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Exploring a Model of Clinical Leadership Grounded in Radiography: Developing Clinical Radiography Leaders

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ACCEPTANCE

This dissertation, EXPLORING A MODEL OF CLINICAL LEADERSHIP GROUNDED IN RADIOGRAPHY: DEVELOPING CLINICAL RADIOGRAPHY LEADERS, by KERRY O'FALLON DUNN, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree, Doctor of Philosophy, in the College of Education & Human Development, Georgia State University.

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EXPLORING A MODEL OF CLINICAL LEADERSHIP GROUNDED IN RADIOGRAPHY: DEVELOPING CLINICAL RADIOGRAPHY LEADERS

by

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ABSTRACT

Purpose: The purpose of this study was to develop a model of clinical leadership that encompasses the specialized technical skills and leadership behaviors exhibited by clinical radiography leaders. This was accomplished by addressing the following research questions: (1) What were the commonly practiced clinical leadership behaviors associated with clinical radiography leaders? and (2) What were the common technical skills performed by radiographers that are associated with clinical radiography leaders?

Theoretical Framework: This study was grounded in collaborative leadership which has been developed from the theoretical constructs of experiential learning and clinical supervision. Collaborative leadership occurs when multiple healthcare providers, including radiographers, utilize their clinical expertise and clinical decision-making skills to collectively image, care for, diagnose, and treat the patient.

Methods**:** During this quantitative study, approximately 432 clinical radiography leaders, completed the Clinical Radiography Leadership Survey, which measured the technical skills and leadership behaviors aligned with clinical leadership in radiography. Data analysis included a correlational analysis to examine the relationships between the dimensions measuring technical skills and dimensions measuring leadership behaviors when defining clinical radiography leaders.

Results: Participant responses were correlated individually, as well as aggregated by dimension, with $p > 0.3$ being significant. The highest inter-dimensional correlation existed between Dimension 1 and 2 ($p = .715$) while exhibiting weak correlations to dimensions associated with clinical leadership behaviors. The results of confirmatory factor analysis revealed that a more global view of clinical leadership behaviors, as well as patient care and technical skills, informed participants' view of clinical radiography leadership.

Significance: This study explored a radiography-specific definition of clinical leadership that more appropriately captured the unique technical skills and leadership behaviors that are exhibited by clinical radiography leaders. By developing a more fine-grained and applicable definition of clinical leadership that is grounded in radiography, educators may embed competencies that align with clinical leadership in their program curriculum. By doing so, this will allow for the development of future clinical radiography leaders who display advanced clinical decision-making skills and provide higher levels of procedure performance and patient care.

INDEX WORDS: clinical competency; clinical leadership; collaborative leadership; healthcare leadership; medical imaging; radiography

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KERRY O'FALLON DUNN

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DEDICATION

This dissertation is dedicated to my husband, Matt, who always provides an endless amount of encouragement and support. It is also dedicated to the numerous mentors I have been privileged to study under and work with, without you I would never have found my passion for this field.

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LIST OF ABBREVIATIONS

ARRT - The American Registry of Radiologic Technologists

ASRT - The American Society of Radiologic Technologists

CLS – Clinical Leadership Survey

CRLS – Clinical Radiography Leadership Survey

JRCERT – The Joint Review Committee on Education in Radiologic Technology

RCS – Radiographers' Competence Scale

1 THE PROBLEM

Clinical leadership is a relatively new concept when applied to not only radiography, but also healthcare in general (Careau, Biba, Brander, Dijk, Verma, Paterson, & Tasson, 2014; Cook & Leathard, 2004; Stanley, Blanchard, Hohol, Hutton, & McDonald, 2017). The development of clinical leaders within radiography is important to propelling the profession forward and establishing higher professional standards of practice (Andersson, 2012; Bloom, 2014; Thompson, Smythe, & Jones, 2016). The development of clinical radiography leaders within educational programs may have the ability to influence the profession towards this end (Bloom, 2014).

While various models of leadership have been applied to the practice of healthcare, these models may be considered incomplete as they fail to incorporate the technical aspects and skills required to practice within the clinical environment (Bloom, 2014; Cook, 2001; Cook & Leathard, 2004; Mannix, Wilkes, & Daly, 2013). However, clinical leadership models allow for the combination of the technical skills required for clinical practice with the leadership behaviors demonstrated within the profession. Nursing has been one of the more prolific with respect to research related to leadership and the clinical setting (Bloom, 2014; Chappell, Richards, & Barnett, 2014; Cook & Leathard, 2004; Mannix et al., 2013; Patrick, Laschinger, Wong, & Finegan, 2011; Pepin, Dubois, Girard, Tardif, & Ha, 2010; Stanley et al., 2017). Researchers in the field of nursing have developed a more comprehensive model of leadership that links their technical skills and expertise to the leadership behaviors demonstrated by leaders in their profession, referred to as clinical nurse leaders (Cook, 2001; Cook & Leathard, 2004; Joseph & Huber, 2015; Patrick et al., 2011). It is my intent to explore a model of clinical leadership that more completely encompasses the technical skills and leadership behaviors exhibited by those within the field of radiography.

History of Radiography Education

On November 8th, 1895, Wilhelm Conrad Roentgen was experimenting with the Crookes tube and darkened his laboratory to study the electrical glow of the cathode rays that were created when the covered Crookes tube was energized (Carlton, Adler, & Balac, 2020; Fauber, 2017). By chance, he noticed, on a nearby bench, that a screen coated in barium platinocyanide would fluoresce whenever the Crookes tube was energized (Carlton et al., 2020; Fauber, 2017). Roentgen surmised that the energy or rays emanating from the Crookes tube was causing the barium platinocyanide-coated screen to fluoresce and when he placed his hand between the energized Crookes tube and the barium platinocyanide-coated screen, he was able to see the bones of his hand glow against the barium platinocyanide (Carlton et al., 2020; Fauber, 2017).

Wilhelm Roentgen is thus credited with the discovery of x-rays on November 8, 1895, and his discovery led to the development of several medical imaging disciplines, such as radiography, sonography, computed tomography, magnetic resonance imaging, nuclear medicine, cardiovascular- interventional science, mammography, bone densitometry, and radiation therapy (Adler & Carlton, 2019; Fauber, 2017). With the advent of each discipline within medical imaging came the progression of education within that discipline.

Radiography is the direct science derived from Roentgen's discovery and, as such, was the first to develop a semi-structured education process (American Society of Radiologic Technologists [ASRT], 2020c). By the early 1900s, x-rays had begun to have widespread medical applications. Initially, radiographic exams were only performed by physicians who became the first radiologists (ASRT, 2020c). These radiologists soon began to train their

receptionists to perform the exams. Eventually, nurses began to perform the exams and develop the films due to their medical background. These nurses became the first x-ray technicians. At this point, the educational process was more guesswork than formal training (ASRT, 2020c).

Ed Jerman was the first to bring education and professional organization to the role of the x-ray technician. He created the first professional organization for x-ray technicians to exchange thoughts on training and radiologic technique (ASRT, 2020c). This led to the printing of the first society journal in 1929 (ASRT, 2020c). The first standardized curriculum was created in 1952 by the American Society of X-Ray Technicians (ASXT) and prescribed a one-year program encompassing physics, anatomy, positioning, and darkroom technique. The society created this curriculum as they advocated for uniform education standards for those practicing in the field (ASRT, 2020c). During the 1960s, the ASXT changed its name to the American Society of Radiologic Technologists (ASRT) to more accurately reflect the professionalism and educational standards desired for those practicing in the profession (ASRT, 2020c).

The ASRT was the first to establish educational standards for radiologic technology practice related to curriculum development and instructor preparation (Joint Review Committee on Education in Radiologic Technology [JRCERT], 2020b). According to the Joint Review Committee on Education in Radiologic Technology (JRCERT), there were approximately 125 schools training x-ray technologists by the 1950s (JRCERT, 2020b). Due to the rapid increase in the number of schools offering training in radiologic technology, the American College of Radiology (ACR) created the Commission on Technologists Affairs Committee on Technologists Training to evaluate these programs. It was during this time that programmatic educational standards were established. This commission eventually became the JRCERT in 1971, and this entity assumed responsibility for the evaluation of educational programs in the

radiologic sciences (JRCERT, 2020b). Today, the JRCERT is considered the premier accrediting body for educational programs in the radiologic sciences. The JRCERT is also the only programmatic accrediting agency in radiologic science education recognized by the United States Department of Education (USDE). The JRCERT evaluates programs in radiography, radiation therapy, magnetic resonance imaging, and medical dosimetry. The JRCERT has established *The Standards*, which is a document containing the minimum educational standards for accredited programs and ensures program quality (JRCERT, 2020a).

Modern medical imaging programs have traditionally been housed in hospital-based programs that require students to complete their clinical hours at the parent hospital with very little to no academic education. Hospitals would sponsor medical imaging programs and hire technologists to teach the incoming students the basic knowledge covered on the national certification exam. Medical imaging is usually situated within the realm of vocational or technical education, and the hospital training model was an ideal environment to house those training programs (Bloom, 2014; Harris, 1995; JRCERT, 2020b). Thus students who complete these programs are thought of as being "trained" due to the hands-on application of knowledge rather than truly being "educated" through the completion of academic coursework (Bloom, 2014; Lehmann, 2009).

Medical imaging's national certification board, The American Registry of Radiologic Technologists (ARRT), has mandated that all applicants sitting for the national certification exam in a primary discipline must demonstrate minimum educational standards (American Registry of Radiologic Technologists [ARRT], n.d.b). All ARRT-approved educational programs must meet specific standards and provide the academic knowledge and clinical experience necessary to sit for the national certification exam (ARRT, n.d.b). Over time,

radiography education has grown from vocational training to a more rigorous academic profession that contains specific learning outcomes (Holmström & Ahonen, 2016). However, while the profession has established and routinely updates a standardized curriculum, it does not present a standard set of leadership competencies. Thus, a knowledge gap with respect to leadership practices in the clinical environment exists. Without a standard set of clinical leadership competencies, students struggle to gain the necessary competence needed to lead others in the clinical setting (Booth, Henwood, & Miller, 2017; Kester, 2017; Watson, 2009). Therefore, further research may be beneficial in defining a model of clinical leadership that encompasses both the technical aspects of radiography and the leadership competencies specific to practicing radiography in the clinical environment.

Research Questions

1. What are the commonly practiced clinical leadership behaviors associated with clinical radiography leaders?
2. What are the common technical skills performed by radiographers that are associated with clinical radiography leaders?

Purpose

The purpose of this quantitative study was to explore a model of clinical leadership that incorporates both the technical skills and leadership competencies practiced by clinical radiography leaders. This was accomplished through the completion of a quantitative survey that measures the clinical leadership behaviors, as well as the technical skills utilized in the practice of radiography.

Significance of the Study

While other health science disciplines may offer a generic definition of clinical leadership, this definition does not encompass the unique technical skills necessary to perform

radiographic procedures, nor do the leadership competencies align entirely with the practice of radiography. Radiography is a complex, high-tech, and high touch field of healthcare. The conventional definition of clinical leadership is not aligned with the actual practice of radiography or with the clinical expertise and clinical decision-making necessary to produce quality radiographic images that lead to sound clinical diagnoses and treatment.

The practice of clinical leadership within radiography can have implications on patient diagnosis, care, and treatment. When radiographers function as clinical leaders, they exhibit higher levels of clinical expertise and clinical decision-making which can positively impact patient imaging, diagnosis, care, and treatment. Therefore, exploring the technical skills and leadership competencies that are better aligned to the clinical decision-making and leadership within medical imaging departments will allow for the incorporation of said competencies into radiography program curricula. The inclusion of clinical leadership competencies into radiography program curricula will allow students to incorporate the specialized technical skills and leadership behaviors that are grounded in the practice of clinical radiography leadership as they progress through the program coursework and enter the profession.

The inclusion of clinical leadership competencies within the radiography program curricula benefits many stakeholders, such as radiography educators, radiography students, radiologic technologists, radiology department directors, and patients. This study provides competencies aligned to the practice of clinical radiography leadership which strengthens the leadership skills of radiography students as they progress through the program and enter the clinical environment. Additionally, it offers a framework that educators can use to create a paradigm shift from a technical career to that of a profession through the development of clinical leaders within the disci-

pline. Students will enter the profession prepared to assume leadership roles within their organizations and practice sound clinical decision making as they image and care for patients. By learning clinical leadership competencies first within the didactic setting, students will have the opportunity to apply these competencies and concepts when they enter the clinical environment for their clinical education experiences. The reinforcement of clinical leadership characteristics and behaviors provide a higher level of clinical decision-making and lead to better patient care and procedure performance. Additionally, it propels the radiography profession forward by highlighting the technical skills and leadership attributes necessary to carry out the complex practice of radiography.

Biases and Errors

As with any research study, there was the potential for bias and error. As the survey utilized in this study, the Clinical Radiography Leadership Survey (CRLS), is based upon the participants' perceived value of the technical skills and self-assessed frequency of leadership behavior performance, there is an inherent bias present. Additionally, there was potential bias related to the fact that those who completed the CRLS are more inclined to have pre-conceived ideas relative to clinical leadership as these individuals are currently, or have in the past, held leadership roles within the profession. These pre-conceived notions as to the behaviors that constitute clinical leadership in radiography could have led to the social desirability bias, meaning the desire to select the choice that would constitute the most socially acceptable response (Chipeta, 2020; Dillman, Smyth, & Christian, 2014; Ethier, Poe, Schulze, & Clark, 2000; Maguire, 2009; Roxas & Lindsay, 2012). Social desirability bias is considered to be a significant threat to study validity as it skews both the data collected, as well as the results of the study overall, by causing misleading correlations and associations (Roxas & Lindsay, 2012). However, research suggests that the bias of social desirability may be meditated when utilizing self-administered surveys, such as

through a web-based link, that allows for a sense of anonymity and confidentiality (Ethier et al., 2000; Maguire, 2009; Roxas & Lindsay, 2012) .

Other sources of bias that were potentially present in this study may include that of avidity bias and nonresponse bias (Chipeta, 2020; Ethier et al., 2000; Maguire, 2009; Roxas & Lindsay, 2012). Avidity bias arises from the idea that those who have a vested interest in the topic are more likely to complete the survey, but that these participants may not be representative of the population that the researcher is attempting to study (Ethier et al., 2000; Maguire, 2009; Roxas & Lindsay, 2012). One of the most effective ways to combat avidity bias is through a high response rate and the use of systematic sampling (Ethier et al., 2000). The high response rate decreases the effect of avidity bias while the use of systematic sampling ensures representation across the desired categorical stratifications for the sampling frame (Ethier et al., 2000).

Nonresponse bias is often due to a low response rate and may be mediated through wave analysis (Creswell & Creswell, 2018). Wave analysis requires the researcher to examine returned surveys weekly in order to determine whether there is a wide variation in responses from week to week (Creswell & Creswell, 2018). If most of the data were consistent throughout the collection timeframe, nonresponse bias has been reduced within the study (Creswell & Creswell, 2018).

Overview of the Study

This study employed a quantitative survey to measure and examine participants' most commonly performed clinical leadership practices in radiography departments in the United States. The developed survey is a combination of the Radiographers' Competence Scale (RCS) and the Clinical Leadership Survey (CLS) (Andersson, 2012; Andersson, Christensson, Fridlund, & Broström, 2012; Andersson, Christensson, Jakobsson, Fridlund, & Broström, 2012; Patrick et al., 2011). The participant sample for this study was comprised of radiology department directors, radiographers (technologists) who have experience in leadership roles, clinical preceptors,

and radiography educators. The study's survey link was emailed to participants based upon membership in common medical imaging credentialing organizations, accrediting bodies, and professional organizations.

Data for this study was collected through the use of a developed clinical leadership survey. The Clinical Radiography Leadership Survey (CRLS) contained items related to the technical practice of radiography, as well as the clinical leadership behaviors exhibited by radiographers in the clinical environment. The data collected during this study was analyzed using SPSS (Statistical Package for the Social Sciences) (Hoy & Adams, 2016). Following data analysis, a visual model of clinical leadership was created where the most commonly performed technical skills and leadership behaviors are demonstrated (Hays & Singh, 2012; Hoy & Adams, 2016).

2 REVIEW OF THE LITERATURE

Clinical leadership is an important aspect of propelling the profession of radiography forward. In order to prepare radiography students to exhibit the attributes and behaviors associated with clinical leadership, these competencies may be beneficially woven throughout the curricula. Before clinical leadership competencies can be integrated into the radiography program curriculum, a standard definition that incorporates both the technical aspects of the profession and the attributes and behaviors associated with leadership in the clinical environment may need to be solidified.

Clinical leadership is grounded in the theoretical framework of collaborative leadership, as well as the constructs of experiential learning and clinical supervision. It is through the construct of clinical supervision that mentoring is connected to clinical leadership. The review of the literature will connect the constructs of experiential learning and clinical supervision to the collaborative leadership framework. Additionally, it will demonstrate that collaborative leadership is derived from characteristics originating in transformational leadership and distributed leadership, as well as clinical supervision.

Clinical Leadership

Clinical leadership is valuable for the successful navigation of the ever-changing and complex healthcare environment (Booth et al., 2017; Stanley et al., 2017). Some institutions mandate that senior radiographers assume a clinical leader-ship role within their department, but few are given the tools or training to be successful (Booth et al., 2017; Kester, 2017; Watson, 2009). Clinical leadership differs from traditional leadership in that clinical leaders must possess the ability to utilize their clinical skills and judgment in addition to the more traditional leadership qualities (Adelman-Mullally, Mulder, McCarter-Spalding, Hagler, Gaberson, Hanner, Oermann, Speakman, Yoder-Wise, & Young, 2013; Booth et al., 2017; Budak & Özer, 2018;

Lovegrove & Long, 2012). In radiography, clinical leadership is considered the process of leadership that is grounded in the practice of radiographic imaging (Breed, 2014; Mannix et al., 2013; Patrick et al., 2011; Pepin et al., 2010). Though a few studies have identified multiple leadership traits (Cook, 2001; Francis, Hills, MacDonald-Wicks, Johnston, James, Surjan, & Warren-Forward, 2016) there are no studies currently available in the United States that have examined radiography preparation for leadership competencies.

