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Exploring the Cohesion-Performance Relationship in Inter-professional Healthcare Teams

Jill Steiner Sanko
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EXPLORING THE COHESION – PERFORMANCE RELATIONSHIP IN INTER-PROFESSIONAL HEALTHCARE TEAMS

By

Jill Steiner Sanko

A DISSERTATION

Submitted to the Faculty of the University of Miami in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Coral Gables, Florida

May 2015
UNIVERSITY OF MIAMI

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

EXPLORING THE COHESION – PERFORMANCE RELATIONSHIP IN INTERPROFESSIONAL HEALTHCARE TEAMS

Jill Steiner Sanko

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In Inter-professional Healthcare Teams  

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Problem  

Healthcare delivery has shifted toward utilizing more teams. Teams are thought to improve the effectiveness, efficiencies, and costs associated with healthcare however, these benefits have not been fully realized. Teamwork and communication are critical to the safe delivery of care. Teamwork and communication failures contribute substantially to healthcare associated errors which are cited to cost over 17 billion dollars a year in the U.S. The development of an improved understanding of the factors that affect team successes and failures is needed to improve team functioning and in turn patient safety. The influence of team cohesion on performance is well established outside healthcare; however, research on the impacts of these variables in healthcare is lacking.  

Methods  

A convenience sample of nursing and medical students participating in an inter-professional simulation-based patient safety course was used for this study. A time series design was employed to explore relationships between time and cohesion, performance and cohesion and differences in cohesion by gender and intended profession.
Results

Mid-week cohesion was found to predict post course cohesion ($p < .001$) and team performance ($p = .010$). No differences in cohesion by gender or intended profession were found.

Implications

Healthcare research, including findings of this study, point toward cohesion as an element necessary for successful team functioning. Cohesion promotes higher levels of quality care, better patient satisfaction, and reduces staff stress and turnover. Cohesion plays an essential role in strengthening effective team qualities (communication, situation monitoring, conflict resolution, and shared goals) that directly contribute to the formation of a strong culture of safety. Healthcare leaders and educators should recognize cohesion as a critical group factor and put effort toward developing practices that encourage team cohesion in order to reduce healthcare associated errors.
In loving memory of my grandmother, Gleda O. Baldini aka “Nanny” (1919-2011); my first nurse mentor. Thank you for introducing me to the importance of perfect hospital corners on every bed. Most importantly, thank you for modeling kindness, compassion for others, and the art of nursing. I miss you every day!
Acknowledgments

Like many explorers I set out on a journey without fully knowing where it might lead. The journey to completing a Ph.D. is never traveled without a team. I have many people who I have been my “teammates”, many I would like to thank. Without you I would have surely failed.

First, my partner in all things, my best friend, my husband Steve; without your incessant and tireless drive to work to provide for our family I would have been unable to take the time to complete this degree. Thank you for allowing me the time, for cheering me on when I got tired, and the continued to encourage when I doubted myself.

To my three kids (Caden, Eva, and Aubrey) thank you for understanding why I missed school events and couldn’t always play. I hope that one day you fully understand the gifts you gave me in being patient and understanding when I too often had to say no and I am sorry, but “Mommy has to work”.

To NIH and the department of Critical Care Medicine who first introduced me to SimMan®, for without this introduction I don’t believe I would have found my passion in simulation-based education.

To the UM-JMH Center for Patient Safety and the people there who make this place unique. Thank you for giving me a chance to be a part of your team. You broadened my view and introduced me to the concept of patient safety and how simulation can assist in
reaching current and future healthcare providers so that they may in turn provide safer healthcare for those in their care.

Dr. David Birnbach thank you for allowing me to work with and learn from you. Thank you for you for agreeing to be on my dissertation committee despite knowing all my flaws and idiosyncrasies. Your mentorship has been a profound constant in my life for the last six and half years, for this I am forever grateful.

To the UMSONHS who had faith in me and gave me one of my most cherished opportunities, education. I am forever appreciative of the chance to pursue my Ph.D. in an area that I am so deeply passionate about. Thank you to all my professors along the way who were honest critics providing me with feedback that made me think and allowed me to grow. Thank you for helping me to close the gaps in knowledge I had that were holding me back from being able to fully contribute to healthcare, nursing education, simulation-based teaching, and patient safety.

Dr. Karina Gattamorta thank you for being my go to person for all things statistics! Without your patience and guidance I would have never found my way.

Dr. Joseph DeSantis thank you for changing my mind about nursing theory and your always available ear and sage advice.

Dr. Mckay, my constant sidekick, partner in crime (safety), and valued mentor. Thank you for your guidance, advice, and partnership. It’s been an adventure I will forever treasure. I hope it’s only the beginning!

Finally, Dr. Ugarriza. Thank you for agreeing to be my dissertation chair and for the opportunity and autonomy to “spread my wings and learn to fly”. Your guidance,
feedback, and humor have been without fail, appreciated, and made this process an amazing learning experience.

“To laugh often and much; To win the respect of intelligent people and the affection of children; To earn the appreciation of honest critics and endure the betrayal of false friends; To appreciate beauty, to find the best in others; To leave the world a bit better, whether by a healthy child, a garden patch, or a redeemed social condition; To know even one life has breathed easier because you have lived. This is to have succeeded.”

Ralph Waldo Emerson

As I complete this journey and begin a new one, another that I will travel beside many others. It is my hope that those who proceed me will be able to say that I have succeeded.
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<th>Full Form</th>
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<tr>
<td>AO</td>
<td>Accelerated Option</td>
</tr>
<tr>
<td>ARHQ</td>
<td>Agency for Healthcare Research &amp; Quality</td>
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<tr>
<td>CFA</td>
<td>Confirmatory Factor Analysis</td>
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<td>CFI</td>
<td>Comparative Fit Index</td>
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<tr>
<td>BSN</td>
<td>Bachelor of Science of Nursing</td>
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<tr>
<td>FIRO</td>
<td>Fundamental Interpersonal Relations Orientation</td>
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<td>GCQ</td>
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<td>GEQ</td>
<td>Group Environment Questionnaire</td>
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<tr>
<td>IOM</td>
<td>Institute of Medicine</td>
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<td>IPE</td>
<td>Inter-professional education</td>
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<td>K-S test</td>
<td>Kolmogorov-Smirnov test</td>
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<td>PI</td>
<td>Primary Investigator</td>
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<td>QCS</td>
<td>Quadripartite Cohesion Scale</td>
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<tr>
<td>RMSEA</td>
<td>Root Mean Square Error of Approximation</td>
</tr>
<tr>
<td>SOM</td>
<td>School of Medicine</td>
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<td>SONHS</td>
<td>School of Nursing &amp; Health Studies</td>
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Chapter I

Introduction to the Study

“Union gives us strength” (Aesop, 550 B.C.).

Introduction

For human beings, living in groups is an inevitable and ubiquitous reality of living and working in society (Cartwright & Zander, 1968). Children are born into families and learn about relating to others through group experiences and interactions. Human beings are educated in classes, play in teams, and reside in communities. Adults encounter groups in the form of companies, departments, and work teams. For human beings, living and working successfully depends on how well they interact with, and feel connected to the groups and individuals in the groups to which they belong. Educational, social, and outcome goals of groups are inexorably tied to the well-being and cohesiveness of the members of groups.

Relations with others and with groups of others have been recognized as significant experiences of human existence (Libo, 1953). Throughout a person’s life, group encounters may be the source of profound satisfaction as well as intense conflicts and frustrations (Libo, 1953). People encounter groups from birth until death, and are socialized to accept being a part of many groups. Group membership, formal and informal, is a significant feature of human culture, as well as a condition which human beings seek (Festinger, 1953). A person who does not seek group membership, favoring to live a solitary life with limited social or group interaction is rare (Festinger, 1953). Understanding group dynamics and what makes groups successful, sought, and
worthwhile is important work for those interested in understanding and improving group dynamics.

The study of groups has been of interest to researchers from a variety of fields. Results of studies have shed light on the uniqueness of small group behaviors and how cohesion affects outcomes of groups. In addition, research findings have been used to better understand ways to improve the successes, attractiveness, and functioning of groups; however, there are still questions to be answered. Currently, research with a focus on group cohesion in inter-professional healthcare teams is lacking. The findings of this study assist in narrowing the gap that exists in current inter-professional healthcare team research. Narrowing the gap in inter-professional team research will help to identify ways to improve healthcare team dynamics. Further, findings might be used to promote the establishment of methods to improve teamwork and the care that teams deliver through the promotion of stronger feelings of group cohesion.

**Background**

Successful group encounters depend on a variety of factors including: (a) attraction to a group and its members (Festinger, 1953), (b) commitment to the group and group goals (Carron, 1982; Yukelson, Weinberg, & Jackson, 1984), (c) identification with the group and group members (Cartwright & Zander, 1968), and (d) the value of group membership (Stokes, 1983). The construct of group cohesion encompasses these factors and has been studied as a part of group dynamics for more than half a century. The construct of group cohesiveness is central to theories of group dynamics (Cartwright & Zander, 1968). Cohesion has long been considered a critical group element (Carron & Brawley, 2000, Lott & Lott, 1965; Yalom, 1970). Research findings demonstrate positive
relationships between cohesion and group outcomes, such as psychological well-being, and performance (Deeter-Schmelz & Kennedy, 2003; Evans & Dion, 2012; Mullen & Cooper, 1994; Yalom, 1970).

The concept of teamwork, defined as a cooperative or coordinated effort on the part of a group of persons acting together as a team or in the interests of a common cause (Teamwork, n.d.) is closely related to the concept of cohesion (Seashore, 1954). Teamwork is based on the idea that individuals working together and interdependently are better able to achieve goals than if they were to work independently (DeOrtentis, Summers, Ammeter, Douglas, & Ferris, 2013). As a whole, teams can accomplish remarkable achievements (e.g. winning a game, saving a life, creating music) when they are cohesive and working toward a shared and understood goal. When teams fail to unite in common pursuit, fail to communicate effectively, or fail to work interdependently as a single cohesive unit, outcomes often suffer. Negative outcomes of dysfunctional teamwork among healthcare teams are commonly attributed to poor teamwork and communication deficiencies (Agency for Healthcare Research & Quality [AHRQ], 2013). Teamwork failures are costly in terms of lives lost and dollars spent. A retrospective review of patient safety incidents in an emergency room found that an average of 8.8 teamwork failures occurred per case, adding on average $3.50 per patient visit for a total cost of $345,460 per 100,000 emergency room visits (Risser et., al 1999). More recent estimates of the costs of medical error validate these older estimates. A study sponsored by the Society for Actuaries and conducted by Milliman in 2010 put the cost of medical errors at $19.5 billion dollars in the United States alone. Some experts, however estimate
that his figure is an under estimation of the actual cost, citing a $1 trillion dollar figure (Andel, Davidow, Hollander, & Moreno, 2012).

Study findings support the notion that teamwork and communication are critical to the safe delivery of healthcare (AHRQ, 2013). Poor teamwork can contribute to patient safety susceptibilities, but effective teamwork can mitigate the impact of technological or human failures that have already occurred (Burke, Salas, Wilson-Donnelly, & Priest, 2004; Helmreisch, 2000; Jarvi, Sultan, Lee, Lussing, & Bhat, 2002). Effective communication increases when group cohesiveness increases (Lott & Lott, 1965). Cohesion also has been linked to decreases in medication errors (Bae, Mark, & Fried, 2010). Lack of cohesion is associated with the commission of medical errors (Baker, Day, & Salas, 2006). Associations among aspects of teamwork including: (a) situational monitoring, (b) communication, (c) leadership, (d) trust, and (e) the development of a shared mental model positively affect clinical outcomes (Baker, Gustafson, Salas, & Barach, 2005; Manser, 2009, Sobero, Farley, Mattke, & Lovejoy, 2008). The science of healthcare teamwork has been developing quickly (Sobero, Farley, Mattke, & Lovejoy, 2008). For growth to continue, a better understanding of what makes successful teams work, and specifically what contributes to the development of cohesion, needs to occur.

**Healthcare Teams.**

A trend in healthcare settings has been toward the delivery of care by teams of inter-professional providers (Temkin-Greener, Kunitz, & Mulamel, 2004). Healthcare teams are found in both clinical and managerial environments (Temkin-Greener, Kunitz, & Mulamel, 2004). In the clinical area, inter-professional teams are the most well established type of team (Temkin-Greener, Kunitz, & Mulamel, 2004); however, multi-
disciplinary teams are also becoming more common place in the management of healthcare and have been shown to improve effectiveness of care (Borrill, et al., 2000). True inter-professional teams consist of members of two or more professions who participate in the team’s activities, share leadership roles, and are reliant on one another in order to reach goals set by the group (Temkin-Greener, Kunitz, & Mulamel, 2004). A stroke team is an example of a true clinical inter-professional healthcare team. Stroke teams commonly consist of providers from several disciplines including, medicine, nursing, social work, physical and occupational therapy, and rehab medicine who work together to coordinate immediate and long term care for patients who have suffered a stroke (Tyson, Burton, & McGovern, 2014).

Healthcare organizations have become more complex and unstable (Baker, Day, & Salas, 2006). The ever changing landscape of cost containment and organizational restructuring taking place to meet the demands of healthcare reform and an increasingly sicker and older population are responsible for the increased use of teams, particularly multidisciplinary teams of providers from varied healthcare disciplines to deliver care. The need to provide high quality and safe healthcare in a setting where cost containment, preservation of patient satisfaction, and outcomes are essential has led to the examination of the use of teams in healthcare more judiciously (Deeter-Schmelz & Kennedy, 2003). Additionally, research findings show that delivering healthcare using teams can be effective and positively impact care outcomes (Baggs, Ryan, Phelps, Richeson, & Johnson, 1985; Gavett, Drucker, McCrum, & Dickenson, 1985; Knaus, Draper, Wagner, & Zimmerman, 1986; Temkin-Greener, Kunitz, & Mulamel, 2004). Armstrong and colleagues (2011) reported that implementation of interdisciplinary teams decreased the
frequency of urgent surgeries and the ratios of high / low amputations in the treatment
course of foot complications of patients with diabetes mellitus. Taber and colleagues
(2013) found a reduction in medication discrepancies, readmissions, occurrences of acute
rejection, and infection rates as a result of the implementation of an inter-professional
team approach in the care of kidney transplant recipients.

While some researchers substantiate team-based healthcare as a promise of
improved delivery of care in a cost effective and efficient manner, there is evidence
demonstrating a need to improve the way that teams function (Baker, Day, & Salas,
2006). In fact, currently, communication and teamwork failures are contributing to a
large percentage of healthcare related errors (Brock, et al., 2013). These communication
and teamwork failures are thought to be caused in part because healthcare providers
(medicine, nursing, respiratory therapy, etc.) are not trained or educated together (Baker,
Day, & Salas, 2006). A consequence of failing to educate healthcare providers together
creates problems with providers being able to relate to each other, as well as being able to
communicate effectively across disciplines. The current predominant educational
paradigm is to educate in silos which fosters behaviors that lead to working in
professional ‘bubbles’ once in clinical practice. Currently, few schools of medicine or
nursing have inter-professional educational (IPE) content built into their curriculum
(Larson, 2012). In addition, curricula of medical school and medical practice currently
have a focus on the attainment of task-specific skills while ‘non-technical’ (team-related,
for example) skills are seldom offered at any stage of the medical professional’s career
(Undre, Sevdalis, Healey, Darzi, & Vincent, 2005).
Recognizing the existing educational paradigm as problematic, several organizations have made recommendations to increase educational opportunities for IPE to occur (Baker, Day, & Salas, 2006). The 1999 landmark Institute of Medicine (IOM) report contained the recommendation that healthcare providers work together in order to improve their ability to act as well-coordinated teams (Kohn, Corrigan, & Donaldson, 2000). More recently, the IOM (2001, 2003) recognized inter-professional teamwork and collaboration as core competencies for all healthcare professionals. Additionally, the Pew Health Professional Commission (1993) made a recommendation to revise healthcare education curricula to include IPE (Sharpe, 1992).

Beyond needing to offer more opportunities for IPE, more research on group factors effecting team dynamics and performance outcomes in healthcare teams is necessary (Deeter-Schmelz & Kennedy, 2003). Further, a more developed understanding of how differences in team characteristics (such as cohesion) affect performance outcomes would be useful (Deeter-Schmelz & Kennedy, 2003; Leach, Myrtle, Weaver, & Dasu, 2009). An improved understanding of the group factors affecting the successes and failures of healthcare teams would allow for a more purposeful approach to training and education. More importantly, it could act as a guide for hospital and other healthcare systems; thus, assisting in guiding efforts to mimic environments and conditions that produce positive outcomes, while steering them away from the settings and situations that yield undesirable results.

Characteristics of high-functioning teams include: (a) effective communication patterns, (b) low levels of conflict and high levels of teamwork, (c) harmonization, (d) cooperation, and (e) cohesion (Lemieux-Charles, Murray, Baker, Barnsley, Tasa, &
Salahadin, 2002; Pinto & Pinto, 1990; Poulton & West, 1999; Shortell et al., 2004; Temkin-Greener, Gross, Kuntz & Mukamel, 2004; Vinokur-Kaplan, 1995). Highly-effective and cohesive teams share many characteristics (Table 1). Research findings support the relationship between team functioning and improved patient outcomes (Bower, Campbell, Bojke, & Sibbald; Haward et al., 2003; Wheelan, Burchill, & Tilin, 2003). The development of a shared group identity has been suggested as a strategy which improves team dynamics (Mitchell, Parker, Giles, & Boyle, 2013). Additionally, neither teamwork nor cohesion are developed through the practice of co-locating people into the same environment, but rather they are cultivated when the members of a team cooperate to achieve shared goals (Baker, Day, & Salas, 2006). To further the quality of healthcare, an enhanced understanding of the elements that assist teams in improving critical patient care outcomes is essential (Deeter-Schmelz & Kennedy, 2003). Through this research study, the PI sought to impact the emerging science of teamwork in healthcare (Baker, Day, & Salas, 2006) and presents findings on the influences of team cohesiveness in inter-professional teams on performance outcomes.

Table 1

*Characteristics of Effective and Cohesive Teams*

<table>
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<tr>
<th>Characteristic</th>
<th>Effective Teams</th>
<th>Cohesive Teams</th>
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<tr>
<td>Shared vision, goals, and objectives</td>
<td>There is a clear and common purpose.</td>
<td>Team members understand and share the leader’s vision, as well as the team’s goals, objectives and mission.</td>
</tr>
<tr>
<td>Respect / Trust</td>
<td>Team members trust other members’ intentions</td>
<td>Group members respect each other.</td>
</tr>
<tr>
<td>Sense of gratification</td>
<td>Purposeful selection of team members who value teamwork.</td>
<td>Group members derive gratification from being a team member.</td>
</tr>
<tr>
<td>Communication</td>
<td>Communication is often.</td>
<td>Communication is open, all members are encouraged to participate in discussions</td>
</tr>
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<td>---</td>
</tr>
<tr>
<td>Decision making</td>
<td>The “right” team members are involved in decision making.</td>
<td>Decision making is shared whenever possible.</td>
</tr>
<tr>
<td>Sense of pride</td>
<td>The team strongly believes in the team’s collective ability to succeed.</td>
<td>The group has a sense of pride.</td>
</tr>
<tr>
<td>Conflict resolution</td>
<td>Conflict is managed well, team members confront each other effectively.</td>
<td>Little conflict exists on the team, when conflict does arise it is handled using constructive problem-solving.</td>
</tr>
<tr>
<td>Cooperation</td>
<td>Work is distributed and assigned effectively.</td>
<td>Cooperation is encouraged.</td>
</tr>
<tr>
<td>Working together</td>
<td>Members understand each other’s roles and how they fit together.</td>
<td>The group works together in a relaxed manner.</td>
</tr>
<tr>
<td>Recognition</td>
<td>Members regularly provide feedback to each other, both individually and as a group.</td>
<td>Team recognition and credit for a good job is freely given.</td>
</tr>
</tbody>
</table>

(Salas, Sims, & Klein, 2004, pp. 497-505; Manning & Haddock, 1995, pp.19)

**Purpose and Significance**

Much of the literature on healthcare teams studies the functioning of teams; however, more recently the focus has shifted toward exploring the effectiveness of teams in order to improve patient outcomes (Lemieux-Charles & McGuire, 2006). A large body of work exists on the influences of cohesion on performance; however, research on the relationship between cohesion and performance in the healthcare arena is lacking. Currently, much of the cohesion research in healthcare has centered on: (a) customer satisfaction, (b) leadership behaviors, (c) job satisfaction, (d) compassion fatigue, and (e) burnout (Bratt, Broome, Kelber, & Lostocco, 2000; Deeter-Schmelz & Kennedy, 2003; DiMeglio, et al., 2005; Li, Early, Mahrer, Klaristendfeld, & Gold, 2014). Most
researchers have explored cohesion as a dependent variable, thus limiting the view of cohesion as a predictor of outcomes of interest, such as performance. Finally, it is necessary and important to understand if, in what way, and under what circumstances healthcare teams affect clinical and organizational effectiveness (Lemieux-Charles & McGuire, 2006).

**Teams’ contribution to medical errors**

Medical error is a significant and costly problem in terms of lives impacted and dollars spent. The IOM’s report *To Err is Human* contained an estimate that between 44,000 and 98,000 deaths occur each year caused by medical errors (Kohn, Corrigan, & Donaldson, 2000). More recent estimates of deaths caused by medical errors, however, are reported to be as high as 200,000 to more than 400,000 (Andel, Davidow, Hollander, & Moreno, 2012; James, 2013). Andel, Davidow, Hollander, & Moreno (2012) published figures citing a $1 trillion annual cost of medical errors, with teamwork failures contributing to a significant number of these (Brock, et al., 2013).

**Purpose**

Developing an understanding of a critical group factor, such as the concept of cohesion would provide an evidence based scaffold from which to effect change in the way healthcare teams are educated and operate. Improving education and operations of healthcare teams could potentially reduce healthcare errors caused by team failures, thus saving lives and reducing healthcare costs. Learning about cohesion and its impact on team effectiveness could also be used to direct educational efforts to bolster the likelihood that cohesion in healthcare teams will occur.
The purposes of this study were to:

1. explore the impact of cohesion on performance outcomes in inter-professional healthcare teams during simulated medical emergencies.
2. assist in understanding how assessments of cohesion change over the course of inter-professional team training.
3. compare differences in assessments of cohesion based on intended profession, and gender.

**Research Design**

A correlational time series research design was used to answer the research questions and test the hypotheses about relationships between group cohesion and performance. Analyses were carried out at the group level using path analysis. Differences in assessments of cohesion by gender and intended profession were also explored using Independent samples $t$ tests. In addition to measuring group cohesion, psychometric analysis of the cohesion tool developed for this study (Quadripartite Cohesion Scale [QCS]), was carried out to assess the reliability of its use in the study population. Individual level analysis was used for exploring the differences in assessments of cohesion and to run the psychometrics of the QCS. A second instrument (the University of Miami Crisis Resource Management tool [UM-CRM]) was used to measure team performance (Sanko, Mckay, Shekhter, Thomas, & Birnbach, 2013; Shekhter, Rosen, Sanko, Everett-Thomas, Fitzpatrick, & Birnbach, 2012).
Research Questions and Hypotheses

Research Questions

1. What is the relationship between cohesion, and team performance across time in teams of medical and nursing students participating in an inter-professional patient safety course?

2. What are the differences in cohesion by gender and intended profession of nursing and medical students when participating on an inter-professional team during a patient safety educational course?

Hypotheses

Hypothesis 1.

There is a statistically significant positive relationship between team performance as measured by the UM-CRM tool and cohesion as measured by the QCS occurring across two time points.

Hypothesis 2.

a. There is no statistically significant difference between males and females in cohesion as measured by the QCS.

b. There is no statistically significant difference between medical students and nursing students in cohesion as measured by the QCS.

