 3 |
| With Dash(es)           |                 |                 |
| Complete                | 5               | 5               |
| Run-On                  | 4               | 3               |
| Fragment                | 0               | 2               |

| Sentence Types:         | Book 1 Sample 3 | Book 7 Sample 3 |
| Traditional Only        |                 |                 |
| Complete                | 19              | 22              |
| Run-On                  | 1               | 0               |
| Fragment                | 5               | 2               |

Table 4. Book 1 Punctuation Type & Substitution

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| Traditional Usage | 77 | 60 | 1 | 4 |
Table 5. Book 7 Punctuation Type & Substitution

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Table 6. Book 1 Sentence Types

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Table 7. Book 7 Sentence Types

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<tr>
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8. Appendix

Dashes are followed by the “traditional punctuation” determined to have been substituted in each situation.

Sentence types are bolded and in parentheses. The black fonts indicates sentences with at least one dash, and the traditional sentences are in red. (C) indicates a complete sentence; (R) indicates a run-on sentence.

Book 1: Harry Potter and the Sorcerer’s Stone

Sample 1 (~333 words) – Excerpt from Chapter 1 – The Boy Who Lived:

“I’ve come to bring Harry to his aunt and uncle. (C) They’re the only family he has left now.” (C)
“You don’t mean —(…) you can’t mean the people who live here?” (C) cried Professor McGonagall, jumping to her feet and pointing at number four. “Dumbledore —(,) you can’t. (C) I’ve been watching them all day. (C) You couldn’t find two people who are less like us. (C) And they’ve got this son —(…) I saw him kicking his mother all the way up the street, screaming for sweets. (R) Harry Potter come and live here!” (C)
“It’s the best place for him,” (C) said Dumbledore firmly. “His aunt and uncle will be able to explain everything to him when he’s older. (C) I’ve written them a letter.” (C)
“A letter?” (F) repeated Professor McGonagall faintly, sitting back down on the wall. “Really, Dumbledore, you think you can explain all this in a letter? (C) These people will never understand him! (C) He’ll be famous —(,) a legend —(,) I wouldn’t be surprised if today was known as Harry Potter day in the future —(,) there will be books written about Harry —(,) every child in our world will know his name!” (R)
“Exactly,” (F) said Dumbledore, looking very seriously over the top of his half-moon glasses. “It would be enough to turn any boy’s head. (C) Famous before he can walk and talk! (C) Famous for something he won’t even remember! (C) Can’t you see how much better off he’ll be, growing up away from all that until he’s ready to take it?” (C)
Professor McGonagall opened her mouth, changed her mind, swallowed, and then said, “Yes, —(,) yes, you’re right, of course. (C) But how is the boy getting here, Dumbledore?” (C) She eyes his cloak suddenly as though she thought he might be hiding Harry underneath it. (C)
“Hagrid’s bringing him.” (C)
“You think it —(…) wise —(…) to trust Hagrid with something as important as this?” (C)
“I would trust Hagrid with my life,” said Dumbledore. (C)
“I’m not saying his heart isn’t in the right place,” said Professor McGonagall grudgingly, “but you can’t pretend he’s not careless. (C) He does tend to —(…) what was that?” (R)
(Rowling, 1997, 13-14)
Sample 2 (~301) – Excerpt from Chapter 5 – Diagon Alley:

1. “Three up... two across...” he muttered.(F) “Right, stand back, Harry.”(C)
2. He tapped the wall three times with the point of his umbrella.(C)
3. The brick he had touched quivered —(.) it wriggled —(.) in the middle, a small hole
4. appeared —(.) it grew wider and wider —(.) a second later they were facing an archway
5. large enough even for Hagrid, an archway onto a cobbled street that twisted and turned out
6. of sight.(R)
7. “Welcome,” said Hagrid, “to Diagon Alley.”(C)
8. He grinned at Harry’s amazement.(C) They stepped through the archway.(C) Harry looked
9. quickly over his shoulder and saw the archway shrink instantly back into the solid wall.(C)
10. The sun shone brightly on a stack of cauldrons outside the nearest shop.(C) Cauldrons —(,)
11. All Sizes —(,: Copper, Brass, Pewter, Silver —(,) Self-Stirring —(,) Collapsible, said a sign
12. hanging over them.(C)
13. “Yeah, you’ll be needin’ one,” said Hagrid, “but we gotta get yer money first.”(C)
14. Harry wished he had about eight more eyes.(C) He turned his head in every direction as
15. they walked up the street, trying to look at everything at once: the shops, the things outside
16. them, the people doing their shopping.(C) A plump woman outside an Apothecary was
17. shaking her head as they passed, saying, “Dragon liver, seventeen Sickles an ounce, they’re
18. mad....”(R)
19. A low, soft hooting came from a dark shop with a sign saying Eeylops Owl Emporium —
20. (: ) Tawny, Screech, Barn, Brown, and Snowy.(C) Several boys of about Harry’s age had
21. their noses pressed against a window with broomsticks in it.(C) “Look,” Harry heard one
22. of them say, “the new Nimbus Two Thousand —(,) fastest ever —(,)”(R) There were
23. shops selling robes, shops selling telescopes and strange silver instruments Harry had never
24. seen before, windows stacked with barrels of bat spleens and eels’ eyes, tottering piles of
25. spell books, quills, and rolls of parchment, potion bottles, globes of the moon....(C)

(Rowling, 1997, 71-72)
Sample 3 (~325 words) – Excerpt from Chapter 16 – Through the Trapdoor:

“Which one will get you back through the purple flames?”
Hermione pointed at a rounded bottle at the right end of the line.
“You drink that,” said Harry. “No, listen, get back and get Ron. Grab brooms from
the flying-key room, they’ll get you out of the trapdoor and past Fluffy — go straight to
the owlery and send Hedwig to Dumbledore, we need him. I might be able to hold
Snape off for a while, but I’m no match for him, really.”
“But, Harry — what if You-Know-Who’s with him?”
“Well — I was lucky once, wasn’t I?” said Harry, pointing at his scar. “I might get
lucky again.”
Hermione’s lip trembled, and she suddenly dashed at Harry and threw her arms around
him.
“Hermione!”
“Harry — you’re a great wizard, you know.”
“I’m not as good as you,” said Harry, very embarrassed, as she let go of him.
“Me!” said Hermione. “Books! And cleverness! There are more important things
friendship and bravery and — oh Harry — be careful!”
“You drink first,” said Harry. “You are sure which is which, aren’t you?”
“Positive,” said Hermione. She took a long drink from the round bottle at the end, and
shuddered.
“It’s not poison?” said Harry anxiously.
“No but it’s like ice.”
“Quick, go, before it wears off.”
“Good luck — take care.”
“GO!”
Hermione turned and walked straight through the purple fire.
Harry took a deep breath and picked up the smallest bottle. He turned to face the black
flames.
“Here I come,” he said, and he drained the little bottle in one gulp.
It was indeed as though ice was flooding his body. He put the bottle down and walked
forward; he braced himself, saw the black flames licking his body, but couldn’t feel them
for a moment he could see nothing but dark fire — then he was on the other side, in
the last chamber. There was already someone there — but it wasn’t Snape. It wasn’t even
Voldemort.

(Rowling, 1997, pp. 286-287)
“Well, he’s taken,” said Harry. “But Hestia Jones and Dedalus Diggle are more than up to the job—(…) (C)

“If we’d even seen CVs—(F) began Uncle Vernon, but Harry lost patience. Getting to his feet, he advanced on his uncle, now pointing at the TV set himself.(C)

“These accidents aren’t accidents —(,) the crashes and explosions and derailments and whatever else has happened since we last watched the news.(C) People are disappearing and dying and he’s behind it —(:) Voldemort.(C) I’ve told you this over and over again, he kills Muggles for fun.(C) Even the fogs —(,) they’re caused by dementors, and if you can’t remember what they are, ask your son!”(C)

Dudley’s hands jerked upward to cover his mouth.(C) With his parents’ and Harry’s eyes upon him, he slowly lowered them again and asked, “There are … more of them?”(C)

“More?” laughed Harry.(F) “More than the two that attacked us, you mean?(C) Of course there are,(!) there are hundreds, maybe thousands by this time, seeing as they feed off fear and despair —(…) (R)

“All right, all right,”(C) blustered Vernon Dursley. “You’ve made your point —(…)”(C)

“I hope so,” said Harry, “because once I’m seventeen, all of them —(,) Death Eaters, dementors, maybe even Inferi —(,) which means dead bodies enchanted by a Dark wizard —(,) will be able to find you and will certainly attack you.(C) And if you remember the last time you tried to outrun wizards, I think you’ll agree you need help.”(C)