Clinical leadership is the combination of clinical expertise, technical skills, and collaborative leadership practices that are used to make clinical decisions, provide patient care, and perform radiographic imaging exams (Andersson, 2012; Budak & Özer, 2018; Careau et al., 2014; Chappell et al., 2014; Falender & Shafranske, 2007; Fewster-Thuente & Velsor-Friedrich, 2008; Francis et al., 2016; Hendry, 2013; Lovegrove & Long, 2012; Mannix et al., 2013; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010; Patrick et al., 2011; Stanley et al., 2017). In order to foster the development of more clinical radiography leaders, it is necessary to clearly define what a clinical radiography leader is and to develop leadership skills and competencies that are aligned with the practice of medical imaging outcomes (Careau et al., 2014; Kutz, 2004). These clinical leadership competencies should encompass the clinical expertise, technical skills, and collaborative leadership practices necessary to work interprofessionally with other healthcare providers in order to make clinical decisions, care for patients, and perform radiographic imaging exams (Careau et al., 2014; Chappell et al., 2014; Fewster-Thuente & Velsor-Friedrich, 2008; Hendry, 2013; Kutz, 2004; Lovegrove & Long, 2012; Mannix et al., 2013; Patrick et al., 2011; Pepin et al., 2010; Stanley et al., 2017). Additionally, if these clinical leadership competencies are interwoven through the radiography educational curriculum, there is an opportunity to scaffold them throughout the students' clinical

experiences, as well as apply clinical leadership concepts and skills within the clinical environment (Brown, Crookes, & Dewing, 2015; Cook, 2001; Kester, 2017; Leigh, Wild, Hynes, Wells, Kurien, Rutherford, Rosen, Ashcroft, & Hartley, 2015). This aspect of developing clinical leadership competencies can be beneficial in that students are able to develop their clinical leadership skills and clinical decision-making as they progress through the program and refine their radiographic imaging expertise (Brown et al., 2015; Cook, 2001; Kester, 2017; Kutz, 2004; Leigh et al., 2015).

This idea of aligning clinical leadership competencies with healthcare practice is a newer concept and has recently been implemented by the field of nursing as they felt that the current and more broad definition of clinical leadership did not adequately capture the leadership behaviors, clinical expertise, or technical skills necessary to function as a clinical leader within nursing (Brown et al., 2015; Careau et al., 2014; Cook, 2001; Joseph & Huber, 2015; Kutz, 2004; Leigh et al., 2015; Patrick et al., 2011; Stanley et al., 2017). By exploring a more comprehensive definition of clinical leadership in radiography, there is the potential to create a paradigm shift within the profession. This more clearly defined definition of a clinical radiography leader could move the profession and education of students from a simple competency-based culture that views the performance of radiographic imaging exams as simply a list of tasks to be completed towards that of a profession that it is inclusive of leadership, mentoring, and lifelong learning (Bloom, 2014; Leigh et al., 2015).

In 2016, a study was conducted by faculty within the University of Newcastle in Australia that examined the characteristics embodied by the ideal practice educator (Francis et al., 2016). Their quantitative study ranked sixteen characteristics linked to practice educators us-

ing a mixed-methods survey (Francis et al., 2016). They defined practice education as the integration of academic study with competency development (Francis et al., 2016). Practice educators are the clinical preceptors who form one part of the student-program faculty-clinical affiliate triad (Francis et al., 2016). These clinical educators manage and enable competency development through clinical experiences, which allow the student to reach educational benchmarks. Francis et al. (2016) posit that the clinical education experience is the primary component for developing professional behaviors and leadership (Francis et al., 2016). Therefore, it may be valuable that specific attributes of effective leadership practice are identified. According to Francis et al. (2016), some of these traits include clinical competence, professionalism, listening skills, enthusiasm, sincerity, and acting as a role model. During the study, a total of sixteen practice educator characteristics were ranked by the sample population by importance. Of the sixteen characteristics identified and ranked during the study, all re-late strongly to the mentality that a practice educator is, in fact, a mentor and leader within the clinical environment (Francis et al., 2016). Cook (2001) also echoed the need for a more definitive collection of clinical leadership attributes that could be better suited to the role that clinical nurse leaders play in the clinical setting. Based upon Cook's (2001) research, five broad attributes of clinical leaders emerged which included highlighting, respecting, influencing, creativity, and supporting. Cook (2001) also found that there are five typologies related to the practice of clinical nurse leadership. These include acting as a discoverer, valuer, enabler, shaper, and modifier (Cook, 2001). While these broad categorizations of clinical leadership may provide a better definition when examining leadership within the nursing profession, they do not encompass the scope of radiography practice or the role that radiography clinical leaders play in the clinical setting.

Studies highlight the fact that building clinical leaders within radiography may be valuable in providing quality patient clinical care and diagnostic imaging examinations. The NHS has created a competency-based model that strives to provide a consistent set of leadership competencies that may be applied across all healthcare professions (Leigh et al., 2015; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010). While this is a positive step forward, leadership competencies may ultimately be situated within the specific discipline for the healthcare professional. This would allow for the application of the knowledge, technical skills, technology, behaviors, and attitudes necessary to function as a clinical radiography leader. Incorporating leadership competencies specific to the radiologic sciences may be beneficial to growing future clinical radiography leaders that can navigate the challenges encountered in the clinical environment.

Clinical leadership is defined by five main components: clinical expertise, effective communication, collaboration, coordination, and interpersonal understanding (Chappell et al., 2014; Cook & Leathard, 2004; Daniëls, Hondeghem, & Dochy, 2019; Hendry, 2013; Hoover, Giambatista, Sorenson, & Bommer, 2010; Patrick et al., 2011; Stanley & Stanley, 2019; Wieczorek & Lear, 2018). Clinical expertise, or clinical competency, is considered to be the blending of clinical knowledge, skills, and competence (Patrick et al., 2011). Clinical competency encompasses the requisite knowledge, technical expertise, clinical reasoning, interpersonal skills, communication, professional behaviors, and personal attitudes that culminate in the performance of radiographic examinations (Andersson, 2012; Andersson, Christensson, Fridlund, & et al., 2012; Andersson, Christensson, Jakobsson, & et al., 2012; Falender & Shafranske, 2007; Patrick et al., 2011). Each patient is unique and requires the radiographer to critically think through the performance of radiographic procedures to create high-quality diagnostic images

(ARRT, n.d.c). This process necessitates the incorporation of anatomical knowledge, radiographic positioning, image evaluation, and pathology with patient care skills to successfully perform the exam and achieve diagnostic images. Clinical radiography leaders are able to situate each clinical experience within the broader context of clinical patient care, diagnosis, and treatment (ARRT, n.d.c, Cook & Leathard, 2004; Patrick et al., 2011).

Through communication and collaboration, clinical radiography leaders are able to foster learning and empower fellow technologists and students to improve their clinical care practices (Breed, 2014; Cook & Leathard, 2004; Mannix et al., 2013; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010; Patrick et al., 2011; Storey, Holti, Hartley, Marshall, & Matharu, 2018). Emotional intelligence plays a significant role in this domain of clinical leadership. In order to create an environment of empowerment for collaboration, clinical leaders that practice emotional intelligence are able to foster trust (Adelman-Mullally et al., 2013; Goodman, 2014). The development of trust is led by demonstrating approachability, availability, and understanding (Breed, 2014; Goodman, 2014). Once trust has been established, other individuals may feel comfortable stepping into leadership roles and collaborating with others (Adelman-Mullally et al., 2013; Goodman, 2014). These clinical leaders collaborate with fellow radiographers and other healthcare professionals to share new knowledge, skills, and technique as a means of improving diagnostic imaging examinations, as well as patient outcomes and care (Cook & Leathard, 2004; Mannix et al., 2013; Pepin et al., 2010; Stanley & Stanley, 2019; Storey et al., 2018). Clinical leaders also employ transformational leadership techniques to motivate and encourage others within their organizations (Kester, 2017; Watson, 2009). Often, clinical leaders act as the visionary who communicates the need for

changes or improvements to the organization's processes, as well as providing the solutions and a roadmap for the accomplishment of these improvements (Breed, 2014; Storey et al., 2018).

Clinical leaders are also charged with coordinating schedules, resources, examinations, and patient clinical care (Cook & Leathard, 2004; Joseph & Huber, 2015; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010; Patrick et al., 2011). Clinical leaders function within four distinct levels: individual, depart-mental, interdisciplinary, and organizational (Fealy, McNamara, Casey, Geraghty, Butler, Halligan, Treacy, & Johnson, 2011; Kester, 2017). At the individual level, the clinical radiography leader practices self-awareness and self-confidence while maintaining an openness for feedback (Fealy et al., 2011). Clinical leaders often model best practices for clinical care while going be-yond the minimal expectations of their role (Adelman-Mullally et al., 2013; Fealy et al., 2011). Within the departmental level, the clinical leader acts as a resource for others and supports fellow technologists and team members through educating and mentoring them (Fealy et al., 2011; Kester, 2017). At the interdisciplinary, or team level, clinical radiography leaders perform their tasks and role in concert with other members of the interdisciplinary care team (Fealy et al., 2011). Through their collaborative efforts at the team level, clinical leaders are able to align patient clinical care with organizational goals (Adelman-Mullally et al., 2013; Fealy et al., 2011; Kester, 2017). On the organizational level, clinical leaders are able to situate their clinical practice into the broader healthcare structure of the organization and can affect process or systematic changes (Adelman-Mullally et al., 2013; Fealy et al., 2011)

Because clinical leaders often still provide clinical care for patients, they are able to leverage their knowledge of the organization's resources and processes to effectively advocate for their patients (Storey et al., 2018). Clinical radiography leaders use the transformational leader-

ship concepts of individual consideration and idealized influence to align individual goals with those of the organization (Adelman-Mullally et al., 2013; Watson, 2009). Studies have demonstrated a strong connection between emotional intelligence and transformational leadership practices (Abu Awwad, Lewis, Mackay, & Robinson, 2020). This is the case specifically in regard to the attributes of transformational leadership most associated with emotional intelligence, including idealized influence, individualized consideration, motivation, and self-awareness (Abu Awwad et al., 2020). Abu Awwad et al. (2020) conducted a pilot study with a cross-sectional survey design that explored the connection between emotional intelligence and leadership traits in chief radiographers. A convenience sample of potential participants was determined, and twenty-two chief radiographers participated in the study (Abu Awwad et al., 2020). The surveys used for this study were the Leadership Self-Assessment Tool (LSAT) and the Trait-EI Questionnaire Short-Form (TEIQue-SF) (Abu Awwad et al., 2020). The substantive conclusions for this study are that there is a positive association between emotional intelligence, leadership qualities, and workplace satisfaction (Abu Awwad et al., 2020). Specifically, the researchers determined that chief radiographers with higher emotional intelligence measurements had a positive correlation to the leader-ship qualities of emotionality and sociability (Abu Awwad et al., 2020). These qualities are valuable when creating a positive and satisfying workplace environment, as they are predictive of staff engagement and performance (Abu Awwad et al., 2020).

Additionally, there have been studies involving clinical radiography leaders that have reported higher emotional intelligence levels in these clinical leaders when compared to staff technologists within the field (Abu Awwad et al., 2020; Mackay, Hogg, Cooke, Baker, & Dawkes, 2012). Mackay et al. (2012) also conducted a quantitative study measuring emotional intelligence in both radiographers and radiography leaders using the Trait-EI Questionnaire

Short-Form (TEIQue-SF). The findings of this study were that radiographers exhibited higher levels of emotional intelligence when compared to other professions (Mackay et al., 2012). However, there were varied levels of emotional intelligence when comparing subgroupings of medical imaging professionals (Mackay et al., 2012). Specifically, angiographers and mammographers scored higher on emotionality, well-being, and global emotional intelligence than did diagnostic radiographers or nuclear medicine technologists (Mackay et al., 2012).

Interpersonal understanding is an important tenet of clinical leadership as it is a key aspect of interprofessional and interpersonal collaboration (Cook & Leathard, 2004; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010; Patrick et al., 2011). Interpersonal understanding is also closely aligned with self-awareness and understanding (NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010; Patrick et al., 2011). Clinical leaders benefit from being aware of their strengths, as well as mitigating for their weaknesses so that they may lead effectively. This aspect of leadership allows clinical leaders to position themselves so that they can respond to and assist with the achievement of both individual and organizational needs (Cook & Leathard, 2004; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010; Patrick et al., 2011). The component of interpersonal understanding is also aligned with supporting others or mentoring them within the clinical environment (Cook & Leathard, 2004; Mannix et al., 2013; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010; Patrick et al., 2011). Clinical radiography leaders can leverage their prior knowledge and experience to provide guidance and mentoring for others in new clinical situations (Adelman-Mullally et al., 2013; Cook & Leathard, 2004; Mannix et al., 2013; Patrick et al., 2011).

Integrating Clinical Leadership Competencies

Ensuring quality patient clinical care means that there is a need to develop more leaders within the clinical environment (Leigh et al., 2015). The Canadian Interprofessional Health Leadership Collaborative (CIHLC) completed a review of literature related to leadership within healthcare and found that while healthcare professionals rely on teamwork and leadership skills in the clinical environment, there are no competencies reflective of this in the current curriculums (Careau et al., 2014). The authors maintain that embedding these leadership competencies within the curriculum will increase leadership development across all healthcare disciplines (Careau et al., 2014). The AACN has also supported the establishment of clinical leadership competencies for clinical nurse leaders (Joseph & Huber, 2015). This curriculum framework includes both leadership behaviors, as well as the more technical aspects of their profession (Joseph & Huber, 2015). The CIHLC has developed six competency domains that address interprofessional practice and leadership (Iachini, DeHart, Browne, Dunn, Blake, E.W., & Blake, C., 2019). The CIHLC posits that interprofessional education (IPE) experiences and development is needed in collaborative leadership practices in order to meet the needs of the patient and function effectively in the healthcare environment (Iachini et al., 2019). Iachini et al. (2019) studied how to promote collaborative leadership practices within the context of interprofessional care and education. They embedded a social change model (SCM) of leadership with an interprofessional education course for undergraduate students (Iachini et al., 2019). The SCM contains seven core values that are categorized based on individual, group, and community domains (Iachini et al., 2019). These domains contain competencies that include collaboration, dedication towards the collective, self-reflection, and values alignment (Iachini et al., 2019). The researchers asked the

participants to report their perceptions related to their collaborative leadership efficacy (Iachini et al., 2019).

The AACN also assert that these competencies should be woven throughout both didactic and clinical experiences (Joseph & Huber, 2015). This validates the need for more leadership-related competencies within the medical imaging curriculum due to the powerful effect it would have on those practicing in the profession. However, leadership development through these competencies should be intentional and aligned with medical imaging outcomes (Kutz, 2004).

Clinical leaders maintain that this must be achieved to keep pace with the changes and advances in technology that are pervasive within the healthcare field (Leigh et al., 2015). This is especially cogent to the discipline of medical imaging, which has constant technological advances relative to equipment, clinical performance, and patient safety. To accomplish this task, clinical leadership competencies specific to radiography would be interwoven throughout the radiologic science curriculum (Booth et al., 2017; Kester, 2017; Watson, 2009). This would necessitate a paradigm shift from providing purely theoretical curricula to a more inclusive leadership curriculum that encourages lifelong leadership learning (Kester, 2017; Leigh et al., 2015; Watson, 2009). A change is recommended from a purely competency-based culture that views healthcare as a simple list of tasks and skills relevant to the field of study (Leigh et al., 2015).

Leadership competencies are complex know-act behaviors that are based on the utilization and combination of knowledge, technical skills, and attitudes (Pepin et al., 2010). This specific type of competency transcends the physical task performance associated with most competencies and incorporates a contextual basis and real-world application of the technical skills, knowledge, and behaviors (Pepin et al., 2010). Therefore, in order to create a curriculum that encompasses the needed leadership, experiential learning activities that are paired with leadership

competencies relevant to radiography may be incorporated throughout the program curriculum (Leigh et al., 2015). As the student progresses through the leadership competencies, there would be opportunities for reflection and application to the clinical setting, as this will situate the competencies with-in the field of radiography (Leigh et al., 2015).

Utilizing a competency-based framework for integrating leadership may facilitate the measurement of leadership development throughout the program curriculum (Leigh et al., 2015). Additionally, it could provide a supportive framework for aligning the leadership competencies and learning experiences to the field of radiography (Leigh et al., 2015). Furthermore, developing clinical competence may go hand in hand with the development of leadership for the medical im-aging student. Scaffolding every course and clinical education experience may afford opportunities for the medical imaging student to grow into a medical imaging professional, as well as a leader in the healthcare setting. This concept has begun to take shape in Great Britain who has developed an initiative that aligns leadership qualities or traits to a competency framework. The Clinical Leadership Competency Framework (CLCF), developed by the National Health Service's (NHS) Leadership Academy, is applicable to every clinician, including medical imaging professionals (Lovegrove & Long, 2012; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010).

The implementation of a multidimensional approach to leadership development has been employed in the United Kingdom and Australia with positive results attributed to both personal and professional development relative to clinical leadership practices (Brown et al., 2015; Leigh et al., 2015). Using a competency-based framework, such as the Clinical Leadership Competency Framework, for curriculum delivery and assessment may allow for the delineation of behaviors associated with each clinical leadership domain and element (Leigh et al., 2015; NHS Institute

for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010). Consequently, it could also permit the assessment of competent performance relative to each leadership competency (Leigh et al., 2015). Through curriculum design, leadership competencies can be aligned to the profession's mission and standards of practice, which may provide a situational context within the clinical practice of radiography (Leigh et al., 2015).

Theoretical Framework

The theoretical framework of this study is grounded in collaborative leadership and informed by the constructs of experiential learning and clinical supervision. The framework of collaborative leadership is derived using characteristics from transformational leadership, distributed leadership, and clinical supervision (mentoring). Below are visual models that demonstrate how the incorporation of the frameworks and constructs of transformational leadership, distributed leadership, and clinical supervision that form the basis of the collaborative leadership framework. Further, the second visual model illustrates how clinical leadership is derived by using collaborative leadership as the foundational base with support from the constructs of experiential learning and clinical supervision to build clinical radiography leaders. The combination of collaborative leadership, experiential learning, and clinical supervision is used to create a multidimensional approach to defining clinical leadership (Careau et al., 2014; Leigh et al., 2015). It is this multidimensional approach that will ultimately prepare individuals to assume clinical leadership roles, both formal and informal, within their respective healthcare organizations (Leigh et al., 2015).