Justification

Research on group cohesion has had an impact on many domains including sports, healthcare, industry, and psychology (Greer, 2012). The cohesion – performance relationship has consistently been shown to have a positive correlational relationship (Geer, 2010). The regularity of this finding over many years of study has made it one of
the most important constructs in small group research (Greer, 2012). While cohesion-performance research has consistently proven to be a robust process which affects teams, effect sizes have varied depending on the context, setting, and population (Greer, 2012). Further, research on the cohesion-performance relationship in healthcare teams lacks full exploration. There are no published studies on the relationship between cohesion and performance of inter-professional teams during simulated medical emergencies. Additionally, since the practice of nursing and medicine often involves group work and because cohesiveness is necessary to the work of groups (Beeber & Schmitt, 1986), it is important to fully understand how group interactions affect group performance and ultimately outcomes of healthcare delivered by teams. Results of research findings indicate that a lack of cohesion in healthcare teams contributes to the inability to focus on patient care (Dreachslin, Hunt, & Sprainer, 1999). Therefore, understanding cohesion in healthcare teams is critical to developing effective teams (Deeter-Schmelz & Kennedy, 2003).

The findings of this work will be useful in providing the first evidence that cohesion in healthcare teams affects performance in a directly attributable care outcome such as care of the acutely ill patient. Further, the use of a simulated medical emergency provides a safe environment to study the impacts and relationships of cohesion and team performance in inter-professional teams of healthcare providers addressing a healthcare crisis.

**Operational Definitions**

Many definitions of cohesion have been introduced since the concept was first presented by Lewin in the late 1930s and early 1940s (Dion, 2000). Multiple definitions
have emerged based on the interpretations of researchers studying the concept (McLeod & von Treuer, 2013). Two commonly cited definitions include Festinger’s (1950, pg. 164) “resultant of all forces acting on members to remain in a group” definition and Gross and Martin’s (1952, pg. 553) contrasting definition of “the resistance of the group to disruptive forces”. These two definitions highlight the inconsistent interpretations of the term (McLeod & von Treuer, 2013). With each new interpretation of the concept of cohesion came a new definition. In addition, as cohesion began to be studied outside psychology, more varied definitions emerged (McLeod & von Treuer, 2013). The result has been the construction of numerous definitions which do not centralize around a common, or agreed upon ideology (Beeber & Schmitt, 1986). Table 2 is a depiction of the diverse definitions which exist for the concept cohesion.

Table 2

*Definitions of Cohesion and Cohesiveness*

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Definition</th>
<th>Components of the concept reflected</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lewin</td>
<td>1939</td>
<td>The set of forces keeping members together, including both the positive and negative forces of repulsion.</td>
<td>Attraction</td>
<td>Cohesion</td>
</tr>
<tr>
<td>Festinger</td>
<td>1950</td>
<td>The result of all the forces (&quot;field of forces&quot;) acting on the members of a group to remain in the group.</td>
<td>Attraction</td>
<td>Cohesiveness</td>
</tr>
<tr>
<td>Gross, N. &amp; Martin</td>
<td>1952</td>
<td>The resistance of the group to disruptive forces.</td>
<td>Attraction</td>
<td>Cohesiveness</td>
</tr>
<tr>
<td>Author, Year</td>
<td>Definition</td>
<td>Components of the concept reflected</td>
<td>Term</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
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<td></td>
</tr>
<tr>
<td>Lewin, 1939</td>
<td>The set of forces keeping members together, including both the positive and negative forces of repulsion.</td>
<td>Attraction</td>
<td>Cohesion</td>
<td></td>
</tr>
<tr>
<td>Lott, B.E., 1961</td>
<td>That group property which is inferred from the number and strength of mutual positive attitudes among the members of a group</td>
<td>Attraction</td>
<td>Cohesiveness</td>
<td></td>
</tr>
<tr>
<td>Anderson, 1975</td>
<td>Individual members' involvement in the group task.</td>
<td>Task cohesion</td>
<td>Cohesiveness</td>
<td></td>
</tr>
<tr>
<td>Carron, 1982</td>
<td>Group members’ inclination to forge social bonds, resulting in members sticking together and remaining unified.</td>
<td>Social cohesion</td>
<td>Cohesion</td>
<td></td>
</tr>
<tr>
<td>Piper, Marrache, Lacroix, Richardson, &amp; James, 1983</td>
<td>Basic bond or uniting forces.</td>
<td>Attraction</td>
<td>Cohesion</td>
<td></td>
</tr>
<tr>
<td>Carron, et al., 1985</td>
<td>A dynamic process which is reflected in the tendency for a group to stick together and to remain united in its pursuit of its instrumental objectives and/ or for the satisfaction of member affective needs.</td>
<td>Task &amp; social cohesion, &amp; attraction</td>
<td>Cohesion</td>
<td></td>
</tr>
<tr>
<td>Yalom, 1985</td>
<td>The resultant of all forces acting on all members to remain in the group or the attractiveness of a group for its members.</td>
<td>Attraction</td>
<td>Cohesiveness</td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Year</td>
<td>Definition</td>
<td>Components of the concept reflected</td>
<td>Term</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------</td>
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<td>-----------------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Lewin</td>
<td>1939</td>
<td>The set of forces keeping members together, including both the positive and negative forces of repulsion.</td>
<td>Attraction</td>
<td>Cohesion</td>
</tr>
<tr>
<td>Budman, Soldz, Demby, Davis, &amp; Merry</td>
<td>1993</td>
<td>Group connectedness, demonstrated by working together toward a common therapeutic goal, constructive engagement around common themes, and openness to sharing personal material.</td>
<td>Task cohesion, social engagement &amp; attraction</td>
<td>Cohesion</td>
</tr>
<tr>
<td>Dion</td>
<td>2000</td>
<td>Derived from the Latin word, cohaesus; it means &quot;to cleave or stick together&quot;.</td>
<td>Attraction</td>
<td>Cohesion</td>
</tr>
<tr>
<td>Aoyagi, Cox, McGuire</td>
<td>2008</td>
<td>How individual members of a team relate to each other a work together as a unit.</td>
<td>Integration, attraction, &amp; task &amp; social cohesion</td>
<td>Cohesion</td>
</tr>
<tr>
<td>Hausknecht, Trevor, &amp; Howard</td>
<td>2009</td>
<td>Shared commitment to the group task and a shared attraction and mutual liking among members.</td>
<td>Task cohesion, &amp; attraction</td>
<td>Cohesion</td>
</tr>
<tr>
<td>Shiue, Chiu, &amp; Chang</td>
<td>2010</td>
<td>The degree to which the group members share group goals and unite to meet these goals</td>
<td>Task cohesion</td>
<td>Cohesion</td>
</tr>
</tbody>
</table>

For this dissertation, cohesion was viewed as a multi-dimensional concept interconnected to several aspects of small group relationships. Three factors are identified in the literature as important in the formation of cohesiveness: impact and initiative, task competence, and like-dislike (similarity – dissimilarity of group members) (Lott & Lott, 1965). These three factors, the view of cohesion as a multi-dimensional construct, and the heterogeneous definitions of cohesion were used for the development
of a new definition employed for this study. *The definition of cohesion is a basic bond and dynamic process which assists to unite members, such that they work collectively in pursuit of identified goals to meet commitments set forth by the individuals of a group* (Budman, et al., 1993; Carron, et al., 1985; Dion, 2000; Hausknecht, Trevor, & Howard, 2009; Piper, et al., 1983). Cohesiveness is a ‘group property which is inferred from the number and strength of mutual positive attitudes among the group members’ (Lott, B.E., 1965 pg.259). Researchers of small groups have used the terms groups and teams, both terms will be used interchangeably throughout this paper to refer to small groups of people working together.

**Expected Outcomes**

The following outcomes are expected as a result of this proposed study:

1. establishment of a greater understanding of the relationship between cohesion and performance in an inter-professional healthcare teams of medical and nursing students.

2. formation of knowledge around the human characteristics such as gender and profession that impact assessments of cohesion.

3. development of an understanding of the dynamic process of cohesion which occurs in the course of learning in a team environment.

4. development and psychometric testing of a quadripartite tool to measure cohesion in inter-professional healthcare teams.
Assumptions and Limitations

Assumptions

This study was implemented with several assumptions. First, the experiences of each team would remain relatively consistent throughout the week-long course being used for this study. Second, all nursing students have had similar nursing education in terms of quantity, quality, and content. Third, the medical students have also had an education which has not varied with regard to quality or experiences from student to student. Finally, all of the students taking part in the IPE course, which was the setting for the study, would participate fully in the learning experiences and course activities, and treat their team members and other students with respect.

Limitations

The major limitations of this study were its narrow population (only medical and nursing students were studied) and the use of simulated medical emergencies in a simulated healthcare environment. While the population of interest, the simulated environment, and the simulated medical emergencies represented excellent surrogates for the study of healthcare teams in health settings where medical emergencies occur, they were not the ‘real thing’. The fact that these students were relatively early in their education and had limited clinical experience might have impacted their ability to develop strong feelings of cohesion when in a new and unfamiliar environment. In addition, the teams used for this study were not permanent teams, but rather, ad hoc teams created for the purposes of facilitating learning of team dynamics during the course. Finally, the students all had previous experience with peers within their own constituent disciplines of study, but had limited to no experiences with constituents
outside their disciplines of study. This condition could have also impacted the ability for
the teams to develop strong cohesiveness in the one-week time frame of the course.
Finally, the use of teams of students who were early in their education might have had an
impact on the ability for findings to be generalized to populations of healthcare providers
who have graduated and are working clinically.

Chapter Summary

Chapter I is an introduction of the concepts and problems which were addressed
in this study. The primary purpose of the study was to explore the relationship between
cohesion and performance in inter-professional teams of medical and nursing students.
In addition, differences in perceptions of cohesion among nursing and medical students
and males and females were examined as a secondary aim. The limitations of the
proposed study were acknowledged. The justification for the study is that the findings
would most likely contribute to a body of knowledge involving the influence of cohesion
on performance in area (healthcare) that lacked exploration of this relationship. Further,
the study was considered to be feasible, innovative, novel, and relevant.

Chapter II is a presentation of a review of the literature, a brief history of the
construct, and the theoretical framework used to underpin the study. The literature
review is organized around the history of cohesion as a construct, followed by examples
of research results on the performance cohesion connection. Finally, research studies
with a focus on cohesion from the nursing and healthcare arenas are presented. The
purpose of the literature review was to provide a framework for how cohesion has been
viewed historically, as well as how the construct has been explored in nursing and
healthcare domains. Based on gaps found in the literature, and guided by the theoretical
framework the research questions and hypotheses for this proposed study were
developed.

Chapter III is a presentation of the research methods, data collection plan, data
analysis plan, and human protection considerations for the study. Also included are
descriptions of the tools which were used to collect data, the sampling plan, power
analysis, and a discussion of the strengths and weaknesses of the research design.

Chapter IV is a presentation of the results of the study. Finally, chapter V is a
discussion of the findings, recommendations for future studies, and implications of the
findings.
Chapter II

Literature Review

History of cohesion as a construct

Psychological research on the construct of cohesion dates back to the 1940s and 1950s; however, the foundation for the concept was first laid by Kurt Lewin in 1939. Lewin believed that cohesion was an essential property of groups, and that without cohesion, groups could not exist. Since its early beginnings in social psychology, cohesion has been studied by theoreticians from many disciplines including industrial-organizational organizations, family studies, military, anthropology, sports, and healthcare (Dion, 2000).

In 1954, Seashore introduced cohesion as an important factor in industrial work group production teams. Seashore demonstrated that cohesive teams established more efficient production of goods. Also members of cohesive teams reported lower levels of anxiety as compared to individuals on less cohesive teams. The development of specific tools to measure cohesion also began during the 1950s. Eugene Gross, in collaboration with William Schutz, developed the most widely used measure of cohesion, the Gross Cohesion Scale (GCS) (Gross, 1957; Schutz, 1955; Stokes, 1983).

In the 1960s, cohesion was identified as one of the most important properties, if not the most influential characteristic of groups (e.g., Cartwright, 1968; B.E. Lott, 1961) as it became more widely studied by small-group researchers (Dion, 2000). In the 1970s and 1980s, Yalom (1973; 1975; 1985) demonstrated the positive impact of cohesion on group therapy outcomes. Carron and colleagues and Yukelson and colleagues broadened
the study of cohesion by exploring the impact of cohesion in team sports (Carron, 1982; Carron & Widmeyer, 1985; Yukelson, Weinberg, & Jackson, 1984). The research results on cohesion in sports served as an indication of the importance of cohesion on the success of sports teams. During this era, Carron and colleagues (1982, 1984, 1985) first suggested that cohesion was a multi-dimensional construct and developed the Group Environment Questionnaire (GEQ), one of the first measures of cohesion with a multi-dimensional approach. Previously, measures which had been created were limited to a single dimension of the construct.

During the 1990s, researchers began to explore cohesion in both the military and healthcare environments more widely. Bliese and Halverson (1996) performed research on cohesion as two related constructs (vertical and horizontal cohesion), exploring cohesion as a reflection of the quality of the relationships within military units. Cohesion has become a broad topic in the military because of the predominant opinion among military researchers that cohesion is vital to the development of high levels of operational effectiveness (Kirke, 2010).

Cohesion was not widely studied in healthcare as a potentially important construct until the 2000s. A few studies, however, were published in the late 1980s and 1990s (Hinshaw & Atwood, 1987; Leppa, 1996; Revicki, Whitley, & Gallery, 1993; Shortell, Rousseau, Gillies, Devers, & Simons, 1991). Many of the researchers examining cohesion in healthcare have come primarily from the discipline of nursing. The exploration of cohesion in healthcare has illuminated the importance of cohesion in job satisfaction (DiMeglio, et al., 2005), patient satisfaction (Bae, Mark, & Fried, 2010; Deeter-Schmelz & Kenndy, 2003), care decisions (Messmer, 2008), and stress
symptomatology (Ba, Early, Mahrer, Klaristenfeld, & Gold, 2014). In addition, as an outcome variable, cohesion has been found to be able to be increased through team training efforts (Barrett, Piatek, Korber, & Padula, 2009; Klipfel, et al., 2011).

Review of the Literature

Research involving cohesion in nursing, healthcare, and medicine

A tripartite classification of outcomes, modeled after Schofield and Amodeo’s (1999) structure was used to organize findings of the review of the literature. Findings are reported in three categories: (a) patient care, (b) personnel, and (c) management and separated by topic explored.

A total of 33 articles were identified and included in the review of the literature. A variety of databases were searched including PubMed, Cumulative Index to Nursing and Allied Health – Plus (CINAHL- Plus), Cochrane, and Medline (OVID, ProQuest, EBSCO and Medline Plus). Key words / phrases included: cohesion in nursing, cohesion in healthcare, cohesion in medicine, group / team cohesion in nursing, group / team cohesion in healthcare, and group / team cohesion in medicine. Articles were included if they contained cohesion as either an independent or dependent variable in a healthcare (nursing, medicine, psychology) arena or discipline. In addition, mixed methods and qualitative studies were included if they contained aspects of cohesion. The majority of the articles contained descriptions of surveys to collect data about perceptions of cohesion. Several studies were intervention studies aimed at improving cohesion (Barrett, Piatek, Korber, & Padula, 2009; Dickey, Truten, Gross, & Deitrick, 2011; DiMeglio, et al., 2005; Klipfel, et al., 2011. Six articles were about cohesion from a
mixed method approach; no studies were found where researchers used a strictly qualitative approach. Eighteen studies were nursing focused, one was physician focused, and 13 had an inter-professional focus. The majority of the studies were personnel based \((n = 29\), including five which had a dual focus on personnel and management). Two were strictly management based and two were patient care focused.

The Studies

Patient care

Two articles were identified as patient care focused (Table 3). Both Deeter-Schmelz and Kennedy (2003) and Bae, Mark, and Fried (2009) linked cohesion to increases in patient satisfaction. In addition, Deeter-Schmelz and Kennedy exhibited a strong relationship between cohesion and the quality of patient care delivered.
Table 3  

*Patient care focused studies*

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Title</th>
<th>Cohesion studied as</th>
<th>N</th>
<th>Results</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deeter-Schmelz &amp; Kennedy</td>
<td>2003</td>
<td>Patient care teams and customer satisfaction: the role of team cohesion</td>
<td>Dependent &amp; Independent variable</td>
<td>427</td>
<td>Adequacy of team training had a significant effect on cohesion (0.22, r=2.40). Team training had a significant direct and indirect effect on patient care (0.21, r=2.40) and patient satisfaction (0.09, r=1.97). Teamwork influenced cohesion (0.58, r=6.52). A relationship between cohesion and quality of patient care with a significant direct effect (0.99, r=6.89) was found.</td>
<td>Inter-professional</td>
</tr>
<tr>
<td>Bae, Mark, &amp; Fried</td>
<td>2009</td>
<td>Impact of nursing unit turnover on patient outcomes in hospitals</td>
<td>Independent</td>
<td>268 units, 141 hospitals</td>
<td>Cohesion was significantly related to patient satisfaction in a model with and without relational coordination. Cohesion ($\beta=0.091$, $p&lt;.01$) and relational coordination with other healthcare providers ($\beta=0.159$, $p=.03$) were significantly associated with patient satisfaction. Cohesion alone was also related to patient satisfaction $p=.028$.</td>
<td>Nursing</td>
</tr>
</tbody>
</table>
**Personnel**

Twenty four articles included studies on the relationship between personnel and cohesion (Table 4). Several researchers (Barrett, Piatek, Korber, & Padula, 2009; Dickey, Truten, Gross, & Deitrick, 2011; DiMeglio, et al., 2005; Klipfel, et al., 2011) explored the use of interventions to improve cohesion. In all four of the interventional studies, cohesion was successfully increased by the intervention (Barrett, Piatek, Korber, & Padula, 2009; Dickey, Truten, Gross, & Deitrick, 2011; DiMeglio, et al., 2005; Klipfel, et al., 2011). Klipfel, and colleagues (2011) found that their intervention also improved feelings of group morale and belongingness. Revicki, Whitley and Gallery (1993) found that among physicians, strong peer support, a cohesive work group, and greater internal control resulted in a reduction in role conflict and ambiguity. In addition, resident physicians reporting good cohesion in their work groups tended to report lower levels of work related stress.

**Work satisfaction.** Authors of six studies explored the cohesion-work satisfaction relationship (Hinshaw, Smeltzer, & Atwook, 1987; Ko, 2011, Kovner, Brewer, Greene, & Fairchild, 2009; Larabee, Janney, Ostrow, Withros, Hobbs, & Burant, 2003; Shader, Broome, Broome, West, & Nash, 2001; Soudif, 2004). All of the studies had a nursing focus. Hinshaw, Smeltzer, and Atwood (1987) found that for Bachelor of Science of Nursing (BSN) nurses and those working in medical / surgical areas, cohesion strongly influenced organizational and professional job satisfaction. Cohesion among diploma prepared nurses, however, predicted only organizational job satisfaction (Hinshaw, Smeltzer, & Atwood, 1987). In a more recent study, Shader, Broome, Broome,
West, and Nash (2001) found similar results, reporting that higher work satisfaction resulted in higher perceptions of cohesion. Furthermore, nurses who had more stable work schedules also reported greater feelings of group cohesion (Shader, Broome, Broome, West, & Nash, 2001). Larrabee and colleagues (2003), Sourdif (2004), Kovner and colleagues (2009) all reported findings of significant correlations between cohesion and work satisfaction. Ba (2011) was the only researcher who found a non-inversed relationship between cohesion and work satisfaction. The nurses in the Ba (2011) study who indicated that they had low satisfaction with nursing had higher levels of cohesion.

**Stress.** Researchers of four studies examined the stress- cohesion relationship (Ba, Early, Mahrer, Klaristenfeld, & Gold, 2014; Bratt, Broome, Kelber, & Lostocco, 2000; Cram, 2002; Shader, Broome, Broome, West, and Nash, 2001). Cram (2002), Bratt and colleagues (2002), and Shader and colleagues (2001) found that as stress increased cohesion decreased. Burnout alongside stress was explored by Ba and colleagues (2014). This study was the only study where cohesion was used as a moderator variable, with findings supporting cohesion as a protective factor in both work stress and job burnout.

**Turnover.** Four studies had a focus on the relationship between turnover of nurses and cohesion (Hayhurst, Saylor, & Stuenkel, 2005; Hinshaw, Smeltzer, & Atwood, 1987; Shader, Broome, Broome, West, & Nash, 2001; Tourangeau & Cranley, 2005). In all of these studies, higher cohesion was associated with decreases in turnover and greater intention to remain employed.
Other variables. Relationships between cohesion and other variables including, empowerment (Larabee, Janney, Ostrow, Withros, Hobbs, & Burant, 2003), Post Traumatic Stress Disorder (PTSD) symptoms (Dickstein, et al., 2010), cynicism (Lasalvia, et al, 2009), peer support (Revicki, Whitley, & Gallery, 1993), experience (Bratt, Broome, Kelber, & Lostocco, 2000), and humor (Niedwiecki, 1997) were also identified in the literature. Revicki, Whitley, and Gallery (1993) found that stronger peer support, a cohesive work group, and internal control resulted in a reduction in role conflict and ambiguity. Bratt, Broome, Kelber, & Lostocco’s (2000) revealed that work experience and patient acuity were related to cohesion; as experience increased, cohesion decreased. Finally, PTSD symptoms were lessened when unit cohesion was high (Dickstein, et, al. 2010).
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Title</th>
<th>Cohesion studied as</th>
<th>N</th>
<th>Results</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinshaw, Smeltzer, &amp; Atwood</td>
<td>1987</td>
<td>Innovative retention strategies for nursing staff</td>
<td>Independent variable</td>
<td>1597</td>
<td>Cohesion in BSNs predicted turnover ($B = -.18$). Cohesion influenced org. job satisfaction ($B = .27$) and prof. job satisfaction ($B = .17$). Cohesion in Diploma nurses predicted org. job satisfaction ($B = -.24$). In critical care nurses cohesion influenced turnover ($B = -.14$), predicted org. job satisfaction ($B = .22$) and prof. job satisfaction ($B = .24$). In med. / surg. nurses cohesion influenced turnover ($B = -.13$) and influenced org. job satisfaction ($B = .39$).</td>
<td></td>
</tr>
<tr>
<td>Revicki, Whitley, &amp; Gallery</td>
<td>1993</td>
<td>Organizational characteristics, perceived work stress, and depression in emergency medicine residents</td>
<td>Independent variable</td>
<td>484</td>
<td>3rd yr. residents are less likely to perceive their work environments as cohesive. Strong peer support, a cohesive work group, and internal control result in a reduction in role conflict and ambiguity. Residents reporting good cohesion report lower levels of work related stress ($r = -.36$ peer support, $r = -.48$).</td>
<td>Physician</td>
</tr>
<tr>
<td>Niedwiccki</td>
<td>1997</td>
<td>Humor and its relationship to cohesion of work group members in</td>
<td>Dependent &amp; Independent variable</td>
<td>71</td>
<td>No significant correlations found between individuals' value and use of humor to cope and assessment of cohesion ($p = .09$). No significant relationship found between group rankings based</td>
<td>Nursing</td>
</tr>
<tr>
<td>Author(s)</td>
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<tr>
<td>Bartone &amp; Adler</td>
<td>1999</td>
<td>Cohesion over time in a peacekeeping medical task force</td>
<td>Dependent</td>
<td>188 pre deployment, 128 mid-deployment, 81 late deployment</td>
<td>Cohesion levels increased over time; pre-deployment ($M = 2.96, SD = 0.81$) mid-deployment ($M = 3.72, SD = 0.87$) end of the 6 month deployment ($M = 3.30, SD = 0.94$). ANOVA comparisons $F(2,379) = 28.31, p &lt; .001$.</td>
<td>Inter-professional</td>
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<td>Author(s)</td>
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<tr>
<td>Bratt, Broome, Kelber, &amp; Lostocco</td>
<td>2000</td>
<td>Influence of stress and nursing leadership on job satisfaction of pediatric intensive care unit nursing</td>
<td>Independent variable</td>
<td>1973</td>
<td>Job stress was negatively correlated to cohesion ($r = -0.37, p &lt; .001$). Cohesion explained 6% of the variance in the model examining job satisfaction. Cohesion was not significantly predicted by shift schedule, $p = .06$. There was a relationship between cohesion and experience in the PICU, $p = .02$. No differences in cohesion were found by educational type. Level of unit acuity influenced cohesion, $p &lt; .001$.</td>
<td></td>
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<tr>
<td>Chaboyer, Najman, &amp; Dunn</td>
<td>2001</td>
<td>Cohesion among nurses: a comparison of bedside vs. charge nurses perceptions in Australian hospitals</td>
<td>Dependent variable</td>
<td>555</td>
<td>No difference between level I or level II/III nurses on the mean responses to the Cohesion Among Nurses Scale (CANS), $p = .17$ was found.</td>
<td></td>
</tr>
<tr>
<td>Shader, Broome, Broome, West, &amp; Nash</td>
<td>2001</td>
<td>Factors influencing satisfaction and anticipated turnover for nurses</td>
<td>Independent variable</td>
<td>246</td>
<td>Greater levels of perceived job stress resulted in lower reported cohesion ($p &lt; .001$). Higher levels of work satisfaction predicted greater reported cohesion, $p &lt; .001$. Nurses with stable schedules</td>
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</table>