There was a brief silence in which the distant echo of Hagrid smashing down a wooden front door seemed to reverberate through the intervening years.(C) Aunt Petunia was looking at Uncle Vernon; Dudley was staring at Harry.(C) Finally Uncle Vernon blurted out, “But what about my work?(C) What about Dudley’s school?(C) I don’t suppose those things matter to a bunch of layabout wizards —(…)”(C)

“Don’t you understand?”(C) shouted Harry. “They will torture and kill you like they did my parents!(C)

“Dad,” said Dudley in a loud voice, “Dad —(,) I’m going with these Order people.”(C)

“Dudley,” said Harry, “for the first time in your life, you’re talking sense.”(C)

(Rowling, 2007, pp. 34-35)
Sample 2 (~355 words) – Excerpt 2 from Chapter 11 – The Bribe:

“How —(...) how dare you?”(C) said Lupin. “This is not about a desire for —(...) for danger or personal glory —(...) how dare you suggest such a —(...)”(R)
“I think you’re feeling a bit of a daredevil,” Harry said.(C) “You fancy stepping into Sirius’s shoes —(...)”(C)
“Harry, no!”(C?) Hermione begged him, but he continued to glare into Lupin’s livid face.(C)
“I’d never have believed this,”(C) Harry said. “The man who taught me to fight dementors —(...) a coward.”(F)
Lupin drew his wand so fast that Harry had barely reached for his own; there was a loud bang and he felt himself flying backward as if punched; as he slammed into the kitchen wall and slid to the floor, he glimpsed the tail of Lupin’s cloak disappearing around the door.(C)
“Remus, Remus, come back!”(C) Hermione cried, but Lupin did not respond. A moment later they heard the front door slam.(C)
“Harry!”(F) wailed Hermione. “How could you?”(C)
“It was easy,”(C) said Harry. He stood up; he could feel a lump swelling where his head had hit the wall.(C) He was still so full of anger he was shaking.(C)
“Don’t you look at me like that!”(C) he snapped at Hermione.
“Don’t you start on her!”(C) snarled Ron.
“No —(...) no —(...) we mustn’t fight!”(C) said Hermione, launching herself between them.(C)
“You shouldn’t have said that stuff to Lupin,”(C) Ron told Harry.
“He had it coming to him,”(C) said Harry. Broken images were racing each other through his mind; Sirius falling through the veil; Dumbledore suspended, broken, in midair; a flash of green light and his mother’s voice, begging for mercy ... (C)
“Parents,” said Harry, “shouldn’t leave their kids unless —(...) unless they’ve got to.”(C)
“Harry —(...)”(F) said Hermione, stretching out a consoling hand, but he shrugged it off and walked away, his eyes on the fire Hermione had conjured. He had once spoken to Lupin out of that fireplace, seeking reassurance about James, and Lupin had consoled him.(C) Now Lupin’s tortured white face seemed to swim in the air before him.(C) He felt a sickening surge of remorse.(C) Neither Ron nor Hermione spoke, but Harry felt sure that they were looking at each other behind his back, communicating silently.(C)
(Rowling, 2007, pp. 214-215)
Sample 3 (~344 words) – Excerpt from Chapter 33 – *The Prince’s Tale*:

1. “Don’t kill me!”(C)
2. “That was not my intention.”(C)
3. Any sound of Dumbledore Apparating had been drowned by the sound of the wind in the branches.(C) He stood before Snape with his robes whipping around him, and his face was illuminated from below in the light cast by his wand.(C)
4. “Well, Severus?(F) What message does Lord Voldemort have for me?”(C)
5. “No —(), no message —(...) I’m here on my own account!”(R) implied ‘there was’
6. Snape was wringing his hands: He looked a little mad, with his straggling black hair flying around him.(C)
7. “I —(...) I come with a warning —() no, a request —(...) please —()”(R)
8. Dumbledore flicked his wand.(C) Though leaves and branches still flew through the night air around them, silence fell on the spot where he and Snape faced each other.(C)
9. “What request could a Death Eater makes of me?”(C)
10. “The —(...) the prophecy ... the prediction ... Trelawney ...”(F)
11. “Ah, yes,”(F) said Dumbledore. “How much did you relay to Lord Voldemort?”(C)
12. “Everything —(...) everything I heard!”(C) said Snape. “That is why —(), it is for that reason —(), he thinks it means Lily Evans!”(C)
13. “The prophesy did not refer to a woman,” (C) said Dumbledore. “It spoke of a boy born at the end of July —(...)”(C)
14. “You know what I mean!”(C) He thinks it means her son, he is going to hunt her down —(,)
15. “If she means so much to you,” said Dumbledore, “surely Lord Voldemort will spare her?(C) Could you not ask for mercy for the mother, in exchange for the son?”(C)
16. “I have —(...) I have asked him —(...)”(C)
17. “You disgust me,”(C) said Dumbledore, and Harry had never heard so much contempt in his voice. Snape seemed to shrink a little.(C) “You do not care, then, about the deaths of her husband and child?(C) They can die, as long as you have what you want?”(C)
18. Snape said nothing, but merely looked up at Dumbledore.(C)
19. “Hide them all, then,”(C) he croaked. “Keep her —(), them —(), safe.(C) Please.”(F)
20. “And what will you give me in return, Severus?”(C)
21. “In —(...) in return?”(F) Snape gaped at Dumbledore, and Harry expected him to protest, but after a long moment he said, “Anything.”(C)

(Rowling, 2007, pp. 676-678)
Presence of Sustainability Indicators in Five South Carolina Cities

**ABSTRACT.** The purpose of this paper is to assess the relative levels of sustainability in the five largest cities in South Carolina. This is accomplished by cataloguing the presence of 38 different sustainability indicators in each city. The author predicted that the cities of Greenville, Charleston, and Columbia would display the presence of more indicators because of several economic, social, and political factors that lend themselves to enhanced sustainability. Data was gathered through a combination of in-person and telephone interviews, as well as the circulation of a 38-indicator survey based on Kent Portney’s landmark work on sustainability. Each city was given a score from 0 to 38, depending upon how many indicators were reported present. The scores ranged from 19 to 24 for all of the cities studied, and the cities of Greenville, Charleston, and Columbia reported a higher number of indicators present than Spartanburg and North Charleston. Each city is more sustainable than this survey belies, as many indicators that were excluded from the end totals were present, but had to be excluded because they were not a function of municipal governance.

**NATALIA ROSARIO** is a 2014 graduate of USC Upstate with a Bachelor’s Degree in Political Science and is currently pursuing a Masters in City and Regional Planning at Clemson University. She became interested in urban planning while taking a course on the subject taught by Dr. Goldberg in her sophomore year and has been involved in the field ever since. She has interned with the City of Spartanburg Planning and Economic Development departments and has contributed to the work of the Upstate regional organization, Ten at the Top, through class projects. Her research was conducted on the topic of sustainability in South Carolina as part of her senior thesis at Upstate and she plans to continue conducting research on the topic of urban sustainability.

**DR. ABRAHAM GOLDBERG**, an Assistant Professor of Political Science, has leveraged his research program to promote citizenship and livable communities throughout South Carolina. He recently released the *South Carolina Civic Health Index*, which analyzes political participation, community involvement, and neighborhood engagement rates across residents with varying levels of educational attainment, race, and age. The report offers recommendations aimed at enhancing citizenship across the state. Dr. Goldberg is also regularly invited to speak to community groups about fostering healthy, vibrant neighborhoods that improve residents’ happiness and quality of life. He frequently connects his students to his scholarship and community work, and is especially proud of Natalia’s very important work.
1. Introduction

The concept of sustainability was famously defined in 1987 by the United Nation’s World Commission on Environment and Development in its Brundtland Commission report as economic progress and growth for the current generation that does not limit the ability of future generations to experience the same benefits and enjoy a healthy natural environment [1, 2]. To this end many cities around the world have implemented policies specifically tailored to preserve environmental integrity and stability while still promoting economic ideals. This has been accomplished through mechanisms such as land-use and transportation planning, and incentivizing pollution prevention and energy efficiency. Much of the academic research on sustainability policies and practices in the United States has focused on the largest cities in the country, with the majority being located in the northeast, pacific west, and southwest. This is true of Kent Portney’s landmark work, which developed a 38-indicator measurement to assess each cities commitment to sustainability [3, 4]. Acknowledging a need to think more broadly about sustainability in America, Saha (2009) advised that research should encompass more than just the largest metropolitan areas [5]. Given the dearth of research on both smaller cities, and those in other regions of the country, this paper assesses and compares the relative presence of sustainability indicators in the five largest cities in South Carolina. Along with addressing a gap in the literature, an examination of small, southeastern cities may also provide new insights on urban sustainability that can add to the current body of knowledge.

