Evaluation of computer-based simulation for pain management education

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EVALUATION OF COMPUTER-BASED SIMULATION FOR PAIN
MANAGEMENT EDUCATION

by

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A thesis submitted in partial fulfillment of the requirements
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Thesis Chair: Dr. Kelly Allred

ABSTRACT

Effective pain management is an elusive concept in the acute care setting. Improving nurses' knowledge about optimal pain management is one way to improve the patient's pain experience. A computer-simulation game was developed as an alternative method of teaching the subject of pain management to nursing students. In the game, two patient scenarios are presented, one male and one female. Both patients present with acute pain and request help from the nurse. The player progresses through a series of nine questions as the scenarios unfold, each with one best or correct answer. The purpose of this study was to evaluate the game's potential as a teaching method compared to traditional methods of teaching, such as a lecture. A total of 30 nursing students participated in the study. After playing through the game, each student was asked to complete a post-game survey consisting of 10 standard 5-point Likert scale items and five open-ended questions. The survey was used to evaluate the students' enjoyment of the game, educational benefits, preference compared to traditional teaching methods, and perceived potential to change nursing practice. Results of the survey show that the majority of nursing students enjoyed playing the game and found it captured their attention more than traditional teaching methods. Nine out of the ten Likert scale items received universal high scores. Nursing students were receptive to the computer-simulation game as a teaching method and found it preferable to traditional methods.

DEDICATION

For my loving husband, thank you for being my best friend and supporting me through all of my ups and downs.

For my mom, thank you for being my inspiration to become a nurse and encouraging me to always follow my dreams.

ACKNOWLEDGMENTS

I would like to express my deepest gratitude to everyone who has made this thesis possible. First and foremost, to Dr. Kelly Allred, my chair person and fearless leader. You have been my guiding light throughout this adventure. I cannot thank you enough for everything that you have done for me. To my committee members, Dr. Linda Hennig and Dr. M.H. Clark, for your constant support and wisdom throughout the creation of this thesis. To my mom, for always being there when I need someone to talk to. And to my husband, for always being there to remind me of my goals when I lose sight of them. My success in nursing school and this thesis would not have been possible without you.

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CHAPTER ONE: INTRODUCTION

Pain management is a responsibility of every direct care nurse, regardless of the practice setting. The management of pain includes accurate patient assessment and development of a treatment plan based on that assessment designed to improve or alleviate the pain. Additionally, the nurse must document the assessment, actions taken, and the outcome of the treatment plan. Optimal management of acute pain often involves a multimodal treatment plan. This treatment plan will likely include the administration of medications, either opioids or non-opioids, or possibly both. Alternative or complementary therapies are also often considered, which might include the use of heat or cold, or distraction techniques such as watching television.

Multiple studies have shown that even though information about acute pain management is widely available, pain continues to be inappropriately managed and patients of all ages continue to suffer from pain during their hospital stay (Coker et al., 2008; Commission of Health Report Online as cited in Subramanian, Allcock, James, & Lathlean, 2011). A study by Coker et al. (2008) of 78 hospitalized older adults showed that on six acute care units at three different hospital sites, pain was inappropriately managed and did not follow the clinical practice recommendation guidelines. Furthermore, 70% of patients reported experiencing pain on the afternoon of the study and their nurses had not assessed, documented, or treated them for their pain (Coker et al., 2008).

Another study performed in 2007 by the National Health Service (NHS) in England surveyed 14,447 inpatients in acute NHS trusts (hospitals). The results showed that 67% of the patients surveyed experienced pain while in the hospital, despite the staff's efforts to treat it

(Commission of Health Report Online as cited in Subramanian, Allcock, James, & Lathlean, 2011).

Mandatory education programs are the primary method of communicating updated clinical practice guidelines, such as pain management techniques, to nurses and other health care professionals (American Nurses Association, 2010). The information provided is based on the most current research and evidence available. Providing this education plays a significant role in health care to ensure that optimum care is provided to all hospitalized patients. In order for current information to be integrated into nursing practice, the audience must be receptive to the information provided and the teaching method being used. Based on the Diffusion of Innovations Model (Rogers, 1995), new ideas are conceptualized in the following five step process: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. The decision process is further broken down into two pathways, adoption and rejection. When evaluating methods of teaching, the most effective methods are those that cause the audience to adopt and implement rather than reject the information that is taught.