soldiers abilities ($p < .001$), confidence in mission success ($p < .001$), satisfaction with the resupply system ($p < .001$) all were related to cohesion.
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<th>Author(s)</th>
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<th>Cohesion studied as</th>
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<th>Results</th>
<th>Focus</th>
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</thead>
<tbody>
<tr>
<td>Larabee, Janney, Ostrow, Withros, Hobbs, &amp; Burant</td>
<td>2003</td>
<td>Predicting registered nurse job satisfaction and intent to leave</td>
<td>Independent variable</td>
<td>90</td>
<td>Cohesion was strongly correlated with job satisfaction $p &lt; .001$, and feelings of empowerment, $p &lt; .05$. The first study to link psychological empowerment to group cohesion.</td>
<td>Nursing</td>
</tr>
<tr>
<td>Sourdif</td>
<td>2004</td>
<td>Predictors of nurses' intent to stay at work in a university health center.</td>
<td>Independent variable</td>
<td>108</td>
<td>Differences were noted in PT ($p = .034$) versus FT ($p = .034$) workers in reported cohesion. Work satisfaction and cohesion were significantly correlated ($p &lt; .01$).</td>
<td>Nursing</td>
</tr>
<tr>
<td>DiMeglio et al.</td>
<td>2005</td>
<td>Group cohesion and nurse satisfaction</td>
<td>Dependent Variable</td>
<td>41,524 comparison group, 255 study group</td>
<td>Pre to post intervention group cohesion increased, $p &lt; .001$. The cultural personality of each unit emerged in the early sessions. One theme revealed the perception that high performing teams were equated with cohesive teams. The &quot;How well are we working together survey&quot;) demonstrated a significant improvement in cohesion post intervention, $p &lt; .001$.</td>
<td>Nursing</td>
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<td>Author(s)</td>
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<tr>
<td>Hayhurst, Saylor, &amp; Stuenkel</td>
<td>2005</td>
<td>Work environmental factors and retention of nurses</td>
<td>Independent variable</td>
<td>272</td>
<td>Cohesion in nurses who stayed in their units was higher compared to those who left ($M_s$ 5.5 versus 5.3, $t = 0.5, p = .58$).</td>
<td>Nursing</td>
</tr>
<tr>
<td>Tourangeau &amp; Cranley</td>
<td>2005</td>
<td>Nurses intention to remain employed: understanding and strengthening determinants</td>
<td>Independent variable</td>
<td>8456</td>
<td>Level of teamwork was used as the indicator of cohesion, and was found to be a predictor of intent to remain employed, $p = .015$.</td>
<td>Nursing</td>
</tr>
<tr>
<td>Messmer</td>
<td>2008</td>
<td>Enhancing nurse-physician collaboration using pediatric simulation</td>
<td>Dependent variable</td>
<td>105</td>
<td>Males had higher cohesion scores then females $p = .005$. There were no correlations between cohesion and competency.</td>
<td>Inter-professional</td>
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<tr>
<td>Barrett, Piatek, Korber, &amp; Padula</td>
<td>2009</td>
<td>Lessons learned from a lateral violence and team-building intervention</td>
<td>Dependent variable</td>
<td>104</td>
<td>Improvement in cohesion scores pre to post time points $p = .37$. Qualitative findings - units trouble articulating their needs.</td>
<td>Nursing</td>
</tr>
<tr>
<td>Author(s)</td>
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<tr>
<td>Kovner, Brewer, Oreene, &amp; Fairchild</td>
<td>2009</td>
<td>Understanding new registered nurses' intent to stay at their jobs</td>
<td>Independent variable</td>
<td>1406</td>
<td>Cohesion was associated with higher levels of work satisfaction ($p &lt; .001$) and organizational commitment ($p = .001$).</td>
<td>Nursing</td>
</tr>
<tr>
<td>Lasalvia, et al.</td>
<td>2009</td>
<td>Influence of perceived organizational factors on burn-out: survey of community mental health staff</td>
<td>Independent variable</td>
<td>1328</td>
<td>Cohesion was predictive of cynicism ($p &lt; .01$), exhaustion ($p &lt; .01$), and burnout ($p &lt; .05$). Groups with poor cohesion had an increased risk of burnout.</td>
<td>Inter-professional</td>
</tr>
<tr>
<td>Dickstein, et al.</td>
<td>2010</td>
<td>Unit cohesion and PTSD symptom severity in air force medical personnel</td>
<td>Independent variable</td>
<td>705</td>
<td>Cohesion had a significant inverse relationship with PTSD symptoms ($r = -.30, p &lt; .01$). Cohesion did not differ by race, $p = .29$, military rank $p = .90$ or level of education, $p = .96$. Differences found were associated with gender; men reported greater cohesion than women, $p &lt; .001$.</td>
<td>Inter-professional</td>
</tr>
<tr>
<td>Dickey, Truten, Gross, &amp; Deitrick</td>
<td>2011</td>
<td>Promotion of staff resiliency and interdisciplinary team cohesion narrative exchange</td>
<td>Dependent variable</td>
<td>155</td>
<td>Cohesion was enhanced regardless of professional position, years in the profession, or number of sessions attended.</td>
<td>Inter-professional</td>
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<tr>
<td>Author(s)</td>
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<tr>
<td>Klipfel, et al.</td>
<td>2011</td>
<td>Using high-fidelity simulation to develop nurse-physician teams</td>
<td>Dependent variable</td>
<td>24</td>
<td>A positive shift in cohesion was found. Time points one and two, all items on the cohesion tool showed improvement; three were statistically significant: morale ($t(24) = -2.200, p = .038$), belongingness ($t(24) = -3.245, p = .004$), and working together ($t(24) = -3.122, p = .005$). There was a positive shift in cohesion from time point one to three. No statistically significant shift was not found between time point two and three. Positive changes in cohesion were found based on age. The youngest participants showed significant positive changes between time points one and two on morale ($t(16) = 2.611, p = .020$), belongingness ($t(16) = -3.416, p = .004$), and working together ($t(16) = -2.236, p = .041$). As the younger participants approached the third time point, significant improvements were found in all items of the cohesion tool. In the older group, there was a decrease in cohesion between time points one and two in belongingness ($t(11) = 2.887, p = .016$). Improvements in all items were found between times points one and three, with a significant improvement in morale ($t(9) = -2.530, p = .035$).</td>
<td>Interprofessional</td>
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<tr>
<td>Cramm &amp; Nieboer</td>
<td>2011</td>
<td>Professionals’ views on inter-professional stroke team functioning</td>
<td>Independent variable 34 teams, 558 professionals</td>
<td></td>
<td>Cohesion was analyzed at the team level. No significant relationship was found between cohesion and team functioning.</td>
<td>Inter-professional</td>
</tr>
<tr>
<td>Ko</td>
<td>2011</td>
<td>Group cohesion and social support of the nurses in a special unit and a general unit in Korea</td>
<td>Independent variable 1784</td>
<td></td>
<td>Group cohesion was significantly different based on clinical experience ($p &lt; .001$), position ($p &lt; .01$), religion ($p = .032$), satisfaction with nursing ($p &lt; .001$), and number of supportive peers ($p &lt; .001$). Chief nurses ($M = 2.74$) had lower group cohesion compared to staff nurses ($M = 2.86$). The group reporting low satisfaction with nursing had higher group cohesion, $p &lt; .001$. Highest group cohesion was found in the group indicating that they had no supportive superiors and peers, $p &lt; .01$. Nurses in specialty wards reported higher group cohesion compared general ward nurses, $p = .004$. A significant correlation between group cohesion and social support scores was found; the group with lower social support had higher group cohesion, $p &lt; .05$.</td>
<td>Nursing</td>
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<td>Author(s)</td>
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<tr>
<td>Ba. Early, Mehrer, Klaristenfeld, &amp; Gold</td>
<td>2014</td>
<td>Group cohesion and organizational factors for nurse residents' job satisfaction, compassion fatigue, compassion satisfaction, and burnout</td>
<td>Moderator variable</td>
<td>232</td>
<td>The interaction between current post traumatic stress disorder (PTSD) symptoms and cohesion accounted for 22% of the variance in the model, $R^2 = 0.22$, $F(1,172) = 46.920$, $p &lt; .001$. Relationships between current PTSD symptoms and burnout were mitigated, thus trauma was less likely to be related to burnout when group cohesion was high. Cohesion moderated the effect of current stress exposure and PTSD symptoms $R^2 = 0.16$, $F(2,172) = 16.678$, $p &lt; .001$. The interaction between cohesion and PTSD symptoms and the interaction between cohesion and stress together accounted for 42% of the variance in the compassion of fatigue/ secondary stress disorder, $R^2 = 0.42$, $F(2,172) = 61.748$, $p &lt; .001$. Concluded that cohesion may serve as a protective factor.</td>
<td>Nursing</td>
</tr>
<tr>
<td>Graetz, Reed, Shortell, Rundall, Bellows &amp; Hsu</td>
<td>2014</td>
<td>The association between EHRs and care coordination varies by team cohesion</td>
<td>Independent variable</td>
<td>1869</td>
<td>Higher reported cohesion predicted significant improvements in reported access to timely and complete information (53% with EHR, 37.6% no EHR) versus lower cohesion teams (31.7% with EHR, 32.6% no EHR), $p &lt; .001$. Agreement on treatment goals was better on teams with higher cohesion (64.3% with EHR, 50.6% no EHR) compared to lower cohesion (44% with EHR, 45.9% no-EHR), $p &lt; .001$. The change in clinician agreement on roles and responsibilities was greater with access to EHR for higher cohesion teams.</td>
<td>Inter-professional</td>
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<tr>
<td>Author(s)</td>
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<td></td>
<td>(63.9% with EHR, 55.2% no EHR) compared to lower cohesion teams (48.7% with EHR, 46.7% no EHR), $p &lt; .05$</td>
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</table>
Personnel / Management

Five personnel and management focused studies were identified in the review of literature (Table 5). Three focused on inter-professional teams, (Kalam, 2008; Lagare, et al., 2013; Temkin-Greener, Gross, Kunitz, & Mukamel, 2004), and two on strictly nursing teams (Birx, Lasala, & Wagstaff, 2011; Jones, 1991). Legare, et al. (2013) utilized a mixed methods approach to explore cohesion and intent to engage in shared decision making in inter-professional teams. Data collected from focus groups revealed that lack of cohesion among professionals was thought to be a barrier to the implementation of inter-professional shared decision making, and that better cohesion could foster the enactment of inter-professional shared decision making (Legare, et al., 2013). Tempkin-Greener and colleagues (2004) found that leadership, communication, coordination, and conflict management were positive predictors of both team cohesion and perceived team effectiveness. They also found that the availability of resources and staff was a statistically significant predictor of cohesion (Temkin-Greener, Gross, Kunitz, & Mukamel, 2004). Additionally, effective communication, conflict management, coordination, and leadership were all found to have statistically significant impacts on team cohesion and effectiveness (Temkin-Greener, Gross, Kunitz, & Mukamel, 2004). Team cohesion studied as an independent variable was also found to be a significant predictor of the effectiveness of teams’ cohesion (Temkin-Greener, Gross, Kunitz, & Mukamel, 2004).

Similar to the findings of the studies conducted by Hayhurst, Saylor, & Stuenkel, (2005), Hinshaw, Smeltzer, & Atwood, (1987), Shader, Broome, Broome, West, and Nash, (2001), and Tourangeau & Cranley, (2005), Jones (1991) found a relationship
between group cohesion and intent to leave their jobs. Results of this study also indicated that those nurses who had high group cohesion had a lesser tendency to indicate intent to leave their jobs (Jones, 1991). Jones’ (1991) research findings added to the conclusions on the cohesion – intent to leave relationships; revealing that cohesion was influenced by satisfaction with head nurse management approaches. Those nurses with greater group cohesion tended to also have more satisfaction with their head nurse managers.

Birx, Lasala, & Wagstaff (2011), conducted a small mixed methods interventional study on the impact of a team-building retreat to promote nursing faculty and job satisfaction and identified five emerging themes: (a) enjoying getting to know peer faculty members better, (b) feeling closer as a group, being able to set a more friendly tone for the semester, and (c) having a positive experience through participation in the retreat (Jones, 2011). Additionally, the authors found a significant increase in the post retreat cohesion scores as compared to the pre retreat scores (Jones, 2011).

Finally, Kalam (2008) demonstrated the effects of similarity and dissimilarity on team cohesion and showed that executives perceived their teams as more cohesive than all other members of the healthcare team including, registered nurses, therapists, and line workers. Team cohesion was found to be greater in smaller hospitals and not-for-profit hospitals (Kalam, 2008). Occupation and education were found to influence perceptions of cohesion. Higher level workers had lower cohesion, as did those who were more highly educated (Kalam, 2008). Finally, as in other studies conducted outside healthcare, Kalam (2008) demonstrated that the similarity of team members positively impacted cohesion. As perceived dissimilarity increases, cohesion decreases (Kalam, 2008).
Kalam (2008) also found that cohesion was the most important predictor of team outcome effectiveness in achieving its intended goals.
<table>
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<tr>
<th>Author (s)</th>
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<tbody>
<tr>
<td>Jones</td>
<td>1991</td>
<td>A study of the effect of group cohesion on the intent to leave among registered nurses in the two federal health care facilities</td>
<td>Dependent &amp; Independent variable</td>
<td>246</td>
<td>Nurses with high cohesion were more likely to indicate low intent to leave, $p = .018$. The overall strength of the relationship moderated $R = -0.333$. Nurses with higher cohesion scores tended to have higher satisfaction with management, $p = .004$.</td>
<td>Nursing</td>
</tr>
<tr>
<td>Temkin-Greener, Gross, Kunitz, &amp; Mukamel</td>
<td>2004</td>
<td>Measuring interdisciplinary team performance in a long-term care setting</td>
<td>Dependent &amp; Independent variable</td>
<td>1220</td>
<td>Leadership, communication, coordination, and conflict management were positive predictors ($p &lt; 0.001$) of cohesion and team effectiveness. Workplace characteristics did not predict cohesion or effectiveness. Resources/staffing availability did predict cohesion ($p = 0.0186$). Communication ($p = 0.001$) was found to impact team cohesion and effectiveness the most, followed by conflict management ($p = 0.002$), coordination ($p = 0.0019$), and finally leadership ($p &lt; 0.0001$). Cohesion as an independent variable was a significant predictor of team effectiveness ($p &lt; 0.001$). In perceptions of cohesion between paraprofessionals and professionals, professionals assessed their teams as being better on all measures including cohesion ($p = 0.0004$).</td>
<td>Inter-professional</td>
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<tr>
<td>Kalam</td>
<td>2008</td>
<td>Effects of Similarity-dissimilarity, team</td>
<td>Dependent &amp; Independent variable</td>
<td>185</td>
<td>Females rated their teams as more cohesive ($M = 15.70$) compared to males ($M = 15.13$), $p = .67$. Non-Hispanics rated their teams as cohesive ($M = 15.50$) and Hispanic-Latinos</td>
<td>Inter-professional</td>
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<td>Author</td>
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<tr>
<td>Dixon, Lasala &amp; Wagstaff</td>
<td>2011</td>
<td>Evaluation of a team-building retreat to promote nursing</td>
<td>Cohesion was measured using a 7-point likert scale.</td>
<td>29</td>
<td>A significant increase was noted in the pre to post cohesion scores, $p &lt; 0.05$. Five themes were identified: 1. Getting to know each other, 2. Better seeing similarities and differences, 3.</td>
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<td>Author(s)</td>
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<tr>
<td>Legare, et al.</td>
<td>2013</td>
<td>Healthcare providers' intentions to engage in an inter-professional approach to shared decision-making in home care programs: A mixed methods study</td>
<td>nursing faculty cohesion and job satisfaction</td>
<td>NA</td>
<td>272</td>
<td>Inter-professional</td>
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</table>
Management

Two management focused studies were identified in the review of the literature (Boyle & Kochinda, 2004; Shortell, Rousseau, Gillies, Devers, & Simons, 1991) (Table 6). Shortell and colleagues conducted a multi-site national study of 42 intensive care units with a focus on gathering evidence for the reliability and validity of a comprehensive set of measures related to: (a) leadership, (b) organizational culture, (c) communication, (d) coordination, (e) problem solving- conflict management, and (f) team cohesiveness. The psychometrics of the tools used to measure the outlined areas had good internal validity with a Cronbach’s alpha of .86 and most subscales exceeding .70 (Shortell, Rousseau, Devers, & Simons, 1991). The subscale used to measure cohesion had a Cronbach’s alpha of .79 (Shortell, Rousseau, Devers, & Simons, 1991). The important conclusions drawn from Shortell and colleagues’ (1991) study were that when unit leadership has a team-satisfaction oriented culture, effective communication, coordination, and a problem-solving approach, team cohesion is consistently associated with improvements in perceived technical quality of care, perceived ability to meet family members' needs, and nursing turnover (Shortell, Rousseau, Devers, & Simons, 1991).

Boyle and Kochinda (2004) implemented a longitudinal intervention study targeted at unit leadership on two intensive care units. The intervention, which was developed to improve cohesion, was found to increase work group cohesion on the unit receiving the intervention; however, it did not reach statistical significance (Boyle & Kochinda, 2004). Collaborative communication skills (a secondary focus of the intervention), however, did show a statistically significant improvement following the
intervention (Boyle & Kochinda, 2004). Overall, the study findings support the feasibility of using interventions targeting unit leadership for the purpose of increasing collaborative communication skills (Boyle, & Kochinda, 2004).
### Table 6

**Management focused studies**

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<th>Author(s)</th>
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<tr>
<td>Shortell, Rousseau, Gillies, Devers, &amp; Simons</td>
<td>1991</td>
<td>Organizational assessment in intensive care units (ICUs): Construct development, reliability, and validity of the ICU nurse-physician questionnaire</td>
<td>Independent variable</td>
<td>1418</td>
<td>10 subscales were measured. Person Correlations are shown for each of the subscales correlated with the cohesion subscale. Nursing leadership ((r = .49)), team satisfaction ((r = .48)), within unit coordination ((r = .44)), open communication with in group ((r = .55)), open communication between group ((r = .40)), Communication accuracy ((r = .41)), Shift communication ((r = .43)), understanding of communication ((r = .45)), timeliness of communication ((r = .55)), and Satisfaction with nurse communication ((r = .48)). When leadership has a team-satisfaction oriented culture, effective communication, coordination, and a problem-solving approach cohesion is associated with improvements in technical quality of care, ability to meet family members' needs and nursing turnover.</td>
<td>Inter-processional</td>
</tr>
<tr>
<td>Boyle &amp; Kochinda</td>
<td>2004</td>
<td>Enhancing collaborative communication of nurse and physician leadership in two intensive care units</td>
<td>Dependent variable</td>
<td>10</td>
<td>Cohesion increased in the participants from one of the two units in the study, but was not statically significant, (p = .13).</td>
<td>Inter-professional</td>
</tr>
</tbody>
</table>
Synopsis of the Literature

The purpose of this review of the literature was to explore the theoretical and empirical literature on cohesion in healthcare teams. The literature reviewed in this analysis relates to the study of cohesion in nursing, medicine, and other healthcare areas. Cohesion in these areas has been studied both as independent and dependent variables, as a single variable of interest and as one of a multitude of variables of interest. Overall, the literature included in this review illustrates the differences in ideas about how cohesion influences healthcare teams’ work.

The diversity noted in the studies illustrates cohesion as a variable which might influence a variety of aspects of healthcare including, work satisfaction, patient outcomes, work related stress, and intent to leave- stay in a job. On the whole, researchers who explored cohesion found that cohesion had moderate to strong influences on the outcome variable when it was explored as an independent variable. When cohesion was explored as a dependent variable cohesion was found to be strongly influenced by interventions aimed at improving it. Few researchers explored cohesion as a predictor of team performance, thus this study is useful to address this gap in the literature.

Theoretical Framework

Theoretical models

A theoretical model of highly cohered groups modeled after King’s Goal Attainment theory is depicted in Figures 1-3. This model is an illustration of the complex nature of the healthcare teams that interact with one another in the course of healthcare.
delivery. In this depiction, there is no single individual who contributes to systems outside of groups. The successes or failures of the smaller groups (the patient system, the primary healthcare team system, and the secondary healthcare team systems) to deliver quality care within the larger healthcare systems (healthcare organizations (hospitals and clinics), and within the national healthcare systems (Medicare, Medicaid, insurance companies, for example) depend on clear communication and coordinated interactions occurring among and between them, and within the larger systems of the healthcare organization and national healthcare system. Theoretically, the communications and interactions which are so vital to the goals of the groups (patient outcomes, maintenance of health or return to health) are most effective when they occur in cohered teams which have a shared mental model with shared goals. The complexity of all the groups which interact to care for a single patient is illustrated in Figure 1 as a highly cohered group (team) where overlaps and frequent communication and interactions are depicted using overlapping circles representative of individuals and bi-tailed arrows representing interactions and communications. This figure represents an ideal model of a team-based healthcare delivery system.

The alternate depiction (Figure 2), represents the PI's theorized current model of team-base healthcare system where non-overlapping circles represent uncoordinated, missed interactions, or missing collaborative opportunities and single directional arrows represent one-way communications occurring when two-way discourse is needed. Figure 3 represents the teams (personal systems) who provide care to individuals (personal micro-systems, Figure 4) within the healthcare system (interpersonal systems).
Patient systems are made up of individuals who interact with and within interpersonal systems in larger social systems.

The three models together represent the complexities of a healthcare delivery system where healthcare teams, made up of individuals (personal systems), interact with other individuals (patients [personal systems], shown in Figure 3), in interpersonal systems (in this case could be hospital units, or other teams), within larger healthcare organizations (organizational systems) (Figure 1) to delivery care.

The use of teams to deliver care is a growing healthcare trend (Temkin-Greener, Kunitz, & Mulamel, 2004). All groups / teams are essentially interpersonal micro-systems with the main goal of its members to work together toward a commonly understood goal. In healthcare, the major goal of teams is to provide effective, efficient, quality safe care in order to return or maintain a state of health and / or well-being to persons in their care, or to provide palliative supportive care at the end of life. Results of research on cohesion indicate that cohesion is an important characteristic of groups necessary for successful achievement of their goals.

The interactions, transactions, and intra-actions among each of the systems (healthcare teams, patient systems, healthcare systems and healthcare organizations) in healthcare lead to a complex network of communications and actions aimed at a mutual goal of providing care to patients. To be most successful, cohesion among the members of each of the groups (systems) should occur. King emphasized the importance of a cohesive and collaborative relationship centered around knowledge and information between the nurse and the patient in order to achieve the agreed upon goals (Fawcett & Messmer, 2008). This idea, as a concept, is expanded beyond the nurse for this study to
include the healthcare team and the relationships among its members and with the patient and other members of the larger healthcare system. King’s Theory of Goal Attainment has been identified by the PI and Messmer (2008; 2006) as a fitting and appropriate framework to underpin and assist in exploring the phenomenon of the impact of group cohesion on team performance in simulated medical emergencies.

**Healthcare Systems – With Team Cohesion**

*Figure 1.* Depiction of the intersection of the relationships among all healthcare groups caring for individuals. Double sided arrows represent interactions and communication
between each group / individuals within each group. Individuals are represented by single circles, groups are represented by overlapping circles within circles and larger group systems are represented by circles within concentric circles.

**Healthcare Systems – Without Team Cohesion**

*Figure 2.* Depiction of the disorderly system of healthcare void of highly cohered teams without coordinated interactions and effective communication. Double sided arrows represent interactions and communications which should be occurring between groups / individuals within each group. Single sided arrows represent one-sided communications. Individuals are represented by single circles, poorly cohered groups are represented by partially and non-overlapping circles within circles and larger group systems are represented by circles within concentric circles.
Figure 3. Depiction of an individual healthcare team.