2. Review of Literature

Following the publication of the Brundtland Commission’s report on sustainability, the United Nations sponsored a meeting of nations in Rio de Janeiro in 1992 dubbed Earth Summit [6]. The outcome of the Earth Summit was the Agenda 21 document that set standards designed to assist cities in their work towards achieving more sustainable futures. The Agenda 21 resolution drew distinct and important lines between the activities of local public authorities and the social, economic, and environmental well-being of the communities and geographic areas in which they exist. It asserts that local officials have the power and responsibility to directly impact the economy and environment, and are especially charged with the task of motivating the public and responding to sustainable development concerns [7]. For the first time sustainability was placed under the jurisdiction of local public authorities.

City administrators are empowered to make decisions that promote or hinder sustainable development in municipalities. Research has found that administrators are more likely to support attempts designed to achieve greater sustainability when their cities are made up of “creative class” types; citizens who are young, educated professionals who are often unmarried and have discretionary money to spend [8]. As their basic needs are met, this creative-class turns its attention to secondary concerns, namely, what is best for their community and society. Fiorino explains that higher incomes do not guarantee that an area will have “better environmental performance”. However, higher incomes do allow for citizens to more easily take action and pressure their local leaders into acting on issues of concern [1]. In short, when conditions are ideal for the citizenry to mobilize in favor of sustainable development, public administrators are more likely to implement policies that coincide with these ideals.

Cities whose economic sectors have moved away from manufacturing, towards service sector jobs also tend to have a stronger interest in sustainability [4]. Presumably the presence of large manufacturing companies prevents the implementation and success of sustainability practices, as ‘green-growth’ is still often perceived as a limiter on overall growth and economic success in many areas. Therefore, in predicting the relative sustainability levels of South
Carolina’s five largest cities, it is important to evaluate the existence of a “creative class” and the strength of manufacturing in each city.

3. Theory & Methodology

Demographic information of the five largest cities in South Carolina is found on Table 1. The relative existence of a Creative Class, which is a predictor of greater attention to sustainability, is determined by populations that are younger, and more affluent and educated. Table 2 offers the relative dominance of manufacturing as a percentage of the industry within the counties of each municipality, which is a predictor of less attention to sustainability. It appears that Greenville, Columbia, and Charleston stand out as having a greater presence of a Creative Class and lower percentages of their industries come from manufacturing than Spartanburg and North Charleston. Accordingly, the research can predict that Greenville, Columbia, and Charleston will have high levels of sustainability than the other two cities.

Table 1. Six demographics for the 5 largest South Carolina cities [9].

<table>
<thead>
<tr>
<th>City</th>
<th>Population</th>
<th>Population % Change Apr. 1 2010 - July 1, 2013</th>
<th>Median Age</th>
<th>Median Household Income</th>
<th>% of Pop. w/ HS Diploma</th>
<th>% of Pop. w/ Bachelors Degree or Higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spartanburg</td>
<td>37,013</td>
<td>1.7%</td>
<td>35.5</td>
<td>$30,574.00</td>
<td>82.0%</td>
<td>27.7%</td>
</tr>
<tr>
<td>North Charleston</td>
<td>104,054</td>
<td>6.5%</td>
<td>38.1</td>
<td>$39,322.00</td>
<td>79.7%</td>
<td>19.1%</td>
</tr>
<tr>
<td>Charleston</td>
<td>120,083</td>
<td>6.3%</td>
<td>32.5</td>
<td>$50,792.00</td>
<td>92.7%</td>
<td>48.9%</td>
</tr>
<tr>
<td>Columbia</td>
<td>130,038</td>
<td>2.6%</td>
<td>28.1</td>
<td>$41,344.00</td>
<td>86.7%</td>
<td>39.5%</td>
</tr>
<tr>
<td>Greenville</td>
<td>58,409</td>
<td>3.8%</td>
<td>34.6</td>
<td>$40,793.00</td>
<td>85.8%</td>
<td>31.2%</td>
</tr>
<tr>
<td>South Carolina</td>
<td>4,625,364</td>
<td>3.2%</td>
<td>37.9</td>
<td>$44,779.00</td>
<td>84.6%</td>
<td>25.1%</td>
</tr>
</tbody>
</table>

Table 2. Percentage of Manufacturing and Professional Services by County (Note that North Charleston is located in Dorchester, Berkeley, and Charleston Counties, Charleston is located in Berkeley and Charleston Counties, and Columbia is located in Lexington and Richland Counties [10]).

<table>
<thead>
<tr>
<th>City</th>
<th>Manufacturing % of All Industry</th>
<th>Professional, Scientific and Technical Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spartanburg</td>
<td>19.72%</td>
<td>4.42%</td>
</tr>
<tr>
<td>Dorchester</td>
<td>14.28%</td>
<td>3.02%</td>
</tr>
<tr>
<td>Berkeley</td>
<td>8.89%</td>
<td>11.90%</td>
</tr>
<tr>
<td>Charleston</td>
<td>6.11%</td>
<td>8.77%</td>
</tr>
<tr>
<td>Lexington</td>
<td>8.21%</td>
<td>5.56%</td>
</tr>
<tr>
<td>Richland</td>
<td>5.10%</td>
<td>5.10%</td>
</tr>
<tr>
<td>Greenville</td>
<td>10.76%</td>
<td>7.73%</td>
</tr>
<tr>
<td>South Carolina</td>
<td>11.20%</td>
<td>6.14%</td>
</tr>
</tbody>
</table>

To assess the policies and practices of sustainability in each city, this paper will employ Portney’s Sustainability Index (PSI) [4]. The PSI is a 38-indicator yes/no survey along the following seven dimensions of sustainability: Smart Growth Activities, Land-Use Planning Programs, Policies and Zoning, Transportation Planning Programs and Policies, Pollution Prevention, Reduction and Remediation, Efficiency, and Sustainable Indicators Project, Organization/Administration/Management/Coordination/Governance. Appendix 1 provides the entire survey, including the indicators that fall within each dimension. Each “yes” answer
equates to 1 point, while a “no” answer equates to a 0. Overall scores were determined by adding the “yes” answers for each municipality. Therefore, scores can range from 38 to 0, with higher numbers indicating more sustainability. Data were collected by conducting in-person or telephone interviews with city officials. The process of collecting data to determine the sustainability of each city consisted of interviews with city officials over the phone and in person.

4. Data Analysis

This section provides a summary of the findings and the Portney Sustainability Index (PSI) scores for each municipality. Appendix 2 provides a complete picture of how each municipality scored on each indicator. As predicted, Greenville, Columbia, and Charleston have higher PSI scores (24, 22, and 22 respectively) than North Charleston and Spartanburg (20 and 19 respectively), thus indicating higher levels of sustainability.

City of Spartanburg

An interview with Assistant City Manager Chris Story led to a score of 19 for the City of Spartanburg. This was the lowest score among the five cities. An important facet in Story’s discussion of sustainability within the City was that although the Administration and City Council are concerned with the future of sustainability for the city, there are major limitations; the city’s small size (Spartanburg was the smallest city examined in this project) and level of difficulty annexing new properties. At this time there are no ‘easy avenues’ for the City of Spartanburg to physically grow. The inability to grow outwardly presents the City with a funding issue, along with incompatible demographics for progressive sustainable development. The current focus is on drawing residents in from the county to live in the City of Spartanburg, which Story feels will allow the city to place more emphasis on a future sustainability goals, by providing the City with more resources to implement sustainable practices.

The most interesting aspects of Spartanburg’s sustainability is it’s version of the “Eco-Village (Urban Infill Housing) Project or Program)” indicator (Question 3), which is fulfilled on page four of the City of Spartanburg’s Downtown Master Plan:

“…the largest scale projects that might be achievable for a City like Spartanburg have already occurred – the Denny’s Tower, the Marriot Hotel, and the Chapman Cultural Center. The Focus now must be on filling in the numerous small-scale gaps with highly detailed mixed-use buildings that enliven the sidewalks with ground level activity such as shops and restaurants and provide opportunities for employment and housing on the upper floors.”

The City of Spartanburg is committed to creating a core Downtown area that is dense and walk able for its citizens. As the city focuses on increasing a pedestrian friendly atmosphere, it is important to note that the City of Spartanburg has long been a bicycle friendly city, and was the first in the state to become so. The B-cycle program is bicycle-sharing program available to the citizens of Downtown Spartanburg, which allows anyone to rent one of the approximately 30 bicycles and pay for the use upon their return!

During the research process the author found that several of the cities in this study, Spartanburg included, showed presence of sustainability indicators that were not necessarily controlled by the municipality itself. For example, the City of Spartanburg itself does not fund it’s own asbestos abatement program (Question 19), as asbestos abatement is a function of state law, and funding for abatement comes directly from the state of South Carolina.