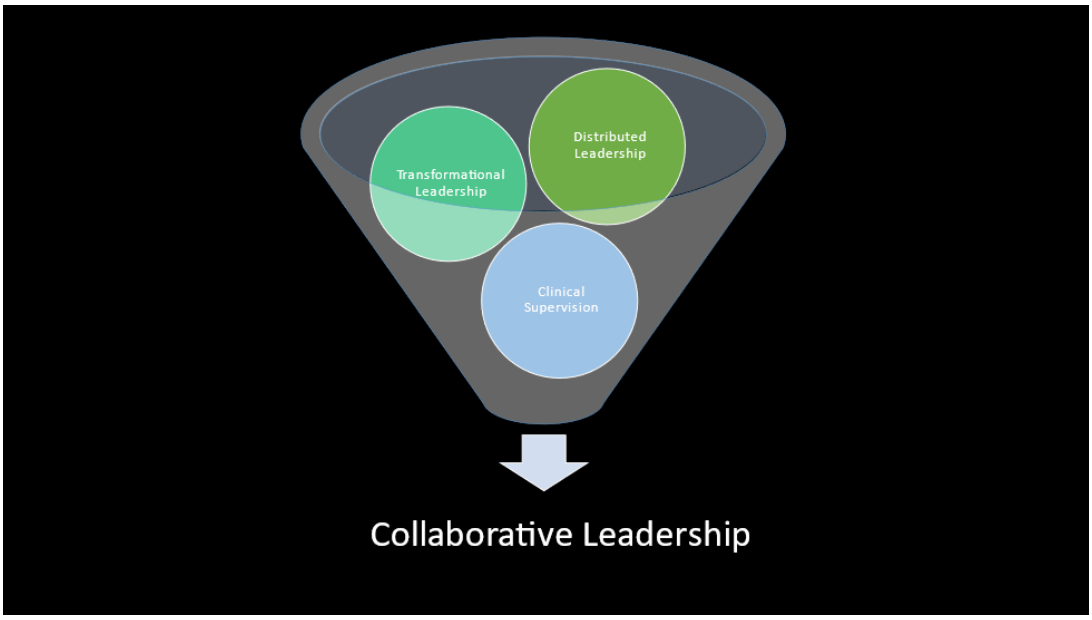


Figure 1. *A visual model demonstrating that characteristics from transformational leadership, distributed leadership, and clinical supervision combine to create the framework of collaborative leadership.*

Figure 2. *A visual model illustrating that the constructs of experiential learning and clinical supervision work in concert with the collaborative leadership framework to create a model of clinical leadership.*

Collaborative Leadership

Collaborative leadership is the guiding framework for this study. Collaborative leadership occurs when multiple individuals concurrently assume leadership roles, both formally and informally, while working together to achieve a common goal (Eva, Cox, Tse, & Lowe, 2019). Ideally, all leadership should be collaborative in nature; however, this is especially relevant when addressing clinical leadership and patient care (Careau et al., 2014; Fealy et al., 2011; Joseph & Huber, 2015; O'Daniel & Rosenstein, 2008; Orchard, Sonibare, Morse, Collins, & Al-Hamad, 2017; Orchard & Rykhoff, 2015).

In Great Britain and Canada, they have developed a competency framework for healthcare providers that addresses clinical leadership through the lens of collaborative leadership or distributed leadership (Careau et al., 2014; Lovegrove & Long, 2012; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010). While the framework of collaborative leadership is similar to distributed leadership, an overriding difference between the two is that leadership roles rotate based on the situation or need in distributed leadership (Daniëls et al., 2019; Kelley & Dikkers, 2016; Lovegrove & Long, 2012; Shava & Tlou, 2018; Wieczorek & Lear, 2018). In distributed leadership, there is a delegation of leadership tasks or the role of leader moves from individual to individual based upon the task being performed or area of expertise (Daniëls et al., 2019; Kelley & Dikkers, 2016; Shava & Tlou, 2018; Sun, Frank, Penuel, & Kim, 2013; Wieczorek & Lear, 2018). Thus, distributed leadership is derived from a more individualistic view of leadership whereby leadership is viewed as a set of individual contributions (Eva et al., 2019). In collaborative leadership, there is an ongoing and interprofessional relationship that exists between all healthcare providers as they diagnose, treat, and provide clinical care to patients (Fewster-Thuente & Velsor-Friedrich, 2008; Gjermundson,

2018; Joseph & Huber, 2015; Lovegrove & Long, 2012; O'Daniel & Rosenstein, 2008; Orchard et al., 2017; Orchard & Rykhoff, 2015; Patrick et al., 2011; Pepin et al., 2010). Collaborative leadership occurs when multiple healthcare providers use their clinical expertise and clinical decision-making as they work collectively to care for the patient (Fewster-Thuente & Velsor-Friedrich, 2008; Gjermundson, 2018; Lovegrove & Long, 2012; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010; O'Daniel & Rosenstein, 2008; Orchard et al., 2017; Orchard & Rykhoff, 2015; Patrick et al., 2011; Pepin et al., 2010). Within healthcare, there has been a shift towards more collaborative models of leadership that allow for a more interprofessional view of leadership that permits individuals within the interprofessional team to assume leadership roles throughout the patient care process (Brewer, Flavell, Trede, & Smith, 2016; Iachini et al., 2019). Collaborative leadership involves more than the sum contributions of individuals and instead views leadership from a holistic and team-centered perspective (Eva et al., 2019). This aspect of ongoing collaboration is what sets collaborative leadership apart from distributed leadership (Orchard et al., 2017; Orchard & Rykhoff, 2015; Shava & Tlou, 2018). It is also this interprofessional collaboration and synergy that defines collaborative leadership as opposed to viewing leadership solely through the transformational leadership framework, as is often done in other disciplines (Gjermundson, 2018; O'Daniel & Rosenstein, 2008; Orchard et al., 2017; Orchard & Rykhoff, 2015). Collaborative leadership is a dynamic process that horizontally positions leadership between the collective team, rather than viewing it within the hierarchical and individualistic framework as it traditionally the case (Eva et al., 2019; Iachini, DeHart, Browne, Dunn, Blake, E.W., & Blake C., 2019).

The CLCF is founded upon the theory of collaborative, or distributed leadership, whereby there is shared leadership responsibility contributing to the success of the collective. This

Concept of shared leadership relates well to the field of healthcare. Due to the innate interconnected-ness in healthcare, all clinicians contribute to the greater good of the organization and assume leadership roles as needed (NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010). As clinical leaders, radiographers work collaboratively and interprofessionally with other healthcare providers in the clinical setting in order to care for patients. Each healthcare provider assumes a leadership role in accordance with their area of clinical expertise when caring for, imaging, and treating patients (Orchard et al., 2017; Orchard & Rykhoff, 2015). In doing so, each healthcare professional contributes to the social network that is created between the team members (Eva et al., 2019). The social network is a pattern if interpersonal and interprofessional relationships that are used when collaboratively caring for patients in the clinical setting (Eva et al., 2019). This social network can be used to encourage higher achievement and better patient outcomes as it often influences leader effectiveness and development at the individual level (Eva et al., 2019).

Not only is there an interdependence and interprofessional relationship between clinical leaders in all disciplines, but there is a shared sense of responsibility to one another and to the patient. This collaborative form of leadership is based upon the team dynamic and is applicable even in a vertically hierarchical leadership framework (Iachini et al., 2019; Orchard et al., 2017; Orchard & Rykhoff, 2015). Studies are demonstrating the effectiveness of collaborative leadership practices with respect to medical errors, infection control, sentinel events, and even patient satisfaction (O'Daniel & Rosenstein, 2008; Orchard et al., 2017).

The CLCF contains five domains of demonstrated leadership: demonstrating personal qualities (self-awareness, personal development, integrity), teamwork, managing (planning, resources, people, performance), improving patient care and safety, and establishing direction and

vision for the organization (NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010). Aspects of each domain align with the concept of collaborative leadership. Demonstrating self-awareness and personal development relate to the development of clinical skills and expertise which allows the clinical leader to assume leadership roles that align with their area of clinical expertise (Fewster-Thuente & Velsor-Friedrich, 2008; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010). The sense of teamwork aligns with interprofessional collaboration as clinical leaders aid in the diagnosis, care, and treatment of patients through coordinated care practices (Fewster-Thuente & Velsor-Friedrich, 2008; Iachini et al., 2019; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010; Orchard et al., 2017). Woven throughout each domain is the concept of communication. Without the continuous communication between every member of the clinical team, collaboration ceases to occur, and clinical outcomes suffer (Al-Sawai, 2013; VanVactor, 2012).

Experiential Learning

Experiential learning is a cognitive construct that is innately tied to clinical leadership. Experiential learning is the placement of clinical learning and decision-making within the greater dimension of clinical leadership (Beard & Wilson, 2018; Cook & Leathard, 2004; Leigh et al., 2015; Waller, Reitz, Poole, Riddell, & Muir, 2017). It is one component that ties clinical supervision and mentoring to the theoretical framework of collaborative leadership. It is also one part of the multidimensional approach that can be used for developing clinical leaders (Leigh et al., 2015). Albert Einstein is quoted as stating that “Learning is an experience. Everything else is just information” (as cited in Beard & Wilson, 2018). This quote resonates strongly as this is the crux of not only education in general, but especially in healthcare. As radiography educators, we

stress the importance of not just taking in the information and being passive learners, but to really embrace the experience of learning as the students will need to apply the knowledge and skills that they learn in our classrooms. We stress that every exam they cover in the classroom and laboratory setting has a greater purpose as these exams that they are learning will become live people that they will interact with, care for, and image once they reach the clinical environment. The quote from Albert Einstein spoke to the need for active and experiential learning (Beard & Wilson, 2018; Leigh et al., 2015; Waller et al., 2017). It illustrated the necessity to situate the learning of material within its situational context (Beard & Wilson, 2018; Leigh et al., 2015).

Experiential learning is the foundational aspect of situating theoretical knowledge from the classroom within the broader context of clinical practice (Beard & Wilson, 2018; Chamunyonga, Singh, Gunn, & Edwards, 2020; Leigh et al., 2015; Waller et al., 2017). Experiential learning takes place through real world application of the knowledge and skills required as a radiographer while also incorporating reflection and constructive feedback (Beard & Wilson, 2018; Waller et al., 2017). Students enter the clinical environment as novice practitioners and through experiential learning in the clinical setting, they progress to entry-level radiographers (Leigh et al., 2015). It is through these immersive clinical experiences that they grow and develop as future radiographers and clinical leaders (Beard & Wilson, 2018; Chamunyonga et al., 2020; Cook & Leathard, 2004; Leigh et al., 2015; Waller et al., 2017). Often, experiential learning is encouraged through clinical supervision and mentoring relationships. Clinical mentors teach students through a process of instruction, role modeling, encouragement, constructive feedback, and the use of reflective debriefing to move radiography students from novice to competent radiographers (Dunn, 2012; Kowtko, 2010; Steele & Yielder, 2004; Yates, 2017).

The theoretical construct of experiential learning is the process of learning through experiences and reflection (Waller et al., 2017). At the core of experiential learning lies the experience, which serves as the foundation of and stimulus for learning (Beard & Wilson, 2018). Experiential learning, therefore, allows for the learning to originate within the learners themselves and is spurred by intentional experiences or activities (Beard & Wilson, 2018). Experiential learning involves meaningful-discovery and is created through the transformation of experience (Beard & Wilson, 2018). The experiential learning activities or experiences allow for active immersion and reflection, both during and after (Beard & Wilson, 2018). The learner is immersed, physically, intellectually, emotionally, psychologically, and even spiritually which permits them to situate the experience cognitively (Beard & Wilson, 2018).

Beard and Wilson (2018) propose that there are four core interactions that exist within the construct of experiential learning. These include the premise that the experience designed for learning is experienced within the learner themselves (inner world), it is experienced in the outer world or real-world, the experience is affected by the inner world of the learner, and the experience of learning is affected by the outer world interactions and conditions (Beard & Wilson, 2018). To be effective, Beard and Wilson (2018) assert that experiential learning must include active immersion, opportunities for reflective engagement, and have real-world applications. Experiential learning, and learning in general, is very much a product of the learner's past experiences, present experience, and future experiences, which are all shaped by cognitive, affective, and behavioral aspects of learning (Beard & Wilson, 2018).

Research has found that experiential learning is a valuable method for developing leadership through these learned experiences (Conger, 2004; Waller et al., 2017). This aspect of experiential leadership is the link between leadership and the clinical education setting. During the

clinical experience, students are required to step outside of their comfort zones and demonstrate the application of knowledge, skills, and competencies learned in the classroom and laboratory setting (Chamunyonga et al., 2020). This challenging and new environment acts as a catalyst for leadership development in the medical imaging student (Dragoni, Tesluk, Russell, & Oh, 2009; Waller et al., 2017). More challenging environments and experiences lead to enhanced leadership development. Radiography students are therefore required to learn and develop new techniques and methods for performing the exams which they have learned and practiced in the classroom and laboratory context. These new techniques, skills, and methods of clinical application prove to cement the knowledge within the individual (Chamunyonga et al., 2020; Waller et al., 2017). Additionally, the integration of simulation to the academic curriculum prepares students for the clinical application of their knowledge and skills while providing a platform for leadership development. Studies have shown that simulated experiences can mimic the stress and challenge of real clinical experiences but offer a secure practice setting for students to develop (Waller et al., 2017). The act of experiential learning continues as the student progresses through their clinical education courses and even into the practice of their profession, in the form of lifelong learning and professional evolution.

Clinical leadership competencies can also encompass a multidimensional approach, meaning that they focus on both preparing the individual to assume leadership roles while also situating the experience within the broader context of organizational goals and objectives (Leigh et al., 2015). Often, this can be accomplished through the creation of a cognitive learning model. A cognitive learning model is generally tied to the creation of a specific competency or skill set and allows progression from novice (radiography student) to expert (clinical radiography leader)

(Pepin et al., 2010). Each progression along the continuum from beginner to expert acts as scaffolding for the next step and allows for both formative and summative assessment of competency (Pepin et al., 2010). A multidimensional model of clinical leadership is valuable as it places the individual at the center of their leadership development (Leigh et al., 2015). It enables the individual to place their learning within the context of the clinical healthcare setting while demonstrating leadership development within both the personal and professional arenas (Leigh et al., 2015). These models of clinical leadership competencies could be woven throughout the radiologic science curricula utilizing a student-centered integrated learning approach to achieve learning saturation (Leigh et al., 2015). Integrating the leadership competencies throughout the program curriculum connects the knowledge, skills, attitudes, and values from each content area to develop a more robust understanding of the concepts taught (Brown et al., 2015). The student-centered integrated learning approach includes the five tenets of learning: examine, education, exposure, experiences, evaluation (Leigh et al., 2015). This approach first exposes students to a specific clinical leadership competency within the didactic curriculum and utilizes case studies or experiential learning activities to allow the student to envision how that competency would be incorporated into their clinical practice (Leigh et al., 2015; Pepin et al., 2010). Next, the student would progress and demonstrate the application of the clinical leadership competency in a laboratory setting and see the competency modeled in the clinical setting (Leigh et al., 2015; Pepin et al., 2010). The final progression would involve the student demonstrating the clinical leadership competency in their clinical practice and providing self-reflection as to their leadership role within the healthcare system (Leigh et al., 2015; Pepin et al., 2010). Radiologic science educators would be able to design curricula that allow students to progress through each tenet of learning during their tenure in the program. Leadership development would be progressive as students

move through the didactic and clinical education courses of the curriculum and would be applicable to their field of study (Brown et al., 2015; Leigh et al., 2015). Experiential learning activities could be developed that address each leadership competency and allow for the application of that competency to the clinical setting and patient clinical care (Brown et al., 2015; Leigh et al., 2015). Assessment, reflection, and debriefing in each clinical or didactic education course could be utilized to assess the appropriate performance of the competency and leadership development (Leigh et al., 2015). Structuring clinical leadership competencies within the clinical education courses allows for the formative development of leadership within the student (Brown et al., 2015). Students would then be able to transfer their leadership competencies to clinical practice in the field of radiography (Leigh et al., 2015).

Clinical Supervision

The theoretical construct of clinical supervision within healthcare differs slightly from that found in other professions. Within healthcare, clinical supervision has been defined as the structural support system that enables students to develop the requisite clinical knowledge and competence necessary to function within the profession (Lyth, 2000; Snowdon, Sargent, Williams, Maloney, Caspers, & Tayor, 2019). Clinical supervision enhances the transition of knowledge to application within the clinical environment (Lyth, 2000). It is a clinical learning support that encourages clinical development and decision-making for students (Lyth, 2000). Unlike other professions, clinical supervision within healthcare is viewed as a practice-centered model where the learning is situated within the clinical environment (Lyth, 2000). It creates a link between the dual learning environments encountered in healthcare; the classroom setting where theory is practiced and the clinical setting is where the knowledge and skills are applied (Lopes Monteiro da Cunha, Morais de Carvalho Macedo, & Fernandes Ferreira Vieira, 2017).

For the purpose of this study, clinical supervision will be defined as a mentorship model that enhances the application of clinical skills and learning for radiography students. Clinical supervision requires a radiography leader that mentor students as they apply their knowledge and skills to the clinical setting through the performance of radiographic imaging examinations while fostering reflection and providing constructive feedback.

The theoretical construct of clinical supervision is intimately tied to the concept of mentoring (Steele & Yielder, 2004). Many of attributes and behaviors associated with clinical supervision mirror those of mentoring (Lopes Monteiro da Cunha et al., 2017; Lyth, 2000). This is especially true when examining the learning that takes place for students within the clinical environment. Clinical supervision is a collaborative process between the student and their mentor (clinical radiography leader) that involves teaching, the practicing of skills, performance assessment, constructive feedback, and self-reflection by the student (Chamunyonga et al., 2020; Dunn, 2012; Francis et al., 2016; Kowtko, 2010; Lyth, 2000; Steele & Yielder, 2004; Thompson et al., 2016; Yates, 2017). Clinical supervision and mentoring are a means of instilling clinical learning and competence, as well as professional standards of practice (Francis et al., 2016; Steele & Yielder, 2004; Thompson et al., 2016; Yates, 2017).

Clinical supervision and mentoring are the bridge that connect the material learned in the classroom and laboratory setting to the clinical application (Chamunyonga et al., 2020; Dunn, 2012; Francis et al., 2016; Kowtko, 2010). This process is performed with the support and encouragement of an experienced radiographer that is committed to student learning (Chamunyonga et al., 2020; Dunn, 2012; Gjermundson, 2018; Kowtko, 2010; Milner & Bossers, 2004; Steele & Yielder, 2004; Thompson et al., 2016; Yates, 2017). The clinical supervision model

forms a triad consisting of the mentor (clinical radiography leader), mentee (student), and the patient (Steele & Yielder, 2004). It is the addition of the patient to the clinical supervision triad that separates clinical mentorship from traditional mentoring in other fields (Steele & Yielder, 2004). These mentors also develop the same clinical leadership skills within those that they mentor and thus contribute to both growing the profession and creating clinical radiography leaders (Bloom, 2014; Steele & Yielder, 2004).