Healthcare Teams

- Individual healthcare providers are represented by each overlapping circle.
- Arrows representing the interactions between individuals and the communication flow.
- Teams interact within healthcare larger systems.

Figure 4. Depiction of the patient system.
**King’s Theory of Goal Attainment**

King’s Theory of goal attainment is a broad view of three dynamic interacting and related systems, personal, interpersonal, and social (King, 1997). The three interacting systems mirror the interacting systems found in all healthcare teams. All healthcare teams have the goal of health and healthcare, as in the framework described by King (1997). The general systems framework is solely focused on the nursing care of human beings, because this study explored inter-professional teams, this aspect of King’s Theory was expanded to include both the nursing and medical care of human beings. As described in King’s Theory of Goal Attainment, healthcare teams phenomena like nursing phenomena are about the health of individuals (personal systems), the health of groups (interpersonal systems), and the health of societies (social systems) within social systems (institutions and organizations). In addition, healthcare groups themselves are made up of these same interrelated systems, in essence resulting in complex systems within simpler systems requiring strong cohesion and frequent back and forth communication and interactions in order to meet the goals of providing quality healthcare to individuals (Figure 1). Finally, the four central concepts of the Theory of Goal Attainment (perception, communication, interaction, and transaction) found in the *transaction process* are also important for healthcare teams to achieve successful facilitation of the assessment of the patient, diagnosis of the illness effecting the patient, planning for the patient’s care, implementing that care, and finally, evaluating the care (King, 2007).
Application in healthcare systems / teams

Among members of healthcare teams, perceptions of events occurring in each interaction should be shared. This sharing assists in a team wide development of a collective understanding of the delineated goals, the progress already made, and the steps which will be taken toward achievement of the goal(s). This is known as a shared mental model. Mental models are understood as mechanisms where human beings create elucidations of a system purpose, form explanations of system functioning, observe system states, and make predictions for future system states based on prior observations (Rouse & Morris, 1986). Shared mental models have been shown to be important in understanding team performance and team decision making (Cannon-Bowers & Salas, 1990; Kleinman & Serfaty, 1989; Orasanu & Salas, 1993). Additionally, in viewing the importance of perceptions within teams, the perceptions of the patient cannot be ignored. Patient perceptions are important determinants of successful patient – provider interactions (King, 2007) which in turn contributes to the total success of the care delivered.

Communication is of utmost importance to the effective functioning of any team. Results of research on team dynamics in healthcare have demonstrated a causal link between communication failures within healthcare teams and resulting unanticipated patient harm (Leonard, Graham, Bonacum, 2004). Communication, with a focus on understanding the perspective of each team member, leads to synergistic problem solving (Cram, 2002). Interactions among team members, across teams, and between the patient and healthcare teams are imperative for the development of team aims and an understanding of treatment options, direction of treatment, and outcomes of care.
Frequent and effective interactions among healthcare team members, including the patient are important in maintaining a view of the team goals and ultimately the success in reaching those goals. Individuals should have the ability to identify and conceptualize desirable goals in action (Lomard, 2006). Further, effective interactions within a variety of environments have been positively linked to the existence of shared mental models within systems (Castellan, 1993). Highly cohesive teams are noted to have more interactions and spend more time planning, exchanging information, and communicating relevant information (Zaccaro, Gualtieri, Minionis, 1995). Finally, effective team performances (especially in military teams) have been shown to require a high degree of member interaction, coordination, and synchronization in both planning and in the employment of actions (Fleishman & Zaccaro, 1992; Guzzo, 1986; Hackman & Morris, 1975; McGrath, 1984, 1991; Morgan, Glickman, Woodward, Blaiwes, & Salas, 1986).

**Chapter Summary**

Chapter II is the literature review, and theoretical framework. The literature examined indicates a link between cohesion and several variables of interest in healthcare including patient outcomes, work stress, burnout, intent to leave, and satisfaction. In addition, the results of interventional studies found in the literature demonstrate the ability for cohesion to be bolstered through a variety of interventions aimed at improving cohesion in healthcare teams. Few studies were found exploring the relationship between cohesion to inter-professional team performance. This study was constructed to assist in addressing this gap in the literature.
This chapter also included a description of King’s Goal Attainment Theory which was used to underpin the study. King’s Goal Attainment Theory illustrates the importance of individual systems functioning interdependently in order to be successful in meeting desired and pre-determined goals. This theory highlights the necessity for frequent, purposeful, and effective communication and interactions to occur among individuals within systems (teams) and between systems (teams) to increase the likelihood that the goals of the teams (systems) will be met. Several figures are used to depict the model of team cohesion used in this study which was based on King’s Goal Attainment Theory.
Chapter III

Research Methods

The purpose of this chapter is to present the research methods used to answer the research questions and to test the hypotheses on the effects of cohesion on performance. The hypotheses evolved from observations made during the PI’s work as a faculty member in previous IPE courses where students were divided into teams for the purposes of facilitating learning about working in teams. Gaps identified in the literature were used as a basis for the hypotheses which were tested in this study. This chapter includes a description of the research design, the sampling plan and setting of the study, measurement tools, human subjects and data collection procedures, and approaches for data analysis.

Research Design

A correlational time series research design was used to answer the research questions and test the hypotheses about relationships between group cohesion and performance. Three variables were studied, cohesion, performance, and time. Analyses were carried out at the group level using path analysis. Differences in assessments of cohesion by gender and intended profession were also explored using Independent samples t test. In addition to measuring group cohesion, and exploring the relationship between cohesion and performance, psychometric analysis of the Quadripartite Cohesion Scale (QCS) which was developed for this study and used to measure team cohesion was carried out to assess its reliability and factor structure. Individual level analyses were used for exploring the differences in assessments of cohesion and to run the
psychometrics analyses of the QCS. A second instrument, the University of Miami Crisis Resource Management tool (UM-CRM) was used to measure team performance. Internal reliability assessment of this tool was also undertaken to assess its internal consistency.

Cohesion

A quadripartite cohesion tool (the Quadripartite Cohesion Scale [QCS]) developed specifically for this study was used to measure cohesion. The QCS consists of 24 items and four subscales (compatibility, instrumental value, attraction, and task integration) measuring key dimensions of cohesion as a multi-dimensional construct. The subscales of the QCS were selected from previously validated and reliable instruments measuring a variety of the dimensions of cohesion in groups. The multi-dimensional view of cohesion is well supported in the literature (Carron, 1982; Mcleod, von Treuer, 2013; Murdrack, 1989; Stokes, 1983; Yuelson, Weinberg, & Jackson, 1984). The view of cohesion as a multi-dimensional construct is based on the opinion that conceptualizing cohesion as a uni-dimensional construct measuring a single manifestation of cohesion (attraction to the group, for example) loses the ‘groupness’ of concept, thus failing to fully capture the essence of the concept (Mcleod, von Treuer, 2013; Murdrack, 1989; Yuelson, Weinberg, & Jackson, 1984).

Single dimensional models of cohesion are thought to be problematic because their worth seems to be partial to certain types of groups (Cota, Evans, Dion, Kilik, & Longman, 1995). Multi-dimensional models of cohesion also have greater potential to accommodate what is known about the construct, both empirically and theoretically. Finally, the use of a multi-dimensional view of cohesion is consistent with the empirical

Researchers studying the factor analytics of cohesiveness have discovered the presence of three important factors (impact and initiative, task competence, and like-dislike) which have a role in the development of group cohesiveness (Lott & Lott, 1965). The subscales selected for the QCS used to measure cohesion in this study reflect these factors. The instrumental value subscale taps into the impact and initiative aspect of cohesion. The task integration subscale taps into the task competence factor and finally, the group compatibility and attraction subscales tap into the factor of like-dislike.

The subscale items used in the QCS were extracted from the subscales of four cohesion instruments. Five items from the Group Environment Questionnaire, group task integration subscale (Carron, 1985) were selected to tap into the group task integration dimension. Nine items from the Stokes cohesion measure (1983) from the subscales measuring instrumental value and inter-member attraction were included in the QCS to measure group members’ attraction to the group and value derived from membership. Finally, six items (four from the Gross Cohesion Questionnaire [GCQ] and two from Yalom’s work) were chosen to tap into compatibility of group members (Gross, 1957; Lieberman, Yalom, & Miles, 1973; Yalom, Houts, Zimerberg, & Rand, 1967; Yalom & Rand, 1966).
Dimensions of the cohesion construct

**Group task integration.** Carron and colleagues (1985) introduced the concept of group integration as social perceptions reflective of an individual’s beliefs about a group’s closeness, similarity, and bonding. Task integration is a component of group integration. Tasks performed by the group and reflect the group’s collective performance, goals, and objectives are captured under the task integration concept (Carron & Brawley, 2012). The idea that task cohesion impacts performance more than social cohesion has been demonstrated in team sports research (Windmeyer, Brawley, & Carron, 1985). In addition, sports researchers have found that group members can dislike each other, and still perform well if task cohesion is high enough to compensate for deficiencies in other areas (Windmeyer, Brawley, & Carron, 1985).

**Instrumental value.** Stokes (1983) introduced instrumental value as an element important to group cohesion. Instrumental value is defined as the attraction group members have to a group in relation to the degree in which participation in the group meets their personal needs (Stokes, 1983). Prior to his study, instrumental value had been discussed as a function of cohesion, but had not been studied. Stokes (1983) demonstrated an existence of a positive correlational relationship between group cohesion and perceived instrumental value.

**Inter-member attraction.** Inter-member attraction is defined as the appeal members have for one another (Stokes, 1983). Inter-member attraction has been included in a large number of studies in small group research and shown to be an important element in the formation of group cohesion (Aiken, 1992; Eisman, 1959; Lott & Lott,
1965; Stokes, 1983; Yukelson, 1984). There is support of the view that inter-member attraction is predictive of perceptions of group cohesion (Lott & Lott, 1965). Early research exploring the link between group members’ attraction to the group and its members and cohesion grew out of the early work of Kurt Lewin. Lewin, was first to introduce the concept of group cohesion, defining the concept as a set of forces keeping members of a group together (Dion, 2000; Lewin, 1939).

**Compatibility.** Compatibility of group members has been studied as a key influence in the development of strong group cohesion for more than 50 years (Gross, 1957; Schutz, 1966). Schutz (1966) defined compatibility as a relation between two or more persons, between an individual and a role, or an individual and a task situation that leads to mutual satisfaction of interpersonal needs and a parsimonious co-existence. Gross is credited with the development of one of the most widely used cohesion measures, the GCQ (Stokes, 1983).

Schutz (1966), produced a three dimensional theory of interpersonal behavior as well as the Fundamental Interpersonal Relations Orientation (FIRO) measure. The FIRO was developed from his work on the interpersonal needs and group behaviors of human beings. The GCQ (Gross, 1957) is included as a subscale of the FIRO, measuring group compatibility. The FIRO has been used in studies of group behavior and cohesion (Fisher, Macronsson, & Walker, 1995; Jenster, 2010; Keyton, 1987; Schutz, 1955). The FIRO is still considered a useful pre-employment tool to evaluate how individuals might contribute to a group environment (Fisher, Macronsson, & Walker, 1995; Jenster, 2010; Keyton, 1987; Schutz, 1955).
Performance

The performance cohesion relationship has been explored in a great number of research studies and across a large number of industries (Evans & Dion, 2012, Chiocchio & Essiembre, 2009 Mullen & Cooper, 1994). In healthcare arenas, this relationship has been studied in the context of customer satisfaction (Deeter-Schmelz & Kennedy, 2003) and patient outcomes (Temkin-Greener, Gross, Kunitz, & Mukamel, 2004) as performance measures. The rational for examination of the relationship between cohesion and performance for this study was based on the idea that members of a tightly unified groups would have greater motivation to work toward being successful in achieving the goals set by the group (Cartwright & Zander, 1968). Results of many studies demonstrate that cohesive teams have better outcomes then teams with poor cohesiveness (Chang & Bordia, 2001; Deeter- Schmelz & Norman, 2003; Evans & Dion; Mullen & Cooper, 1994). The aim of this study was to test if this theory holds true in the setting of inter-professional teams of nursing and medical students encountering a simulated patient crisis. Performance was measured through the expert assessment of each teams’ handling of a simulated multi-patient scenario using a previously developed tool (UM-CRM tool) that measures the crisis resource management abilities of a team.

Population, Setting, and Sampling Plan

Target Population

The target population of this study was beginning third year medical students and second semester Accelerated Option (AO) Bachelor of Science Nursing (BSN) students enrolled in the School of Medicine or School of Nursing and Health Studies at a large
private research university located in the Southeastern United States. All beginning third year medical students \((N = 140)\) and only second semester AO BSN students taking Adult Health II \((N = 60)\) participated in the university’s annual inter-professional education (IPE) patient safety course. Only those students participating in the 2014 IPE patient safety course were included in the study.

**Setting**

The university used for this study was a private research university in the Southeastern United States which had both a medical and nursing school. The course used for this study is an annual inter-professional simulation-based patient safety course. Students attending the course are enrolled in the course based on where they are in their program.

**School of Nursing and Health Studies (SONHS).** The SONHS is located on the main campus of the university used in this study. It offers a broad range of undergraduate and graduate degrees options. Nursing students from the BSN Program are prepared as nurse generalists.

**School of Medicine (SOM).** The SOM is located on the university’s medical campus. It offers a variety of degree options as well as other healthcare master’s degree and doctoral degree areas of study. The medical students are prepared at the general doctor of medicine level.

**The Inter-professional patient safety course.** The study took place during the university’s annual SONHS and SOM Inter-professional Patient Safety Course. The interactive simulation-based 5-day course was in its second year and the time of the study and took place on both the medical campus and the main campus of the university.
In order to facilitate many simulation activities incorporated into the course, three simulation centers were used (two on the medical campus and one on the main campus). Each of the simulation centers’ facilities were equivalent and provided ideal settings to carry out realistic simulated medical emergencies in a safe environment. Each center also had adequate areas for facilitation of important post-simulation debriefing sessions.

The 5-day course consisted of multiple simulation activities including: (a) a team based game (Puzzle game), (b) a standardized patient encounter, (c) a patient environment hazards scavenger hunt (Room of Horrors), (d) three simulated medical crisis encounters, and (e) a crisis resource management competition (Sim-Olympics™). In addition, there were lectures presented by lead faculty that were used to anchor concepts introduced during interactive activities and group discussions to reinforce the patient safety concepts that were covered. The 2014 course also included two humanities themed activities: The *Fine Art of Healthcare* and a string quartet performance by the university’s school of music used to illustrate the importance of leadership, shared mental models, and non-verbal communication. Key concepts of patient safety were incorporated into each course activity. Daily course content built on the material previous presented. Concepts included in the course as a whole were: (a) communication, (b) team dynamics, (c) task delegation, (d) leadership, (e) calling for help, and (f) situational awareness. Visual thinking strategies, non-judgmental listening, and effective communication methods were the concepts covered during the *Fine Art of Healthcare* activity. Demonstration of the importance of clear and effective communication using non-verbal approaches and the effects of communication breakdown in a group performance were introduced during the string quartet activity.
Randomization was used to assign each student to a team; however the mix of approximately four medical students and two nursing students remained consistent within each team. In order to facilitate an optimal learning experience and to increase the comfort of the students, the PI assigned at least two medical students and two nursing students to every team. There were six to seven students assigned to each team. The students encountered each simulation activity in their assigned teams. The exception was the standardized patient activity. During this activity, students were paired with every attempt made to have one nursing student and one medical student within each dyad. The medical students outnumbered the nursing students 2:1 so some pairs consisted of only medical students.

The course lectures and Sim- Olympics™ were held in lecture halls that could accommodate large group forums. As part of the course requirements, the PI and other course faculty instructed the students to complete group assignments. The assignments extended the time spent working in a team environment and allowed the students to apply learned patient safety principles in a written scholarly presentation.

**Sampling**

A convenience sample was used for this study. The population was chosen because of the accessibility of inter-professional teams of students enrolled in an annual patient safety course. In addition, this group of students presented an opportunity to study performance outcomes during simulation encounters without needing to create opportunities specific for the study of cohesion on group performance. The annual IPE patient safety course offering presented the PI with an opportunity to study characteristics
of team behaviors in an inter-professional setting not readily available outside the outlined group.

Two hundred students, were divided into 29 teams and were accessible for the study. These numbers were contingent on enrollment of the third year medical school class and the second semester accelerated BSN students enrolled in Adult Health II during the summer 2014 semester. Only students participating in the 2014 patient safety course were included in the study.

**Sample Size**

In estimating the sample size needed for the study, the major consideration was whether or not there would be adequate numbers of both teams and individual participants to find differences in variable means and relationships between variables. Statistical analysis for this study was completed at two levels, the individual level and the group level, therefore sample size and power considerations were taken into account at each. Power was set at .80.

A convenience sample was utilized, and there was no guarantee that every participant of the Patient Safety Course would answer both the mid-week and post course cohesion measures (mid-week and post course QCS), however, there was reasonable assumption that there would be adequate data points to complete planned analyses. In addition, there was an assumption that the majority of participants would answer the QCSs since they were added to the course as expected tasks. Further, during the 2013 Patient Safety Course a total of 161 out of 220 (73%) participants responded to both the pre and post surveys given as part of that course and also gave permission for their data to be used for research purposes (Mckay, Sanko, Shekhter, Fitzpatrick, & Birnbach,
2013). Using the assumption that the rates of survey / questionnaire responses and permissions would mimic those of the 2013 course, it was anticipated that there would be approximately 21 groups’ and 146 individuals’ data available for analysis.

An a priori power analysis using G* power (Erdfelder, Faul, & Buchner, 1996) was completed to determine how many individual participants would be needed for the analyses which were conducted at the individual level (hypothesis 2). An N of 54 was needed. Based on historic survey / questionnaire response rates it was anticipated that there would be more than adequate numbers of participants answering the QCS at both time points for the individual level analyses (Appendix A).

In addition to looking at historic data, a second literature search was used for power considerations for the group analyses. A meta-analysis of 16 studies of relationships on group cohesion and performance was examined (Evans & Dion, 2012) along with other studies. The $N$ values of the studies included in the Evans and Dion (2012) meta-analysis ranged from 6 to 94 teams with a mean of 31. Other researchers examining correlated relationships between cohesion and performance successfully demonstrated relationships between these two variables with moderate effect sizes using as few as 10 teams (Bakeman & Helmreich, 1975). Based on historic survey responses from previous courses the PI approximated 21 available teams. Historic data coupled with findings from the literature demonstrated a strong likelihood that there would be a large enough sample at the group level to be able to show a statistical relationship should one exist (hypothesis 1).

Desired effect size was also considered. For all levels of analysis, a medium effect size was used. Evans & Dion (1991) and Oliver (1990) reported mean
cohesiveness-performance effect sizes of $r=.364$ and $r=.320$ respectively; therefore, setting a medium effect size for this study was appropriate. The significance level for this study was set at an alpha of .05.

**Instrumentation**

**Cohesion Measurement**

A multi-dimensional view (Figure 5) of the construct cohesion was used for this study. Each of the four subscales included in the QCS (Appendix B) was extracted from widely studied tools used to examine group cohesion. The following four dimensions were included: (a) Group task integration (Windmeyer, Brawley, & Carron, 1985), (b) Instrumental value (Stokes, 1983), (c) Inter-member attraction (Stokes, 1983), (d) Compatibility (Gross, 1957; Lieberman, Yalom, & Miles, 1973; Schutz, 1966; Yalom, Houts, Zimerberg, & Rand, 1967; Yalom & Rand, 1966), and (e) Yalom’s work on group cohesion (two items) (Yalom & Rand, 1966). See Appendix B for complete tool. The 24 item, four factor QCS, uses a five point Likert scale (*strongly agree to strongly disagree*) to select agreement with each item included in the tool.

![Figure 5. Cohesion multi-dimensional view.](image-url)
The most recent version of the GEQ consists of 18 items (Windmeyer, Brawley, & Carron, 1985). The GEQ measures four dimensions of team cohesion: (a) individual attraction to the group-task (five items), (b) individual attraction to the group-social (five items), (c) group task integration (five items), and (d) group social integration (four items). The selection of dimensions included in the GEQ was based on Carron and colleagues’ (1985) conceptual model of cohesion. The GEQ is widely used in team sports research (Whitton & Fletcher, 2014) and is the most widely used multi-dimensional measure of cohesion in sports psychology (Eys, Carron, Bray, & Brawley, 2007), and has also been successfully used in studies outside of sports (Dyce & Cornell, 1996). The original GEQ was a 53 item measure. Later, Windmeyer, et al. following findings of a psychometric analysis, decreased it to an 18 item inventory designed to assess four dimensions of team cohesion: (a) individual attraction to the group-task (five items), (b) individual attraction to the group-social (five items), (c) group task integration (five items), and (d) group social integration (four items). Reductions to the original measure were made based on intrascale and interscale equivalence analyses performed during psychometric studies conducted to assess the validity and reliability of the tool (Windmeyer, Brawley, & Carron, 1985). The selection of dimensions included in the GEQ was based on Carron and colleagues’ (1985) conceptual model of cohesion. While its use has been almost exclusively in the sports arena, there is at least one study using it in the field of music (Dyce & Cornell, 1996).
Validity and Reliability.

Validity: Psychometric evaluation of the validity of the GEQ was performed on the second and final versions of the GEQ. Item reductions were made based on two rounds of psychometric tests carried out by Widmeyer, Brawley, & Carron (1985). The second version’s (24 items) evaluation included an exploratory factor analysis, consistent with the conceptual model on which the tool was developed. Widmeyer, Brawley, & Carron (1985) implemented the first studies using the GEQ and provided the first evidence that the GEQ is a valid measure of team cohesion. More recent uses and psychometric evaluations of the tool have also provided evidence that it continues to be a valid measure of cohesion (Ntoumanis & Aggelonidis, 2004; Whitton & Fletcher, 2014). In addition, Whitton and Fletcher (2014) showed that the GEQ may also have multilevel factorial validity. Carron, Brawley, and Widmeyer (2002) have developed the GEQ test manual which includes normative values which can be used to compare groups. Normative values include those for the GEQ as a whole as well as for each of the subscales included in the tool.

Reliability: Widmeyer, Brawley, & Carron’s (1985) initial psychometric evaluation of the original version of the GEQ demonstrated poor internal consistency for the socially aligned dimensions. Good internal consistency was demonstrated for both the task-oriented dimensions during the initial phase of testing of the original version. Elimination of items were made if items did not correlate well with their own factor or if the factors correlated better or equally well with the total score of another factor (Widmeyer, Brawley, & Carron’s,1985). The revised 24 item version (version 2) underwent a second psychometric study. Internal consistency was improved; however,
the dimensions measuring attraction to group tasks and attraction to social aspects of group cohesion remained only in the acceptable range. During this second psychometric evaluative study a factor analysis was performed. Again confirming a four factor measure which was consistent with their conceptual model. There was some overlap noted in several of the items so these items were eliminated creating the final 18 item measure which is still used today. Based on the findings from these two studies, Widmeyer, Brawley, and Carron (1985) concluded that the GEQ was a reliable tool with good internal consistency. A more recent study by Ntoumanis and Aggelonidis (2004) also supported this conclusion.

**Considerations.** While the results of the outlined studies have provided some evidence of the GEQ’s reliability and validity, care was taken in the interpretation of these findings, as there were also study outcomes uncovered that indicate inconsistencies and deficiencies (Steca, Pala, & Grecco, 2013). Further, the tool has had limited use outside sport settings. Despite these noted potential issues, use of the factor items which tap into the dimension of task integration are acceptable because task integration is an important aspect of work in healthcare teams dealing with the management of medical emergencies. Additionally, no identified tools are available to assess task integration as well as the GEQ.

**Stokes Cohesion Scale**

**Description**

The Stokes’ Cohesion Scale (Stokes, 1983) is a 13 item tool consisting of three subscales: (a) inter-member attraction, (b) instrumental value, and (d) risk taking. The scale is a seven point Likert scale ranging from disagree strongly to agree strongly. An inter-item correlation matrix using principal components analysis was used to analyze the
measure. This analysis demonstrated that three components had an eigenvalue greater than one and were, therefore, retained for inclusion in the oblique rotation analysis (Stokes, 1983). The three principal components corresponded to the three hypothesized factors (Stokes, 1983). Further validity or reliability analyses were not reported; however, multiple regression analyses revealed that each of the predictor variables added a significant contribution in predicting cohesion \( (p < .01) \) (Stokes, 1983). In addition, more than 56% of the variance in cohesion was predicted by the three factors: (a) risk taking, (b) inter-member attraction, and (c) instrumental value (Stokes, 1983).