The “Alternative energy offered to consumers (solar, wind, biogas)” and “Water Conservation program” (Questions 27 and 28) indicators were also not directly under the control of the City of Spartanburg. Duke Energy provides much of the energy needed in the Upstate,
but almost all of the entire alternative and renewable energy research and applications have been focused in North Carolina and Florida. The Spartanburg Water System is a sister entity that is partly overseen by the City of Spartanburg, which still maintaining its independence and identity. Through the Spartanburg Water System, water conservation is overseen for the entire county.

City of North Charleston

Ryan Johnson, staff for the Office of the Mayor in the City of North Charleston provided the information in the City of North Charleston’s questionnaire. Its final score was 20, the second lowest score among the five cities. North Charleston is partially located in Berkeley County, which had one of the highest percentages of manufacturing and lowest percentages of professional services among all of the cities studied. The population is also the oldest, had the lowest levels of education, and the second lowest income among the five cities. This score is likely caused by an unfavorable combination of demographics that do not lend themselves to the support of sustainable initiatives.

The City of North Charleston has four different “eco-villages”; Oak Terrace Preserves, Mixson, Hunley Waters, and GARCO – all of which are built with green concepts and sustainability in mind. These neighborhoods are modern and architecturally attractive, while still operating in a manner that preserves energy usage and are built with renewable resources. North Charleston’s public transit system; CARTA (Charleston Area Regional Transit Authority) is not directly under the city’s control. The City of North Charleston does contribute funding to CARTA, so the presence of this indicator did earn another point for North Charleston, despite not being directly under the control of the City.

Mr. Johnson made the point that “Tax incentives for environmentally friendly development” (Question 7) was fulfilled by state incentives offered by the South Carolina Electric and Gas Company, which provides energy for much of the state that is not covered by Duke Energy. SCANA is a region-wide entity, making it clear that incentives and alternative energy for citizens are not under the control of any one municipality in the state of South Carolina. The City of North Charleston also builds all of it’s building to meet LEED certification, but due to cost it chooses to forego official designation. Although they are not officially LEED certified, this is still a contribution to sustainability within the city. Mr. Johnson noted that the city employs the use of wind turbines on the roof of City Hall, as well as solar water heaters in several of the fire stations. While North Charleston may not be able to regulate alternative energy for its citizens, it has taken some steps to mitigate its own use of non-renewable energy.

The final note on sustainability in North Charleston is the fact that private enterprise within the city handles industrial and hazardous waste recycling, and Charleston County picks up all recycling within the city and sells it. While these indicators are present within the city, they are not a function of the city, meaning that North Charleston may be more sustainable than this survey belies.

City of Charleston

Carolee Williams, Project Manager for the City of Charleston’s Planning, Preservation & Sustainability Department answered the questionnaire, which resulted in a score of 22. Charleston and Columbia were the only two cities to have specified a department and official to focus on sustainability issues. While the City of Charleston did not have an indicators project within the last 10 years, it did have a program that did not fall into any indicator in the index. The Green Business Challenge is an annual competition that encourages businesses to show improvements such as decreased energy consumption, or becoming LEED certified.
The City of Charleston also features household waste, industrial, and hazardous waste recycling programs similar to the City of North Charleston, where the county handles hazardous and industrial waste recycling. Charleston has placed such emphasis on historic preservation and sustainability that it is the only city in the survey to have changed the title of their planning department to include clear mention of the other two operations. The Office of Planning, Preservation, and Sustainability has 40 employees, four of whom are tasked to handle all planning and sustainability issues and goals. Besides the City of Columbia, Charleston was the only other city to explicitly assign a department and administrator to focus on Sustainability.

The City of Charleston has also partnered with the South Carolina Sustainability Institute, and initiated a program to launch the first ‘Eco-District’ in South Carolina. The goal of this project will be to encourage an entirely sustainable mixed-use neighborhood – not just green housing – where businesses, homes, shops, and other activities will all take place under sustainable guidelines. The City has also declared its support for offshore wind energy development.

City of Columbia

Mary Pat Baldeauf, Sustainability Coordinator for the City of Columbia responded to my survey request and discussed the topic of sustainability. The final score for Columbia was 22. The City has the Climate Protection Action Campaign (CPAC), an office that deals with sustainability and green programs within the Public Works department. This department handles air quality, recycling, energy conservation, green building, transportation, and green business. Columbia’s dedication to sustainability is arguably the most robust among the five cities in the state – but the index and the responses given to the survey still resulted in a middling score.

One of the main reasons the City of Columbia does not appear to surpass any of the other cities with similar characteristics is because it did not meet the requirements for the fifth and sixth questions: “Zoning used to delineate environmentally sensitive growth areas” and “Comprehensive land-use plan that includes environmental issues.” However the Zoning Ordinance and the Comprehensive Plan for the City are being completely re-written and the CPAC is actively engaged in both projects. Columbia is also similar to the cities of North Charleston and Charleston in that it does not run the public transit, but it supports COMET – the transit system in Columbia, which is undergoing a major transition into a 100% alternative energy fleet. The City also has two electric vehicle charging stations, and the state of South Carolina is 8th in the nation overall for vehicle charging stations. Columbia is adding alternative energy fueled vehicles to its fleet, has a bicycle-sharing program for city employees, and has reached the achievement of a Bronze Level Bicycle City.

Columbia was the only city in the study to have its own “Air pollution reduction program” (Question 16), which was formed in 2006 specifically for this purpose. Baldeauf reported that the entire Midlands area faces non-attainment for ground-level ozone, and the City of Columbia is working with other governments in the region to reduce air pollution through several projects. It is also unique in that it is one of only two (the other being the City of Greenville) cities in the study to have an established organization for “Green Business”. The City of Columbia’s Green Business membership program boasts over one hundred-and-fifty members, and holds an annual Green is Good for Business conference.

Columbia lacks official programs for asbestos and lead paint reduction programs, as well as recycled product purchasing by the city government (Questions 17, 18, and 20) and has no renewable energy use by the city government, or energy conservation incentives for builders (Questions 26 and 27). The other cities in the study had some form of these, either through the municipality itself or through some function of a regional or state requirement. It may be that sustainability has become an important issue in recent years and opportunities to affect change have only arisen recently in the process of re-writing the Zoning Ordinance and Comprehensive
plan. The author believes that if this same study were to be repeated five years hence, the results for the City of Columbia would likely include the presence of several more indicators.

**City of Greenville**

Nancy Whitworth, Director of Economic Development for the City of Greenville completed the index survey by circulating it among several administrators within the City of Greenville. This city’s score reached a total of 24, the top score among the cities surveyed.

Greenville was the only city in the study to include its own drop off locations for items such as batteries, ink cartridges, cell phones, and eye glasses, as well as the only city to have implemented Integrated Pest Management, an effective and environmentally sensitive approach to pest management. It is also unique among the cities in its emphasis on heat mitigation and has increased tree and vegetative cover. The City also has a landscape ordinance that specifies landscape regulations in new construction sites – relevant to the City of Greenville as it has the highest level of new construction among the five cities.

All new construction projects within the city are required to meet Energy Star standards, and the Community Development department works through a program to improve energy efficiency in existing homes by replacing light fixtures, windows, insulation, and plumbing. The city uses Energy Star appliances for its facilities and several of its vehicles are fueled with biodiesel, natural gas and propane injection.

Most important to the City of Greenville’s sustainability is the existence of the Green Ribbon Advisory Committee, which is citizen led and staffed through the Parks and Development department. This committee includes several prominent leaders within the city, and makes recommendations to the City Council and City Manager. Through the Green Ribbon Advisory Committee, meetings are held with residents to craft livability and sustainability goals for the city. Greenville has also gained several grants in order to fund the Connections for Sustainability program, which holds workshops and seminars within the city in order to raise awareness on urban sustainability. Greenville’s dedication and implementation of various projects and programs to increase sustainability place it among the top two cities examined.

**5. Conclusion**

The data analyses support the hypothesis. The cities of Greenville, Charleston, and Columbia did have higher PSI scores (24, 22, and 22 respectively) than North Charleston and Spartanburg (20 and 19 respectively). As indicated above, the three higher scoring cities also have a greater presence of a Creative Class (younger and more affluent and educated population) and a weaker presence of manufacturing as a percentage of the total industry.

There are two instructive points worth noting about the two cities with the highest (Greenville) and lowest (Spartanburg) scores. First, these two cities are in the same region of the state and are only a 30-minute drive apart from each other. This suggests that regional differences within the state are likely unrelated variations in sustainability. Second, they are considerably smaller than the other three cities in the study, indicating that population size is not likely a predictor of sustainability. The findings suggest that the most important factors in determining the sustainability of a city in South Carolina is the economy and demographics people who live there.