Many allied health fields, such as occupational therapy, optometry, audiology, and pharmacy, have adopted Proctor's model of clinical supervision to guide their clinical practices (Snowdon et al., 2019). Proctor's model of clinical supervision provides a framework for supporting allied health professional in the formative, restorative, and normative practice domains (Snowdon et al., 2019). The formative domain of practice relates to the development of clinical skills specific to the profession, such as radiographic positioning and technical factor selection (Snowdon et al., 2019). During the restorative domain, the clinical supervisor (mentor) supports the student during times of emotional stress as they navigate the complex field of healthcare and in the normative domain, the clinical supervisor (mentor) guides the student through the processes and procedures of the clinical facility and profession (Snowdon et al., 2019). Proctor's model of clinical supervision addresses several areas of traditional clinical supervision and mentoring practices. These areas include the development of clinical competence, skills, and professional standards of practice in the formative domain and professional development and guidance during the normative and restorative domains (Snowdon et al., 2019). The Proctor model of clinical supervision follows the health network guideline used by allied health professionals in Australia (Snowdon et al., 2019). In this model of clinical supervision, there is an emphasis placed

on reflective supervision, which requires both the student and clinical supervisor (mentor) to reflect on clinical experiences through the deconstructing of the cognitive and emotional components of their profession (Snowdon et al., 2019).

Steele and Yielder (2004) propose a clinical supervision model of mentoring that allows for the development of professionalism within medical imaging students. The earliest proponents of clinical supervision as a means of mentoring within the healthcare field were Butterworth and Faugier, authors of Clinical Supervision and Mentorship in Nursing (as cited in Butterworth & Faugier, 1992; Steele & Yielder, 2004). Mentoring and clinical supervision are a means of instilling professional practice standards, skills, and the exchange of best practices within a profession (Steele & Yielder, 2004). Clinical supervision is a formal method for professional support that generates clinical competence (Steele & Yielder, 2004). The clinical supervision model presented in this study is a triad between the patient, mentor, and student. Within this triad, there exists a cycle of teaching, practice, assessment, feedback, and reflection. In this cycle proposed by Steele & Yielder (2004), there are five modes. In mode one, the student observes the seasoned technologist who teaches the student techniques for performing medical imaging exams. In the second and third mode, the student begins to practice their clinical skills in a supportive environment while developing standards of practice. During modes four and five, the mentoring technologist assesses the student's performance and provides feedback. The student is then able to use this feedback and self-reflect on their performance so that they may grow and develop as a medical imaging professional (Steele & Yielder, 2004). The reflection portion of this cycle is especially vital to leadership development as it leads to a maturation of the medical imaging student.

Mentoring

Clinical mentoring provides that connection between didactic training and clinical practice while allowing students to practice their new skills and apply their new knowledge under the support of an experienced clinician (Chamunyonga et al., 2020; Dunn, 2012; Milner & Bossers, 2004; Wachira, 2019; Yates, 2017). Mentoring is a collaborative learning relationship between the clinical leader and student (Wachira, 2019). The development of clinical competence is greatly enhanced when a mentoring relationship is present. Clinical mentoring is a critical component for acquiring tacit knowledge, as this is knowledge derived from experience, intuition, and judgment (Kowtko, 2010; Milner & Bossers, 2004; Yates, 2017). This process of imparting tacit knowledge enhances the student's ability to critically think or be innovative when approaching a challenging radiographic exam (Dunn, 2012; Kowtko, 2010).

Mentoring and the transition from student to professional have recently been the focus of research within nursing and other healthcare fields. Chappell et al. (2014) studied the efficacy of New Graduate Nurse Transition Programs (NGNTPs) with regards to increasing the clinical leadership skills of newly graduated nurses. This study has implications that can be seen in medical imaging. The NGNTPs are formalized programs that pair a freshly graduated nurse with a seasoned nurse mentor. During these transition programs, the newly graduated nurse participates in professional development that is meant to increase critical thinking, leadership, and clinical skills (Chappell et al., 2014). The authors found that newly graduated nurses who had participated in NGNTPs did experience increased clinical leadership skills, especially when participating in high quality NGNTPs (Chappell et al., 2014). This finding has enormous implications for medical im-aging, as it validates the need for mentorship when progressing through the clinical education experience. It also substantiates the perception that a formalized system for mentoring

within the clinical setting proves beneficial in the development of not only clinical competence but also clinical leadership (Chappell et al., 2014).

A study in Auckland, New Zealand (Thompson et al., 2016) examined the lack of preparation medical imaging students receive concerning leadership and mentorship. The authors assert that this lack of educational training leads to medical imaging professionals who are ill-equipped to provide the instruction, supervision, and reflection needed by students during their clinical experiences (Thompson et al., 2016). Thompson et al. (2016) conducted a qualitative study utilizing fourteen focus groups of medical imaging technologists and medical imaging students to present an overview of a learning cooperative that paired medical imaging students with medical imaging technologists in the clinical environment (Thompson et al., 2016). In order to create meaningful clinical experiences that allow for the growth of clinical skills and the development of leadership, a relationship must first be established. This relationship involves the process of artfully connecting (as cited in Paton, 2010; Thompson et al., 2016, p. e119). Artfully connecting is analogous to the concept of mentoring in that it necessitates the medical imaging technologist learning about the student's previous clinical experiences and academic requirements. This creates a mutual system of input and trust, feedback, and support for their learning (Thompson et al., 2016; Wachira, 2019). This mentoring relationship creates a supportive environment in which the student learns and develops clinical competency (Wachira, 2019). Mentors inhabit many roles when interacting with students, which can include that of advisor, support, challenger, and guide (Wachira, 2019). This relationship also increases the student’s motivation, participation in the profession, and leads to a more significant leadership role (Thompson et al., 2016; Wachira, 2019). For the mentoring relationship to be a valuable learning experience, mentors should serve as a role model and leaders that possesses clinical expertise while emphasizing

student learning and clinical application (Milner & Bossers, 2004). The role of a mentors is to assist students in the application of theory, clinical assessment, provide constructive criticism, and facilitate reflective practices on their experiences in the clinical environment (Wachira, 2019). Thompson et al. (2016) propose that the support the student receives from the mentoring relationship provides a sense of belonging and allows them to find their places within the profession (Thompson et al., 2016). Not only does clinical mentoring form the connection between theory and clinical practice, but it also pro-vides psychosocial support (Kowtko, 2010). Psychosocial support can be in the form of interpersonal relationships, a sense of belonging to the profession, and a sense of competency (Kowtko, 2010; Yates, 2017). During the clinical education experiences, medical imaging students were paired with more seasoned technologists to form a mentoring relationship (Thompson et al., 2016). This relationship allowed the technologists to assume a leadership position in their facility while also molding their student mentees into future leaders within the profession. Additionally, students were able to progress much faster with regards to clinical competency due to the support they received from their mentor (Thompson et al., 2016).

3 METHODOLOGY

This research study explored a clinical leadership model that incorporated both the technical skills and leadership competencies practiced by radiographers. The purpose of this study was accomplished by examining the following research questions:

1. What are the commonly practiced clinical leadership behaviors associated with clinical radiography leaders?
2. What are the common technical skills performed by radiographers that are associated with clinical radiography leaders?

The proposed research paradigms for this study were reflective inquiry and constructivism. Reflective inquiry is a research method based on defining a problem and formulating hypotheses that was tested during the study (Hoy & Adams, 2016). Reflective inquiry was chosen as one aspect of research design as survey items on the CRLS were used to test whether the technical skills and leadership behaviors assumed to be most closely associated with the practice of clinical leadership in radiography truly are, based upon the responses of the study participants.

The research paradigm of constructivism was also utilized in this study as a model of clinical leadership situated within the practice of radiography does not yet exist, which is akin to the idea of theory generation (Creswell & Creswell, 2018). By using a constructivist framework in the research design, study participants contributed to the construction of a more clearly defined concept of clinical leadership as it relates to the practice of radiography (Creswell & Creswell, 2018; Stake, 1995). Traditionally, constructivism is associated with qualitative studies as the use of open-ended questions and interviewing allows the participants to share their views as a way to construct meaning (Creswell & Creswell, 2018). However, as a model of clinical leadership that incorporates the specialized knowledge, technical skills, and leadership behaviors that

are associated with the practice of radiography does not yet exist, the study participants were informing research that will construct a new and more clearly defined definition as it pertains to clinical radiography leaders (Lincoln & Guba, 2011). This process blended the use of a quantitative survey that also incorporated open-ended questions to solicit input from study participants regarding any technical skills or leadership behaviors that should be added to the definition of a clinical radiography leader. In this way, constructivism informed aspects of this study's research design.

A descriptive research methodology was used to frame this study as it allowed for the exploration of a model of clinical leadership that combined the technical skills used within radiography, as well as the leadership behaviors most commonly associated with those identified as clinical radiography leaders (Forister & Blessing, 2020; Hoy & Adams, 2016; Winston-Salem State University, n.d.). Utilizing a descriptive research methodology provided a means for the systematic exploration of the various clinical leadership behaviors and technical skills and knowledge used by clinical radiography leaders (Winston-Salem State University, n.d.).

Participant Sample

The participant sample for this study was stratified across four categories: radiology directors, clinical preceptors, radiographers with experience in leadership roles, and radiography educators (Dillman et al., 2014). These four categorical stratifications were selected as the individuals within each area would have experience in a leadership role. Study participants were selected using the membership rosters from national and state professional organizations, as well as the national credentialing body for medical imaging. This method of participant selection provided a large sampling frame as there are approximately 322,755 credentialed radiographers in the United States; with approximately 132,066 holding membership in the national professional

organization (American Registry of Radiologic Technologists, 2020; American Society of Radiologic Technologists, 2019).

Purposive sampling was used to collect data for this study as a method of intentionally ensuring appropriate variation of cases within my study over the four delineated categorical stratifications (Dillman et al., 2014; Fraenkel & Wallen, 2006; Heckathorn, 2011; Merriam & Tisdell, 2015). The inclusion criteria for the participant sample in this study included: membership in the national or state professional organizations, experience in a leadership role, and geographical location. This information was collected within the demographics section of the CRLS.

Survey links were emailed from both the credentialing agency (ARRT) and the national professional organization (ASRT) to the sample population. All completed surveys were analyzed and categorized based upon the demographic information collected, the participants' professional designation, and geographical location. In order to obtain a more representative sample, a minimum of 1,056 participants spread across the four professional designations and geographical locations was needed (Dillman et al., 2014; Salant & Dillman, 1994). The minimum sample size of 1,056 is based upon the sample size necessary for a 95% confidence level as presented by Salant and Dillman (1994). A significant degree of reliability may be ensured through a minimum of 740 completed surveys being returned, which constitutes a 70% return rate (American Association for Public Opinion Research, 2021; Dillman et al., 2014; Salant & Dillman, 1994). Based upon the return rate for the RCS (40.6%) and the CLS (46%), an anticipated rate of return for the CRLS was 40% (Andersson, Christensson, Fridlund, et al., 2012; Patrick et al., 2011). A return rate of 40% would constitute 423 completed surveys. A response rate of 50% (528 returned surveys) or higher was desirable and would allow for the results to be generalized to clinical radiography leaders across the United States (Andersson, Christensson, Fridlund, et al.,

2012). However, for the results of the study to be generalized to the entire population of clinical radiography leaders within the United States, there must also be representation across all subgroupings of respondents within the sample (gender, ethnicity, and professional designation) (Dillman et al., 2014; Salant & Dillman, 1994).

Survey Instrument

In order to develop a more comprehensive definition of clinical radiography leaders, this study explored the topic of clinical leadership in radiography quantitatively. This was accomplished through the creation of a CRLS, which was derived from the Radiographers' Competence Scale (RCS) and Clinical Leadership Survey (CLS) (Andersson, 2012; Andersson, Christensson, Fridlund, et al., 2012; Andersson, Christensson, Jakobsson, et al., 2012; Patrick et al., 2011).

The RCS was developed by Bodil Andersson (2012) to measure radiographers' professional competence and technical skill performance. The RCS was designed in two phases: development of the tool and evaluation of its psychometric properties (Andersson, 2012; Andersson, Christensson, Fridlund, et al., 2012; Andersson, Christensson, Jakobsson, et al., 2012). The RCS is a 28-item questionnaire divided into two categories; "Nurse initiated care" and "Technical and radiographic processes" (Andersson, 2012; Andersson, Christensson, Fridlund, et al., 2012; Andersson, Christensson, Jakobsson, et al., 2012). Some of the items associated with "Nurse initiated care" included: Adequately informing the patient, Protecting the patient's integrity, and Observing and monitoring the patient (Andersson, 2012; Andersson, Christensson, Fridlund, et al., 2012; Andersson, Christensson, Jakobsson, et al., 2012). Items aligned with "Technical and radiographic processes" included: Responsibility for preparing the medico-technical equipment, Adapting the examination to the patient's prerequisites and needs, and Optimizing the quality of

the image (Andersson, 2012; Andersson, Christensson, Fridlund, et al., 2012; Andersson, Christensson, Jakobsson, et al., 2012). The RCS measured the self-perceived competence of radiographers in clinical practice and had a strong internal consistency measurement of >.70 as the RCS is a newer instrument (Andersson, 2012; Andersson, Christensson, Fridlund, et al., 2012; Andersson, Christensson, Jakobsson, et al., 2012). The dimensions measured within the RCS are "Nurse initiated care" and "Technical and radiographic processes" (Andersson, Christensson, Fridlund, et al., 2012). These two dimensions correspond to Dimension 1: Patient Care Skills (questions 1-5) and Dimension 2: Technical and Radiographic Skills (questions 6-11) on the CRLS [see Appendix A] (Andersson, Christensson, Fridlund, et al., 2012).

The CLS was developed by Allison Patrick, Heather Laschinger, Carol Wong, and Joan Finegan in 2011 to measure clinical leadership specific to the tasks and behaviors exhibited by nurses and is based on Kouzes and Posner's model of transformational leadership (Patrick et al., 2011). The CLS consisted of 15 items with categories that measured aspects of clinical nursing leadership, including: Challenging the Process, Inspiring a Shared Vision, Enabling Others to Act, Modeling the Way, and Encouraging the Heart (Patrick et al., 2011). Examples of items within the CLS included: I engage in reflective practice and try to understand what went well and what did not, I actively listen to colleagues' diverse points of view, and I provide positive feedback to colleagues when their actions contribute to the well-being of patients and families (Patrick et al., 2011). The dimensions measured within the CLS are "Challenging the Process", "Inspiring a Shared Vision", "Enabling Others to Act", "Modeling the Way", "Encouraging the Heart", and "Global Clinical Leadership Scale" (Patrick et al., 2011). These correspond to dimensions 3-8 on the CRLS (questions 12-30) and are named similarly to those contained on the CLS [See Appendix A] (Patrick et al., 2011).

Data Collection

The CRLS was used to collect data in this research study. Each item on the CRLS was measured using a 5 point Likert scale rating that measured the importance of that item when assessing clinical leadership skills and behaviors in radiographers [See Appendix A] (Forister & Blessing, 2020; McLeod, 2019).

Approximately 14, 447 survey links were emailed to participants within the sampling frame to ensure a higher response rate. The American Registry of Radiologic Technologists (ARRT), national credentialing agency, emailed the survey link to 4,447 technologists credentialed in radiography. These individuals have previously identified their professional designation as chief technologist, educational faculty, clinical preceptor, or director with the ARRT. The American Society of Radiologic Technologists (ASRT), the national professional organization, emailed the survey link to 10,000 technologists credentialed in radiography. All survey participants would identify their professional designation within the demographic section of the CRLS. Included with each survey link emailed to participants was a letter containing information regarding the nature of the research study, that participation in the study is voluntary, and that confidentiality will be maintained through the use of a unique survey link for each participant (Andersson, Christensson, Fridlund, et al., 2012). The CRLS consisted of 30 questions that encompass the technical skills required to practice in radiography, in addition to the leadership behaviors commonly associated with clinical leadership [See Appendix A]. The dimensions on the CRLS that relate to the technical skills necessary to practice in radiography are Dimension 1: Patient Care Skills and Dimension 2: Technical and Radiographic Skills [see Table 1]. The dimensions on the CRLS that correspond to clinical leadership behaviors are contained in Dimension 3: Challenging the Process, Dimension 4: Inspiring a Shared Vision, Dimension 5: Enabling Others

to Act, Dimension 6: Modeling the Way, Dimension 7: Encouraging the Heart, and Dimension 8: Global Clinical Leadership Scale [see Table 1].

Table 1

Dimensions and items of CRLS

Dimension 1: Patient Care Skills
1. Obtaining an appropriate patient clinical history.
2. Ensuring patient identification prior to initiating the exam.
3. Professionally communicating and providing instructions to the patient during the exam.
4. Observing and monitoring the patient throughout the exam.
5. Practicing ALARA and providing appropriate radiation protection methods during the exam.
Dimension 2: Technical and Radiographic Skills
6. Competently manipulates all radiographic and imaging equipment.
7. Adapts the radiographic exam to the patient's condition.
8. Utilizes sound clinical decision-making skills.
9. Selects appropriate technical factors for the exam being performed.
10. Produces diagnostic quality radiographic images.
11. Evaluates and critiques the radiographic image for pertinent anatomy and pathology.
Dimension 3: Clinical Leadership Behaviors-Challenging the Process
12. When I am concerned about the patient's or student's well-being, I take risks by questioning orders and treatments.
13. I am able to provide evidence-based rationale for my clinical decisions.
14. I engage in reflective practice and try to understand what went well and what did not.
Dimension 4: Clinical Leadership Behaviors-Inspiring a Shared Vision
15. I negotiate with and support members of the interdisciplinary health-care team to help patients and students achieve positive outcomes.
16. I am enthusiastic and engaged when communicating with patients and students to achieve positive outcomes.
17. I engage in meaningful conversations with colleagues to foster our ability to provide patient-centered care and student educational opportunities.
Dimension 5: Clinical Leadership Behaviors-Enabling Others to Act
18. I actively listen to colleagues' diverse points of view.
19. I establish therapeutic relationships with patients and students that are based on trust.
Dimension 6: Clinical Leadership Behaviors-Modeling the Way
20. I do my best to follow through on the promises and commitments that I make.
21. I try to ensure we work towards achievable goals, make concrete plans, and establish measurable objectives in achieving clinical outcomes.
22. I am committed to patient-centered care and positive student educational experiences.
Dimension 7: Clinical Leadership Behaviors-Encouraging the Heart
23. I publicly acknowledge my colleagues who exemplify commitment to professional values.
24. I provide positive feedback to colleagues when their actions contribute to the well-being of patients and students.
25. I find ways to celebrate colleagues' accomplishments.
Dimension 8: Global Clinical Leadership Scale
26. I consider myself a clinical leader in my practice.
27. I demonstrate leadership behaviors in my practice.
28. Please list any technical skills that you feel are important as a clinical radiography leader that have not been addressed in this survey.
29. Please list any leadership behaviors that you feel are important as a clinical radiography leader that have not been addressed in this survey.

The web-based survey should have taken the participants approximately thirty minutes to complete and each survey participant's link was unique and associated participant responses with an email address. The desired sample size was 1,056 and was based upon the necessary number of participants needed to ensure a 95% confidence level (Salant & Dillman, 1994). Survey data analysis for this study occurred weekly to assess for bias or errors throughout the research study.