**Validity and Reliability**

**Validity.** The Stokes Cohesion Scale has been used successfully in a number of studies as well as in a variety of types of groups (Rapisarda, 2002; Rosenfeld & Gilbert, 1989; Stokes, 1983; Susskind, & Borchgrevink, 1999). Its successful use demonstrates its validity as a tool to measure cohesion.

**Reliability.** The Stokes Cohesion Scale has excellent internal consistency as demonstrated by Rapisarda (2002). Cronbach’s alpha of .84 for the student group and .94 for the faculty group was found (Rapisarda, 2002).

**Yalom and colleagues’ work**

**Description**

Yalom focused primarily on cohesiveness and its importance in group therapy. Yalom (1975) contended that cohesion was a key feature of successful and efficacious group therapy. Throughout his career, he studied group cohesion in the context of group therapy examining its relationships on: (a) the outcomes of therapy, (b) satisfaction of group members, and (C) leadership influences (Lieberman, Yalom, & Miles, 1973; Yalom, Houts, Zimerberg, & Rand, 1967; Yalom & Rand, 1966). The items from
Yalom’s work selected for use as part of the QCS are the same two items used in the Stokes’ (1983) study. These items have been used as a part of Yalom and colleagues’ work as well as in studies by Stokes (1983) and Waldon (2001) and have evidence supporting them as sound items to examine the dimension of compatibility as a measure of cohesion. Reliability of these two items has been completed as part of the reliability testing completed on the Stokes Cohesion Scale.

**Gross Cohesiveness Questionnaire**

**Description**

The Gross Cohesiveness Questionnaire (also sometimes referred to as the Gross Cohesion Questionnaire and Gross Cohesion/ Cohesiveness Scale) has been recognized as one of the most widely used tools to measure cohesion (Stokes, 1983). Gross (1957) conceptualized cohesion as a single dimension construct, therefore the Gross Cohesion Questionnaire (GCQ) measures a single dimension of cohesion, compatibility. It is a nine item measure using a five point Likert type scale tailored to each question as its response schema.

**Validity and Reliability**

**Validity.** Guttman scaling procedures were used to determine the validity data for this tool. Guttman scaling, also referred to as Scalogram analysis, is a method of determining the ability of a multi-item tool to measure what it is designed to measure (Robinson, 1973). Guttman scaling is used exclusively for single dimension scales (Robinson, 1973). A Guttman scale is used to predict the pattern of a person’s responses based on his or her total scale score (Guttman, 1944).

Gross, in his analysis of the GCQ, found that the final nine item tool had a Guttman scale value of .91 (Gross, 1957). Upon finding a sufficient Guttman coefficient
for the GCQ, Gross (1957) sought to replicate these findings by administering the scale to an additional 25 participants. The second round of scaling of the GCQ revealed a Guttman coefficient value of .90. Gross, in the course of these studies, was also able to confirm that the tool was indeed a uni-dimensional measure of cohesion.

Cota, Dion, and Evans (1993) also used Guttman Scaling as well as parallel analysis to analyze the GCQ. They re-analyzed data from two studies (Stokes, 1983 & Johnson & Fortman, 1988). Their findings confirmed that the GCQ was a uni-dimensional measure of cohesion (Cota, Dion, & Evans, 1993). Lieberman, Yalom, and Miles (1973) also found good internal consistency (Cronbach’s alpha .84) of the GCQ in their analysis of the tool as part of their study. Perrone & Sedlacek (2000) used the modified version of the GCQ from the Stokes’ (1983) study with success. Waldon (2001) used a modified version of the GCQ and found good reliability (Cronbach’s alpha .84).

**Reliability.** The GCQ has been widely used across a number of studies and across a variety of populations with good results (Cota, Dion, & Evans, 1993; Gross, 1957, Stokes, 1983; Yalom, 1995; Yalom. Houts, Zimierberg, & Rand, 1967; Yalom & Rand, 1966; Waldon, 2001). Based on the extensive use, long history, the evidence provided from several studies (Cota, Dion, & Evans, 1993; Gross, 1957, Stokes, 1983; Yalom, 1995; Yalom. Houts, Zimierberg, & Rand, 1967; Yalom & Rand, 1966; Waldon, 2001) and its highly respected status, it was reasonable to conclude that the GCQ had enough evidence to support the conclusion that the GCQ is a reliable and valid tool to measure compatibility as a dimension of cohesion.
Performance Measurement
Modified Ottawa Tool (UM-CRM tool)

**Description.** Performance was measured using a modified Ottawa tool (the UM CRM tool) (Appendix C). The Ottawa tool is a 13 item, single factor tool originally developed by Kim and colleagues (Kim, Neilipovitz, Cardinal, & Chiu, 2009; Kim, Neilipovitz, Cardinal, Chiu, & Clinich, 2006) to measure the crisis resource management of a medical emergency in a simulation. This tool was modified by researchers at the University of Miami to assess crisis resource management of simulated medical emergencies during their patient safety course (Sanko, Mckay, Shekhter, Thomas, & Birnbach, 2013; Shekhter, Rosen, Sanko, Everett-Thomas, Fitzpatrick, & Birnbach, 2012).

**Reliability and Validity**

**Reliability.** Kim and colleagues’ (2006; 2009) demonstrated moderate reliability of the Ottawa tool. Psychometric evaluation of the modified version of the tool was further conducted by researchers at the University of Miami (Sanko, Mckay, Shekhter, Thomas, & Birnbach, 2013). Their testing revealed excellent reliability with a Cronbach’s alpha of .88 and good internal consistency with all total item correlations measuring above .40.

**Validity.** The recent introduction of the Ottawa tool makes providing strong evidence of its validity somewhat difficult; however, findings provided by both the Kim, et al. (2006; 2009) and the University of Miami’s researchers (Sanko, Mckay, Shekhter, Thomas, & Birnbach), provide enough evidence to demonstrate reliability and validity as a tool to measure performance during simulated medical emergencies. The University of Miami version was used to measure performance for this study.
Permissions

Permission for use of each of the tools/items was sought and granted (Appendix D). Permission to use the GCQ was requested from Harvard, and consent was approved for use of the GCQ from the Harvard Archives. Per a request from the Harvard Archives to contact Dr. Eugene Gross for his permission was made; however, the letter was returned unopened and marked ‘Addressee Unknown’ (Appendix D).

The GEQ test manual (Carron, Brawley, & Widmeyer, 2002) was purchased. Purchase of the test manual includes permission to use the tool (Appendix D). Copies of each request and corresponding permissions (granted by the authors or surrogates of the authors [where applicable]) are provided in Appendix D.

Finally, permission to conduct the study was sought from the course director of the annual IPE patient safety course. Permission was given from the course director to add the QCS as a measure to the course at both the mid-week and post course time points.

Procedures: Ethical Considerations and Data Collection Methods

Following Institutional Review Board approval, the 24-item cohesion tool (QCS) developed for this study was included as a part of the university’s annual inter-professional (IPE) patient safety course as a course survey/questionnaire and measure of team cohesion. The modified Ottawa tool (UM CRM tool, Appendix C) was already included as part of the usual course to measure team performance during simulated medical emergencies.

Plan for data collection. Items numbered 1, 7, 8, 12, 13, 14, 15, 16, and 17 were completed as part of the usual procedures for the course and were not changed or
modified in any manner for the purposes of the study. Items numbered 2, 3, 11, and 19 were completed for the dual purposes of meeting course needs as well as for data collection purposes of research being conducted for this study. Finally, items numbered 4, 5, 6, 9, 10, and 20 were done for the purposes of meeting the needs of collecting data for the study.

1. The PI obtained a list of all the students assigned to participate in the 2014 Inter-professional Patient Safety course from the SOM and SON.

2. The PI randomly assigned each student from the provided lists using the excel randomization tool to 1 of 29 teams. The PI then created a spreadsheet with the names of each student and his/her team number. This spreadsheet served as both the linking list for the study as well as the student participant list for the course. The students were assigned to teams for the purpose of learning about team dynamics and working in inter-professional teams. Team dynamics and teamwork were the main objectives of the Inter-professional Patient Safety course.

3. The PI placed the linking list/student participant list in a password protected folder on the university’s server as well as in the shared course folder which was also password protected and had limited access to only the key course personnel and the PI. Because the teams were formed for the purpose of learning during the course it was necessary for key course personnel to also have access to the team assignments contained in the linking list/student participant list for the purposes of scheduling, course attendance, and other course communications.
4. All collected data were de-identified, using team numbers throughout the data collection and data analysis processes. In addition, results were reported only at the group level.

5. The QCS was used to collect data on cohesion. The PI inputed the items of the QCS into the university’s Qualtrics\textsuperscript{©} system (Qualtrics, Provo, UT) to develop an electronic version of the QCS. During this process, an electronic link was created which was added to the course’s Blackboard\textsuperscript{TM} (online learning platform) site and other course communications.

6. The PI added the link for the electronic QCS made in Qualtrics\textsuperscript{©} to the Patient Safety Course Blackboard\textsuperscript{TM} site\textsuperscript{1} in the course modules for days 2 and 5.

7. The course manager emailed a course To Do list a week prior to the start of the course to all registered students. The To do list included directions for the use of the course Blackboard\textsuperscript{TM} site, as well as detailed instructions regarding items which were in need of be completed prior to the start of the course and on each day of the course. In addition, the To Do list included a list of course readings, assignments, and survey’s (including the QCS) which needed completion. The course manager sent the To Do list via e-mail using a mail merge application to ensure all students received the information.

8. The course directors conducted a brief course orientation on the first morning of the course. During orientation, students were instructed on use of Blackboard\textsuperscript{TM}.

\textsuperscript{1} Blackboard\textsuperscript{TM} is an educational technology platform which allows for the organization of course materials, communications and assignments.
of the course’s Blackboard™ site via a live presentation of the Blackboard™ site. Students were shown how to access and navigate the course’s Blackboard™ site. The course directors instructed the students on how to enter each day’s module, how to access course readings, how to complete course surveys including the QCS, as well as how to turn in assignments.

9. The PI asked the students to complete the QCS twice during the course, once following completion of day two of the course (mid-week) and a second time on the final day of the course following completion of all course activities (post course). Instructions contained in the day two module of the course Blackboard™ site were that students complete the QCS using the provided link to the electronic version of the QCS. Instructions contained in the day five module of the course Blackboard™ site also and similarly prompted students to complete the QCS using the provided link to the electronic version of the QCS.

10. Only completed QCS tools from the day two module which were completed prior the start of day three were included as data. This cut off for completion of the QCS at the first time point was done to ensure that adequate time elapsed between the two time points to assess differences in cohesion between the two time points.

11. The PI followed up with a reminder email to complete the mid-week QCS. This email was sent to all students assigned to the course through the course’s Blackboard™ site on day two of the course in the evening. The
email served as a reminder to the students to complete the QCS and other course requirements which needed completion as noted in the module for day two of the course (Appendix E). The reminder emails also contained the link for the QCS.

12. On day three of the course, the students (in their assigned teams) took part in a multi-patient simulated medical emergency scenario. In order to collect data on team performance, two course faculty, following training, observed the students’ in their teams handling of the presented multi-patient simulated medical emergency scenarios and scored each team using the UM-CRM tool.

13. The PI provided the faculty orientation and a training session on use of the UM-CRM tool to the two faculty who scored the performances of the student teams before any observations or scoring of teams were completed. Orientation to the tool occurred prior to the start of the multi-patient simulated emergency scenarios and was conducted in the simulation lab at the SONHS. Training consisted of orientation to the tool and each its items. The PI then observed and scored alongside each of the two faculty assessors as several teams completed their encounters. The dual scoring of teams occurred during the first few scenarios which took place on the third day of the course. The PI also debriefed each of the faculty assessors discussing the scores given to the teams as well as the rational for the chosen scores on each item of the UM CRM tool as part of the dual scoring procedure. Through this process, the PI was able to
provide feedback to the faculty assessors and ensure that they were able to accurately assess and score team performance using the UM-CRM tool. Once the faculty assessors were deemed able to assess team performance by the PI and articulated that they felt comfortable they were allowed to score the remaining teams on their own.

14. Paper versions of the UM-CRM tool were used to collect data on team performances. The PI provided each faculty assessor with paper copies of the UM-CRM to use while they were observing and scoring the student teams during the multi patient scenarios.

15. The faculty assessors recorded the team numbers of each team they observed in the space provided on the UM CRM tool. Team numbers were the only identifier used on the UM CRM tool.

16. The PI collected all completed paper copies of the UM CRM tool from the faculty assessors following the last team’s completion of the multi patient simulated medical emergency scenario.

17. The PI calculated a total score for each team based on the data provided on the paper UM CRM tools by the faculty assessors.

18. The PI transcribed the data collected on the paper version of the UM CRM tool into an excel spreadsheet. An excel spread sheet was used for ease in importing data into both SPSS and Mplus for analysis. The PI kept the excel spreadsheet in a password protected folder. The PI kept the paper copies of the UM CRM tool in a locked drawer in the PI’s office.
19. On day five of the course, the PI sent an email to all students assigned to the course through the course’s Blackboard site to provide a reminder for the students to complete the items in the day five course module including the QCS (Appendix E). The first reminder email was sent immediately following completion of all course activities on day five of the course. The emails contained the link for the QCS and the post course evaluation survey which also needed to be completed at the end of the course. The PI also sent a second reminder email as needed to prompt students to complete the QCS and the post course evaluation. The QCS was kept open for a period of five days following the end of the course.

20. The PI pulled the data collected from the QCS off the university’s Qualtrics© site into an SPSS file for analysis after the QCS has been closed. The PI kept the data which has been pulled off the Qualtrics© site in a password protected folder.

**Risks and benefits of participation**

There was minimal risk associated with participation in this study. Risks were similar to those encountered during the normal course of participation in the university’s annual Patient Safety Course. There were few, if any, recognized direct benefits for the students participating in this study; however, their participation assisted in forming a better understanding of how team cohesion in inter-professional teams affects performance and learning. In addition participation in the study allowed for the formation of a better understanding of how much the students value the group learning
environment, and perceptions of compatibility with other team members. This information can be used in planning for future courses.

**Evaluation of Research Methods**

In this section, internal and external validity will be discussed in order to highlight the strengths and weakness of the research methods employed for this research study.

**Internal Validity**

**Strengths.**

1. Use of path analysis presented a powerful test of the relationship between cohesion and performance. Additionally, when path analysis is used, causation can more firmly be established because causal modeling can be performed.

2. Cohesion was measured using a multi-dimensional tool, the QCS. The factors included in the tool were extracted from highly researched tools which demonstrated validity and reliability. Psychometric analysis of the QCS demonstrated good preliminary reliability, validity, and a factor structure consistent with the theorized factor structure.

3. Randomization of team assignments decreased the possibility of researcher bias. Randomization also reduced the possibility that prior relationships among the participants skewed assessments of group cohesion.

4. Completion of the QCS as part of course requirements eliminated the possibility of researcher bias.
5. Completion of performance assessments by trained evaluators ensured intra-rater reliability. Completion of performance assessments by evaluators other than the PI decreased potential researcher bias.

6. Statistical approaches utilizing independent sample $t$ tests and path analysis were rigorous tests that were appropriate for the study design.

**Weaknesses.**

1. There was a possibility of being under-powered, given the limited sample for this study. Efforts were taken to collect as much data as possible using e-mail reminders to prompt the participants to complete the cohesion measures.

2. The PI was a member of the course faculty team. Although no course content was changed, it is possible that biases of the PI could have existed and affected her role as a course faculty member.

**External Validity**

**Strengths.**

1. Despite the limited nature of the study population, generalizability to other similar populations, such as healthcare providers currently working is possible. Further, the similarity of the study population to working healthcare professionals may shed light on how group cohesion effects performance in an actual healthcare environment.

2. Use of a realistic simulated medical crisis as a surrogate to measure performance outcomes provided a good platform to study outcomes
without needing to be in an actual healthcare environment during real medical emergencies.

3. Data collection occurred during a naturally occurring educational course and without alterations being made to the course content, thus external validity is strengthened.

**Weaknesses.**

1. The target population was narrow, thus the possibility of decreased variability was conceivable.

2. The target population was students who are still learning, so their performance abilities may not have be reflective of their performance potential later in their educational program or following graduation.

3. The target population was students who interact in an educational setting in large groups as a part of their everyday educational experience. It is possible that their assessments of cohesion could reveal assessments of cohesion reflective of the large group experience rather than feelings generated from being assigned to the smaller teams as part of the IPE patient safety course.

4. Only accelerated option nursing students were included in the course and therefore in the study. It is possible that this group of nursing students differ from other nursing students, as these students tend to be older then nursing students in traditional programs, and they all have previous degrees in other fields. The average ages and educational backgrounds of accelerated option nursing students more closely match those of the
medical students in this study. It is possible that these factors had an impact on the development of cohesion.

**Hypotheses Testing**

The cohesion - performance relationship outside healthcare has consistently been shown to be a positive one. Carron et al. (2002) demonstrated that the cohesion-performance relationship seems to be stronger for females then males. Dickstein, et al. (2010) showed that cohesion differed based on gender, with men reporting statistically significant higher cohesion then women in their study.

The healthcare setting has also begun to show positive correlations between group cohesion and performance related outcomes. In a 2008 intervention study researchers using simulation training to enhance nurse-physician relationships demonstrated that males had a significantly higher group cohesion scores as compared to the females who participated in the study (Messmer, 2008). Temkin-Greener, et al.’s (2004) research findings demonstrated that cohesion improves team effectiveness. Cramm and Neiboer (2011), however, were not able to demonstrate a significant relationship between cohesion and team functioning. To date, there is an insufficient number of completed studies to make a solid case for or against team cohesion as a predictor of performance in healthcare environments. These findings assisted in the development of hypotheses 1 and 2 for this study.

Study findings support the ever changing nature of cohesion. Feelings of cohesion are thought to change over time. Klipfel, et al. (2011) demonstrated a sustained positive shift in cohesion. Bartone and Adler (1999) also found that cohesion increases
over time. Based on these study findings, the time aspect incorporated into hypothesis 1 was developed.

The development of cohesion among teams has been explored from a variety of vantage points including cultural, gender, and professional differences within group members (Harrison, Price, & Bell, 1998; Thomas, Ravlin, & Wallace, 1994; Wright, & Drewery, 2002). Several study findings are that groups with a less diverse population tend to have greater feelings of group cohesion (Thomas, Ravlin, & Wallace, 1994; Wright, & Drewery, 2002). In addition, Similarity Theory suggests that human beings feel a greater sense of attraction to those who are most similar to themselves (Nahemow & Lawton, 1983). Finally, perceptions of intragroup similarity have been shown to hold significant implications for group functioning (Dunlop & Beauchamp, 2011). An identified positive relationship between perceptions of similarity and group cohesion has been found (Harrison, Price, Gavin, & Florey, 2002; Hobman et al., 2003, 2004). These findings noted in the literature were used to further support the development of hypothesis 2.

**Methods of Data Analysis**

Three primary methods of data analysis were used for this study. Psychometric analysis of the QCS and UM-CRM tools were used to perform confirmatory factor analysis. These analyses allowed for assessment of the reliability of the tools to measure team cohesion and team performance in this population. In addition, confirmatory factor analysis was used to determine the factors which are included in each of the tools.

Independent samples t tests were used to explore differences in how males and females and nursing and medical student assess levels of group cohesion. Path analysis
was used to explore the relationship between cohesion and performance as well as to examine the effects of time on the development of cohesion.

The independent samples $t$ tests were used to carry out mean comparisons using SPSS version 22 (IBM, 2013). The path analysis, reliability, and factor structure of the tools analyses will be conducted using Mplus version 7 (Muthen & Muthen, 2012).

**Research Questions**

Two research questions were proposed for this study:

1. What is the relationship between cohesion, and team performance across time in teams of medical and nursing students participating in an inter-professional patient safety course?
2. What are the differences in cohesion by gender and intended profession of nursing and medical students when participating on an inter-professional team during a patient safety educational course?

**Variables.**

The variables used in this study are:

1. Gender
2. Intended profession
3. Cohesion
4. Team performance.

Variables one through three are independent variables; number four is the dependent variable.
Hypotheses

Hypothesis 1.
There is a statistically significant positive relationship between team performance as measured by the UM-CRM and cohesion as measured by the QCS occurring across two time points.

Hypothesis 2.
a. There is no statistically significant difference between males and females in cohesion as measured by the QCS.
b. There is no statistically significant difference between medical students and nursing students in cohesion as measured by the QCS.

Data Analysis

Analysis of Psychometric Qualities
Psychometric qualities of the QCS including the factor structure were carried out prior to testing the hypotheses. Reliability was assessed by estimating internal consistency using Cronbach’s alphas for total scales and subscales. Cronbach’s alpha values between .70 and .80 are considered to be satisfactory (Bland & Altman, 1997).

Psychometric Properties Analysis
Confirmatory Factor Analysis (CFA) was conducted to explore the factors within the QCS to determine if the tool’s factors matched the hypothesized four dimensional model of cohesion presented (Figure 5). Additionally, factor loadings were evaluated to assess the variance explained by each of the measurement items (Figure 6).
A CFA of the QCS was conducted using Mplus version 7 (Muthen & Muthen, 2012). CFA is a multivariate statistical model of reliability used when a theoretical model for a measure is already known (Hoyle, 2000). Since the development of the QCS was done utilizing items used in other cohesion measures a theoretical model was developed which aligned with the structure of the tools used to supply the items used. The theorized factor structure is presented in Figure 6 and is based on what each item of the tool is thought to test.

The following fit statistics were used to determine how well the theorized four factor model performed: Model Chi-square ($\chi^2$), the Steiger- Lind Root Mean Square
Error of Approximation (RMSEA) and the Bentler Comparative Fit Index (CFI). Chi-square, also known as the likelihood ration chi-square or generalized likelihood ratio is an absolute fit index which reflects the degree to which a theorized model matches existing data (Hoyle, 2000; Kline, 2011). A $\chi^2$ value equal to zero indicates that each observed covariance equals its counterpart implied by the model (a perfect fit) (Klien, 2011). Interpretation of this index should include examination of the $p$ value. A non-significant value is desired, thus demonstrating that the model is consistent with the covariance data provided (Klien, 2011). A limitation of the $\chi^2$ is the failure to reject an inappropriate model when there is a small sample size and rejection of an appropriate model with large sample sizes. Since this is a possibility, two additional fit statistics (RMSEA and CFI) will be used alongside the $\chi^2$ test.

The Steiger- Lind Root Mean Square Error of Approximation is scaled as a badness-of-fit index where a value of zero indicates the best fit (Klein, 2011). It was first introduced by Steiger and Lind (1980) for evaluation of covariance structure models (Steiger, 1998). RMSEA is parsimony-adjusted index that follows a non-central chi-square distribution (Klein, 2011). An advantage of RMSEA is that confidence intervals can be constructed around point estimates (Chen, Curran, Bollen, Kirby, & Paxon, 2008). Cut-off parameters for RMSEA are widely used, however some authors have demonstrated that little empirical evidence support the use of universal cut off values (Chen, Curran, Bollen, Kirby, & Paxon, 2008), therefore this research uses established cut off values (.08 acceptable, .05 good, .01 excellent) in conjunction with model specifications, degrees of freedom, and sample size to determine acceptability of the tested model.
The Bentler Comparative Fit Index was also examined to determine model fit. CFI is an incremental fit index that measures the relative improvement in the fit of a researcher’s model over that of a baseline model, usually the independence model (Klein, 2011). A CFI value of > .95 is considered to demonstrate an acceptable fit (Klein, 2011), thus was used to inform decisions about model fit.