Although not specifically designed for smaller cities, the Portney Sustainability Index is widely accepted in the academic and political communities as the dominant measurement to evaluate the policies and practices of municipalities. The research process does, however, uncover some two potential limitations. First, the indicators that were associated with renewable energy resources, air pollution reduction, and industrial/hazardous waste recycling were present, but were created and run by the non-profit sector, private businesses, or
statewide entities. Had the municipalities themselves controlled these indicators, they would have added points to the overall scores of the cities. This may hint that sustainability in South Carolina is as much of a statewide as a municipal issue, despite the differences between the five largest cities. The PSI focuses solely on municipalities rather than states. Further studies might assess sustainability policies at a state level using other measurements.

Second, the PSI evaluates the simple presence of an indicator through a dichotomous (yes or no) alternative. While this information allows research such as this to shed light on differences between cities, it does not measure the level in which an indicator is present. For example, two different cities might respond, “yes” to the existence of a bicycle ridership program. But if one program has 5,000 bikes and the other has 50, then it could be argued that the first city is more sustainable even though both meet the criteria for the PSI. Future research should consider these differences. Despite these limitations, while past research has focused squarely on large metropolitan areas in other regions of the country, this paper is a significant first attempt in evaluating sustainability in South Carolina. Further it supports past research that finds that demographics and economic factors promote sustainable policies and practices.

6. Conclusions and Discussion

The key findings of this study indicate that rural hospitals are lagging behind their urban counterparts in the implementation of CDS systems. Studies have demonstrated the ability of CDS to improve patient outcomes, thereby improving quality and efficiency. Policymakers should consider the disparities in EHR implementation by location for future policies as a tool to improve the disparities in health outcomes that exist across rural and urban locations.

The finding that nonteaching hospitals have significantly higher levels of implementation for COPE and CDS than teaching hospitals is important to note. Teaching hospitals play a vital role in experiential learning for new physicians. The implications of failing to train new physicians on systems that will be required by health policy in the years to come could be of concern. Understanding the barriers to implementation for teaching hospitals should be further investigated in order to close the gap among the levels of implementation across nonteaching and teaching hospitals.

The overall examination of implementation by structural characteristics revealed that CDS seemed to have more variation in implementation of its functions than CPOE. This is as the authors anticipated, in that the use of CDS relies on the input of data using the CPOE sub-functions. Therefore, it could be said that some CPOE sub-functions are likely required to be in use in order for a CDS system to work. For example, if a patient’s medications are not entered electronically using the CPOE medication ordering sub-function then that would possibly prevent the CDS sub-function drug-drug interaction from alerting the physician that the drug he/she is ordering interacts with something a physician might have prescribed a day prior. Thus, it could be concluded that some CDS sub-functions are implemented by those that already have certain CPOE sub-functions being used. Further examination of the adoption and implementation patterns examining the relationship between implementation of certain CDS sub-functions and their potential contingency on the implementation of select CPOE functionalities would be of interest.

Computerized provider order entry (CPOE) and clinical decision support (CDS) systems have been touted as being key functionalities of EHRs that have the potential to improve patient outcomes. Understanding how to motivate the implementation of EHR adoption laggards is important for policymakers in order to determine the characteristics, including a consideration of structural factors, of hospitals that should be targeted with incentives to implement this technology. The government is one of the largest payers of healthcare and has a direct interest
in potential benefits that EHR use can generate, which warrants the need for studies of this kind that can be used to guide policymakers in their decision-making.

7. References


8. Appendices

Appendix 1.

Sustainability Indicator Questionnaire:

Each indicator present is counted as a +1 to a municipality’s overall score, with 0 being the lowest and 38 being the highest. If your municipality has a presence of any of these indicators, you may simply answer yes or no and/or briefly describe the program in one or two sentences, or more, if you feel necessary. Please add your comments to this document, preferably in a font color other than black.

Does your city have:

Smart Growth Activities
1. Eco-industrial park development?:
2. Targeted or cluster economic development?:
3. Eco-village (urban infill housing) project or program?:
4. Brownfield redevelopment (project or pilot project?)?:

Land-Use Planning Programs, Policies and Zoning
5. Zoning used to delineate environmentally sensitive growth areas?:
6. Comprehensive land-use plan that includes environmental issues?:
7. Tax incentives for environmentally friendly development (other than energy efficiency counted elsewhere)?
Transportation Planning Programs and Policies
8. Operation or sponsorship of public transit (buses and/or trains)?
9. Limits on downtown parking spaces?
10. Car pool lanes on city streets (high occupancy vehicle or diamond lanes)?
11. Alternatively fueled city vehicle (green fleet) program?:
12. Bicycle ridership program?:

Pollution Prevention, Reduction and Remediation
13. Household solid waste recycling?:
14. Industrial recycling?:
15. Hazardous waste recycling?:
16. Air pollution reduction program (e.g., reduction in volatile organic compounds)?
17. Recycled product purchasing by city government?:
18. Superfund (non-brownfield) site remediation?:
19. Asbestos abatement program?:
20. Lead paint abatement program?:
21. Pesticide reduction program?:
22. Urban garden/sustainable food system or agriculture program?:
23. Heat island mitigation program (other than green roofs)?:

Efficiency
24. Green building program?:
25. Green affordable/low income housing program?:
26. Renewable energy use by city government?:
27. Energy conservation/efficiency incentives or rebate program (other than green building program)?:
28. Alternative energy offered to consumers (solar, wind, biogas, etc.)?:
29. Water conservation program?:

Sustainable Indicators Project
30. Sustainable indicators project active in last five years?:
31. Indicators progress report in last five years?
32. Does indicators project include “action plan” for policies/programs?:

Organization/Administration/Management/Coordination/Governance
33. Single government agency, office or person responsible for implementing sustainability programs?:
34. Sustainability an explicit part of a citywide comprehensive or general plan?:
35. Involvement of county government or metropolitan council?:
36. Involvement of mayor or the chief executive officer?:
37. Involvement of business community (e.g., chamber of commerce, sustainable business organization)?:
38. General public involvement (public hearings, visioning process, neighborhood groups or associations, etc.)?:
Appendix 2.

Sustainability Indicator Index:

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Variation in Implementation of Electronic Health Record (EHR) Functionalities Across Hospital Characteristics

**ABSTRACT.** The American Recovery and Reinvestment Act's Health Information Technology for Economic and Clinical Health (HITECH) provision of 2009 seeks to incentivize provider adoption and use electronic health records (EHRs) in a "meaningful" way, including functions related to error reduction and cost containment. The aim of this study is to investigate the relationship between three levels of computerized provider order entry (CPOE) and clinical decision support systems (CDS) implementation of select functionalities and hospital structural characteristics in order to understand the current state of technology use. Bivariate analyses using chi-square significance tests were used to determine if the level of EHR implementation across hospitals (n=347) for five computerized provider order entry (CPOE) and five clinical decision support (CDS) functionalities varied by hospital ownership (profit status), teaching status (academic/non-academic), rural/urban location, and multi-hospital membership. Bivariate analyses revealed significant relationships between levels of implementation for four of the five select CDS sub-functions for location, almost all CPOE and CDS sub-functions by academic status, and four of five CDS sub-functions by location. The implementation level of the CPOE functionality nursing orders was the only hospital characteristic of significance by hospital ownership status. The HITECH provision initiatives could play a vital role in achieving the goal of title III of the Patient Protection and Affordable Care Act to improve the quality and efficiency of health care. In order to achieve this goal studies such as this are important in the examination of the current state of use.

**AMANDA STEVENS** is a senior at USC Upstate pursuing a Bachelor's Degree in Information Management and Systems with a focus in Healthcare Information Systems. She began working with Dr. Deshia Leonhirth in the Spring of 2014. The focus of their research was how the level of implementation of electronic health records varies across hospitals based on structural characteristics. Amanda has presented this and similar research at the James E. Clyburn Health Disparities Lecture in Columbia, SC, USC Columbia Discovery Day, and the USC Upstate Research Symposium. Upon graduation Amanda hopes to pursue a Master of Science in Informatics at USC Upstate and then gain RHIA Certification with the goal of working in a hospital setting. Through these experiences at USC Upstate Amanda hopes to be more prepared on how to properly conduct research, gather data, and create reports that will help her in the future as she furthers her career.