Survey Validity and Reliablity

As the CRLS has been adapted for my research study from the RCS and the CLS, it is important to discuss the validity of each survey instrument that comprises the CRLS (Andersson, 2012; Andersson, Christensson, Fridlund, et al., 2012; Andersson, Christensson, Jakobsson, et al., 2012; Patrick et al., 2011). The RCS, developed by Bodil Andersson, has an internal consistency reliability measurement of >.70 (Andersson, 2012; Andersson, Christensson, Fridlund, et al., 2012; Andersson, Christensson, Jakobsson, et al., 2012). While an internal consistency measurement of >.80 is desired for established survey instruments, an alpha measurement of >.70 may be considered acceptable for this tool, in light of the fact that the RCS is a newly created measurement instrument (Andersson, 2012; Andersson, Christensson, Fridlund, et al., 2012; Andersson, Christensson, Jakobsson, et al., 2012). The validity of RCS may also be considered acceptable as it was developed in two separate phases that included pilot testing of the face and content validity during the first phase, as well as a psychometric evaluation of the construct validity in phase two (Andersson, 2012; Andersson, Christensson, Fridlund, et al., 2012; Andersson, Christensson, Jakobsson, et al., 2012). The pilot testing for content validity was conducted in accordance to Lynn's Criteria which measures the content relevance, clarity, concreteness, understandability, and readability of the scale (as cited in Lynn, 1986; Andersson, Christensson, Fridlund, et al., 2012). Lynn's Criteria determines the validity of a survey based upon whether the created tool measures what it intends to measure, how clearly it words each item, and how

understandable the items contained on the survey are (as cited in Lynn, 1986; Andersson, Christensson, Fridlund, et al., 2012). Construct validity for the RCS included psychometric evaluation during phase two of survey construction (Andersson, Christensson, Fridlund, et al., 2012). Construct validity ensures that the measurement instrument has a clear and theoretically sound factor structure with respect to the items contained on the survey (Andersson, Christensson, Fridlund, et al., 2012). Each item's Eigenvalue was assessed and those items with an Eigenvalue < 1.0 were retained in the survey (Andersson, Christensson, Fridlund, et al., 2012). Based upon the fact that the RCS was a newly developed tool, a total variance of 60% may be considered acceptable (Andersson, Christensson, Fridlund, et al., 2012).

The CLS, developed by Patrick, Laschinger, Wong, and Finegan in 2011 has a Cronbach alpha reliability coefficient of 0.86, which is considered a strong indicator of reliability for this instrument (Patrick et al., 2011). Face validity for the CLS was established by the research team while the content validity of the survey was evaluated by a panel of six experts chosen by the research team (Patrick et al., 2011). The content validity index was calculated for the CLS using Lynn's Criteria while the expert panel was selected using guidelines detailed by Grant and Davis (1997) (Patrick et al., 2011). The expert panel examined each item on the CLS to assess alignment with the theoretical foundations of Kouzes and Posner's leadership practices using a four-point rating scale (Patrick et al., 2011). The content validity index for the CLS was 85%, which is within the acceptable limits for newly developed instruments (Patrick et al., 2011).

Data Analysis

Data analysis for this study included confirmatory factor analysis of the data utilizing SPSS (Statistical Package for the Social Sciences) (Hoy & Adams, 2016). Confirmatory factor analysis permits the researcher to confirm that all the intended leadership themes and technical skill assessment that comprises the CRLS were appropriately measured (Hoy & Adams, 2016).

The use of confirmatory factor analysis may confirm the validity of the results from the previous studies when compared to the findings of this study (Harrington, 2009; Schreiber, Nora, Stage, Barlow, & King, 2006). This is especially relevant, given the lack of empirical studies found within the radiography profession, as well as those specific to the leadership behaviors and attributes of clinical radiography leaders.

In addition to confirmatory factor analysis, data were correlated to each research question based upon individual survey items, as well as the aggregated items under each dimension (Hoy & Adams, 2016). By correlating specific items under each dimension to the research question that is most closely aligned with them, the researcher was able to determine the strength of the relationship between that specific survey item and the research question being investigated (Hoy & Adams, 2016). Additionally, when examining the results of aggregated data from the survey items under specific dimensions, the researcher was able to determine how each dimension answered the research question, as well as how it informed the creation of a clinical leadership model based in the field of radiography (Hoy & Adams, 2016). This process was completed through SPSS and allowed the researcher to further examine the relationships that exist between each dimension and the corresponding items listed under it (Creswell & Creswell, 2018; Hoy & Adams, 2016). Listed below are the variables that were placed in the correlation model for each research question.

Research Question 1: What are the commonly practiced clinical leadership behaviors associated with clinical radiography leaders? [see Table 2]

Table 2

Dimensions and items of CRLS correlated with Research Question 1

Dimension 1: Patient Care Skills
3. Professionally communicating and providing instructions to the patient during the exam.
Dimension 2: Technical and Radiographic Skills
8. Utilizes sound clinical decision-making skills.
Dimension 3: Challenging the Process
12. When I am concerned about the patient's or student's well-being, I take risks by questioning orders and treatments.
13. I am able to provide evidence-based rationale for my clinical decisions.
Dimension 4: Inspiring a Shared Vision
14. I negotiate with and support members of the interdisciplinary health-care team to help patients and students achieve positive outcomes.
15. I am enthusiastic and engaged when communicating with patients and students to achieve positive outcomes.
16. I engage in meaningful conversations with colleagues to foster our ability to provide patient-centered care and student educational opportunities.
Dimension 5: Enabling Others to Act
17. I actively listen to colleagues' diverse points of view.
18. I establish therapeutic relationships with patients and students that are based on trust.
19. I develop cooperative relationships with my peers and colleagues.
Dimension 6: Modeling the Way
20. I do my best to follow through on the promises and commitments that I make.
21. I try to ensure we work towards achievable goals, make concrete plans, and establish measurable objectives in achieving clinical outcomes.
22. I am committed to patient-centered care and positive student educational experiences.
Dimension 7: Encouraging the Heart
23. I publicly acknowledge my colleagues who exemplify commitment to professional values.
24. I provide positive feedback to colleagues when their actions contribute to the well-being of patients and students.
25. I find ways to celebrate colleagues' accomplishments.
Dimension 8: Global Clinical Leadership Scale
26. I consider myself a clinical leader in my practice.
27. I demonstrate leadership behaviors in my practice.
30. Please list any leadership behaviors that you feel are important as a clinical radiography leader that have not been addressed in this survey.

Research Question 2: What are the common technical skills performed by radiographers that are associated with clinical radiography leaders? [see Table 3]

Table 3

Dimensions and items of CRLS correlated with Research Question 2

Dimension 1: Patient Care Skills
1. Obtaining an appropriate patient clinical history. 2. Ensuring patient identification prior to initiating the exam. 3. Professionally communicating and providing instructions to the patient during the exam. 4. Observing and monitoring the patient throughout the exam. 5. Practicing ALARA and providing appropriate radiation protection methods during the exam.
Dimension 2: Technical and Radiographic Skills
6. Competently manipulates all radiographic and imaging equipment. 7. Adapts the radiographic exam to the patient's condition. 8. Utilizes sound clinical decision-making skills. 9. Selects appropriate technical factors for the exam being performed. 10. Produces diagnostic quality radiographic images. 11. Evaluates and critiques the radiographic image for pertinent anatomy and pathology.
Dimension 3: Challenging the Process
12. When I am concerned about the patient's or student's well-being, I take risks by questioning orders and treatments. 13. I am able to provide evidence-based rationale for my clinical decisions.
Dimension 8: Global Clinical Leadership Scale
28. Please list any technical skills that you feel are important as a clinical radiography leader that have not been addressed in this survey.

Analysis of the collected data included the ranking of survey items by both importance and the intended theme. This process was conducted by ranking each item according to its Eigenvalue, which allowed for comparison between the sample population in this study (clinical radiography leaders in the United States) versus those in the studies utilizing the RCS (Swedish radiographers) and the CLS (clinical nurse leaders) (Andersson, 2012; Andersson, Christensson, Fridlund, et al., 2012; Andersson, Christensson, Jakobsson, et al., 2012; Patrick et al., 2011; Rahn, 2012). Following confirmatory data analysis, a visual model of clinical leadership was created that incorporated both the technical skills and leadership behaviors contained within the CRLS (Hays & Singh, 2012; Hoy & Adams, 2016). The Eigenvalue for each item on the CRLS also permitted the ranking of the technical skills and leadership behaviors that are most closely aligned to this model of clinical radiography leadership (Hays & Singh, 2012; Hoy & Adams, 2016; Rahn, 2012).

4 RESULTS

This study sought to develop a model of clinical leadership that could be applied to the practice of radiography. This model of clinical leadership encompasses the technical skills and leadership behaviors that are commonly exhibited by clinical radiography leaders. The research questions posed during this study were: (1) What were the commonly practiced clinical leadership behaviors associated with clinical radiography leaders? and (2) What were the common technical skills performed by radiographers that are associated with clinical radiography leaders?

Using a quantitative survey, technical skills and leadership behaviors were examined in relation to the practice of clinical radiography leadership. This survey, the Clinical Radiography Leadership Survey (CRLS), asked participants to reflect on the various leadership behaviors and technical skills used as a clinical radiography leader. These behaviors and skills were then correlated to determine whether each dimension measured aligned with the practice of clinical radiography leadership as rated by the participants.

Participants for this study were selected based upon their status as a credentialed radiographer, as well as membership within the national professional organization. Approximately 14, 447 individuals were emailed the link for the CRLS survey. 432 participants out of the required sample size of 1,056 completed the CRLS, which results in a response rate of 41%. The participant sample was purposely stratified across four professional designations: Radiology Director (31.9%), Radiography Educator (24.9%), Clinical Preceptor (5.4%), and Radiographer (37.9%). Participants also answered demographic questions related to their area of clinical practice and the highest level of education attained. 76.5% of participants practiced within either the university/college setting or a hospital setting. It is interesting to note that while 61.6% of participants practiced in a hospital or imaging center, nearly three quarters of the participants had received a

baccalaureate degree or higher, when national credentialing only requires a minimum of an associate's degree.

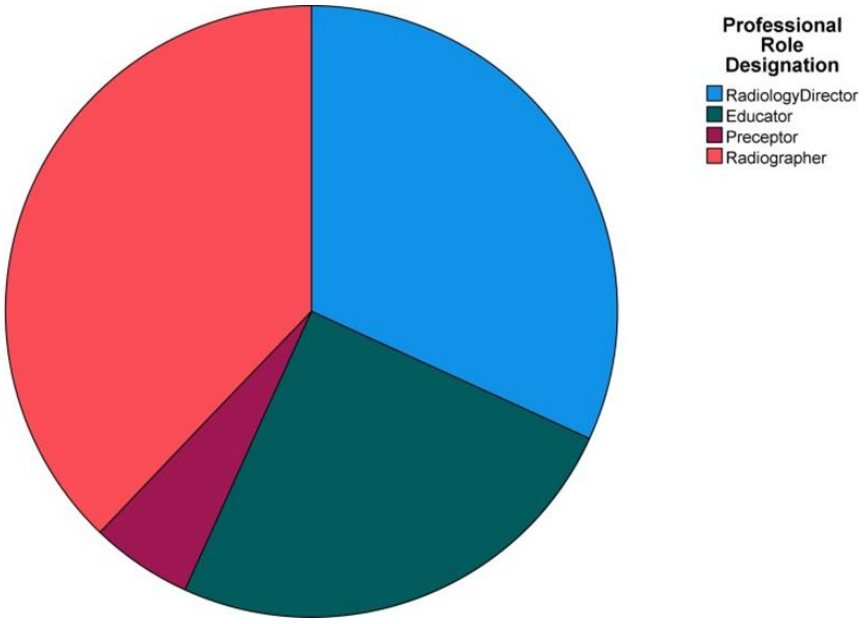


Figure 3

Professional Role Designation	Frequency	Valid Percent
Radiology Director	101	31.9
Educator	79	24.9
Preceptor	14	5.4
Radiographer	120	37.9
N = 317		

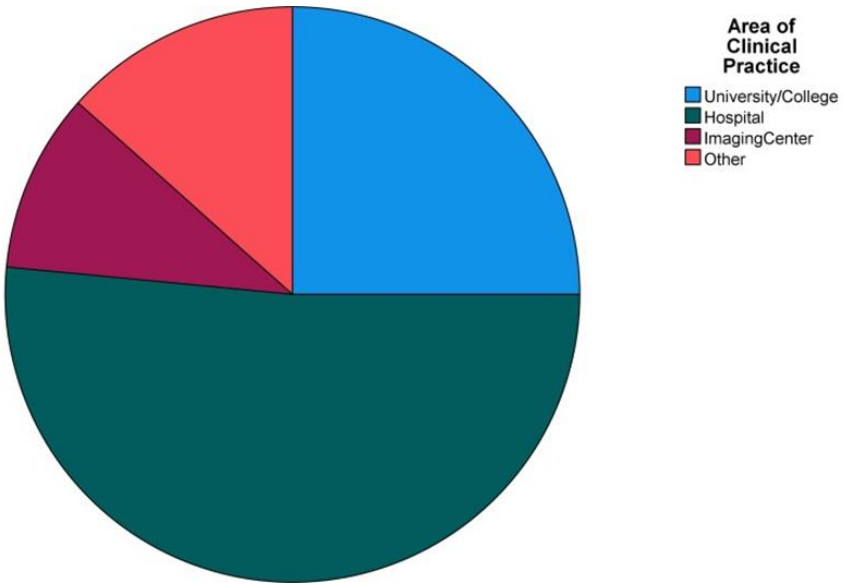


Figure 4

Area of Clinical Practice	Frequency	Valid Percent
University or College Setting	82	25.0
Hospital	169	51.5
Imaging Center	33	10.1
Other	44	13.4
N = 328		

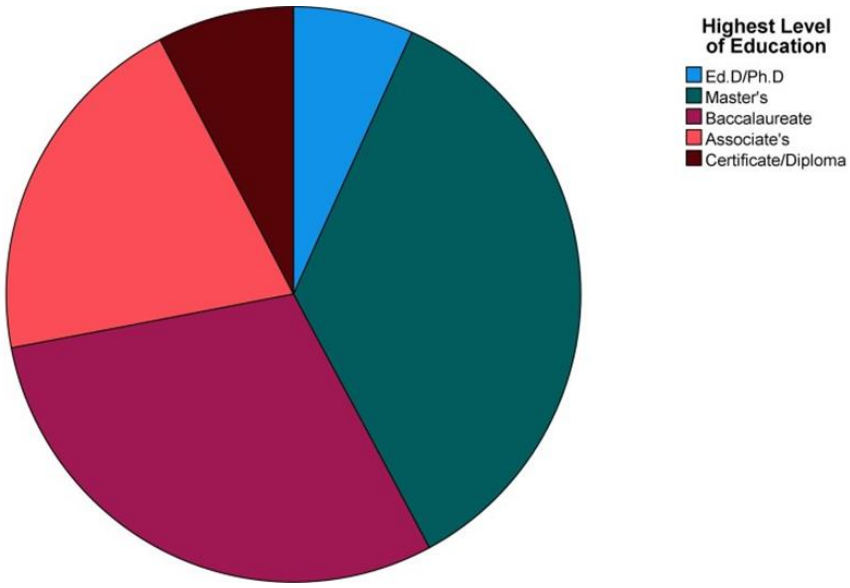
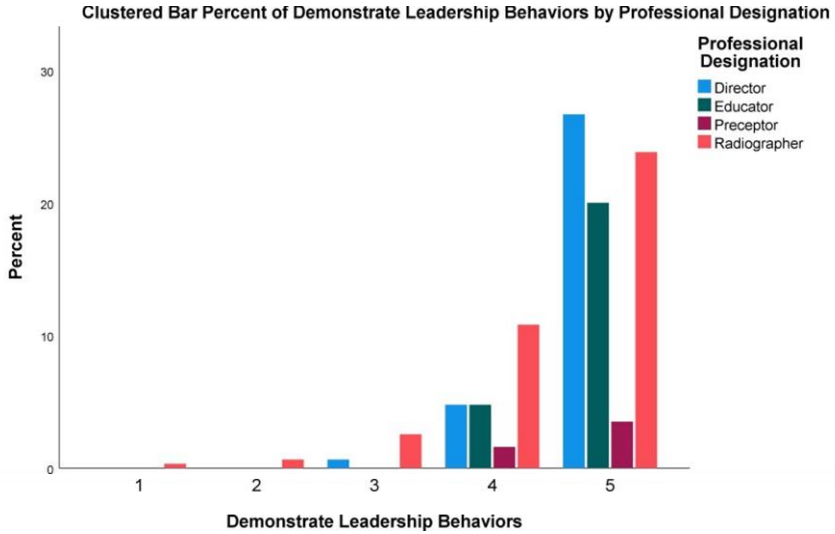


Figure 5

Highest Level of Education	Frequency	Valid Percent
Ed. D or Ph.D.	22	6.8
Master's Degree	115	35.4
Baccalaureate Degree	97	29.8
Associate's Degree	66	20.3
Certificate or Diploma	25	7.7
N = 325		

A correlational analysis was conducted following data collection to measure the fit of the technical skills and leadership behaviors contained in the CRLS. The Cronbach's Alpha score for the 28 item CRLS was calculated as .902, which is indicative of a reliable survey instrument. Much of this score may be attributed to the internal consistency and reliability found within the original surveys from which the CRLS was derived.

Participants were asked to rate their level of identification as a clinical leader, as well as their demonstration of leadership behaviors in their clinical practice. The items were then analyzed based on the categorical stratifications of Professional Designation, Area of Clinical Leadership Practice, and Highest Level of Education Completed. Based on analysis, nearly all Clinical Preceptors viewed themselves as Clinical Leaders, while a larger percentage of Radiographers did not self-identify as clinical leaders in their practice. Not surprisingly, a large number of Radiography Educators identified as clinical leaders, as did Radiology Directors. When data was examined based on the Area of Clinical Practice, the participants that practiced in the hospital setting were more likely to self-identify as clinical leaders. This trend could be due to the increased exposure to student and patient interactions that encourage clinical leadership practices. Participants that have earned a Baccalaureate and Master's degree were much more likely to self-identify as clinical leaders, whereas those individuals that hold a Ed. D or Ph. D did not appear to identify as clinical leaders as strongly in practice. Participants that practiced in the university or college setting more strongly rated themselves as demonstrating leadership behaviors in their practice. This would likely correlate strongly with their position as a Radiography Educator, where they would practice clinical leadership behaviors in their teaching and instructing. Participants that practiced in the clinical setting had more mixed views when rating their demonstration of clinical leadership behaviors. The bar graphs in Figure 6 display the level to which participants felt as though they demonstrated leadership behaviors in their practice as a radiographer. The bar graphs in Figure 7 demonstrates study participants' levels of self-identification as a clinical leader stratified across the categories of professional designation, area of clinical practice and highest level of education.