As technology continues to advance, alternative teaching methods such as computer gaming and interactive simulation are becoming more accessible. A meta-analysis performed by Vogel, Vogel, Cannon-Bowers, Muse, and Wright (2006) compared the effectiveness of computer gaming and interactive simulation to traditional education methods. The study results yielded better attitudes toward learning and significantly higher cognitive gains when gaming and simulation methods were used instead of traditional methods (Vogel et al., 2006). These results were found to be significant across all age groups, with no differences between males and

females. The individuals who participated in the computer-based teaching methods on their own outperformed their peers who used the same methods within a group setting (Vogel et al., 2006).

With these results in mind, a computer-based game was designed to teach nursing students about pain management. The game is interactive and novel in appearance. This research examines the educational potential of the interactive computer game. Specifically, the purpose of this study is to evaluate how student nurses respond to an innovative computer-based game and evaluate its potential to change nursing practice related to the management of acute pain.

CHAPTER TWO: METHODS

The Educational Intervention

The computer simulation game consists of two simulated scenarios, one male patient and one female patient, set in an acute care hospital setting. In both scenarios, the patient is experiencing acute pain and seeks help from the nurse. A screen shot of the male patient scenario can be found in Appendix A. As the scenarios unfold, the player is walked through a series of 10 questions, each including one correct or best answer based on gold standards reported in the literature about pain assessment and management. The game is designed to award the player points for selecting the correct/best answer for each part of the scenario. At the conclusion of the game, a computer-delivered didactic summary featuring the author reviews the rationale for the correct/best answers.

Design

A one-group post-test only design was used to evaluate various aspects of the computer-based simulation game. The post-test was administered immediately following the participants completion of the game.

Human Subjects

Approval was obtained from the Institutional Review Board (IRB) at the University of Central Florida. Identifying information was collected when participants signed up for time slots to complete the study. This sign-up sheet was kept separate from the completed post-tests. Both forms were stored in locked file cabinets within a locked office. Participants were able to withdraw from the study at any time without penalty. A $10 gift card to a local coffee shop was provided as compensation to all that completed the study.

Sample

The sample was a convenience sample of nursing students matriculating through a Bachelor of Science program. Approximately 240 students were invited to participate in the study. The first 30 students that responded to the request were allowed to participate. Those who volunteered completed the computer-based simulation game and filled out the post-test immediately following completion of the game.

Setting

This research took place at the University of Central Florida in Orlando, Florida. The computer testing and post-test completion took place in an office with a computer, with no others present. The office was in a quiet location with minimal noise to avoid interruption or distraction.

Procedures

An announcement inviting participants was made verbally in class and also via email within the online course delivery system. Potential participants indicated interest in participating in the research by responding to the email or approaching the principal or co-principal investigator. Once contact was made, all questions were entertained and the subject determined if they wished to continue and participate in the study. No person opted to not participate after the initial contact. A mutually agreed upon time was determined to conduct the research. When the subject arrived to participate in the research, any additional questions were answered and the informed consent document was provided to the participant. This research qualified for waiver of the written consent process. The consent document was reviewed with the participant. All

participants were fluent in the English language, so all oral and written information was provided in English.

Measurement

The measures used in this study included a post-game survey adapted from Ogershok and Cottrell (2004) consisting of a standard 5-point Likert scale. The Likert scale was used to obtain quantitative data about the ease and enjoyment of game play, educational value on the subject of pain management, and perceived potential of the game to change nursing practice. There were a total of 10 questions on this portion of the survey. The answer choices included "Strongly Agree", "Agree", "Neutral", "Disagree", and "Strongly Disagree".