**DR. DESHIA LEONHIRTH** is an Assistant Professor of Health Information Management in the Department of Informatics at USC Upstate. She is from Greenville, SC and joined the faculty at USC Upstate in the Fall of 2013. Dr. Leonhirth earned her Master of Business Administration from Winthrop University and her Ph.D. from the University of South Carolina in Columbia in 2013. As a Doctoral student she worked at the South Carolina Rural Research Center as a Graduate Assistant on projects examining health disparities locally and nationally. Her other research interests include health information technology, quality improvement, patient outcomes, health policy, and operations management. Since her arrival at USC
1. Introduction

Electronic Health Records (EHRs) have slowly become recognized as an important tool within the healthcare industry. EHRs are used by many healthcare professionals, from physicians to nurses to health information managers (HIM). EHRs help make the process of data entry and maintenance easier and more convenient. It is thought that by 2024 EHRs will have reached their maximum amount of facilities [1]. Electronic health records (EHRs) have many benefits to offer the healthcare industry, even though some are still skeptical to adopt and implement the systems. Most drawbacks among individuals come from concerns about initial costs, maintenance costs, and temporary productivity reduction during training times [2]. However, the majority of experts believe that EHRs will have more benefits than drawbacks within an organization, especially when used in a “meaningful” way [2].

Understanding the patterns in which organizations are implementing EHRs and the characteristics of the organizations is of importance in determining how to shape healthcare policy to incentivize providers to adopt and implement EHR technology. The aim of this study is to investigate the relationship between three levels of computerized provider order entry (CPOE) and clinical decision support systems (CDS) implementation of select sub-functions and hospital structural characteristics.

There are four key functionalities of an EHR that contain various sub-functions/applications. The four main functionalities widely recognized include: Clinical documentation, computerized provider order entry (CPOE), clinical decision support systems (CDS), and results viewing. This study will focus on CPOE and CDS. Computerized provider order entry (CPOE) functionalities include five main applications considered by the AHA (2010): laboratory tests, radiology tests, medications (e-prescribing), consultation requests, and nursing orders. CPOE is most frequently noted for its quality benefits in the reduction of medication errors (MEs) and adverse drug events (ADEs), particularly when coupled with clinical decision support (CDS) systems that include drug-allergy and drug-drug interaction check applications [3]. Computerized provider order entry (CPOE) systems allow physicians to electronically enter their orders for tests, medications, and other requests rather than use the traditional paper-based ordering. Clinical decision support (CDS) systems can provide guidance to providers regarding care delivery in variety of ways: providing clinical standards of care based on what the patient is being treated for, clinical reminders (i.e., alerting the physician a patient is due for mammogram), and providing alerts if a physician is electronically prescribing a drug using CPOE if the patient has allergies to the drug, if there is a dosing error, or interactions with other drugs prescribed that may be of concern. While studies have shown CPOE and CDS have benefits when used together, some results have shown a reduction in errors and improved patient outcome with the exclusive use of CPOE [4]. This study will investigate implementation of select CPOE and CDS sub-functions.

2. Background

Structural factors, environmental factors, and interactions with other providers are three main mechanisms that have been used to describe the diffusion (market acceptance) and adoption of new health technologies [5]. This study will focus on the examination of structural factors. Structural factors or hospital characteristics can include hospital ownership/control (government-nonfederal, not-profit, for-profit), teaching status (academic, non-academic), hospital size (specific to region, location, and teaching status), and location (rural or urban).
Mixed literature on the adoption and implementation of EHRs has created the need for studies that further investigate this area. This study will focus on the examination of structural factors.

A. Hospital Ownership

Hospital ownership or profit status has been shown to have a mixed effect on health information technology (HIT) adoption decisions. McCullough [5] found that ownership has no relationship with adoption decisions. In some studies certain application clusters are more likely to be adopted by for-profit hospitals [6], while for-profit were more likely to adopt clinical type applications [7]. Other studies have also shown that non-profit hospitals are more likely to have EHR systems than for-profit, rather the implementation be with the CPOE or CDS [8]. The decision to implement in non-profit hospitals could be the result of the size of the IT budget, which is often larger than for-profit [9].

Within a hospital, regardless of ownership, CPOE and CDS adoption are evaluated based on the benefit to the organization. Medical errors are a challenge within healthcare, and a way to reduce them is always a topic of interest. Within hospitals implementing EHR systems, CPOE use demonstrated a significance reduction in the rate of medical errors [10]. Additionally, CDS use has shown an increase in quality improvements [11]. Despite both CPOE and CDS documented improvements in quality of patient care, the implementation of EHR technologies is minimal and information on hospital ownership as a diffusion factor is mixed. The mixed results in the literature call for the need for further investigation in this area.

B. Teaching Status

When a hospital is academic versus non-academic, some may think that it is better not to implement EHRs. This could be true because when teaching students, it is more useful for them to know how to perform tasks manually as well, so that if in the instance the technology were to fail they would be prepared to handle the challenges. In many academic hospitals, paper-based forms have a higher priority than electronic-based [12]. In some academic hospitals, mortality rates are an issue; however, when a highly commercial CPOE was implemented within a children’s academic hospital, the mortality rate decreased by a statistically significant amount [13]. In non-academic hospitals, CDS shows to perform well and help integrate patient data easily [14]. In some instances in academic hospitals, CDS attributes among EHR systems showed no consistent increase in quality [15]. It is important that as researchers we investigate the adoption and implementation of the sub-functions of COPE and CDS by teaching status to see if some hospitals are more likely to implement certain sub-functions over others.

C. Hospital Location

Hospital location in either a rural or urban setting is another type of structural factor that is frequently examined. Rural hospitals have the tendency to be smaller in size and lack the resources of their urban counterparts [16]. The differences in resource availability and populations served have created a number of health disparities across geographic location. In a national survey, HIT adoption and use in primary care offices was not much difference across rural and urban locations [16]. Research on hospital implementation found that rural hospitals seem to be behind urban hospitals in almost every aspect of “meaningful use,” which provides monetary compensation to incentivize providers to implement and use select functionalities of EHRs [17]. Other studies have found similar results; hospitals with rural designations have lower adoption of HIT than those in urban designations [6], [9], [18].

D. Multi-hospital Ownership
A multi-hospital system includes one or more branches that are owned by one central organization. When it comes to the implementation of EHRs, not only does hospital size and tax status relate to the rate of implementation, but system membership does as well [19]. Multi-hospital membership is considered one of the largest determining factors when considering whether or not to adopt and implement an EHR system [5], [9]. This membership serves as one of the most important factors because benefits are experienced more within these hospitals due to the time and expenses to implement the technology being spread among multiple locations for one organization [19]. Among hospitals adopting, multi-hospital pediatric systems became the leader in EHR system implementation [9]. While it seems as though the results are conclusive, it is important to evaluate the variation over time as EHRs should be adopted at a higher frequencies and determine if the gap between single hospital and multi-hospitals implementation is closing over time.

3. Significance & Aim

The aim of this study is to investigate the relationship between three levels of computerized provider order entry (CPOE) and clinical decision support systems (CDS) functionalities implementation and hospital structural characteristics. By examining the five sub-functions of both CPOE and CDS, our results will add to the current literature in providing a more focused investigation of the implementation patterns of implementation of the sub-functions. Most of the results presented are somewhat outdated today, as EHR implementation has increased drastically since the availability of financial incentives. The hope is now that more hospitals are implementing EHRs, there is less of a disparity among the characteristics of those hospitals. The results of this study are intended to provide clarification on findings of previous studies that reported mixed results on implementation by structural characteristics.

4. Methods

A. Data Sources

The 2010 American Hospital Association (AHA) Information Technology (IT) Supplement [20] was merged with the 2010 Nationwide Inpatient Sample [21]. The AHA-IT supplement surveys hospital’s on their level of implementation of EHR functionalities. We examined two main categories of functionalities: CPOE and CDS. The two main functionalities were selected from those that aligned with government incentives for “meaningful use” of EHR technology. We examined the level of implementation of five sub-functions of CPOE (medications, laboratory tests, radiology tests, consultation requests, nursing orders) and six sub-functions of CDS (drug-allergy alerts, drug-drug interaction alerts, clinical guidelines, clinical reminders, drug-lab interaction alerts, drug dosing support). For each sub-function, hospitals responded with their level of implementation from 1-6 as shown in Table 1.