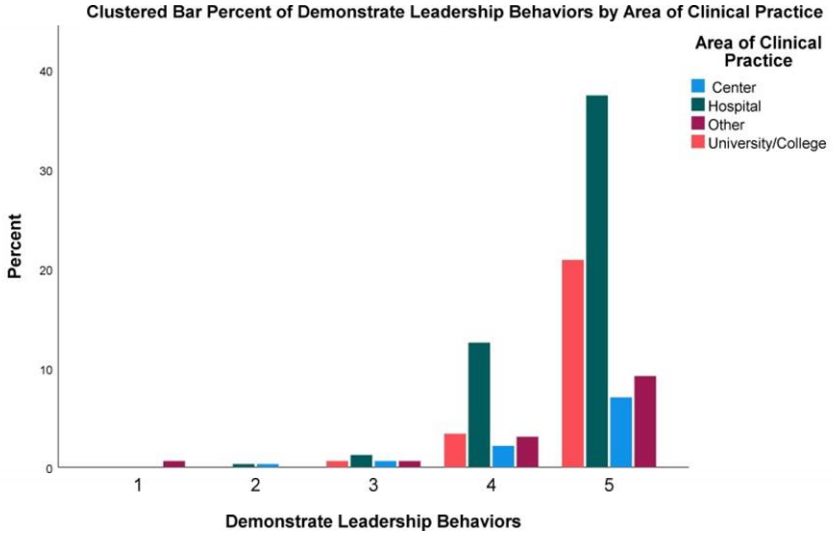
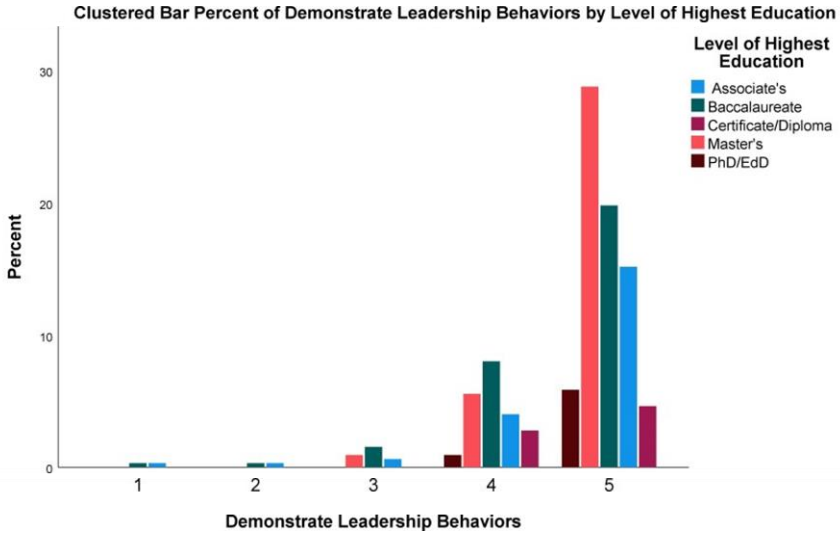
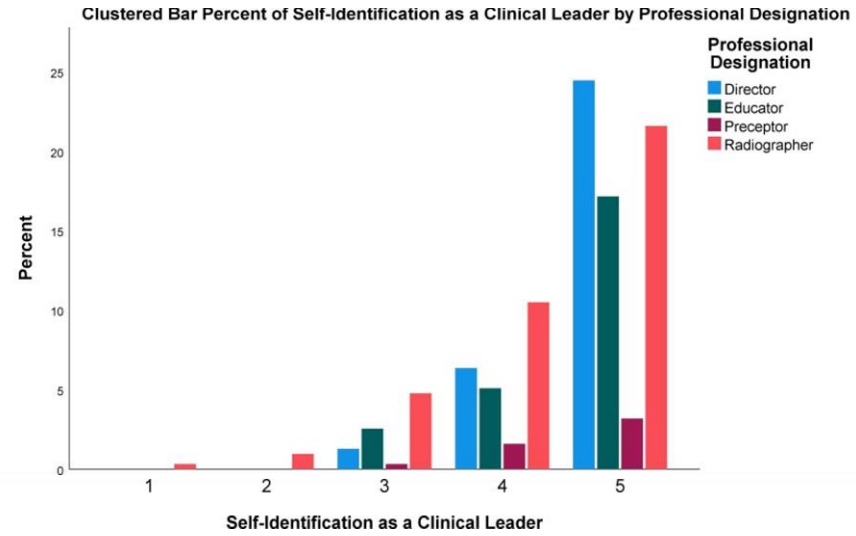


Figure 6. Bar graphs displaying the level to which participants felt as though they demonstrated leadership behaviors in their practice as a radiographer.





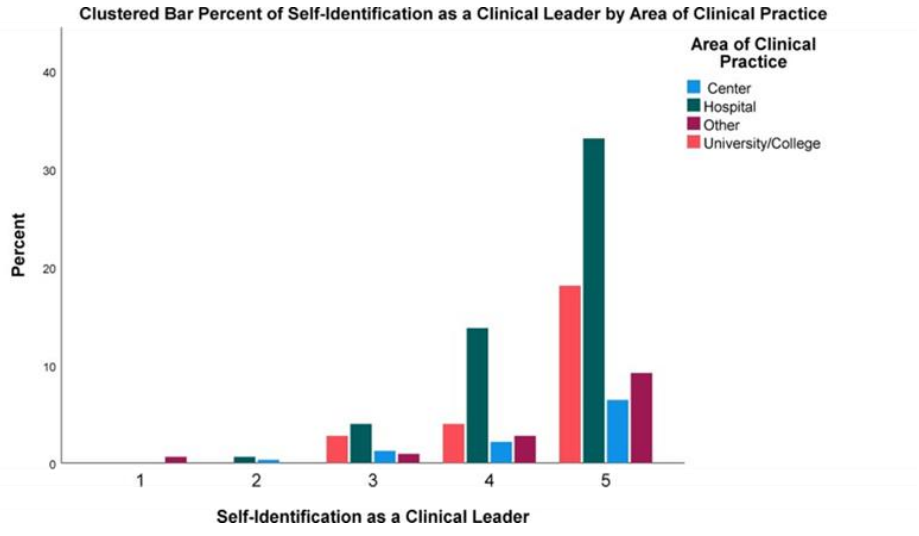
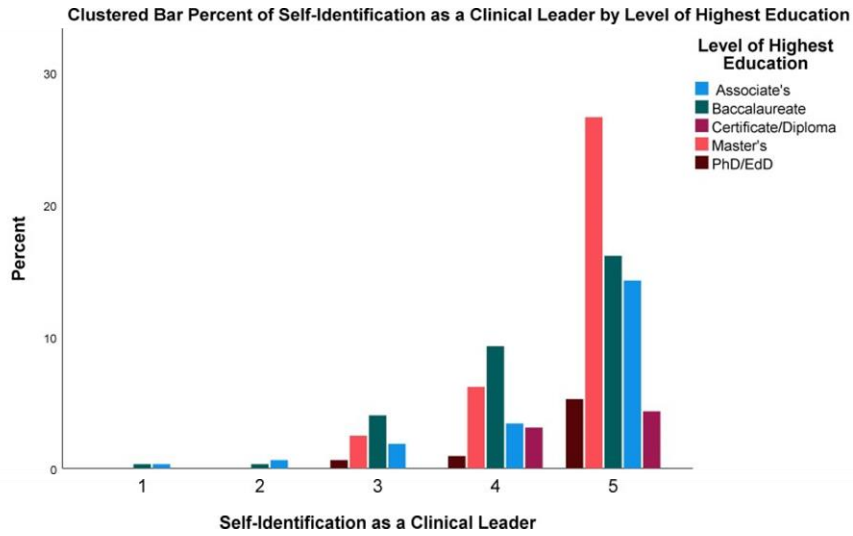


Figure 7. Bar graphs demonstrating self-identification as a clinical leader.



Research Question 1 (RQ1) Results

Research question 1 asked: "What are the commonly practiced clinical leadership behaviors associated with clinical radiography leaders?" When surveyed regarding leadership behaviors that participants felt were associated with clinical radiography leadership, scores varied more widely. Additionally, survey items related to the most commonly practiced leadership behaviors on the CRLS were completed by only approximately 78.6% of participants. The scores related to demonstrated leadership behaviors ranged from 4.35 to 4.85. The items that were ranked highest were those that related to following through on promises and commitments (4.85) and being committed to patient-centered care and positive student educational experiences (4.85). The two items ranked lowest by participants were "When I am concerned about the patient's or student's well-being, I take risks by questioning orders and treatments" (4.48) and "I find ways to celebrate colleagues' accomplishments" (4.35).

Most notable with respect to the data collected during this study was the disparity in the number of participants that perceived themselves to be clinical leaders and to demonstrate clinical leadership behaviors in their practice. 89.7% of participants (296) considered themselves as clinical leaders in their practice as a radiographer while 95.8% (316) stated that they demonstrated leadership behaviors in their practice. While this percentage appears high, only 330 of the total participants answered the two items in the survey related to their own perceptions of being a clinical leader. This means that nearly one quarter of the participants did not view themselves as clinical leaders or believe that they demonstrate clinical leadership behaviors in their practice.

Table 4

Descriptive Statistics Related to Leadership Behaviors

Leadership Behavior	*N*	Mean	Standard Deviation	Skewness
When I am concerned about the patient's or student's well-being, I take risks by questioning orders and treatments.	341	4.48	0.75	-1.621
I am able to provide evidence-based rationale for my clinical decisions.	343	4.62	0.64	-1.900
I engage in reflective practice and try to understand what went well and what did not.	343	4.61	0.65	-2.252
I negotiate with and support members of the interdisciplinary health-care team to help patients and students achieve positive outcomes.	343	4.57	0.70	-1.888
I am enthusiastic and engaged when communicating with patients and students to achieve positive outcomes.	343	4.73	0.53	-2.346
I engage in meaningful conversations with colleagues to foster our ability to provide patient-centered care and student educational opportunities.	343	4.59	0.64	-1.931
I actively listen to colleagues 'diverse points of view .	343	4.57	0.63	-1.449
I establish therapeutic relationships with patients and students that are based on trust.	343	4.59	0.62	-1.696
I develop cooperative relationships with my peers and colleagues.	342	4.71	0.54	-2.260
I do my best to follow through on the promises and commitments that I make.	343	4.85	0.39	-2.956
I try to ensure we work towards achievable goals, make concrete plans, and establish measurable objectives in achieving clinical outcomes.	343	4.62	0.62	-2.016
I am committed to patient-centered care and positive student educational experiences.	342	4.85	0.40	-3.075
I publicly acknowledge my colleagues who exemplify commitment to professional values.	343	4.56	0.73	-2.145
I provide positive feedback to colleagues when their actions contribute to the well-being of patients and students.	343	4.63	0.65	-2.365
I find ways to celebrate colleagues' accomplishments.	342	4.35	0.87	-1.465

Table 5
Perception as a Clinical Leader & Demonstration of Leadership Behaviors

	N	Mean	Standard Deviation
I consider myself a clinical leader in my practice.	330	4.55	0.74
I demonstrate leadership behaviors in my practice.	330	4.69	0.62

Research Question 2 (RQ2) Results

Research question 2 addressed the common technical skills performed by radiographers that are associated with clinical radiography leaders. Participants rated the importance of each technical skill as it relates to the embodiment and practice of a clinical radiography leader. Statistical analysis of the data revealed that participants viewed the technical skills related to the practice of radiography as more salient to their practice with mean scores ranging from 4.82 to 4.97. Items related to patient identification (4.97), professional communication (4.90), and producing diagnostic quality radiographs (4.91) were ranked highest by participants. Items that ranked lowest based on participant feedback were image evaluation and critique (4.82), selecting appropriate technical factors (4.83), and obtaining an appropriate patient clinical history (4.83). However, over 85% of participants generally rated these items as Very Important (5) based on their practice as a clinical radiography leader. Therefore, these skills are still viewed as highly valuable in the clinical setting by clinical radiography leaders.

Table 6

Descriptive Statistics Related to Technical Skills

Technical Skills	*N*	Mean	Standard Deviation	Skewness
Obtaining an appropriate patient clinical history.	428	4.83	0.55	-4.078
Ensuring patient identification prior to initiating an exam.	431	4.97	0.26	-12.561
Professionally communicating and providing instructions to the patient during the exam.	431	4.90	0.39	-5.084
Observing and monitoring the patient throughout the exam.	429	4.88	0.41	-4.626
Practicing ALARA and providing appropriate radiation protection methods during the exam.	429	4.85	0.49	-4.046
Competently manipulates all radiographic and imaging equipment.	429	4.84	0.45	-3.610
Adapts the radiographic exam to the patient's condition.	429	4.86	0.43	-4.134
Utilizes sound clinical decision-making skills.	428	4.88	0.41	-4.488
Selects appropriate technical factors for the exam being performed.	427	4.83	0.5	-3.950
Produces diagnostic quality radiographic images.	429	4.91	0.38	-5.969
Evaluates and critiques the radiographic image for pertinent anatomy and pathology.	429	4.82	0.49	-3.282

The technical skills most correlated to the practice of clinical radiography leadership were selecting appropriate technical factors, producing diagnostic quality radiographic images, professional communication with the patient, and competently manipulating all radiographic and imaging equipment, with Pearson correlation coefficients ranging from .674 to .712. There were strong Pearson correlation coefficients for all survey items contained within the technical skill dimensions of Patient Care Skills and Radiographic Skills. This not only supports the internal

consistency of these dimensions, but also indicates a strong connection to the technical aspect of the profession.

Exploratory Open-Ended Questions

Two open-ended questions were included on the CRLS to solicit feedback relative to technical skills and leadership behaviors that participants felt should be included on the survey to encompass the skills and behaviors of a clinical radiography leader more fully. Upon analysis of the skills and behaviors listed by participants, several themes emerged. Many of the themes or skills listed flowed between the two categories measured on the CRLS: technical skills and leadership behaviors. Some of the most frequently listed technical skills revolved around communication and interpersonal skills, computer networking knowledge, clinical experience, and continuing education related to clinical practice and technology. Critical thinking, emotional intelligence and interpersonal skills, role modeling were also listed frequently by participants. One participant noted that clinical radiography leaders should be "able to communicate in a language that creates a bridge between the technologist staff and the radiologist. That is essentially the role of a clinical radiography leader. Being able to communicate the type of images the radiologists want, using technical language that the technologists can understand, and helping them achieve that level of image quality." Another participant stated that "Education is the most important tool-CRA Certification, Crucial Conversations Leadership training, MS (or advanced degree) in the profession, Listening and Perseverance toward the Professional Standard…; national and state professional organization engagement."

Participants echoed many of the same themes found under the technical skills category. However, professional engagement and emotional intelligence were cited multiple times when asked to list leadership behaviors that are tied to the practice of clinical radiography leadership.

One participant felt it was important to practice "professional advocacy outside of work" and another stated that clinical radiography leaders should demonstrate "Empathy. Not only for patients but for my staff. Being a good radiology manager also means the ability to work with your staff when they face personal or professional problems." Transformational leadership skills were listed as very important, which correlates highly with the CRLS survey items contained within the clinical leadership behaviors dimensions.

Correlations Between CRLS Dimensions

When examining correlations related to each dimension within clinical leadership, Pearson correlation coefficients > 0.3 were considered to be significant. Pearson correlation coefficients with significance levels of 0.01 and 0.05 have been displayed in Table 8. When examining the dimensions related to leadership behaviors for RQ1, there were several dimensions that exhibited moderate to strong correlations. The strongest correlation existed between Dimension 4 (Inspiring a Shared Vision) and Dimension 5 (Enabling Others to Act), with a Pearson coefficient of .699. High correlation values were also calculated between Dimensions 4 and 6 (.617), as well as Dimensions 5 and 6 (.620). Specific survey items related to each of these dimensions which have exhibited moderate to strong correlation coefficients have been outlined in Table 7 below. Moderately correlated items possess a Pearson correlation coefficient of 0.50 – 0.79. Highly correlated items exhibit a Pearson correlation coefficient of 0.80 – 1.00. A comprehensive display of the correlation coefficients between all dimensions on the CRLS is located in Table 8.

Table 7

CRLS Items by Dimension Exhibiting Moderate to Strong Correlations

Dimension 3 – Challenging the Process
When I am concerned about the patient's or student's well-being, I take risks by questioning orders and treatments.
I am able to provide evidence-based rationale for my clinical decisions.
I engage in reflective practice and try to understand what went well and what did not.
Dimension 4 – Inspiring a Shared Vision
I negotiate with and support members of the interdisciplinary health-care team to help patients and students achieve positive outcomes.
I am enthusiastic and engaged when communicating with patients and students to achieve positive outcomes.
I engage in meaningful conversations with colleagues to foster our ability to provide patient-centered care and student educational opportunities.
Dimension 5 – Enabling Others to Act
I actively listen to colleagues' diverse points of view.
I establish therapeutic relationships with patients and students that are based on trust.
I develop cooperative relationships with my peers and colleagues.
Dimension 6 – Modeling the Way
I do my best to follow through on the promises and commitments that I make.
I try to ensure we work towards achievable goals, make concrete plans, and establish measurable objectives in achieving clinical outcomes.
I am committed to patient-centered care and positive student educational experiences.
Dimension 7 – Encouraging the Heart
I publicly acknowledge my colleagues who exemplify commitment to professional values.
I provide positive feedback to colleagues when their actions contribute to the well-being of patients and students.
I find ways to celebrate colleagues' accomplishments.

It is not surprising that there is a strong correlation between Dimensions 4 through 6. These dimensions address behaviors that lead to patient-centered care, positive student educational experiences, and interdisciplinary communication and support. These behaviors are foundational to the practice of clinical leadership within the field of radiography. Radiography leaders function collaboratively with other healthcare providers to care for, diagnose, and treat patients. These individuals must display behaviors that support cooperation and the building of trust in order to provide patient-centered care. In addition, these clinical radiography leaders function as clinical mentors during student clinical experiences. The leadership behaviors within these dimensions align well with the characteristics necessary to effectively mentor students and ensure a positive clinical learning experience for them.

Dimensions that exhibited moderate positive correlations between one another were Dimensions 3 – 7. These dimensions possessed a Pearson correlation coefficient of .5 or greater. Dimension 3 (Challenging the Process) demonstrated a moderate correlation to the dimensions of Inspiring a Shared Vision (Dimension 4) and Enabling Others to Act (Dimension 5). These dimensions had a Pearson value of .570 and .530 respectively. Dimension 7 also showed a positive correlation to dimensions 4-6, with Pearson values ranging from .507 to .534. The dimension that addresses challenging the process may be valued by clinical radiography leaders as these individuals must continuously assess clinical history, patient condition, and the radiographic image during their exam performance. Radiographers are taught to critically think through an exam and correlate it to the patient's history and condition. This concept of critical assessment is foundational to basing clinical decisions on evidence-based practices and engaging in reflective practices, both during and following an exam.