**Factor analysis procedure.** Confirmatory factor analysis was conducted using a modern CFA approach.

1. The PI inputted data into Mplus, as well as wrote syntax (Appendix F) to perform the analysis.
2. The PI then described the data, as well as indicated the variable names and type of data being used.
3. The PI defined each factor, set free loadings to each of the first items of each factor and set the factors at 1 (the modern way to perform CFA).
4. Once all the information was inputted into Mplus, the PI ran the data using a general type, maximum likelihood estimation with 1000 iterations and convergence set to 0.000005.
5. The PI examined the model fit indices and re-specified the model as needed based on model fit parameters as discussed above.

**Scaling procedure.** Using SPSS scaling was performed to assess the internal consistency and reliability of the QCS and UM-CRM tools.

**QCS**

1. The PI inputted data gathered from the QCS into a SPSS file.
2. The PI using the scaling function generated a Cronbach’s Alpha value and item total correlations for each item in the QCS.

3. The PI then examined the Cronbach’s Alpha to determine the consistency of the tool.

4. The PI examined the item total correlation values for each item and determined if any items should be thrown out due to poor performance. Items were thrown out if they did not perform well and also improved the Cronbach’s Alpha value.

**UM-CRM Tool**

1. The PI inputted data gathered from the UM-CRM tool into a excel spread sheet which was converted into an SPSS file.

2. The PI using the scaling function generated a Cronbach’s Alpha value and item total correlations for each item in the UM-CRM tool.

3. The PI then examined the Cronbach’s Alpha to determine the consistency of the tool.

4. The PI examined the item total correlation values for each item and determined if any items should be thrown out due to poor performance. Items were thrown out if they did not perform well and also improved the Cronbach’s Alpha value.

**Hypotheses 1 and 2**

**Assumptions testing.** Prior to analyzing the data, the PI examined the data to determine if it met the assumptions for path analysis and independent samples $t$ test. The assumptions for path analysis and independent samples $t$ test are the same and include:
Independence is assured through good sampling techniques where care is taken to avoid sampling from within a single group. Independence can also be affirmed by examining residuals. Independent samples demonstrate no systematic pattern of errors (Lomax & Hahs-Vaughn, 2012). Linearity is tested using any of the following: the standard F-test (Gertheiss & Oehrlein, 2011), \( \eta^2 \) (Eta square) (Sevier, 1957), residual plots from previous research, examination of theory, routinely running regression analysis incorporating curvilinear components, and visually inspecting the fit lines looking for non-linear relationships (Lomax & Hahs-Vaughn, 2012; Osborne & Waters, 2002; Cohen & Cohen, 1983). Normality is determined through visualization of data plots, skewness and kurtosis values, and running a Kolmogorov-Smirnov test (Lomax & Hahs-Vaughn, 2012; Kline, 2011). Finally, homoscedasticity can be established by looking at the standard errors (Lomax & Hahs-Vaughn, 2012), through examination of residual plots (Miles & Shevlin, 2011), and running the Levene’s test. The Levene’s test is an inferential statistic used to assess variance. In order for the assumption of homoscedasticity to be met, the calculated \( p \) value of the Levene’s test should be non-significant.

SPSS was used to examine normality of the data using data plots as well as looking at the skewness and kurtosis values, and produce results of a Kolmogorov-Smirnov (K-S test) test. The following information was used to interpret the normality tests which were performed as part of this study.
The data plots should depict a symmetrically distributed data pattern without data falling far beyond centrally clustered data points. A skewness value greater than 1 or less than -1 would be a conservative indication of non-normally distributed data. Kurtosis is examined by looking at the shape of the curve which is generated from the data. Generated curves should not appear to be flat or sharply peaked. The K-S test is a nonparametric test which allows for comparison of a set of data with a reference probability distribution for the purposes of determining normality. A statistically significant Kolomogorov-Smirnov test should not be observed; this finding would demonstrate a non-normal sample (Lomax & Hahs-Vaughn, 2012; Kline, 2011).

**Procedure for the examination of assumptions.** Assumptions which could be statistically tested were tested using SPSS.

**Independence.** Independence was assured through sound data collection procedures. Participants were not allowed to answer the QSC more than once at each time point. Participants were asked to complete the QSC individually. Attempts to preserve independence were made, however since some analyses were completed at the group level and all participants were participating in the same course it is possible that violation of the assumption of independence was not completely avoided in this study.

**Linearity.**

1. The PI inputted data into a SPSS file.
2. The PI then used the graphs function to produce a scatter plot of the data to be examined.
3. The PI then added a trend line over the scatter plot.
4. The PI examined the plot looking to see if the distribution of the data points followed a linear pattern.

**Normality.**

1. The PI inputted data into a SPSS file.
2. The PI used the descriptive statistics / frequency function to generate histograms, and normality tests.
3. The PI examined the histograms looking for non-normal patterns.
4. The PI examined the K-S test looking at the generated p value, and noting any significant values.
5. The PI examined the skewness and kurtosis through the examination of the generated values and line graph.

**Homoscedasticity.**

1. The PI inputted data into a SPSS file.
2. The PI used the linear regression function to choose the residuals of the dependent variable which were generated during previous tests of normality in order to generate a scatter plot.
3. The PI then added a fit line and examined the plot looking for equal number of data points on each side of the fit line.
4. The PI ran the Levene’s test under the compare means function by selecting homogeneity tests.
5. The PI examined the Levene’s test looking at the generated p value, and noting any significant values.
6. Finally, standard errors were examined looking for consistency in variances of errors for all parameters.

**Hypotheses 2.** Path analysis was used to test hypothesis 2. Path analysis is an extension of multiple regression statistical techniques used to examine the strength of direct and indirect relationships among variables (Lleras, 2005). A series of estimated parameters is implemented by solving one or more structural equations to test the fit of a correlation matrix between two or more causal hypothesized models (Lleras, 2005). Directionality of the relationship nor causality of the findings can be specifically tested using path analysis, however, an advantage of its use is the ability to specify how the variables relate to one another thus allowing for the development of theories about processes under investigation (Lleras, 2005).

**Team cohesion scores.** For each of the 29 teams, a team cohesion average was calculated using the individual QCS scores.

1. The PI examined the data from the mid-week cohesion scores. All individuals who did not indicate their team number were excluded.

2. The PI then calculated a team cohesion average by adding the individual scores for each team member of each team and then dividing by the total number of team members who indicated their team number and responded to the mid-week QCS.

3. The PI then used this data along with the team performance scores to perform the Path analysis.

**Path analysis procedure.**
1. The PI described types of data, and indicated variable names as part of the data preparation.

2. The PI wrote Syntax to describe the variables and modeling which will be used to explore the relationship between cohesion and performance (Appendix F). On statements were used between team cohesion scores at time point one and two to examine the direct effects between cohesion at time point one and two. On statements were used between the performance score and cohesion at each time point.

3. The PI then ran the data and interpreted the findings looking first at the model fit indices and making model re-specifications as necessary.

4. The PI examined direct, indirect, and total effects, as well as $r^2$ values, Betas and standardized Beta values, Standard Errors, Confidence Intervals, and $p$ values.

Figure 7. Path Analysis diagram.
Independent samples \( t \)-test procedure.

1. The PI inputted the data into SPSS.
2. The PI ran independent samples \( t \) tests for each grouping variable using the compare means function.
3. The PI interpreted the findings looking at means, standard deviations, standard error means, and \( p \) values.

Chapter Summary

This chapter was a presentation of the proposed research plan, design, and methodology. Additionally, a description of the measurement tools which were used to collect data, as well as the methods used to collect and analyze the data were discussed.
Chapter IV

Results

The results of this study about the relationship between team performance and cohesion in teams of nursing and medical students participating in an interprofessional patient safety course are presented. Included in this chapter are the psychometric analyses of the Quadripartite Cohesion Scale (QCS) which was developed to measure cohesion for this study and the UM-CRM tool which was used to measure team performance. The answers to the research questions and results of hypotheses testing are also presented. Methods of data analysis used in this study included: reliability testing, confirmatory factor analysis, and exploratory factor analysis of the QCS and reliability testing of the UM-CRM tool. Means comparisons, and path analysis were also utilized to test the hypotheses.

Sample

A total of 200 participants were available for this study ($N = 140$ [medical students], $N = 60$ [nursing students]). An a priori power analysis showed that a total of 54 respondents would be needed to appropriately power the analyses for hypothesis 2. This number was exceeded three fold at both the mid-week and post course time points. Additionally, total response rates for this study (83%) exceed the prior year’s response rate of 73% which was used as a historical reference to anticipate probability of having enough data available to power the study.

A total of 190 participants completed the survey at time point 1 (mid-week) ($N = 132$ [medical students], $N = 58$ [nursing students]) representing a 95% response rate
for this time point (Table 7). A total of 165 participants completed the survey at time point 2 (post course) \((N = 118 \text{ [medical students]}, \ N = 47 \text{ [nursing students]})\) representing an 83% response rate for this time point (Table 7).

It was estimated that at least 10 teams providing data would be needed to power the analysis for hypothesis 1. There were data available from at least one member of each of the 29 teams, thus allowing for team cohesion scores to be calculated for every team \((n = 29)\). No student elected to have their data removed from the analyses for this study.

Twelve participants who answered the surveys at time point 1, and 19 at time point 2 did not include their team number when they completing the surveys. Their data were included in the analyses exploring gender and intended profession mean differences as the team number was not used for these analyses. Students, however who did not include their team number had their data removed from the analysis at the group level since knowledge of which team they were on was necessary to calculate the team cohesion scores. No other missing data patterns emerged.

Table 7

*Survey respondents by gender and intended profession*

<table>
<thead>
<tr>
<th></th>
<th>Time point 1</th>
<th>Time point 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total respondents &amp; % of total respondents at time point 1</td>
<td>Total respondents &amp; % of total respondents at time point 2</td>
</tr>
<tr>
<td>Medical students</td>
<td>132 (69%)</td>
<td>118 (72%)</td>
</tr>
<tr>
<td>Nursing students</td>
<td>58 (31%)</td>
<td>47 (28%)</td>
</tr>
<tr>
<td>Male</td>
<td>79 (42%)</td>
<td>69 (42%)</td>
</tr>
<tr>
<td>Female</td>
<td>111 (58%)</td>
<td>96 (58%)</td>
</tr>
</tbody>
</table>
Psychometric Analysis of the QCS

Confirmatory factor analysis (CFA) was conducted to assess how well the QCS’s factor structure matched the hypothesized four factor model depicted in figure 6. It was theorized that a four factor model would be found based on the construction of the tool utilizing items from a variety of tools measuring dimensions of cohesion. A CFA in Mplus 7.11 (Muthen & Muthen, 2012) was used to test the four factor model. Initial model fit demonstrated poor model fit $\chi^2 (df=164) = 478.40, p < .001, \text{CFI} = 0.78, \text{RMSEA} = 0.107$. Modification indices (MI) suggested improvements for the model. A number of rounds of model modifications were undertaken using the suggested MIs and theory as guides to improve the model fit.

The final model was found to be acceptable, $\chi^2 (df=155) = 318.97, p < .001, \text{CFI} = 0.90, \text{RMSEA} = 0.08$. The final model had multiple items which were significantly correlated (Figure 8). All the factors were found to be significantly correlated (Figure 8) and all items loaded significantly on their requisite factors (Table 8). While the four factor model was supported as hypothesized, there were multiple items which were correlated. The correlations conceptually made sense. For example, it is not surprising that the question ‘would like to see people more often’ and ‘would like more opportunity to socialize outside of the course’ are correlated, as they both tap into wanting to have more time with the members of the team. The questions in the instrumental value factor tapping into learning and helpfulness of participating on the team were also highly correlated. Again, not surprising given the nature of the questions. In the future these correlations may be used to assist in reducing the number of items tapping into specific constructs.
The compatibility factor had the most item correlations, with five of the six items have significant error correlations suggesting that these items overlap in tapping into the construct of compatibility. Variances explained by each item ranged from 6% (Worked well together) to 55% (Liked assigned) (Table 8). Further studies are suggested to more fully examine the dimensional nature of the QCS.

*Figure 8. QCS with Factor loadings and correlated errors.*

*p<.05*
Table 8.

Varians by item from QCS

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>S.E.</th>
<th>Two-Tailed Estimated S.E.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>United</td>
<td>.489</td>
<td>0.07</td>
<td>6.89</td>
<td>.000</td>
</tr>
<tr>
<td>Responsibility</td>
<td>.365</td>
<td>0.07</td>
<td>5.32</td>
<td>.000</td>
</tr>
<tr>
<td>Conflicting aspirations</td>
<td>.078</td>
<td>0.05</td>
<td>1.54</td>
<td>.123</td>
</tr>
<tr>
<td>Problems</td>
<td>.477</td>
<td>0.07</td>
<td>6.76</td>
<td>.000</td>
</tr>
<tr>
<td>Communication</td>
<td>.378</td>
<td>0.07</td>
<td>5.30</td>
<td>.000</td>
</tr>
<tr>
<td>Spend time</td>
<td>.606</td>
<td>0.07</td>
<td>8.75</td>
<td>.000</td>
</tr>
<tr>
<td>Similar people</td>
<td>.407</td>
<td>0.07</td>
<td>5.99</td>
<td>.000</td>
</tr>
<tr>
<td>Liked people</td>
<td>.222</td>
<td>0.06</td>
<td>3.50</td>
<td>.000</td>
</tr>
<tr>
<td>See people often</td>
<td>.274</td>
<td>0.07</td>
<td>4.11</td>
<td>.000</td>
</tr>
<tr>
<td>Socializing outside</td>
<td>.097</td>
<td>0.05</td>
<td>2.01</td>
<td>.000</td>
</tr>
<tr>
<td>Haven’t learned</td>
<td>.397</td>
<td>0.07</td>
<td>5.76</td>
<td>.000</td>
</tr>
<tr>
<td>Influenced me</td>
<td>.615</td>
<td>0.06</td>
<td>9.72</td>
<td>.000</td>
</tr>
<tr>
<td>Not helpful</td>
<td>.516</td>
<td>0.07</td>
<td>7.88</td>
<td>.000</td>
</tr>
<tr>
<td>Helped to meet goals</td>
<td>.539</td>
<td>0.07</td>
<td>8.19</td>
<td>.000</td>
</tr>
<tr>
<td>Liked assigned</td>
<td>.656</td>
<td>0.06</td>
<td>11.53</td>
<td>.000</td>
</tr>
<tr>
<td>People fit</td>
<td>.473</td>
<td>0.07</td>
<td>7.05</td>
<td>.000</td>
</tr>
<tr>
<td>Activities</td>
<td>.184</td>
<td>0.06</td>
<td>3.14</td>
<td>.000</td>
</tr>
<tr>
<td>Felt included</td>
<td>.423</td>
<td>0.06</td>
<td>6.62</td>
<td>.000</td>
</tr>
<tr>
<td>Helped attain</td>
<td>.390</td>
<td>0.07</td>
<td>6.03</td>
<td>.000</td>
</tr>
<tr>
<td>Worked well together</td>
<td>.061</td>
<td>0.041</td>
<td>1.50</td>
<td>.135</td>
</tr>
</tbody>
</table>

Evaluation of the internal validity was also carried out. SPSS 22 (IBM, 2013) was used to perform this analysis. Excellent reliability ($\alpha = .90$) was found (Cronbach, 1951). Additionally, good internal consistency was demonstrated with all but one (Conflicting aspirations [.30]) total item correlations at or above .40 (Table 9) (Meyers, 2013). Removal of the item conflicting aspirations would increase the alpha value by a nominal degree (.01) therefore it was retained for use in the model. Further use of the tool in a variety of healthcare teams would assist in providing additional evidence to support its use as a valid and reliable tool for measuring cohesion.
With satisfactory factor structure and reliability analysis demonstrated, the data collected using the QCS was used to answer the research questions as well as to perform the path analysis and independent samples \( t \) tests used to test the study hypotheses.

Table 9.

*Item Total Correlations QCS*

<table>
<thead>
<tr>
<th>Observed Variable</th>
<th>Item-Total Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>United</td>
<td>.55</td>
</tr>
<tr>
<td>Responsibility</td>
<td>.62</td>
</tr>
<tr>
<td>Conflicting aspirations</td>
<td>.30</td>
</tr>
<tr>
<td>Problems</td>
<td>.54</td>
</tr>
<tr>
<td>Communication</td>
<td>.45</td>
</tr>
<tr>
<td>Spend time</td>
<td>.56</td>
</tr>
<tr>
<td>Similar people</td>
<td>.66</td>
</tr>
<tr>
<td>Liked people</td>
<td>.40</td>
</tr>
<tr>
<td>See people often</td>
<td>.56</td>
</tr>
<tr>
<td>Socializing outside</td>
<td>.40</td>
</tr>
<tr>
<td>Haven’t learned</td>
<td>.50</td>
</tr>
<tr>
<td>Influenced me</td>
<td>.67</td>
</tr>
<tr>
<td>Not helpful</td>
<td>.62</td>
</tr>
<tr>
<td>Helped to meet goals</td>
<td>.71</td>
</tr>
<tr>
<td>Liked assigned</td>
<td>.76</td>
</tr>
<tr>
<td>People fit</td>
<td>.70</td>
</tr>
<tr>
<td>Activities</td>
<td>.44</td>
</tr>
<tr>
<td>Felt included</td>
<td>.64</td>
</tr>
<tr>
<td>Helped attain</td>
<td>.58</td>
</tr>
<tr>
<td>Worked well together</td>
<td>.61</td>
</tr>
</tbody>
</table>

**Validity and Reliability of the UM-CRM Tool**

Scale reliability was conducted on the UM-CRM tool for measurement of performance in the sample population. The Cronbach’s alpha of .86 demonstrated good reliability (Cronbach, 1951). Overall, correlations also indicated good discrimination with results ranging from .24 (Assessment) to .69 (Listening). Standardized loadings
were greater than the suggested minimum of 0.4 for all items except for assessment (.24) and call for help (.35), which were in the acceptable range (table 10) (Meyers, 2013). The increase in the Cronbach’s alpha if assessment and call for help were deleted only increased the alpha nominally (.007, assessment and .001 call for help); therefore, both items were retained. These findings were consistent with the prior reliability testing of the tool carried out previously (Sanko et al, 2013). Moreover, these findings provide additional evidence for the reliability and validity of the UM-CRM tool as a measure of team performance.

Table 10.

*Total Item Correlations UM-CRM*

<table>
<thead>
<tr>
<th>Observed Variable</th>
<th>Item-Total Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment</td>
<td>.24</td>
</tr>
<tr>
<td>Tasks</td>
<td>.56</td>
</tr>
<tr>
<td>Fixation</td>
<td>.55</td>
</tr>
<tr>
<td>Re-assessment</td>
<td>.49</td>
</tr>
<tr>
<td>Call for Help</td>
<td>.35</td>
</tr>
<tr>
<td>Resource Use</td>
<td>.54</td>
</tr>
<tr>
<td>Listening</td>
<td>.69</td>
</tr>
<tr>
<td>Communication</td>
<td>.62</td>
</tr>
<tr>
<td>Names</td>
<td>.46</td>
</tr>
<tr>
<td>Delegation</td>
<td>.66</td>
</tr>
<tr>
<td>Calm</td>
<td>.62</td>
</tr>
<tr>
<td>Decisiveness</td>
<td>.64</td>
</tr>
<tr>
<td>Big Picture</td>
<td>.59</td>
</tr>
</tbody>
</table>

**Assumptions**

All study assumptions were examined. Normality tests were not found to be violated. The histograms demonstrated a normal data distribution pattern. Skewness and
kurtosis values were within acceptable ranges. Homogeneity of variance not violated. Finally, Independence was assured through careful data collection.

Research Questions

Research Question 1

What is the relationship between cohesion, and team performance across time in teams of medical and nursing students participating in an inter-professional patient safety course?

Path analysis was used to explore the relationship between cohesion and performance across time. Mid-week team cohesion was found to be a statistically significant predictor of post course team cohesion $p < .001$. Mid-week team cohesion was also found to be a statistically significant predictor of performance $p = .010$. The relationship between mid-week cohesion and post course cohesion was noted to have a large effect size ($R^2 = .437$), whereas, the relationship between mid-week cohesion and performance had a moderate effect size ($R^2 = .187$) (Cohen, 1988; Cohen, 2003). Performance as a predictor of post course cohesion was not found to be statistically significant ($p = .191$). These findings demonstrate a positive and likely causal relationship between cohesion and performance. Time was also found to significantly improve cohesion in this target population.

Research Question 2

What are the differences in cohesion by gender and intended profession of nursing and medical students when participating on an inter-professional team during a patient safety educational course?
Independent samples \( t \)-tests were used to determine if the means of two sample distributions differed significantly from each other. The comparisons between the means for male and female students were not found to be statistically different at either time point \( (p = .764 \text{ [mid-week]}, \ p = .802 \text{ [post course]}) \) (Table 11). At the mid-week time point male students had a higher cohesion score \((M = 85.04)\) as compared to the female students \((M = 84.62)\). The post course measures of cohesion mean values were equal, with males having a mean value of 87.48 and females having a mean of 87.09. Time had a nearly equal effect on cohesion across both genders with males increasing 2.44 and females increasing 2.47 from mid-week to post course time points.

Comparisons of the means of the students’ intended profession also did not show statistical differences, \( p = .805 \text{ [mid-week]}, \ p = .429 \text{ [post course]}) \) (Table 11). Medical students had a cohesion mean value slightly higher \((M =84.91)\) at the mid-week time point then the nursing students \((M = 84.54)\). The post course measure of cohesion had similar findings. Medical students had a mean cohesion score of 87.63 and nursing had a mean of 86.31. The effect of time appeared to have a greater impact on cohesion scores in medical students. The mean cohesion scores of the medical students increased by 2.72 from the mid-week time point to the post course time point. The nursing students had a smaller increase of 1.77. These findings suggest that for this sample population, there are no differences in cohesion in males or females or in students entering medicine or nursing.
Hypothesis Testing

Hypothesis I

There is a statistically significant positive relationship between team performance as measured by the UM-CRM tool and cohesion as measured by the QCS occurring across two time points.

Path analysis was used to explore the relationship between team performance and cohesion. Mplus version 7 (Muthen & Muthen 2012) was used to carry out the analysis. Model fit statistics demonstrated acceptable fit, $\chi^2 (df = 3) = 22.66, p < .001, CFI = 1.0, RMSEA = 0.000$. A statistically significant relationship was demonstrated between team cohesion values at the two time points measured (mid-week and post course) ($B = .621, SE = .173, \beta = .556, CI [.176 – 1.07], p > .001, r^2 = .437$). Mid-week cohesion was found to be a statistically significant predictor of post course cohesion with 44% of the variance explained by the model (figure 9). These findings indicate that in this population cohesion continues to develop and strengthen over time during an inter-professional patient safety course.

Cohesion was also found to positively impact team performance of inter-professional teams of nursing and medical students. As cohesion increased so did performance scores; teams with higher cohesion measured using the QCS had better performance scores as measured using the UM-CRM tool.

There was a statistically significant relationship found between cohesion at the mid-week time point and team performance ($B = .480, SE = .186, \beta = .432, CI [.001 – .960], p = .010, r^2 = .187$). The mid-week cohesion scores were found to be a statistically significant predictor of performance with 19% of the variance being explained by the
model (figure 9). While the mid-week cohesion was found to be a statistically significant predictor of team performance, the model only accounted for 19% of the variance in performance. This finding might indicate that there are other factors which were not tested that were responsible for the performance scores. Further research adding other variables such as leadership, communication, feelings of collegiality, and individual capabilities for example, may shed more light on what other factors may also or better predict performance.

Finally, the relationship between performance and post course cohesion was examined. In this analysis, performance was examined as the predictor variable. There was no significant relationship found between performance as a predictor of post course cohesion scores $p = .191$ (Figure 9).

These finding are not entirely surprising; they are consistent with numerous other study results showing a causal relationship between cohesion and performance and the improvement of cohesion over periods of time. These findings support the hypothesis that cohesion influences team performance and that time plays a role in the development of cohesion.

Figure 9. Path analysis with results.
Hypothesis II

Hypothesis two postulated that there would be no statistically significant differences in cohesion scores when comparing the gender or intended profession of the study participants.

a. There is no statistically significant difference between males and females in cohesion as measured by the QCS.

b. There is no statistically significant difference between medical students and nursing students in cohesion as measured by the QCS.