B. Study Design and Sample

The study sample used a conservative estimate of the levels of implementation by focusing on those hospitals that had fully implemented the selected functions across all clinical units (Table 1, see Level 1). This conservative criterion is consistent with that [22] used in the examination of a comprehensive EHR. A comprehensive EHR includes full implementation of all 24 sub-functions across all clinical units. The sample included hospitals present in both datasets (n=347). Using SAS 9.2 software, bivariate analyses using chi-square significance tests were used to determine if level of EHR implementation for five CPOE and six CDS functionalities varied by ownership, teaching status, urban/rural location, and multi-hospital ownership.
Table 1. Levels of EHR Implementation

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<td>(1) Fully implemented across all clinical units</td>
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<tr>
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<td>(2) Fully implemented in at least one clinical unit</td>
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<tr>
<td>1</td>
<td>(3) Beginning to implement in at least one clinical unit</td>
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<td>(4) Have resources to implement in the next year</td>
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<td>(5) Do not have resources but considering implementing</td>
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<td>(6) Not in place and not considering implementing</td>
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5. Results

All analyses were conducted at 95% confidence interval ($\alpha = 0.05$). Bivariate analyses revealed that non-profit hospitals have significantly higher levels of implementation of the CPOE sub-function nursing orders as compared to for-profit and government owned hospitals (Table 2). Significant relationships were detected across implementation levels of all CPOE and CDS functionalities by teaching status (Table 3), showing that nonteaching hospitals have higher levels of implementation than teaching hospitals. Within the hospitals studied, there were no significant differences detected for the five CPOE sub-functions (medications, laboratory tests, radiology tests, consultation reports, and nursing orders), or within the CDS sub-function drug dosing support for rural/urban locations (Table 4). However, the analysis did reveal that urban hospitals had significantly higher levels of implementation for four of the five CDS sub-functions (clinical guidelines, clinical reminders, drug allergy alerts, and drug-drug interaction alerts) across rural-urban locations (Table 4). Hospitals that are members of a system were found to have significant differences in the implementation of consultation requests (CPOE) and clinical reminders (CDS). In comparing hospitals by multihospital membership (Table 5) we found significant differences in hospitals who achieved the two most advanced levels (Levels 1 and 2) of implementation for consultation requests (CPOE) and clinical reminders (CDS) showing that hospitals who are not part of a system implemented these sub-functions more frequently.
Table 2: Hospital level of EHR implementation by ownership status, 2010 (*p < 0.05).

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Clinical Decision Support

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</table>

*p<0.05

Table 3: Hospital level of EHR implementation by academic status, 2010 (*p < 0.05).

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Clinical Decision Support

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Table 4: Hospital level of EHR implementation by rural or urban location, 2010 (*p < 0.05).

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<td>53.85*</td>
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<td>54.89</td>
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Table 5: Hospital level of EHR implementation by multi-hospital ownership, 2010 (*p < 0.05).

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<td>Drug-drug Interaction Alerts</td>
<td>45.83</td>
<td>54.17</td>
<td>57.14</td>
</tr>
</tbody>
</table>
| Drug Dosing Support      | 46.83       | 53.17       | 53.45       | 46.55       | 39.57       | 60.43       

5. Conclusions and Discussion

The key findings of this study indicate that rural hospitals are lagging behind their urban counterparts in the implementation of CDS systems. Studies have demonstrated the ability of
CDS to improve patient outcomes, thereby improving quality and efficiency. Policymakers should consider the disparities in EHR implementation by location for future policies as a tool to improve the disparities in health outcomes that exist across rural and urban locations.

The finding that nonteaching hospitals have significantly higher levels of implementation for COPE and CDS than teaching hospitals is important to note. Teaching hospitals play a vital role in experiential learning for new physicians. The implications of failing to train new physicians on systems that will be required by health policy in the years to come could be of concern. Understanding the barriers to implementation for teaching hospitals should be further investigated in order to close the gap among the levels of implementation across nonteaching and teaching hospitals.

The overall examination of implementation by structural characteristics revealed that CDS seemed to have more variation in implementation of its functions than CPOE. This is as the authors anticipated, in that the use of CDS relies on the input of data using the CPOE sub-functions. Therefore, it could be said that some CPOE sub-functions are likely required to be in use in order for a CDS system to work. For example, if a patients medications are not entered electronically using the CPOE medication ordering sub-function then that would possibly prevent the CDS sub-function drug-drug interaction from alerting the physician that the drug he/she is ordering interacts with something a physician might have prescribed a day prior. Thus, it could be concluded that some CDS sub-functions are implemented by those that already have certain CPOE sub-functions being used. Further examination of the adoption and implementation patterns examining the relationship between implementation of certain CDS sub-functions and their potential contingency on the implementation of select CPOE functionalities would be of interest.

Computerized provider order entry (CPOE) and clinical decision support (CDS) systems have been touted as being key functionalities of EHRs that have the potential to improve patient outcomes. Understanding how to motivate the implementation of EHR adoption laggards is important for policymakers in order to determine the characteristics, including a consideration of structural factors, of hospitals that should be targeted with incentives to implement this technology. The government is one of the largest payers of healthcare and has a direct interest in potential benefits that EHR use can generate, which warrants the need for studies of this kind that can be used to guide policymakers in their decision-making.

6. Acknowledgements

This study was funded by the Office of Sponsored Awards and Research Support.

7. References

Variation in implementation of electronic health record (EHR) functionalities across hospital characteristics


Factors Influencing a Woman’s Decision to Receive Medical Treatment for Infertility

**ABSTRACT.** Previous research has shown a definite connection between infertility and higher amounts of stress along with copious other negative mental health consequences. This makes one wonder why a woman would not seek treatment for infertility. Based on an analysis of a primary survey of 68 women, this study examines factors that influence a woman’s decision to receive or decline treatment for infertility. The influence of income, previous children, beliefs about motherhood and family, ethical concerns, and social support are examined. Respondents were divided into two groups; those who had received treatment and those who had not. The former (the treatment group) was analyzed based on their responses to actual treatment received while the latter (the hypothetical or control group) was analyzed based on responses to prospective treatment. Results show that the hypothetical and treatment groups differ in terms of the influence of certain socio-economic factors and also the effect of certain cultural and social belief statements associated with infertility treatment decisions. The findings provide important bases for understanding fertility treatment decisions and for developing appropriate intervention measures.

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**DR. CALVIN ODHIAMBO,** PhD is originally from Kenya and is an Assistant Professor of Sociology in the department of Sociology, Criminal Justice, and Women Studies at USC Upstate. Dr. Odhiambo earned his Ph.D. in Sociology from Indiana University and both his Master’s and Bachelor’s degrees from the University of Nairobi, Kenya. Much of his research is in medical sociology, particularly in the intersection between HIV/AIDS and Cardiovascular Disease. He has provided scholarly presentations regionally and nationally on the topics of health and teaching pedagogy. The current work with Kelsey on infertility captures Dr. Odhiambo’s growing interest in the woman’s health and in collaborative scholarly work with students. Some of his previous publications have been in such journals as Cross-cultural Studies, College Teaching, International Journal of Humanities and Social Science, and Ethnicity and Health, among others.
1. Introduction

The desire to have children is a powerful and widespread quest for many. However, for some people, this desire is not easily fulfilled due to infertility. The medical community generally defines infertility as the inability to conceive after twelve months of regular, unprotected sexual intercourse [1]. According to the Center for Disease Control and Prevention (CDC), infertility affects 6% of married women in the United States between the ages of 15 and 44. Additionally, eleven percent of women in their reproductive ages will experience some difficulty in becoming pregnant or carrying a pregnancy to term.

At some point most women will have to make a decision about their intent to have children. For some this decision may be a result of carefully calculating the timing of a child and ensuring that career and educational goals are first achieved [2]. There are also women who cannot have children due to medical reasons and thus the decision is biologically determined. Women facing infertility often have difficult choices to make regarding family planning. What happens when a woman has decided that she wishes to start a family and finds herself experiencing infertility?

Infertility can cause an array of negative outcomes for a woman - including, but not limited to, heightened stress, marital problems, and depression [3]. In a study on the stigma of involuntary childlessness, [4] found that women who were struggling with infertility felt like they had failed, were stigmatized, and generally ashamed because of their infertility. Drawing from Pearlin's stress model, [5] determined that infertility qualifies as a stressor. Although they examined several hypotheses, the study ultimately concluded that a woman who wishes to have a child, yet remains childless, will experience the greatest amount of stress as a result of infertility and that this stress is most likely a result of losing the master status of “mother”. Couples dealing with infertility can find themselves having marital problems due to the wife’s inability to conceive. Such marital problems could include fighting about medical decisions, experiencing a decrease in sexual drive, and experiencing social isolation [6]. Given these and many other negative outcomes one must wonder why some women may choose to treat infertility while others would not.

Several previous studies identified factors associated with decisions to seek infertility treatment. Some of the factors included an overwhelming desire to have children [7], having income of more than $50,000 a year [8], higher education, being married and being infertile for more than five years [9]. On the other hand, major barriers to infertility treatment included probability of treatment failure, couple's age and possibility of high risk pregnancy [10], injection-related anxiety and desire to conceive naturally [11], adverse obstetric outcomes [12], increased risk of cancer in children born following fertility treatment [13], increase in breast cancer risk among women who have received repeated treatment, particularly due to widespread use of ovulation-stimulating fertility drugs [14], and risk of certain mental disorders and certain diseases such as asthma in children born following fertility treatment [15]–[16].