Based upon the data that was examined, there was an exceptionally high correlation between Dimension 1 (Patient Care Skills) and Dimension 2 (Technical and Radiographic Skills). This correlation aligns strongly with the statistical analysis conducted for RQ2. Study participants ranked the survey items within Dimensions 1 and 2 as the more salient with respect to their role as a Clinical Radiography Leader. The mean scores for items contained within these two dimensions ranged from 4.82 to 4.97, with 85% of participants ranking these items as Very Important (5) with regard to their practice as a clinical leader. Both dimensions 1 and 2 exhibited weak correlations to the dimensions associated with leadership behaviors. Most notably, was the tenuous connection that participants felt existed between the Global Clinical Leadership Scale (Dimension 8) and dimensions 1 (Pearson value of .156) and 2 (Pearson value of .117). This further supports the fact that participants felt as though Patient Care Skills (Dimension 1) and Technical and Radiographic Skills (Dimension 2) had little to do with their role as a Clinical Radiography Leader.

Table 8

Correlations Between Clinical Leadership Dimensions

Clinical Leadership Dimensions (x-axis)	D1	D2	D3	D4	D5	D6	D7	D8
Patient Care Skills (D1)	1	.715**	.333**	.398**	.340**	.312**	.199**	.156**
Technical & Radiographic Skills (D2)	.715**	1	.382**	.433**	.329**	.326**	.223**	.117*
Challenging the Process (D3)	.333**	.382**	1	.570**	.530**	.443**	.436**	.227**
Inspiring a Shared Vision (D4)	.398**	.433**	.570**	1	.699**	.617**	.501**	.317**
Enabling Others to Act (D5)	.340**	.329**	.530**	.699**	1	.620**	.534**	.306**
Modeling the Way (D6)	.312**	.326**	.443**	.617**	.620**	1	.517**	.330**
Encouraging the Heart (D7)	.199**	.223**	.436**	.501**	.534**	.517**	1	.262**
Global Clinical Leadership Scale (D8)	.156**	.117*	.227**	.317**	.306**	.330**	.262**	1

**Correlation is significant at the 0.01 level (2-tailed)
*Correlation is significant at the 0.05 level (2-tailed)

The dimensions of Patient Care Skills (D1) and Technical & Radiographic Skills (D2) demonstrate a moderately strong positive correlation to one another. This data is aligned with the Pearson *r* value of .715, which indicates a more directly linear relationship between the skills and behaviors within these items on the CRLS. Many participants scored the items contained within these two dimensions are Important or Very Important with respect to their practice as clinical radiography leaders.

Dimensions 4-8 exhibit a weakly positive correlation with the first dimensions (D1 and D2) on the CRLS. This lack of a strong link between the more technical aspect of radiographic

imaging and specific leadership behaviors is reinforced throughout the data analysis. These dimensions had a *r* value of .398 or below. This is likely due to the fact that many of the behaviors or skills listed in these dimensions are aligned with the foundational patient care and technical/radiographic skills of a radiographer. Many participants did not indicate that they viewed themselves as clinical leaders within their own practice. This is likely the reason behind the lower correlation *r* values that were calculated for these dimensions.

Though there was a weakly positive correlation between dimensions 4-8 with the first dimensions, there is a moderately strong correlation that exists between these dimensions themselves. Pearson *r* values of .501 - .699 were calculated for these dimensions. There was a strong correlation between dimensions 4 and 5 with a Pearson correlation coefficient of .699. Moderately strong relationships are also demonstrated between dimensions Enabling Others to Act (5)/Modeling the Way (6), as well as Challenging the Process (3)/Inspiring a Shared Vision (4). These dimensional relationships had a correlation coefficient of .617 and .570 respectively.

It should be noted there is little correlation between the Global Clinical Leadership Scale (D8) and dimensions 1-7. The strongest correlation (.330) existed with Dimension 6 (Modeling the Way). This data aligns with the lack of empirical research conducted within the radiologic sciences with respect to clinical leadership. Additionally, this could indicate a need for a more refined survey instrument to appropriately reflect the clinical practices and leadership behaviors that radiographers identify in clinical leaders.

Confirmatory Factor Analysis Results

A confirmatory factor analysis was conducted in SPSS to determine the most important items on the CRLS as it relates to the definition of a clinical radiography leader. A dimension reduction was conducted in SPSS for both the entire list of CRLS survey items, as well as between

the 8 dimensions contained on the CRLS. The varimax rotation was utilized in SPSS to redistribute the factor loadings to decrease the number of factors that each CRLS item measured. Figure 8 demonstrates the scree plot of the five highest loading factors when the confirmatory factor analysis was run to include all 28 items contained in the CRLS. Loading factors were determined by possessing an Eigenvalue of 1.0 or greater. Table 9 displays each item on the CRLS as grouped by the loading factor and ranked from highest to lowest correlation. Based on the analysis of the factor loadings and scree plot, there were several CRLS items that measured more than one factor.

Factor 1 relates heavily to the profession-specific skills contained within dimensions 1 and 2 of the CRLS. This correlation tracks with the importance placed on patient care skills and technical skills utilized as radiographers. Participants identified strongly with the patient-centered and technical side of clinical leadership while maintaining that some of the more transformational components of clinical leadership were not as salient to their practice. It is worthy of noting that there is a strong correlation with respect to communication and interprofessional collaboration. This supports the idea that clinical leadership is collaborative in nature and that communication and patient-centered care are at the heart of this practice.

Factors 2 and 3 align strongly with aspirational and transformational leadership behaviors within the clinical setting. The dimensions associated with these factors are Inspiring a Shared Vision, Enabling Others to Act, and Modeling the Way. These dimensions have a foundation in both transformational and collaborative leadership behaviors. Factor 4 is associated with the dimensions of Challenging the Process and Enabling Others to Act. Items within these dimensions address patient and student well-being through the establishment of trusting relationships, as well as basing clinical decisions on evidence-based practices. These ideals align with the tenets of

clinical supervision and mentoring whereby the practitioner uses sound clinical decision-making skills that are grounded in evidence-based practices. This is done in order to ensure positive patient care and outcomes through the establishment of a trusting relationship. This relationship will allow the clinical radiography leader to effectively mentor students while providing high quality patient care during radiographic exams. Lastly, Factor 5 is aligned with the global clinical leadership scale on the CRLS, which addresses the participants perception that they consider themselves to be a clinical leader in their practice and that they demonstrate leadership behaviors while functioning as a clinical radiography leader.

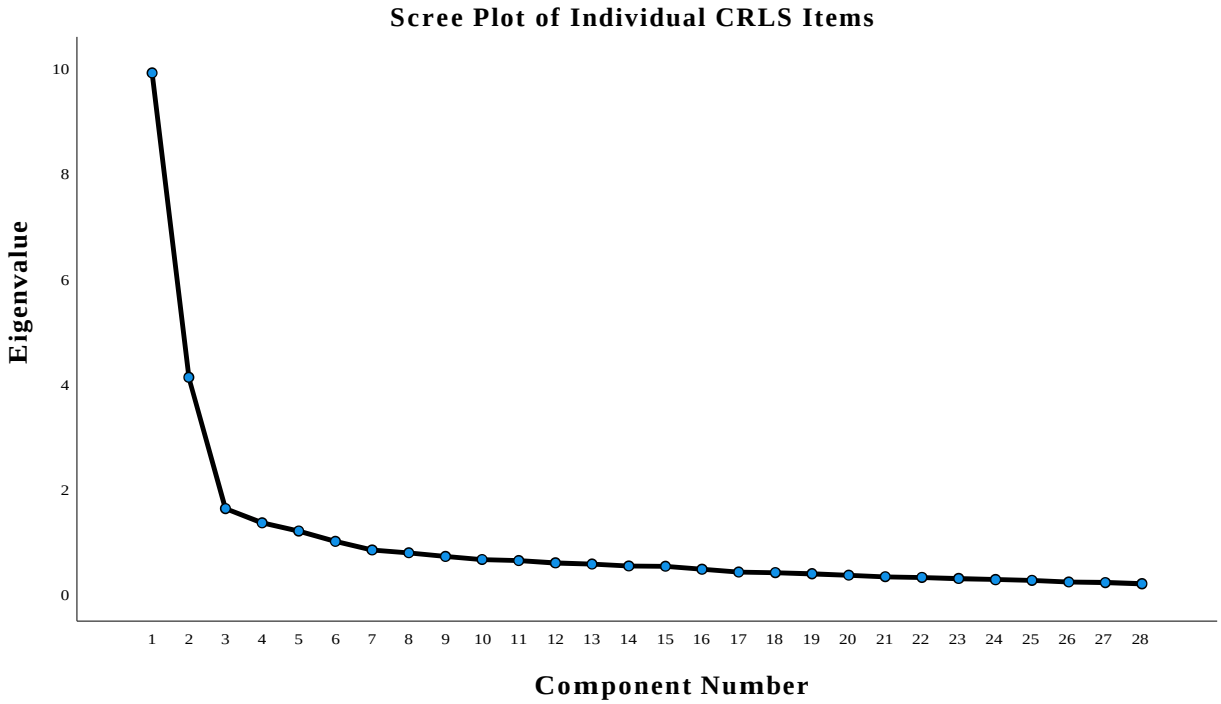


Figure 8. Scree plot depicting loading factors of all CRLS items.

Table 9
Factor Loading of CRLS Items with Correlations

CRLS Items	Component				
	1	2	3	4	5
Ensuring patient identification prior to initiating an exam.	.861				
Produces diagnostic quality radiographic images.	.838				
Professionally communicating and providing instructions to the patient during the exam.	.823				
Observing and monitoring the patient throughout the exam.	.803				
Utilizes sound clinical decision-making skills.	.791				
Adapts the radiographic exam to the patient's condition.	.771				
Competently manipulates all radiographic and imaging equipment.	.744				
Selects appropriate technical factors for the exam being performed.	.741				
Practicing ALARA and providing appropriate radiation protection methods during the exam.	.699				
Evaluates and critiques the radiographic image for pertinent anatomy and pathology.	.699		.304		
Obtaining an appropriate patient clinical history.	.578				.300
I am enthusiastic and engaged when communicating with patients and students to achieve positive outcomes.	.352	.711			
I develop cooperative relationships with my peers and colleagues.		.706			
I do my best to follow through on the promises and commitments that I make.		.704			
I actively listen to colleagues 'diverse points of view.		.683	.313		

Table 9
Factor Loading of CRLS Items with Correlations (continued)

CRLS Items	Component				
	1	2	3	4	5
I engage in meaningful conversations with colleagues to foster our ability to provide patient-centered care and student educational opportunities.		.665	.321		
I am committed to patient-centered care and positive student educational experiences.		.656			
I negotiate with and support members of the interdisciplinary health-care team to help patients and students achieve positive outcomes.		.532	.377		
I try to ensure we work towards achievable goals, make concrete plans, and establish measurable objectives in achieving clinical outcomes.		.529	.427		
I engage in reflective practice and try to understand what went well and what did not.	.303	.415	.353		
I provide positive feedback to colleagues when their actions contribute to the well-being of patients and students.			.826		
I publicly acknowledge my colleagues who exemplify commitment to professional values.			.796		
I find ways to celebrate colleagues' accomplishments.			.793		
When I am concerned about the patient's or student's well-being, I take risks by questioning orders and treatments.				.790	
I am able to provide evidence-based rationale for my clinical decisions.				.673	
I establish therapeutic relationships with patients and students that are based on trust.		.464		.519	
I demonstrate leadership behaviors in my practice.					.873
I consider myself a clinical leader in my practice.					.865

The dimension reduction between the 8 dimensions within the CRLS was much more useful in examining the connection between the skills and behaviors of a clinical radiography leader. Figure 9 demonstrates the scree plot of the two highest loading factors when the confirmatory factor analysis was run to include the 8 dimensions of the CRLS. Table 10 displays each CRLS dimension as grouped by the loading factor and ranked from highest to lowest correlation. When examining the factor loading interdimensionally, there is clear delineation between clinical leadership globally in healthcare versus that which defines clinical radiography leaders. Factor 1 is aligned strongly with the global clinical leadership behaviors while Factor 2 is heavily skewed towards the technical and patient care skills utilized by radiographers in their practice. Figure 10 illustrates the relationship between the two loading factors identified and the corresponding dimensions contained on the CRLS.

Table 10
Ranked Factor Loading of CRLS Dimensions with Correlations

CRLS Dimensions	Component	
	1	2
Enabling Others to Act (D5)	.806	
Modeling the Way (D6)	.776	
Inspiring a Shared Vision (D4)	.758	.383
Encouraging the Heart (D7)	.753	
Challenging the Process (D3)	.612	.405
Global Clinical Leadership Scale (D8)	.553	
Technical & Radiographic Skills (D2)		.915
Patient Care Skills (D1)		.904

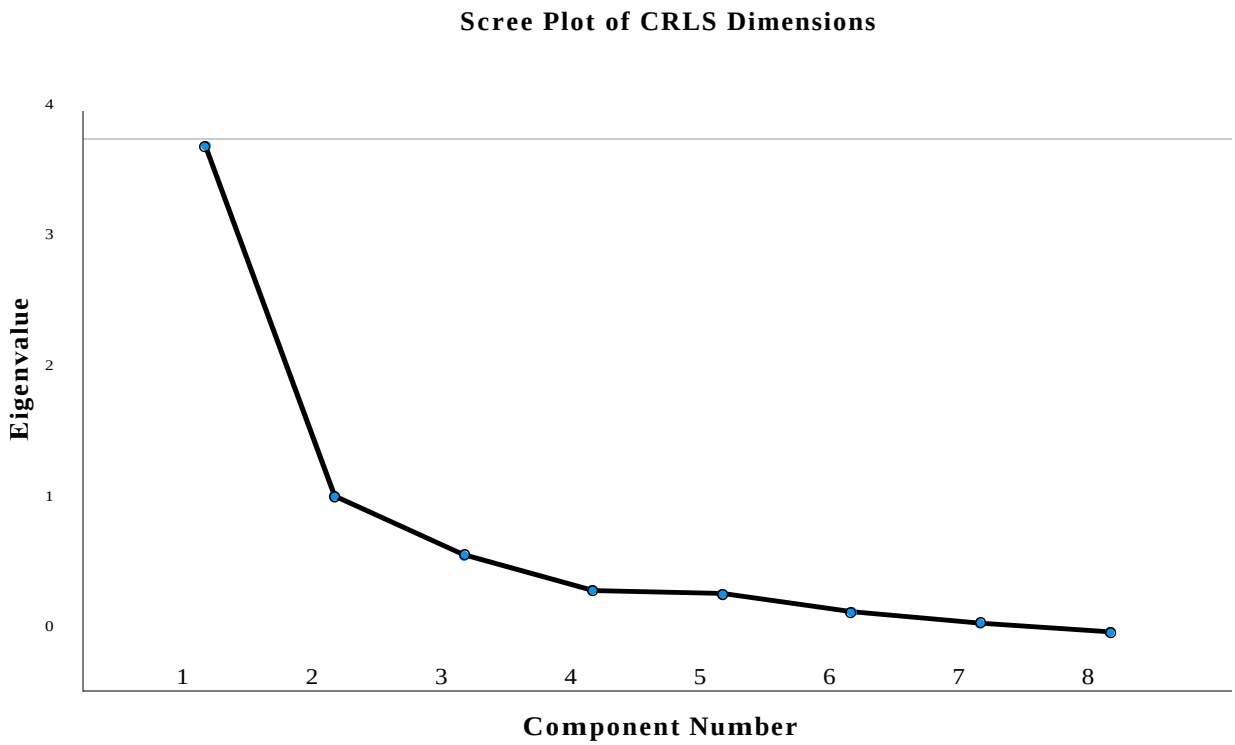


Figure 9. Scree plot depicting loading factors between dimensions on the CRLS.

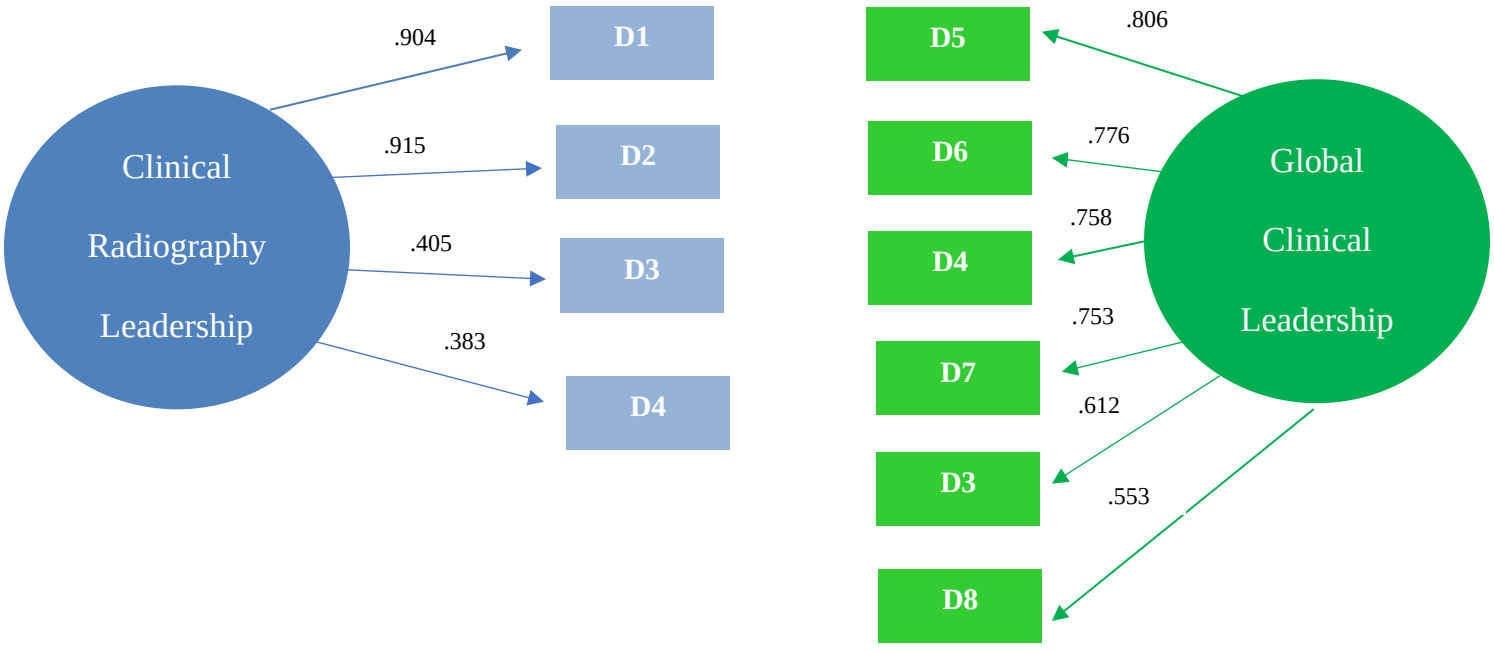


Figure 10. Illustration of the relationships between identified loading factors and corresponding CRLS dimensions.