Five short answer questions were used to obtain qualitative data. These questions further assessed the educational benefits of the game and provided participants with an opportunity to make suggestions for changes within the game. A copy of the survey tool can be found in Appendix B. After completing the computer simulation game, each participant was asked to complete the survey. Descriptive statistics of the survey data were completed on SPSS for Windows (version 20).

CHAPTER THREE: RESULTS

Demographic Data

A total of 30 nursing students from the University of Central Florida participated in this study. This included 3 men and 27 women. The mean age among participants was 26.93 and ranged from 20 to 51 years. Education levels varied and included juniors in a Baccalaureate nursing program (n=2), seniors in a Baccalaureate nursing program (n=17), and second semester students of an Accelerated Baccalaureate nursing program with a previous bachelors degree in another subject (n=11).

Quantitative Data

Reliability of the questionnaire was done using Cronbach's alpha. The item related to the challenging aspect of the game was not included as this aspect was not directly related to the use of the technology. Cronbach's alpha for the 9 items that related to the technology was 0.784.

The computer simulation game was played and evaluated by 30 nursing students. Means and standard deviations for each question can be found in Table 1 (Appendix C). Question 1 asked each participant to rate their comfort level using technology. Approximately 97% (n=29) strongly agreed they were comfortable using the computer to point and click. Question 2 asked participants to rate if the instructions to play were easy to understand. Approximately 83% (n=25) strongly agreed the instructions were easy to understand while 13.3% (n=4) simply agreed, and another 3% (n=1) disagreed. Question 3 asked participants to rate the creativity and quality of the game. Approximately 53% (n=16) strongly agreed the game was creative and 37% (n=11) agreed. Question 4 asked participants to rate how entertaining and fun the game was to play. Approximately 47% (n=14) strongly agreed the game was entertaining and fun to play and

33% (n=10) agreed. Another 13% (n=4) were neutral about the game being entertaining and fun to play, and 7% (n=2) disagreed the game was entertaining and fun to play. Question 5 asked the participants to rate the educational value of the game on the subject of pain management. Approximately 63% (n=19) strongly agreed the game had educational value while approximately 37% (n=11) agreed. Question 6 asked participants to rate the amount of motivation it gave them to learn and read more on the subject of pain management. Approximately 37% (n=11) strongly agreed the game motivated them to learn more about pain management, 40% (n=12) agreed, and 23% (n=7) were neutral. Question 7 asked participants to rate their level of preference to play a game like this instead of a regular lecture. Approximately 87% (n=26) strongly agreed and 13% (n=4) agreed that they would prefer this type of game rather than the traditional lecture. Question 8 asked participants to rate how challenging they found the game to be. Approximately 3% (n=1) strongly agreed the game was challenging while 37% (n=11) agreed. An additional 23% (n=7) were neutral about the game being challenging, 27% (n=8) disagreed, and another 10% (n=3) strongly disagreed the game was challenging. Question 9 asked participants to rate how much they agreed with the statement "Overall rating of game experience was excellent". Approximately 53% (n=16) strongly agreed that the game experience was excellent, while 40% (n=12) agreed. Question 10 asked participants to rate the amount of potential of this game to change pain management practice in nursing. Approximately 50% (n=15) strongly agreed the game has the potential to change practice and 40% (n=12) agreed, and 10% (n=3) were neutral on this question.

Pearson Chi Square test results for each question are reported in Table 2 (Appendix D). The statistical assumption for having at least five cases per cell was violated. The only question showing statistical significance was question 8,

$x^2(5, N = 30) = 10.57, p < .05$. This question was related to the level of challenge of the computer simulation.

Qualitative Data

The post-test survey included five open-ended questions and all 30 participants responded to each question, providing a total of 150 responses to evaluate. The first question asked for suggestions to improve the game. These suggestions included the request for more answer options, to add subtitles, to improve the realistic appearance of the characters, to improve the ability to see nonverbal cues of pain more clearly, to add the ability to repeat a scenario, to slow down the conversation, and for additional patients and scenarios. Several participants had no suggestions for improvement.