Independent samples t-tests were used to explore mean differences by gender and intended profession. SPSS version 22 (IBM, 2013) was used to perform these analyses. There were no statistical differences noted by gender ($p = .764$ [mid-week], $p = .802$ [post course]) or by intended profession ($p = .805$ [mid-week], $p = .429$ [post course]) (Table 11). Mean values calculated by group were essentially equal at both time points in all groups explored. Additionally, increases in cohesion from the mid-week time point to the post course time point were nearly equal in all groups. Male participants had a mean cohesion value of 85.04 at the mid-week time point and 87.48 at the post course time point with an increase of 2.44. Female participants had a mean cohesion value of 84.62 at the mid-week time point and a mean of 87.09 at the post course time point with an increase of 2.47 in female participants from time point one to two.

Medical students had a mean cohesion score of 84.91 mid-week and a mean of 87.63 post course. Overall, their cohesion increased a total of 2.72 from time point one to two. Finally, the nursing students had a mid-week cohesion score of 84.54 and 86.31
post course, with an increase of 1.77 from the first time point to the final time point. These findings suggest that time has the smallest effect on cohesion of nursing students. The findings of the independent samples $t$–tests also demonstrate that there are no differences in cohesion in males or females or in students entering the profession of nursing or medicine. The results of the independent samples $t$–tests support hypothesis II a. and b.

Table 11.

*Gender and profession results*

<table>
<thead>
<tr>
<th></th>
<th>$N$</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>$df$</th>
<th>$p$</th>
<th>$t$</th>
<th>95% CI</th>
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</thead>
<tbody>
<tr>
<td><strong>Mid-Week</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>76</td>
<td>85.04</td>
<td>9.31</td>
<td>.012</td>
<td>178</td>
<td>.764</td>
<td>.300</td>
<td>-2.31 – 3.13</td>
</tr>
<tr>
<td>Female</td>
<td>104</td>
<td>84.62</td>
<td>9.02</td>
<td></td>
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<td><strong>Nursing</strong></td>
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<td>84.54</td>
<td>9.38</td>
<td>.227</td>
<td>178</td>
<td>.805</td>
<td>.248</td>
<td>-2.55 – 3.29</td>
</tr>
<tr>
<td><strong>Medicine</strong></td>
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<td>84.91</td>
<td>9.04</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Post course</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>58</td>
<td>87.48</td>
<td>9.25</td>
<td>.018</td>
<td>142</td>
<td>.802</td>
<td>.251</td>
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</tr>
<tr>
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<td>8.88</td>
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<td>142</td>
<td>.429</td>
<td>.794</td>
<td>-1.98 – 4.63</td>
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<tr>
<td><strong>Medicine</strong></td>
<td>102</td>
<td>87.63</td>
<td>9.70</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Chapter Summary**

Chapter IV is a description of the sample, the psychometric evaluation of the measurement scales (QCS & UM-CRM), the results of the analysis of the research questions, and hypothesis testing for this study. Chapter V is a discussion of the findings, limitations, implications, conclusions, and recommendations for future study of the
cohesion performance relationship in inter-professional teams of healthcare students and providers.
Chapter V

Discussion

Chapter V is a discussion of the results of this study exploring the cohesion – performance relationship in inter-professional teams of nursing and medical students taking part in simulation – based patient safety course. This chapter also contains a summary and interpretations of the findings, limitations of the study, implications of the results, and recommendations for future exploration of the cohesion – performance relationship in inter-professional teams of healthcare providers. The overarching purposes of this research were to:

1. Explore the impact of cohesion on performance outcomes in inter-professional healthcare teams during simulated medical emergencies
2. Assist in understanding how assessments of cohesion change over the course of inter-professional team training.
3. Compare differences in assessments of cohesion based on intended profession, and gender.

Summary and Interpretations

The relationship between cohesion and team performance has been widely explored in a number of disciplines including anthropology, sports, and the military (Dion, 2000). Practically every study on the relationship between cohesion and performance resulted in a positive relationship between these two variables (Greer, 2010). However this relationship has not been fully studied or explored in healthcare teams. This study of the cohesion – performance relationship in inter-professional teams
of medical and nursing students sought to address this gap. The findings of this study add
to the body of knowledge around the role of team cohesion on team performance of
healthcare teams.

Time has also been explored as a factor thought to impact the development of
cohesion. Bartone and Adler (1999) explored the effect of time on levels of cohesion.
Their findings demonstrated that time positively contributed to cohesion development in
the groups that they studied. Thus the use of a time series design and measurement of
cohesion at two time points was chosen to examine the relationship of time on cohesion
in the target population for this study. The finding of continued development of cohesion
which was time dependent was also found in this study. These findings support the time
dependent phenomenon of cohesion. Specifically these findings demonstrate that the
relationship between cohesion and time holds true in healthcare teams as well.

Examinations of cohesion by gender have been explored outside of healthcare
domains with mixed conclusions. Carron and colleagues 2002 study demonstrated that
cohesion was a stronger factor related to performance for females then for males.
Dickstein, et al. (2010), however, demonstrated the opposite findings, concluding that
males reported higher levels of cohesion then females. The exploration of the effects of
gender on cohesion were aimed at answering the question whether gender effects
perceptions of team cohesion in the same manner in male and female medical and nursing
students. Finally, there was only a single study found on differences in cohesion based
on occupation and education (Kalam, 2008). Kalam (2008), found that there were
significant differences in perceptions of cohesion based on occupational and educational
levels. There were, however, no studies that on perceptions of cohesion in nurses and
physicians, thus exploration of the effects of intended profession was explored as part of this study.

Utilizing a convenience sample of 140 medical and 60 nursing students (N = 200) each of the 200 students was randomized to 1 of 29 teams. With the exception of lectures, all activities that were included as part of the patient safety course were completed with the students in their assigned teams. Teams were kept intact throughout the course. Every team had at least two nursing students and four to five medical students. This arrangement was to ensure that each team had at least two members from each profession in order to lessen potential feelings of isolation that may develop related to being the only member of a specific professional group (safety in numbers hypothesis).

The setting for this study was a week-long simulation-based inter-professional patient safety course at a large research university in the southeastern United States. None of the course content was modified for the purposes of the study. Performance scores, which were routinely done as part of the course were taken from the mid-week multi-patient simulation encounter and were used as the performance measure for the study. Because it was a course requirement, every team participated in the mid-week multi-patient simulation activity, therefore performance data was available for all 29 teams.

The measurement of cohesion was the only addition to the course made. This data served as the cohesion measure for this research. There was a good response rate at both time points. One hundred ninety participants completed the QCS at the mid-week time point and a 165 participants completed it at the post course time point. Cohesion scores were captured at two time points (mid-week, [prior to the mid-week multi patient simulation encounter] and immediately post course). Several days separated the two
measured time points to allow for exploration of the effect of time on cohesion. Response rates for the QCS were consistent with response rates for tools used in previous years’ courses; however, for this study, no student elected to have their responses removed from the data analysis for this study even though the option was given to them. At least one member of every team indicated their team number and responded to QCS; therefore, a team cohesion score could be calculated for all 29 teams at both time points. Differences in cohesion by gender and intended profession were also examined, as described above.

A positive and statistically significant relationship was found between cohesion and performance ($p = .010$). Time was found to affect cohesion. Mid-week cohesion predicted post course cohesion. Cohesion improved from the mid-week time point to the post course time point ($p < .001$). Dissimilarity did not play a role among the participants in this study. The examination of gender and intended profession did not show statistically significant differences in perceptions of cohesion and in most cases the means were equal. The comparisons between the means for male and female students were not found to be statistically different at either time point (Table 11). Comparisons of the means of the students’ intended profession also did not show statistically significant differences (Table 11).

**Psychometric Evaluation of the Measurement Tools**

Both of the study tools (UM-CRM tool [performance] and QCS [cohesion]) were psychometrically examined prior to hypothesis testing. The current findings of the UM-CRM tool were consistent with previous psychometric evaluations of validity and reliability of the tool ($\alpha = .86$). A hypothesized four factor model of the QCS was found, with good internal consistency and reliability ($\alpha = .90$). In addition, the QCS appeared to
tap into the four dimensions of cohesion (task cohesion, compatibility, instrumental value, and member attraction) in which it was developed to explore. Further, and importantly, the QCS was able to successfully measure overall cohesion of inter-professional teams of nursing and medical students. The preliminary success of the QCS to measure cohesion is encouraging, nevertheless further work will need to be completed using this newly constructed tool to fully explore its potential as a valid and reliable tool to measure cohesion in healthcare teams. At the time of this study, there were no other multi-dimensional tools to measure cohesion in inter-professional healthcare teams. Future use of the QCS in inter-professional teams of healthcare providers and in clinical settings would provide more evidence to support it as a valid and reliable multi-dimensional measure of cohesion for healthcare teams.

**Summary and Interpretations of the Research Questions**

**Research Question I**

*What is the relationship between cohesion, and team performance across time in teams of medical and nursing students participating in an inter-professional patient safety course?*

A statistically significant relationship between cohesion and team performance was found. These findings add to, and support the consistency of this association found in other studies on the cohesion-performance relationship. These findings also illuminate the effect of cohesion on team performance as it relates to the care of a patient. Time was likewise noted to predict cohesion. The mid-week cohesion scores predicted the post course cohesion scores. These results mirror what has been found in other studies on the effect of time on cohesion development. While this study sheds further light on the effect
of time on the development of cohesion, the total span of time was less than one week. It is not known if longer periods of time would have shown a peak followed by a drop in cohesion over longer periods of time as was noted by Bartone and Adler (1999) in their 6 month study of military unit cohesion. Even with the drop in cohesion found, the results still demonstrated an overall positive time effect (Adler & Bartone, 1999). The post-deployment cohesion scores were statistically significantly higher than the pre cohesion scores \( (p < .001) \) (Adler & Bartone, 1999).

**Research Question II**

*What are the differences in cohesion by gender and intended profession of nursing and medical students when participating on an inter-professional team during a patient safety educational course?*

While other investigators have found mixed results as related to gender’s effect on cohesion, this study’s findings demonstrated no statistically significant differences in cohesion related to gender. Mean scores differences in males and females in this study were less than a half a point different at both time points, with males having a slightly higher average scores than females.

Differences by intended profession also did not emulate findings in other studies which where dissimilarities in healthcare profession and educational level where studied (Kalam, 2008). The findings of this study did not reveal a statistically significant difference in cohesion based on intended profession. These findings indicated that having the intended profession of nursing or medicine did not affect perceptions of cohesion. At both the mid-week and post course time points those students entering medicine had a slightly higher cohesion score, but like gender, were found to be small
differences. There was less than a half a point difference between professions at the mid-week time point and less than 1.5 point difference at the post course time point.

**Summary and Interpretations of the Hypotheses**

To test hypothesis I in this study, path analysis was used to explore the relationship between cohesion and performance as well as what effect time has on cohesion. To test hypothesis II, differences in cohesion based on gender and intended profession, Independent samples t tests were used.

**Hypothesis I**

*There is a statistically significant positive relationship between team performance as measured by the UM-CRM tool and cohesion as measured by the QCS occurring across two time points.*

Team averages of cohesion were calculated from individual team member cohesion scores gathered using the QCS at the mid-week time point and used as the cohesion measure for this analysis. Performance measures for each team were taken from the data gathered measuring performance using the UM-CRM tool at the mid-week multi-patient simulation encounter. The statistically significant findings showing a positive relationship between cohesion and performance, as well as the statistically significant explanatory variable, time, support hypothesis one.

Path analysis allows for variables to be explored as both dependent and independent variables. Because one of the questions was whether time influences cohesion it was important to ascertain if performance had any effect on cohesion in order to fully test this relationship. Also, since the post course measure of cohesion was taken following the mid-week team performance this analysis was possible. Performance was
therefore explored as a predictor variable, and was found not to predict post course team cohesion ($p = .191$). This finding strengthens the conclusion that time is a significant factor of cohesion and that it is not influenced by team performance.

**Hypothesis II**

Data used to test this second hypothesis was gathered from individual responses of the participants of the inter-professional simulation-based patient safety course to the QCS at each study time point

1. **There is no statistically significant difference between males and females in cohesion as measured by the QCS.**

   The almost equivalent cohesion scores of males and females at both time points and failure to reject the null hypothesis because no statistically significant difference in cohesion scores by gender were found support this hypothesis.

2. **There is no statistically significant difference between medical students and nursing students in cohesion as measured by the QCS.**

   The nearly identical cohesion scores of the nursing and medical students at both time points and failure to reject the null hypothesis because there was no statistically significant difference in cohesion scores by intended profession support this hypothesis.

It would be interesting to understand if other demographics such as race, age, or undergraduate degree impact cohesion, because other studies have demonstrated differences in cohesion related to similarity and dissimilarity within teams (Kalam, 2008).
Practical Implications

The performance - cohesion relationship has been explored in numerous studies and across a multiplicity of disciplines (Evans & Dion, 2012, Chiocchio & Essiembre, 2009 Mullen & Cooper, 1994). In the healthcare arena, this relationship has been studied in the context of customer satisfaction (Deeter-Schmelz & Kennedy, 2003) and patient outcomes (Temkin-Greener, Gross, Kunitz, & Mukamel, 2004) as the performance measures. The rational for examination of the relationship between cohesion and performance is based on the idea that members of a tightly unified group will have greater motivation to work toward being successful in achieving the goals established by the group (Cartwright & Zander, 1968). Results of many studies support the theory that cohesive teams have better outcomes than poorly cohered teams (Chang & Bordia, 2001; Deeter- Schmelz & Kenndy, 2003; Evans & Dion; Mullen & Cooper, 1994). This study demonstrates that this relationship also exists in healthcare teams as well as in the context of direct patient care experience. These findings have both clinical and educational implications.

Clinical Implications

Healthcare teams are becoming more and more universally used to provide healthcare (Temkin-Greener, Kunitz, & Mulamel, 2004). The use of inter-disciplinary teams to deliver care has expanded for a variety of reasons. These include the economics of healthcare and the need to reduce costs in a setting of increased complexity, patient acuity and having to care for patients that are increasingly more infirm, and finally, needing to care for an increasing aging population (Deeter-Schmelz & Kennedy, 2003). While there are many positives to delivering care using inter-disciplinary teams of
providers, the lack of team training weakens the ability for these teams to deliver care at the highest, most cost effective, and safest levels (Baker, Day, & Salas, 2006). It is known and well documented that communication breakdown and teamwork failures are contributing to a great number of the healthcare related errors occurring in care organizations across the United States (Brock, et al., 2013). To fully realize the benefit of an inter-professional team based approach to the delivery of healthcare, there must be a greater understanding of the factors that contribute to, or undermine their successes and failures. Cohesion is a critical factor shown time and time again to influence team performance regardless of the type of team or the setting in which they occur (Carron & Brawley, 2000; Deeter-Schmelz & Kennedy, 2003; Evans & Dion, 2012; Lott & Lott, 1965; Mullen & Cooper, 1994). Forming a more complete understanding of this critical group factor and its effects on healthcare teams’ successes stands to have significant and far reaching economic and patient outcome related impacts.

The findings of this study demonstrate the existence of a positive and causal relationship between cohesion and team performance in a healthcare context. The results showed that those teams who had higher levels of cohesion performed better on objective measures of teamwork including (a) patient assessment, (b) calling for help, and (c) communicating among the members of the team and across teams. Establishing that this relationship exists in teams of healthcare students caring for simulated patients in a simulated medical emergency, suggests that a relationship between cohesion and performance may also hold true for actual teams of healthcare providers caring for actual patients. Further research in clinical settings would refute or support this hypothesis. Finally, these and others’ results suggest that an individual’s willingness to work in a
team can influence that team’s ability to develop strong feelings of cohesion and perform effectively, thus it may become important to consider prescreening applicants to determine if individuals are well suited for work in a team setting (Deeter-Schmelz & Kenndy, 2003).

**Educational Implications**

It is understood that for there to be great teams there needs to be exceptional training and high quality team based education that occurs with regular frequency. Further, people expected work in teams need to be trained and educated in teams. Forming a more complete picture as to which team factors contribute to, or derail the success of team encounters will assist in honing the educational content included as part of healthcare team training / education. The findings of this study demonstrate that cohesion has a positive influence on team performance in a healthcare context. Additionally, spending time together in an educational team-based patient safety course fosters the development of feelings of team unity. This finding can be used as a basis for increasing these encounters in both pre-licensure and post graduate education. The findings of this study also support the contention that teams that train together, tend to work better together. Thus, efforts need to be made to increase the frequency of inter-professional team training opportunities. Further, during these encounters, a focus on bolstering team cohesion through interventions directed at improving cohesion should be made. Finally, and perhaps most importantly more opportunities should be made to include inter-professional team training during school. Having exposure to other healthcare students at this impressionable time would assist in fostering the habit working across disciplines when out in practice following graduation.
Limitations

The major limitations of this study included the use of a student population (only medical and nursing students were studied), and the use of simulated medical emergencies in a simulated healthcare environment. While the population of interest, the simulated environment, and the simulated medical emergencies represented excellent surrogates for the study of healthcare teams in settings where medical emergencies occur, they are not the “real thing”. The students are early in their education and have had relatively limited clinical experience. These factors might have impacted their ability to develop strong feelings of cohesion, to work as a team, and to fully perform in a medical emergency. In addition, the teams used for this study are not permanent teams, but rather, were ad hoc teams created for the purposes of facilitating learning in an interprofessional team environment. Finally, the students had previous experiences with peers within their own constituent discipline of study, but likely had limited to minimal involvements with constituents outside their area of study. This condition could have impacted the ability for the teams to develop strong cohesiveness in the short time frame of the course. All participants were educated at the same university which could have also impacted the development team cohesion. Finally, the use of teams of students who are relativity early in their education may impact the ability for findings to be generalized to populations of healthcare providers who have graduated and begun to practice nursing or medicine.

Conclusions

The culmination of healthcare team research, including the findings of this study, point to cohesion as a central element in the ability for teams to function
effectively within the current system of healthcare. The degree to which inter-professional teamwork improves patient outcomes depends on how well team members collaborate (Temkin-Greener, Gross, Kunitz, & Mukamel, 2004). Cohesion as a critical group variable offers the promise of higher levels of quality care, better patient satisfaction (Deeter-Schmelz & Kenndy, 2003), reductions in staff stress, (Ba, Early, Mahrer, Klaristenfeld, & Gold, 2014) and bolsters the likelihood that nurses will stay in their jobs (Hinshaw, Smeltzer, & Atwood, 1987). Cohesion plays an essential role in strengthening effective team qualities (communication, situation monitoring, conflict resolution, and shared goals) that directly contribute to the formation of a strong culture of safety (Temkin-Greener, Gross, Kunitz, & Mukamel, 2004). A culture that nurtures an environment based on trust, and one where providers work together with the goal of providing high quality safe care.

The centrality of the role in which team cohesion effects outcomes is becoming evident in inter-professional team-based healthcare. A model (Figure 10) of an interdisciplinary team-based system of care emerges where cohesion exists at its core. This new model’s conceptualization comes from what is known about successes of teams, what is presumed to be true, and what is already proven through research. Interventions aimed at improving cohesion do improve cohesion (Barrett, Piatek, Korber, & Padula, 2009; Dickey, Truten, Gross, & Deitrick, 2011; DiMeglio, et al., 2005; Klipfel, et al., 2011. Therefore, they should be initiated and utilized more within a team-based systems such as healthcare. As team communication improves so do the levels and feelings of cohesion, and communication is influenced strongly by the number and frequency of positive interactions occurring among team members (Messmer, 2008). As
the frequency and quality of team interactions increase, communication improves, thus a positive feedback loop develops which assists in driving continued improvements in communication and cohesion.

As these improvements take place, the ability of the team to manage and resolve conflicts expand (compatibility) (Temkin-Greener, Gross, Kunitz, & Mukamel, 2004). Willingness to be a continued member of a team (instrumental value of team membership) shifts away from feelings of wanting to leave (attraction), and as shared goals (tasks), are communicated and understood (Deeter-Schmelz & Kenndy, 2003; Hinshaw, Smeltzer, & Atwood, 1987) unity in achieving those goals grows. Internal occurrences of feedback and evaluations begin to take place out of a shared desired to continually build up the team as a whole. These actions further improve cohesion and feelings of commitment to the team and its goals (Tumerman & Carlson, 2012). The outcome, is a cohesion driven, team-based system with consequences including: (a) decreased healthcare provider stress levels, (Ba, Early, Mahrer, Klaristenfeld, & Gold, 201; Revicki, Whitley, &Gallery, 1993), (b) decreased intentions to leave, and (c) decreased feelings of burnout (Ba, Early, Mahrer, Klaristenfeld, & Gold, 2014).

Additionally, improvements in patient outcomes, safety, and reductions in healthcare associated costs occur as a product of the synergy.

The view of healthcare teams needs to shift toward a view of them as interacting systems with shared goals. King (1968; 1971; 1981) introduced this concept when she developed her Theory of Goal Attainment and model of Interacting Systems framework based on von Bertalanffy’s General System Theory (1968). Both King (1981) and von Bertalanffy (1968) used their theories to guide the study of “organized complexity” as
whole systems. King (1985) viewed systems not as parts, but as wholes, a view reflective of teams which are cohesive. Cohesiveness is a necessary and critical group element for teams to successfully meet their goals regardless of what those goals are.

Healthcare teams are complex organized systems with the goals of information processing, goal-seeking, and decision-making for the main purpose of maintaining or returning health to a patient. The view of healthcare teams as interacting systems within systems, caring for personal systems (patients) allows for alignment of the goals of each of these interacting systems to occur. This alignment promotes the development of shared goals, decision making, effective communication, and team cohesion across each of the teams (systems) caring for patients. This orientation, this open systems approach, this philosophy can be used to underpin efforts to promote effective, efficient, and wholeness in the larger healthcare arena and within smaller teams of providers.

The unmet requisite of modern healthcare is a theory-based, valid and reliable measure of practices and processes (systems based) that can be used to explain differences in patient outcomes, and ways to improve the quality and safety of patient care (Berwick, 1989). King’s Interacting Systems Framework and Theory of Goal Attainment fills this unmet need. Formulating an understanding of which critical group elements such as cohesion, affect healthcare team performance and team-based systems is useful. The contribution of cohesion as a critical group element has been shown to be vitally important in essentially every other industry which has studied its effect on performance. Its contribution in the healthcare industry, however, has yet to be fully realized. Healthcare is based on a team-based approach, but providers have not yet devised the best way to train, educate or unify healthcare teams. It will be up to the
current leaders and educators to recognize cohesion as a critical group factor necessary for healthcare team successes and to set the ground work necessary to build and develop practices that encourage the formation of strong team cohesion.

Figure 10. Elements and consequences of cohesion: A new model of team-based healthcare delivery systems.

**Recommendations for Future Studies**

The findings of this study are not entirely surprising. Many of the findings mirror what have been found in other studies, however this is perhaps the first look at how cohesion affects and is affected by factors within a healthcare environment, albeit a
simulated one of healthcare students. These findings, nonetheless, suggest that similar to other areas, cohesion of healthcare teams affects their performance.

The relationship between cohesion and performance is not fully understood as it relates to healthcare, healthcare teams, patient safety, and patient outcomes. Establishing that there is a statistically significant relationship between cohesion and performance in inter-professional teams of nursing and medical students is a preliminary step in fully understanding if cohesion is a predictor of team performance in the healthcare field as it is in other fields. Utilizing inter-professional teams of nursing and medical students as a surrogate to initially study this phenomenon and finding a positive and statistically significant relationship between cohesion and performance is a strength of this study. To fully explore this relationship, research in actual inter-professional healthcare teams needs to be conducted in a stepwise approach.

First efforts need to be directed at firmly establishing a reliable tool to measure cohesion in this population. The QCS needs to be tested further to establish whether or not it can reliably measure cohesion in actual healthcare settings and in real inter-professional teams of healthcare providers. Next, reliable, consistent and universally recognized measures of team performance need to be established. A common measure of team performance will enable it to be measured as a standard outcome variable across multiple organizations and hospital units so that comparisons can be made. Finally, a multi-site, multi-unit, large scale study of cohesion and team performance needs to be conducted. In addition, it would be worthwhile to explore other variables that may affect performance and cohesion such as leadership capabilities, gender distributions, age, skill mix, and area of specialty.
Today’s healthcare organizations and providers must work diligently to ensure that they are providing both safe and cost effective care. Studies of the relationship between cohesion and economic factors such as average length of stay and/or care related complications such as catheter associated blood stream and urinary tract infections (CABSI, CAUTI), medication errors, wrong site surgeries, ventilator associated pneumonia, and successes in return of spontaneous circulation (ROSC) following Cardio-Pulmonary Resuscitation (CPR) would assist in understanding if team cohesion also plays a role in positive or negative outcomes related to the healthcare metrics of safety and cost. Furthermore, studies on the relationship between cohesion and performance measures in hospitals would help to illuminate if patient safety habits such as reporting errors and near misses are also impacted by levels of cohesion. Finally, differences in cohesion across disciplines beyond nursing and medicine (respiratory therapy, social work, physical therapy, etc.) would assist in forming a more complete understanding of how perceptions of cohesion differ across other allied healthcare professions.