Medical and natural science disciplines have contributed the majority of research on infertility treatment. Even though infertility is a biological fact, sociological studies are needed to evaluate the stigma attached to an infertility diagnosis, including some of the societal and individual responses to infertility. In addition to examining the physical and biological factors associated with infertility treatment seeking decisions among women, this paper will also examine a host of social and demographic factors that may be in play. In particular, this study will examine the contribution of factors such as annual family income, current number of children, beliefs regarding family, motherhood and adoption, ethical and financial concerns, and amount of social support available.
2. Methods

Data for this study came from an original survey created on www.surveymonkey.com utilizing a combination of availability and snowball sampling methods. The survey was initially administered to a network of friends from a social media website and to a private social media group consisting of Korean-American adoptees. One electronic mail copy was sent to a select group of friends. Participants were encouraged to send the survey to friends that they thought may be willing to respond to the survey. Respondents were given 7 days to access the survey. In total 74 women over the age of 18 completed the survey. Six of these women were excluded from the analysis because they were over the child-bearing age (according to CDC). The final sample therefore consisted of 68 women of child-bearing age.

Consistent with the CDC definition infertility was measured based on respondents’ answer to the question, “Have you had regular, and unprotected sex without the use of any contraception for 12 consecutive months without becoming pregnant? If the respondent answered “yes” she was considered infertile. Respondents were also asked to indicate if they had any children and this included step-children, biological children, and/or adopted children.

Of the remaining 68 women, an additional 14 were excluded from the analysis because they reported that they had experienced infertility and sought treatment. The final sample consisted of 54 women who were of child bearing age but did not experience infertility or did not seek treatment if they experienced infertility.

Respondents were further put into two groups based on their response to whether they had received infertility treatment or not. Each respondent was presented with a comprehensive list of infertility treatment options (generated from existing literature) and asked to select the ones they had used. The treatment options included: consulting a medical doctor and/or receiving advice from a doctor; fertility testing on self; fertility testing on partner; ovulation drugs; surgery or treatment for blocked tubes; artificial insemination; assisted reproductive technology; treatment for uterine fibroids; treatment for endometriosis; medical help to prevent miscarriage; surrogacy. Respondents were also given the option to indicate that they had not received any infertility treatment. Those who indicated that they had received infertility treatment were categorized as the “treatment group”, the rest were categorized as the "hypothetical group".

If the respondents had not received infertility treatment, they were asked how likely they were to utilize infertility treatment if an infertility issue should ever arise. These respondents were put in the "hypothetical group".

A series of belief statements were listed on the survey and respondents were asked to rate each statement on a scale of 1 to 5, with 1 being “strongly disagree” and 5 being “strongly agree”. These belief statements were constructed by drawing on research that found cultural and social factors as possible determinants of seeking treatment (see the appendix for a copy of the questionnaire). The data was analyzed using the Scientific Package of Social Sciences (SPSS).

3. Results

Table 1, below, presents the correlation analysis of the “treatment” and “hypothetical” groups. There was no statistically significant relationship between hypothetical treatment and having children. In fact, the relationship between hypothetical treatment and children was slightly negative (-.21), suggesting that those who had children had an overall lower score on hypothetical treatment. For this set of data, income and infertility were not significantly correlated. Likewise, insurance was not significantly correlated with the respondent’s hypothetical treatment score. On the other hand, both income and insurance turned out to have positive and significant relationships with decision to seek treatment in the treatment group. Five
of the eleven belief statements associated with cultural and social factors turned out to be significantly correlated with hypothetical treatment. Two of the statements assessing the respondent’s feelings about motherhood and family were significantly correlated with treatment.

The first statement was “family is the most important thing in my life” (r value = .273; p value = .041). The second statement was “If I found out I could not become pregnant I would be devastated” (r value = .437; p value = .001). The statement regarding treatment, “I would do anything I could in order to treat infertility” was strongly correlated with hypothetical treatment (r

<table>
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**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
value = .620; p value = .000). Lastly, the two statements regarding adoption were significantly correlated with treatment scores. The first statement, “If I could not have children I would consider adoption” had a stronger correlation (r value = .439; p value = .001) than the second statement, “I would consider adoption whether I could or could not have children “(r value = .291; p value = .029). It is important to note that none of these five statements were significantly correlated for the treatment group. Possible reasons for this are discussed below.

Table 1 highlights one more important difference between the hypothetical and the treatment group regarding the belief statements associated with cultural and social factors. As already pointed out above, the first adoption statement (“If I could not have children I would consider adoption”) had a positive and statistically significant relationship for the hypothetical group. However, the first adoption statement showed a negative correlation in the treatment group; although the negative correlation was not statistically significant, the trend indicates that those in the treatment group may be less likely to adopt children. The second adoption statement stated that “I would consider adoption whether I could or could not become pregnant”. Again, this statement was significant and positive for the hypothetical group but both negative and not significant in the treatment group, again, suggesting that those in the treatment group would not adopt a child regardless of their infertility status. Finally, the statement about having a social support system that the respondent can rely on was positive. While this may give the impression that social support was not important for the treatment group, a likely explanation here is that since they already had a child (or children), their need for social support was partly met by their having children, unlike those who did not have any children.

4. Discussion/Conclusion

Based on the results of this study we can infer a few things regarding treatment-seeking behavior for women who are dealing with infertility. Having previous children appears to deter a woman from seeking infertility treatment. It is plausible that the women who received treatment had children as a result of their treatment, which obviated the need to seek further treatment. This would be consistent with studies that found infertility treatment was, in part, driven by an “overwhelming desire to have a child”[7], which suggesting that studies should clearly distinguish between “primary infertility” (i.e., the inability to conceive after twelve months of regular, unprotected sexual intercourse) and “secondary infertility” (i.e., the inability to conceive a child after a previous child or children following twelve months of regular, unprotected sexual intercourse). The reason for such vigilance is that both states of “infertility” produce different outcomes.

Income and insurance appear to be important factors in seeking treatment. This is also consistent with previous studies that found that ability to pay for the infertility treatment influenced treatment-seeking decisions. Some of these studies actually found that incomes had the strongest positive association with infertility treatment. The observation that incomes were negatively associated with the hypothetical treatment suggests that for some women who may desire infertility treatment, the prospective high cost becomes a barrier to their infertility treatment decisions.

There are two possible ways to understand the difference between the hypothetical and the treatment group involving the five belief statements associated infertility treatment decisions. First, taken together, the five belief statements that were statistically significant (see Table 1 above) suggest that the intensity of one’s desire to have a child becomes a powerful determinant of infertility treatment decision. The statement that captures this sentiment best is the one that says “I would do anything I could in order to treat infertility.” Even though the outcome for religion is not statistically significant, the positive association here suggests that, for some women, the desire to have a child would be strong enough to trump any religious
teachings that may try to prevent one from utilizing fertility treatment. This overwhelming desire to have a child is accentuated by the observed views about adoption, as an option. On the other hand, though, the lack of statistically significant correlations for the treatment group should not be seen as a contradiction of the above observation. Instead, the outcome for this group is possibly a result of the low number of cases in this category (only 12 as opposed to 56 in the hypothetical group), as correlation analyses tend to be unstable with smaller samples. Small sample sizes can be considered as one of the main limitations of this study. Another one is the lack of random sampling in our study design. Snowball sampling, similar to that used in this study, tends to not be very representative of the general population or to capture the different nuances of a particular phenomenon. A larger and more representative sample may yield more reliable findings.

In spite of our study’s limitations, our findings provide some important observations. First, it is important to examine cultural and social factors that may encourage or discourage a woman to seek infertility treatment (e.g., importance of motherhood and ethical concerns). In addition, researchers should not ignore practical factors, such as financial ability to afford treatment and availability of insurance, as they are critical in determining a person’s access to treatment. While the decision to seek treatment is primarily based on a couple’s desire for a child, the decision could be constrained by associated cost and the potential financial burden associated with treatment.

Infertility is considered a “disease” of the reproductive system [17] and a disability under the Americans with Disability Act [18]. Thus, meaningful treatment of this disease or disability should involve the elimination of one of the biggest barriers to treatment – cost. Effort should be made to provide affordable infertility treatment options, regardless of income levels, and to ensure availability of comprehensive and universally available health insurance coverage for the treatment. In addition, since previous research demonstrated that some of the barriers to infertility treatment involve adverse effects associated with the treatment itself, greater care should be taken by health professionals to develop treatment options that limit adverse treatment outcomes and to provide education to the general public on available safe treatment options.

5. Acknowledgements

This study would not have been possible without the help and guidance of Dr. Andrew Beer, particularly in the initial data analysis.

6. References