The second open-ended question asked how realistic the scenarios were compared to recent clinical experiences. The responses to this questions indicated the scenarios were realistic. Only one response was neutral, while 29 responses indicated the scenarios were realistic. One student wrote, "Very realistic. I felt like I was re-experiencing some of my clinical days." Another wrote, "very realistic – it offered realistic scenarios with appropriate nursing responses."

The third question asked if the participant thought this type of computer-based game could be beneficial in educating on pain management. Every participant agreed this type of game could be beneficial in educating on pain management. One student wrote, "Yes. For some, like

myself, I like non-traditional forms of learning that will keep my attention. Games are fun and it makes learning easier and enjoyable." Another student wrote, "Yes – interactive learning experience is much more beneficial than the traditional lecture. It made me think and allowed me to see a more complete clinical picture." One student addressed the more traditional method of teaching in the following comment, "Yes – it would allow for something other than 'boring Power Point' and encourage participants to follow along."

The fourth question asked if this type of computer-based game could be used to educate on other nursing-related topics. Every participant responded positively for this question. One student wrote, "Yes – I like that it is a 'safe space' to choose a treatment option without potentially harming a patient. Great for new nursing students." Another student wrote, "Yes! It's like a virtual simulation lab. I never forget my days in the Sim Lab and I don't think I will forget this easily either."

The final open-ended question asked the participants to compare this learning experience with the traditional classroom experience, describing both the pros and cons of each. Responses to this question were much more varied than the other responses, but were overall positive towards the computer-based game. Only a few students offered a con in their response. Several students mentioned the inability to ask questions as a con. The following response by one student was fairly typical: "This is more interactive so it helps you learn. It also makes you think critically before choosing an answer based on the situation." One student offered both a pro and con to the computer game in this statement, "Pros – more personal and can be related much more readily to REAL LIFE/clinicals. Cons – can't get as much information to students, this takes more time. I still feel this should be integrated though. Pros>Cons!"

CHAPTER FOUR: DISCUSSION

The game received high scores universally on questions one through seven and nine through ten. Question one asked the student to rate their level of comfort using the basic point and click functions of a computer. This question was asked first to determine if a discomfort with the computer as a delivery system may have impacted the overall simulation experience. The majority of participants were comfortable with this process, which was not surprising due to the increasing use of technology in both education and personal activities. Question two assessed the instructions provided and how easy they were to understand. This question was provided to determine if a lack of clarity in instructions may impact the overall experience. The majority of participants found the instructions easy to understand, indicating that the overall experience was not affected. The next two questions (three and four) assessed the quality of the game and level of enjoyment experienced by the participants. The majority of participants found the game to be both creative and enjoyable to play. Questions five and six assessed the educational value of the game by asking the participants to rate the educational value and level of motivation provided to study pain management. The majority of participants answered that the computer simulation game provided an excellent educational value on the subject and motivated them to further study the topic of pain management. Question seven assessed the main purpose of this study. When compared to traditional teaching methods, such as a lecture, which method do students prefer? The majority of participants within the study answered that they would occasionally prefer to play a computer simulation game like this one instead of attending a traditional lecture. This is significant because it displays the preference of nursing students to learn through a more interactive method rather than the traditional methods typically used. When viewed along with

the previous question results, it is clear that the students who participated in this study found it to be a creative and effective way of providing education through a process that was also enjoyable. Furthermore, the students were motivated by the game to continue learning and researching information on the subject.

Question eight evaluated the level of challenge within the game. This question was scored significantly lower than the others, indicating that the majority of students did not find the game to be challenging. Closer analysis showed a significant difference between junior and senior nursing students. Students at the senior level marked "Strongly disagree", "disagree", or "neutral" while students at the junior level answered the same question with "Strongly agree", "agree", or "neutral". The students who had progressed further into the nursing program and received education regarding pain management found the game to be less challenging than those who had not. Interestingly, the perceived level of challenge did not significantly affect the responses for the 9 other questions. The remaining questions received high ratings universally, with no difference between classes or ages. Students agreed that the game was easy to play and understand, enjoyable to play, educational, preferable to the standard lecture method of teaching, and had potential to change pain management practice in nursing.