Establishment of a relationship between team cohesion and performance in healthcare teams would suggest that targeted interventions should be initiated for teams with levels of cohesion below an established threshold. Creation of normative levels of cohesion could be used to create baseline minimum levels for practice to be used as benchmark standards. Qualitative studies could be used to more fully understand factors that foster or undermine feelings of cohesion. Individuals found to have below standard levels cohesion scores could be interviewed to assist in building an understanding of their team experiences that diminished feelings of unity. Likewise, information gathered from
interviews with individuals with above average levels could assist with forming a more complete understanding of team experiences that promote cohesion. These efforts could then be used correct environments which foster poor cohesion and model settings that promote it.

The findings of this work should be useful in providing preliminary evidence that cohesion in healthcare teams affects performance in a directly attributable care outcome such as care of the acutely ill patient. The evidence provided can be used to springboard other research aimed at further exploration of cohesion and its contribution to improved team-based delivery of healthcare.

Healthcare providers must embrace the emerging team based approach to delivering modern health care. There must be ongoing and purposeful efforts made to understand team dynamics, correct deficiencies, and foster cohesion. The outcomes of care, the costs of care, and patients’ lives count on it.

“Coming together is a beginning. Keeping together is progress. Working together is success” - Henry Ford.
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Appendices

APPENDIX A

A PRIORI ANALYSIS USING G* POWER

![Diagram showing critical t = 2.00575]

<table>
<thead>
<tr>
<th>Test family</th>
<th>Statistical test</th>
</tr>
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<tbody>
<tr>
<td>t tests</td>
<td>Means: Difference between two dependent means (matched pairs)</td>
</tr>
</tbody>
</table>

| Type of power analysis | A priori: Compute required sample size – given \( \alpha \), power, and effect size |

<table>
<thead>
<tr>
<th>Input Parameters</th>
<th>Output Parameters</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Noncentrality parameter ( \delta )</td>
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<td></td>
<td>Critical t</td>
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<tr>
<td></td>
<td>Df</td>
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<tr>
<td></td>
<td>Total sample size</td>
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<tr>
<td></td>
<td>Actual power</td>
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<tr>
<td>Determine =&gt;</td>
<td>Effect size dz</td>
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<td></td>
<td>( \alpha ) err prob</td>
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<tr>
<td></td>
<td>Power (1-( \beta ) err prob)</td>
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</tbody>
</table>
### APPENDIX B

**QUADRIPARTITE COHESION SCALE**

**Table 3. Quadripartite Cohesion Scale**

<table>
<thead>
<tr>
<th>Question mid-week version</th>
<th>Question post course version</th>
<th>Factor/dimension</th>
<th>Author</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is your team number?</td>
<td>What is your team number?</td>
<td>Demographics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you use a team number other than the number it was assigned?</td>
<td>Demographics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is your intended profession?</td>
<td>What is your intended profession?</td>
<td>Demographics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is your gender?</td>
<td>What is your gender?</td>
<td>Demographics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our team is united in trying to reach its goals for performance.</td>
<td>Our team was united in trying to reach its goals for performance.</td>
<td>Group Integration-Task</td>
<td>Windmeyer, Brawley, &amp; Carron (1985)</td>
<td></td>
</tr>
<tr>
<td>We all take responsibility for any performance by our team.</td>
<td>We all took responsibility for any poor performance by our team.</td>
<td>Group Integration-Task</td>
<td>Windmeyer, Brawley, &amp; Carron (1985)</td>
<td></td>
</tr>
<tr>
<td>Our team members have conflicting aspirations for the team’s performance.</td>
<td>Our team members had conflicting aspirations for the team’s performance.</td>
<td>Group Integration-Task</td>
<td>Windmeyer, Brawley, &amp; Carron (1985)</td>
<td></td>
</tr>
<tr>
<td>If members of our team have problems in simulation or other course activities everyone wants to help them so we can get back on track.</td>
<td>If members of our team had problems in simulation or other course activities, everyone wanted to help them so that we could get back on track.</td>
<td>Group Integration-Task</td>
<td>Windmeyer, Brawley, &amp; Carron (1985)</td>
<td></td>
</tr>
<tr>
<td>Our team members communicate freely about each person’s responsibility during simulation</td>
<td>Our team members communicated freely about each person’s responsibility during the simulation</td>
<td>Group Integration-Task</td>
<td>Windmeyer, Brawley, &amp; Carron (1985)</td>
<td></td>
</tr>
<tr>
<td><strong>Question mid-week version</strong></td>
<td><strong>Question post course version</strong></td>
<td><strong>Factor/dimension</strong></td>
<td><strong>Author</strong></td>
<td><strong>Scoring</strong></td>
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<td>-------------------------------</td>
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<tr>
<td>encounters or other course activities.</td>
<td>encounters or other course activities.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most of the people on the team are the kind of people I would enjoy spending time with outside the course.</td>
<td>Most of the people on the team were the kind of people I would enjoy spending time with outside the course.</td>
<td>Inter-member attraction</td>
<td>Stokes, J (1983)</td>
<td></td>
</tr>
<tr>
<td>If I were to participate on another team like this one, I would want it to include people who are very similar to the ones on this team.</td>
<td>If I were to participate in on another team like this one, I would want it to include people who are very similar to the ones who were on this team.</td>
<td>Inter-member attraction</td>
<td>Stokes, J (1983)</td>
<td></td>
</tr>
<tr>
<td>There are not many people I like as individuals on my team.</td>
<td>There were not many people I liked as individuals on my team.</td>
<td>Inter-member attraction</td>
<td>Stokes, J (1983)</td>
<td></td>
</tr>
<tr>
<td>When this course is over, I would still like to see the people on this team as often as I could.</td>
<td>Even though this course is over, I would still like to see the people on this team as often as I could.</td>
<td>Inter-member attraction</td>
<td>Stokes, J (1983)</td>
<td></td>
</tr>
<tr>
<td>I wish I had more time for socializing outside the course with other team members.</td>
<td>I wish I had more time for socializing outside the course with other team members.</td>
<td>Inter-member attraction</td>
<td>Stokes, J (1983)</td>
<td></td>
</tr>
<tr>
<td>I am not learning very much from participating on this team.</td>
<td>I haven’t learned very much from participating on this team.</td>
<td>Instrumental value</td>
<td>Stokes, J (1983)</td>
<td>Reverse</td>
</tr>
<tr>
<td>The team is influencing me in a lot of positive ways.</td>
<td>The team has influenced me in a lot of positive ways.</td>
<td>Instrumental value</td>
<td>Stokes, J (1983)</td>
<td></td>
</tr>
<tr>
<td>I don’t think this team is being very helpful to me.</td>
<td>I don’t think this team has been very helpful to me.</td>
<td>Instrumental value</td>
<td>Stokes, J (1983)</td>
<td>Reverse</td>
</tr>
<tr>
<td>Question mid-week version</td>
<td>Question post course version</td>
<td>Factor/dimension</td>
<td>Author</td>
<td>Scoring</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
<td>--------------------------------------</td>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>The team is helping me to meet the personal goals I had in mind when I was assigned to it.</td>
<td>The team has helped me to meet the personal goals I had in mind when I was assigned to it.</td>
<td>Instrumental value</td>
<td>Stokes, J</td>
<td>(1983)</td>
</tr>
<tr>
<td>I like the team I am on.</td>
<td>I liked the team I was on.</td>
<td>Compatibility</td>
<td>Gross, E</td>
<td>(1957)</td>
</tr>
<tr>
<td>Many of the people on my team fit what I feel to be the idea of a good team member (do not include yourself).</td>
<td>Many of the people on my team fit what I felt to be the idea of a good team member (do not include yourself).</td>
<td>Compatibility</td>
<td>Gross, E</td>
<td>(1957)</td>
</tr>
<tr>
<td>I find the activities in which I am participating in as a member of the team attractive.</td>
<td>I found the activities in which I am participated in as a member of the team attractive.</td>
<td>Compatibility</td>
<td>Gross, E</td>
<td>(1957)</td>
</tr>
<tr>
<td>I feel included by the team.</td>
<td>I felt included by the team.</td>
<td>Compatibility</td>
<td>Gross, E</td>
<td>(1957)</td>
</tr>
<tr>
<td>I feel that working with this particular team is enabling me to attain my personal goals for learning.</td>
<td>I felt that working with this particular team enabled me to attain my personal goals for learning.</td>
<td>Compatibility</td>
<td>Yalom, I, et al.</td>
<td>(1967,1973, 1975)</td>
</tr>
<tr>
<td>Compared to other teams, I imagine this team is working well together.</td>
<td>Compared to other teams, I imagine this team worked well together.</td>
<td>Compatibility</td>
<td>Yalom, I, et al.</td>
<td>(1967,1973, 1975)</td>
</tr>
</tbody>
</table>

*Permissions for use of the subscales have been granted by each of the authors in the cases of the questions taken from the Stokes cohesion scale and Yalom, et al.’s work. The testing manual for the GEQ was purchased by the PI, and Permission for use of the GCS was given Courtesy of the Harvard University Archives.
APPENDIX C
UM CRM TOOL

Please use a 3 point scale to rate each action. 0 not done or done to late to make an impact, 1 partially done or done late, and 2 completely done or in a timely manner.

<table>
<thead>
<tr>
<th>Actions</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem Solving (Team)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prompt assessment of airway, breathing and circulation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tasks are undertaken simultaneously by individuals. Multiple people only doing the same task when necessary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Situational Awareness (Team)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avoid fixation errors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Re-assessment and re-evaluation is taking place</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resource utilization (Team)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calls for help when the situation is beyond their abilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uses nurse appropriately</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Leadership (Leader only)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delegates and directs appropriately</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintains a calm demeanor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acts decisively and maintains control of the situation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Correspondence with Dr. Yalom

Irvin Yalom <lyalom@gmail.com>  
Mon 3/24/2014 12:50 PM

yes, you’re most welcome to use any of these instruments - irv yalom

Sanko, Jill Steiner  
Mon 3/24/2014 12:45 PM

Sent Items

To: lyalom@gmail.com

Dear Dr. Yalom,

I am a PhD candidate at the University of Miami school of Nursing and Health Studies. I am interested in team/group cohesion. I am writing you today to see if you would allow me to use the two questions you added to the Gross cohesion scale in my dissertation project. The questions I am interested in are I feel that working with the particular group will enable me to attain my personal goals for which I sought the group. and Compared to other groups like yours how would you imagine your group works together. I also plan to seek permission to use the Gross Cohesion scale in order to be able to use the questions from there which you used for your study of cohesion. I will be modifying the questions slightly to fit the context in which I plan to use them. I will convert them to past tense since I will collect data at the end of a course where students are separated into teams.

Thank you for your consideration of this request.

Best

Jill Sanko
Correspondence with Dr. Stokes

Joseph Stokes <jstokes@uic.edu>
Tue 3/11/2014 8:24 AM

To: Jill Sanko, Jill Steiner;

- You replied on 3/11/2014 9:54 AM.

Sure, it is fine to use the scale for research. Let me know if you need anything else from me. Actually, I am about 50 miles from Chicago but staying overnight. This was an especially good winter to be in Miami instead of Chicago. joe

On 3/10/14 6:00 PM, "Sanko, Jill Steiner" <j.sanko@miami.edu> wrote:

> Hi Dr. Stokes,
> Thank you very much for returning my call. I actually have the article
> which has the scale, so really all I need is your permission to use it.
> The items that pertain to instrumental value are most interesting to me
> as they tap into the idea that groups are useful to its members.
> I hope you are out of town on a fun trip as Chicago is still cold this
> time of year. I received my BSN from Rush University and lived on
> Harrison down the street from UIC.
> Warm regards
> Jill Sanko
> University of Miami School of Nursing
> 
> Sent from my iPhone
Correspondence with Harvard University

Dear Jennifer,

I am requesting permission to use the group cohesion scale developed by Eugene F. Gross in his honors thesis titled *An empirical study of the concepts of cohesiveness and compatibility* for use as part of my dissertation (see attached questions from his thesis). This was dated April 12, 1957 (see title page attached). I will likely modify the questions slightly for the group in which I will be looking at this in. For example, I will be asking the students to reflect on their experiences on a team, so I will change group to team and put the questions in past tense.

The current proposed title of my dissertation is *Does team cohesion effect performance of interdisciplinary pre-nursing & pre-medicine teams in simulation based encounters*. I will be the author Jill Steiner Sanko. As of now the intended publication will be in the University’s Pro-quest dissertation publication. Depending on the outcome of the proposed study, I may pursue further publication of the findings in nursing or medical education journals following graduation. Anticipated date of publication of the dissertation is May 2015.

Thank you for your consideration of this request. Please don’t hesitate to contact me if you have any questions.

Regards,

Jill Sanko

Jill S. Sanko, MS, ARNP-BC, CHSE-A, PhDc
University of Miami School of Nursing and Health Studies
Dear Jennifer,
I hope this finds you well.
I am just following up on this request to see if it was received, if you have the information you need and how long you think it might be until a decision is made.
Warl regards,
jill

Jill S. Sanko, MS, ARNP-BC, CHSE-A, PhD
University of Miami School of Nursing and Health Studies

Dear Jill:

I finished my part and it is with the final person. I will let them know that you have written to follow up. It shouldn’t be long.

Best,
jennifer
Dear Dr. Gross,

I hope this letter finds you well. My name is Jill Sanko, I am a PhD candidate at the University of Miami. I am currently working toward a PhD in nursing with a concentration in patient safety and simulation education. I am interested in how team/group cohesion effects performance outcomes in healthcare teams. I had written to the Harvard University Archives seeking permission to use your cohesion scale which was published in your honors thesis. I would like to use your compatibility questions to assess the compatibility dimension of cohesion in my population of interest. Harvard was able to give me permission as far as their rights extended, however they provided me with your contact information so I decided to reach out to you as well. My intention is to use your questions as part of a larger cohesion tool that I have developed from other cohesion tools. My intention is to publish my results in my dissertation as

Attested correspondence with Dr. Gross

May 2\textsuperscript{nd}, 2014

Dear Dr. Gross,

I hope this letter finds you well. My name is Jill Sanko, I am a PhD candidate at the University of Miami. I am currently working toward a PhD in nursing with a concentration in patient safety and simulation education. I am interested in how team/group cohesion effects performance outcomes in healthcare teams. I had written to the Harvard University Archives seeking permission to use your cohesion scale which was published in your honors thesis. I would like to use your compatibility questions to assess the compatibility dimension of cohesion in my population of interest. Harvard was able to give me permission as far as their rights extended, however they provided me with your contact information so I decided to reach out to you as well. My intention is to use your questions as part of a larger cohesion tool that I have developed from other cohesion tools. My intention is to publish my results in my dissertation as
well as possibly see other publication opportunities if they present themselves. I will of course give credit to both you and Harvard in any publications and any use of the tool. Thank you for your consideration in this matter.

Regards,
Jill S Sanko

My contact information is:
J.sanko@miami.edu (if you use e-mail).
Or 7930 SW 152nd Terrace
  Palmetto Bay, FL 33157

Returned letter:
Purchase agreement for use of the Group Environment Questionnaire (GEQ)

The widely acclaimed Group Environment Questionnaire, a test that assesses group cohesion in sport, measures the task and social aspects of an athlete's perceptions of and attraction to the group. The GEQ contains 18 items and has four scales: Individual Attraction to Group-Task; Individual Attraction to Group-Social; Group Integration-Task; and Group Integration-Social.

The Group Environment Questionnaire Test Manual provides the test user with extensive detail about the GEQ. The manual is organized into the following chapters:

Chapter 1: An Introduction to Group Cohesion in Sport
Chapter 2: Development and Description of the GEQ
Chapter 3: Psychometric Properties of the GEQ
Chapter 4: Normative Data for the GEQ

The Group Environment Questionnaire Test Manual also contains the GEQ and scoring key. Purchase of the manual entitles the user to reproduce multiple copies of the GEQ for test projects.

An electronic version of the GEQ and manual are also available at www.fitinfotech.com. By purchasing a license to the GEQ, the user can provide test participants with password access to complete the GEQ online. Scale scores for each participant are calculated automatically and can be easily accessed by the test user. We can also provide the test user with the raw data of their participants in a database format. The test user has the option of downloading hard copies of the GEQ when test participants do not have Internet access. The electronic version of the manual contains convenient hyperlinks for easy access to each chapter.
Correspondence with Dr. Birnbach to gain permission to add the QCS to the patient safety course

You replied to this message on 7/29/2013 1:50 PM.

From: Birnbach, David <dbirnbach@med.miami.edu>
To: Sanko, Jill Steiner
Cc: 
Subject: RE: Permission

Yes. As we previously discussed, you have my permission.

David

David J. Birnbach, MD, MPH
Miller Professor and Vice Provost
University of Miami
Senior Associate Dean for Quality, Safety and Risk Management
Director, UW-MM Center for Patient Safety
Miller School of Medicine
Tel: (305) 284-2002
Fax: (305) 284-0750
dbirnbach@miami.edu

Jill Sanko, RN, MS, ARNP-BC, CHEC-III, PhD
University of Miami School of Nursing and Health Studies
Office phone: 305-284-2538  Mobile: 240-402-7900

From: Sanko, Jill Steiner [sangoj1@med.miami.edu]
Sent: Tuesday, July 29, 2013 1:44 PM
To: Birnbach, David
Subject: Permission

Hi Dr. Birnbach,

I know you had given me permission verbally to add my cohesion tool to measure cohesion during the IPE patient safety course, but I need a written record of this permission as well. May I have permission to add this to your patient safety course?

Thank you

Jill
APPENDIX E

INSTRUCTIONS FOR COMPLETING SURVEYS

Mid-week survey correspondence
Dear Students,
We hope you are learning a lot so far this week. The rest of the week is filled with more simulation and fun learning experiences. Please take a few moments to complete a survey asking about your experiences on your assigned team. Please attempt to complete this before tomorrow morning.
Thank you
Link for mid-week cohesion embedded here.

Reminder:
Dear Students,
Yesterday evening you were asked to complete a short survey on your experiences as part of an inter-professional team. If you have not already done so please take a few minutes to complete this before attending your simulation activities today.
Thank you
Link for mid-week cohesion embedded here.

Post course survey correspondence
Dear Students,
Thank you for great week of learning with you, about you and from you. It is always rewarding for the educators who work hard to put this all together to see you grow. Please take a few minutes to respond to the post course and team questionnaires located in blackboard under the modules day V. Your responses on these is important to us and appreciated. The links for these are also below for your convenience.
Link for post cohesion survey embedded here.
Link for post course evaluation embedded here

We wish you well as you enter your careers as healthcare providers

Reminder:
Dear Students,
Thank you to those who have completed the post course evaluation and team questionnaire. There are still about a quarter of you who have not yet completed either of these questionnaires, please take a few minutes to complete the two questionnaires. The information we gather from these is important to us and is used to improve and make decisions about future courses.
The links for each are found below
Link for post cohesion survey embedded here.
Link for post course evaluation embedded here
Thank you for your time
APPENDIX F

MPLUS SYNTAX

Factor analysis:
ANALYSIS:
TYPE IS GENERAL;
ESTIMATOR IS ML;
ITERATIONS= 1000
CONVERGENCE = 0.0005;

MODEL:
!factor analysis QCS;
task BY Q4*, Q6, Q7, Q9, Q10;
attraci BY Q11* Q12 Q13 Q14 Q15;
value BY Q16* Q17 Q18 Q19;
compat BY Q20* Q21 Q22 Q23 Q24 Q25;
!modern CFA format;
task@1 attraction@1 value@1 compat@1;

Path analysis:
VARIABLE:
  NAMES ARE Team TCWed TCFri Performance;
  USEVARIABLES ARE TCWed TCFri Performance;

ANALYSIS:
  TYPE IS GENERAL;
  ESTIMATOR IS ML;
  ITERATIONS = 1000;
  CONVERGENCE = 0.00005;

OUTPUT: SAMPSTAT MODINDICES RESIDUAL STANDARDIZED CINTERVAL;
MODEL:
!path
TCFri ON TCWed ;
!correlation
Performance ON TCWed ;
TCFri ON TCWed Performance;
Appendix G

IRB APPROVAL

Copy of IRB approval letter

May 20, 2014

David Birnbach
305-585-6443
dbirnbach@miami.edu

Dear Dr. David Birnbach:

On 5/15/2014, the IRB reviewed the following submission:

<table>
<thead>
<tr>
<th>Type of Review:</th>
<th>Modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title of Study:</td>
<td>Using a Longitudinal view to evaluate a patient safety curriculum for medical students and residents</td>
</tr>
<tr>
<td>Investigator:</td>
<td>David Birnbach</td>
</tr>
<tr>
<td>IRB ID:</td>
<td>MOD00001456</td>
</tr>
<tr>
<td>Funding:</td>
<td>None</td>
</tr>
<tr>
<td>IND, IDE, or HDE:</td>
<td>None</td>
</tr>
<tr>
<td>Documents Reviewed:</td>
<td>Patient Safety Week Survey, Category: Questionnaire/Survey; The Tool for Team Cohesion, Category: Questionnaire/Survey;</td>
</tr>
</tbody>
</table>

The IRB approved the study from 5/15/2014 to 4/7/2015 inclusive. Before 4/7/2015 or within 45 days of the approval end date, whichever is earlier, you are to submit a completed Continuing Review to request continuing approval or closure.

If continuing review approval is not granted before the expiration date of 4/7/2015 approval of this study expires on that date.

NOTE: Translations of IRB approved study documents, including informed consent documents, into languages other than English must be submitted to HSRO for approval prior to use.

In conducting this study, you are required to follow the requirements listed in the Investigator Manual (HRP-103), which can be found by navigating to the IRB Library within the IRB system.
Should you have any questions, please contact: Meghan Stein, IRB Regulatory Analyst, (phone: 305-243-3195; email: m.stein@med.miami.edu)

Sincerely,

[This is a representation of an electronic record that was signed electronically and this page is the manifestation of the electronic signature]

Amanda Coltes-Rojas, MPH, CIP
Director
Regulatory Affairs & Educational Initiatives
VITA

Jill Steiner Sanko was born and raised in Miami, Florida. Her parents are Jeffrey and Gale Steiner. She received her elementary education at Kenwood Elementary and Glades Middle School. She graduated with her high school diploma in 1991 from Miami Killian Senior High School. Following graduation she began a degree in Anthropology at the University of Florida where she graduated in 1995 with a B.A. in Cultural Anthropology. She immediately followed this degree with a two year post bachelorette degree in nursing from Rush University in Chicago, Illinois. After she graduated she moved back to Miami where she began her first job working at Miami Children’s Hospital. In May of 1999 she left Miami again to work as a travel nurse in the Washington, DC / Maryland area. In January 2000 she began a master’s degree in nursing at the University of Maryland and began working as an ICU nurse at the National Institutes of Health (NIH). She married in 2002 in Washington, DC. She graduated with a master’s of science degree in nursing with a specialization in acute care and Trauma nursing in 2003, 2 weeks after giving birth to her son. Following graduation she worked as clinical research specialist for the National Institutes of Health’s Critical Care Medicine department as well as the National Institute of Heart Lung and Blood (NHLBI). During her time at NIH she also worked to establish their simulation program. In May of 2008 she joined a team of simulation researchers and educators at the University of Miami – Jackson Memorial Center for Patient Safety as a research and simulation education specialist. In August of 2012 she began a Ph.D. in nursing at the University of Miami School of Nursing and Health Studies and was granted a degree in May of 2015.
Currently she resides with her husband Steve and three children Caden, Eva Grey, and Aubrey in Palmetto Bay, Florida.