The final questions (nine and ten) asked participants to rate the overall game experience and potential of the game to change pain management practice in the nursing profession. The majority of students agreed that the overall experience was excellent and it had potential to change practice. As future members of the nursing profession, the insight provided by the participants is invaluable. People must be receptive to the method of teaching being used in order for learning to take place. The results of this survey indicate students who are entering the

nursing profession are receptive to the computer simulation game as a method of teaching and can apply this obtained knowledge to enhance pain management practice within the clinical setting.

Limitations

Student participants were recruited using the convenience method due to time and resource limitations of the researcher. The first 30 students who responded to the request for participants were invited to take part in the study. This recruitment method may have skewed the results by gathering participants who were more proactive than others within their classes. The same proactive attitude that motivated them to sign up for the study as one of the first 30 would also likely be found in their study practices and they may have more knowledge of pain management compared to others in the class.

Limited time and resources prevented more than 30 students from being recruited into the study. All 30 participants were students within the same university. These limitations impacted the study by decreasing the diversity among participants. The results of the study are reflective of this university but may not be consistent with the views and opinions of nursing students from other schools either locally and nationally.

Due to the researcher's status as a student within the studied population, recruitment and results may have been skewed. Those who are familiar with the researcher may have been more likely to participate than other students. Such participants may have also felt inclined to answer positively due to their relationship with the researcher, regardless of their true opinions.

Recommendations for Education

The nursing profession utilizes current research and modern technology to constantly improve quality of care and patient outcomes. The same initiative should be used to provide education within the profession. The traditional methods of teaching, such as lectures, were once considered the gold standard. As technology continues to advance, innovative teaching methods have developed. The computer simulation game being studied is an example of such innovation. Students and nurses who have grown up with modern technology may react more positively to innovative teaching methods over traditional methods, as demonstrated in the current study. The wide age range of nurses currently employed prevents traditional teaching methods from becoming obsolete. Those who did not grow up with modern technology may still benefit from these methods and may even struggle to keep up with more innovative methods. In order to successfully educate the entire profession, both the traditional and innovative teaching methods should be utilized within the profession to address the different learning preferences.

Recommendations for Future Research

Future research should continue to assess the efficacy of traditional teaching methods versus innovative methods, such as computer simulations. The current study should be duplicated and expanded to a larger population to determine how receptive students and nurses are to this type of teaching tool. To further determine its efficacy, pain management practices should be monitored among direct care nurses in the clinical setting to determine if the education provided successfully changes their practice leading to improved patient outcomes.

Data from this research study suggests that computer-based simulation may be valuable in educating nursing students about pain management. This technology may be used to educate

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on other topics as well. Knowing students appear to be very receptive to nontraditional teaching strategies should give educators the confidence to think outside of the box and search for novel ways to deliver information to students.

APPENDIX A: SCREEN SHOT OF MALE PATIENT SCENARIO

Screen shot of Male Patient Scenario

Patient History: Derek Robinson

Mr. Derek Robinson is a 46 year old male, admitted to the unit a few hours ago with a diagnosis of anemia. He has a history of Hepatitis C and cirrhosis of the liver, as well as hypertension. He presented to the hospital with complaints of weakness and fatigue, and generalized muscle pain. He has been lying in bed since arrival to the unit, not "feeling well enough to get up". He denies nausea and vomiting.

Provider's Orders

Date	Time	Orders
	0730	Admit to unit. Admitting diagnosis: anemia of unknown origin
		Allergies: Latex and PCN
		Activity: OOB with assistance prn
		Diet as tolerated
		Morphine 4 mg IVP q 4 hours prn severe pain
		Vicodin 1-2 tablets PO q 6 hours prn moderate pain
		Captopril 50 mg PO BID (1 hour before breakfast and 2 hours after dinner)
		Hold for BP <120 systolic
		D5 .45 NS IV at 75 ml per hour

Medication Administration Record

Medication	DATE Time/ Initials	DATE Time/ Initials	DATE Time/ Initials
Captopril 50 mg PO BID: 1 hour before bkft (0700) and 2 hours after dinner (1900)			
Morphine 4mg IVP q 4 hr prn severe pain			
Vicodin 1-2 tablets PO q 6 hr prn moderate pain			
D5 .45 NS IV at 75 ml per hour			

APPENDIX B: DATA COLLECTION INSTRUMENT

Data Collection Instrument

Age: _____ Gender: _____ Current Semester of Nursing: (Circle One)
First Semester Generic BSN Program
Second Semester Accelerated BSN Program
Senior BSN Program

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I am comfortable using the computer to point and click	☐	☐	☐	☐	☐
Instructions to play are easy to understand	☐	☐	☐	☐	☐
Creativity and quality of computer game	☐	☐	☐	☐	☐
Entertaining and fun to play	☐	☐	☐	☐	☐
Game provided excellent educational value on the subject of pain management	☐	☐	☐	☐	☐
Motivated me to learn and read more about pain management	☐	☐	☐	☐	☐
I would occasionally prefer to play a game like this instead of regular lecture	☐	☐	☐	☐	☐
I found the game challenging	☐	☐	☐	☐	☐
Overall rating of game experience was excellent	☐	☐	☐	☐	☐
The game has potential to change pain management practice in nursing	☐	☐	☐	☐	☐

This survey was adapted from Ogershok & Cottrell, 2004.

What changes would you make to improve this game?

_____

_____

How realistic are the scenarios as compared to your experience in clinical?

_____

_____

Do you think this type of computer-based game could be beneficial in educating you on pain management? Explain.

_____

_____

_____

Do you think this type of computer-based game could be used to successfully educate you on other nursing-related topics?

_____

_____

Compare this computer-based game to the traditional classroom experience. Describe your thoughts on the pros and cons of each.

_____

_____

_____

_____

Thank you so much for participating in this research!!

Nicole Gerardi and Dr. Kelly Allred

APPENDIX C: RESULTS

Table 1: Results

Question	Mean (n=30)	SD (n=30)
1. I am comfortable using the computer to point and click	4.97	0.183
2. Instructions to play are easy to understand	4.77	0.626
3. Creativity and quality of computer game	4.40	0.770
4. Entertaining and fun to play	4.20	0.925
5. Game provided excellent educational value on the subject of pain management	4.63	0.490
6. Motivated me to learn and read more about pain management	4.13	0.776
7. I would occasionally prefer to play a game like this instead of regular lecture	4.87	0.346
8. I found the game challenging	2.97	1.098
9. Overall rating of game experience was excellent	4.47	0.629
10. The game has potential to change pain management practice in nursing	4.40	0.675

APPENDIX D: CHI-SQUARE ANALYSIS

Table 2: Chi-Square Analysis

Question	Value	df	Asymp. Sig.
1. I am comfortable using the computer to point and click	1.353	1	.245
2. Instructions to play are easy to understand	1.860	2	.395
3. Creativity and quality of computer game	4.825	3	.185
4. Entertaining and fun to play	4.140	3	.247
5. Game provided excellent educational value on the subject of pain management	0.032	1	.858
6. Motivated me to learn and read more about pain management	3.490	2	.175
7. I would occasionally prefer to play a game like this instead of regular lecture	0.084	1	.773
8. I found the game challenging	10.570	4	.032
9. Overall rating of game experience was excellent	1.833	2	.400
10. The game has potential to change pain management practice in nursing	0.407	2	.816

APPENDIX E: UNIVERSITY OF CENTRAL FLORIDA IRB APPROVAL

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Kelly D. Allred** and Co-PI: **Nicole B. Gerardi**

Date: **October 16, 2012**

Dear Researcher:

On 10/16/2012, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review:	Exempt Determination
Project Title:	Evaluation of Computer-Based Simulation for Pain Management Education
Investigator:	Kelly D Allred
IRB Number:	SBE-12-08737
Funding Agency:	Florida Hospital for Children(FHC)
Grant Title:	Florida Hospital for Children Using Computer-Based Simulation for Pediatric Pain Managemetn Education
Research ID:	1051106

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 10/16/2012 09:54:16 AM EDT

IRB Coordinator

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