Summary of Results

Based on the data gleaned from this study, I developed a visual model of clinical radiography leadership that incorporates both the leadership behaviors demonstrated and the technical skills performed by clinical radiography leaders. One of the most notable findings was the overlap that exists between the participants' perceived leadership behaviors and the technical skills utilized in the practice of radiography. CRLS items related to professional communication and utilizing sound clinical decision-making skills correlated highly with both the leadership behaviors exhibited by clinical leaders, as well as with the technical skills valued in a clinical radiography leader.

Figure 11. *Visual model of CRLS dimensions most correlated to RQ1.*

Figure 11 is a visual model which links CRLS dimensions that demonstrated a strong correlation to the first research question: What were the commonly practiced clinical leadership behaviors associated with clinical radiography leaders? Dimensions that contained survey items with a Pearson correlation coefficient of .60 or greater have been included as the most salient to the practice of a clinical radiography leader when viewed through the demonstration of leadership behaviors.

The items were aligned with Dimension 1: Patient Care Skills, Dimension 2: Technical and Radiographic Skills, Dimension 4: Inspiring a Shared Vision, Dimension 5: Enabling Others to Act, and Dimension 7: Encouraging the Heart. In Dimension 1, "Professionally communicating and providing instructions to the patient during the exam (Q3)" was found to be highly correlated to the ability to "Utilize sound clinical decision-making skills (Q8)" in Dimension 2, with a Pearson coefficient of .641. The ability to "Utilize sound clinical decision-making skills (Q8)" was also found to be highly correlated to the technical skills necessary to function as a clinical radiography leader. Thus, this item is one of the two items contained within the CRLS this ties leadership behaviors to the technical skills of a radiography when examining the definition of clinical leadership as it functions within the profession of radiography. Likewise, the ability to professionally communicate is also viewed as a significant skill and behavior when examining the definition of a clinical radiography leader as it is also serves to tie the technical practice of radiography to specific leadership behaviors within the clinical environment. These skills and behaviors are considered foundational to the practice of radiography and are stressed throughout the medical imaging curriculum.

Leadership behaviors that involved the dimensions of Inspiring a Shared Vision, Enabling Others to Act, and Encouraging the Heart also demonstrated a strong Pearson correlation

value. CRLS items 17/18 (Inspiring a Shared Vision/Enabling Others to Act) and 24/26 (Encouraging the Heart) also demonstrated strong alignment between the dimensions. The engaging in meaningful conversations with colleagues to foster the ability to provide patient-centered care and student educational experiences (Q17) aligns strongly with the active listening to colleagues' diverse points of view (Q18) (Pearson value of .664). This may point to clinical radiography leaders' ability to communicate both within the department and interprofessionally with other healthcare providers to ensure patient-centered care and positive outcomes. Additionally, it could demonstrate the clinical radiography leaders' ability to effectively communicate with colleagues in the department to ensure positive student educational experiences. These behaviors are associated with CRLS items that include the leader publicly acknowledging colleagues that exemplify commitment to professional values (Q24), which include patient-centered care and positive student educational experiences, as well as finding ways to celebrate colleagues' accomplishments (Q26) (Pearson value of .665). These items on the CRLS are also aligned with professional communication (Q3) in Dimension 1. The final CRLS item that demonstrated a high correlation to clinical radiography leadership was providing positive feedback to colleagues when their actions contribute to the well-being of patients and students (Q25). Once again, this links professional values and professional communication to providing patient-centered care and positive student educational experiences.

The visual model in Figure 11 demonstrates that there is a significant degree of leadership behaviors and skills that are exhibited by radiographers in the clinical setting. Additionally, it illustrates the foundational tie between the technical/radiographic and patient care skills needed to function as a radiographer with other common leadership behaviors. The data from this study

and this model point to the ideal that radiographers believe that their technical/radiographic and patient care skills are some of the most important criteria when identifying clinical leaders.

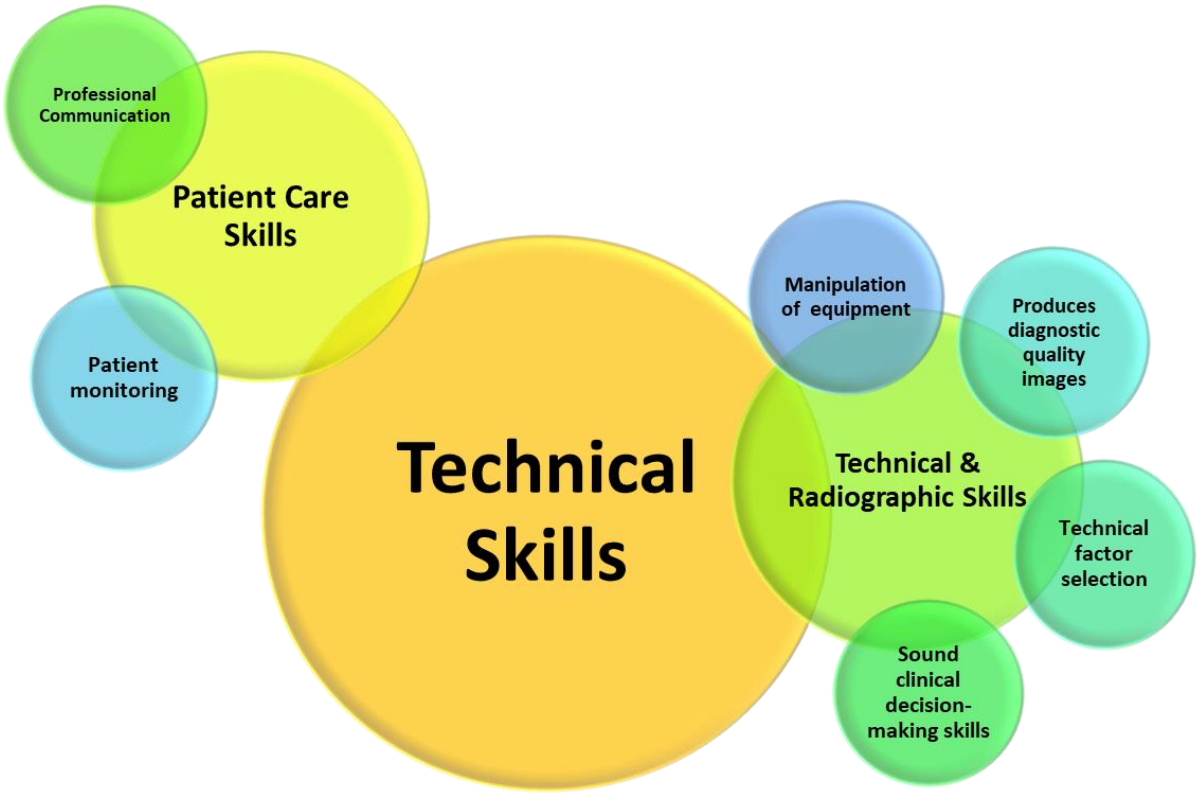


Figure 12. *Visual model of CRLS dimensions and items most correlated to RQ2.*

When examining CRLS dimensions and survey items related to the technical skills and practice of radiography, only items with a Pearson correlation coefficient of .60 or greater have been included in the visual model associated with clinical radiography leaders. Figure 12 illustrates the CRLS dimensions that demonstrated a strong correlation to the second research question: What were the common technical skills performed by radiographers that are associated with clinical radiography leaders? The visual model (Figure 12*)* developed to answer RQ2 differs from the model developed to answer RQ1. This is due to the fact that individual items from the CRLS have been added to the dimensions most strongly tied to the technical skills necessary to function as a clinical radiography leader. I have chosen to highlight the importance placed on the technical/radiographic and patient care skills utilized by clinical radiography leaders as identified by study participants. Upon examining inter-item correlations and inter-dimensional correlations from the CRLS, it was clear that participants placed higher importance on the technical aspect of radiography, as well as specific items contained within the respective dimensions. This information has informed the visual model presented in Figure 12.

Examining the survey items within Dimensions 1 and 2 yielded further evidence that research participants viewed technical and radiographic skill items as the most fundamental aspect to their practice as a clinical radiography leader. Based on the analysis of data, survey items related to Dimension 1: Patient Care Skills, as well as Dimension 2: Technical and Radiographic Skills demonstrated a stronger inter-item correlation than those related to leadership behaviors. Again, this points to the assertion that radiography professionals highly value the technical aspect of radiography practice and believe that it is the most important indicator of clinical leadership. As stated above, there was a connection made between the technical skills required to function as a radiographer with those leadership behaviors in clinical radiography leaders. CRLS

items contained within the associated dimensions have been added peripherally to Figure 12 in order to signify the strong link that exists between these specific CRLS items and the dimensions within the survey that yielded the highest correlation. Professional communication and utilizing sound clinical decision-making had an even stronger correlation score when examined using the lens of technical skill performance. CRLS items “Selects appropriate technical factors for the exam being performed (Q9)” and “Produces diagnostic quality radiographic images (Q10)” had the highest inter-item correlation, with a Pearson value of .712. Additionally, a Pearson correlation coefficient of .680 was correlated between professional communication (Q3) and monitoring the patient throughout the exam (Q4). It is validating to know that the patient care skills and technical/radiographic skills educators stress during didactic and laboratory courses are considered by radiography professionals to be the highest indicators of clinical leadership. There also was found to be a moderately strong correlation between professional communication with the patient (Q3) and competently manipulating radiographic and imaging equipment (Q6) (.674).

5 DISCUSSION

This study intended to develop a model of clinical leadership specific to the profession of radiography. The CRLS, a survey that addressed both the technical skills and leadership behaviors, was created to answer the following research questions: (1) What were the commonly practiced clinical leadership behaviors associated with clinical radiography leaders? and (2) What were the common technical skills performed by radiographers that are associated with clinical radiography leaders?

Based on the findings for this study, it was determined that participants highly rated the technical and radiographic skills associated with the practice of radiography. While some leadership behaviors that have roots in transformational and collaborative leadership practice were identified as relevant to their practice as clinical radiography leaders, it was obvious that the technical aspect of their practice was the most salient.

Implications

There are several implications related to this study of clinical radiography leadership. One of the most significant implications was that it highlights the lack of perception of radiographers as clinical leaders. This was illustrated by the fact that only 78.6% of participants completed the CRLS items related to leadership behaviors. This presumes that approximately 21.4% of participants did not perceive themselves as clinical leaders or that they demonstrate leadership behaviors in their practice. This assertion is not surprising given that radiography curricula do not currently contain specific leadership competencies related to the practice of clinical leadership. As such, this study could identify this lack of identification as clinical leaders and guide the development of leadership competencies that will better prepare students to assume clinical radiography leadership roles. Subsequently, this could provide a more positive clinical experience for students as clinical radiography leaders function as mentors and instill professional values in

radiography students through their clinical interactions. Over time, this could lead to the development of more masters' level programs, as well as the establishment of a doctoral pathway for professionals. As the profession moves towards a terminal degree, students will be better prepared to function as clinical radiography leaders and to provide a higher level of clinical decision-making. As our profession evolves, it will be viewed as the vital healthcare profession that it truly is as it functions as the eyes of the physician when diagnosing patient pathologies.

Theoretical Implications

Based on the development of the CRLS and participant responses, there are a number of leadership behaviors that may be linked to transformative and collaborative leadership practices. Collaborative leadership is derived from a mixture of behaviors gleaned from transformational leadership, distributed leadership, and clinical supervision. By combining aspects of each construct, collaborative leadership may lead to a multidimensional approach when examining clinical leadership in radiography (Careau et al., 2014; Leigh et al., 2015). Empirical research, especially research related to clinical leadership, is scarce within the medical imaging profession (Bloom, 2014; Careau et al., 2014; Cook, 2001; Cook & Leathard, 2004; Mannix et al., 2013; Stanley et al., 2017). This study has begun to address the need for a definition of clinical leadership that fully encompasses the specialized knowledge, skills, and behaviors that are found within the practice of radiography. By developing a survey that addresses both leadership behaviors and the technical and radiographic skills necessary for radiography leaders, this study has opened dialogue relative to clinical leadership practices within the radiography profession. This study could begin to highlight the need for specific leadership competencies within radiography, such as is found in the United Kingdom (Leigh et al., 2015; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010).

Figure 13. Visual model of Clinical Radiography Leadership.

Based on the data collected from the CRLS during this study, a developing model of clinical leadership has been created as illustrated in Figure 13. Participant data demonstrated that clinical radiography leadership is the amalgamation of both leadership behaviors and technical

skills utilized as a radiography professional. Further, there is a blending of both aspects of clinical practices, especially related to professional communication and the utilization of sound clinical decision-making processes. As data were analyzed and correlated, it became clear that radiography leaders find the application of technical and radiographic skills to be the most significant when defining clinical radiography leadership. Figure 13 illustrates a model of clinical radiography leadership that visually demonstrates the blending of leadership behaviors with technical skills as a means of defining clinical radiography leadership. The construct of technical skills has been enlarged to signify the significant importance placed on the technical aspect of the profession by radiography leaders. Additionally, the items linked to technical/radiographic and patient care skills that were most strongly valued by the participants have been added peripherally to visually highlight the importance placed on these specific skills and behaviors. Leadership behaviors in Dimensions 4, 5, and 7 are most associated with those exhibited by clinical radiography leaders. Thus, the dimensional constructs of Inspiring a Shared Vision, Enabling Others to Act, and Encouraging the Heart have been added peripherally to the area of Leadership Behaviors on Figure 13 to demonstrate their importance as rated by participants. These clinical leadership dimensions have foundations within transformational and collaborative leadership practices. The lesser degree to which participants valued specific leadership behaviors when defining clinical radiography leaders is illustrated by the decreased size of that construct in Figure 13.

Dimensions 1 and 2 address the patient care and technical/radiographic skills utilized by clinical radiography leaders. These dimensions contained clinical leadership items that addressed clinical expertise, technical skills, and collaborative practices amongst healthcare providers (Careau et al., 2014; Chappell et al., 2014; Fewster-Thuente & Velsor-Friedrich, 2008; Hendry,

2013; Kutz, 2004; Leigh et al., 2015; Lovegrove & Long, 2012; Mannix et al., 2013; Patrick et al., 2011; Pepin et al., 2010; Stanley et al., 2017). It is this combination of clinical expertise, specialized knowledge and skills, and collaborative leadership practices that are leveraged when clinical radiography leaders make clinical decisions, provide patient care, and perform radiographic exams, that defines clinical leadership in radiography (Andersson, 2012; Budak & Özer, 2018; Careau et al., 2014; Chappell et al., 2014; Falender & Shafranske, 2007; Fewster-Thuente & Velsor-Friedrich, 2008; Francis et al., 2016; Hendry, 2013; Lovegrove & Long, 2012; Mannix et al., 2013; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010; Patrick et al., 2011; Stanley et al., 2017). Clinical expertise, specialized skills, and collaboration are strongly tied to the framework of collaborative leadership (Careau et al., 2014; Lovegrove & Long, 2012; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010). Collaborative practices exist, both within the department, as well as interprofessionally with other healthcare providers (Brewer et al., 2016; Eva et al., 2019; Fewster-Thuente & Velsor-Friedrich, 2008; Gjermundson, 2018; Joseph & Huber, 2015; Lovegrove & Long, 2012; O'Daniel & Rosenstein, 2008; Orchard et al., 2017; Orchard & Rykhoff, 2015; Patrick et al., 2011; Pepin et al., 2010).

The construct of experiential learning informs aspects of the clinical leadership model that was developed in this study. Experiential learning is the situation of clinical learning and clinical decision-making within the framework of clinical leadership (Beard & Wilson, 2018; Cook & Leathard, 2004; Leigh et al., 2015; Waller et al., 2017). This construct is addressed in Dimension 2 (Technical and Radiographic Skills). Participants highly correlated the utilization of sound clinical decision-making skills with the practice of clinical radiography leadership. Other CRLS items that are tied to the construct of experiential learning are the practice of ALARA

(Q5), competently manipulating radiographic equipment (Q6), adapting the exam to the patient's condition (Q7), and selecting appropriate technical factors (Q9). These skills and knowledge are learned first in the classroom setting and then applied during a student's clinical experience. It is this application of the learned skills and knowledge that contribute to the individual's evolution as a clinical radiography leader (Beard & Wilson, 2018; Chamunyonga et al., 2020; Cook & Leathard, 2004; Leigh et al., 2015; Waller et al., 2017).

Often, the development of clinical radiography leaders occurs through mentorship practices by clinical preceptors and staff technologists. These clinical mentors assist students and fledgling radiographers as they navigate the complex clinical environment (Dunn, 2012; Kowtko, 2010; Steele & Yielder, 2004; Yates, 2017). Mentors are the link between the experiential learning construct and clinical supervision. Mentoring and clinical supervision inform a large part of the clinical leadership, especially in radiography, where formal training and education are often not provided (Booth et al., 2017; Kester, 2017; Watson, 2009). As found within the literature, the concept of interpersonal understanding is linked to mentoring practices and clinical leadership (Adelman-Mullally et al., 2013; Cook & Leathard, 2004; Mannix et al., 2013; NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010; Patrick et al., 2011). Clinical radiography leaders leverage their emotional intelligence to support and motivate students and colleagues. Through their influence and collaborative leadership practices, clinical radiography leaders build trusting relationships between themselves and those they mentor. It is this trusting relationship that serves to influence positive clinical performance and outcomes. Clinical radiography leaders are able to display emotional intelligence through self-awareness and reflection (NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010; Patrick et al., 2011).

Clinical supervision is the support system (mentor) that assists students in developing the clinical expertise, clinical decision-making skills, and leadership behaviors that will permit them to function competently within the profession (Lyth, 2000; Snowdon et al., 2019). Clinical supervision may be leveraged as a means of developing clinical radiography leaders through reflective and collaborative leadership practices. Clinical supervision embraces many of the aspects of mentoring while situating them within the construct of experiential learning in the clinical setting (Lopes Monteiro Da Cunha et al., 2017; Lyth, 2000; Steele & Yielder, 2004). Clinical supervision is a collaborative process between the student and the mentor (clinical radiography leader) which involves reflection, modeling, feedback, and teaching (Chamunyonga et al., 2020; Dunn, 2012; Francis et al., 2016; Kowtko, 2010; Lyth, 2000; Steele & Yielder, 2004; Thompson et al., 2016; Yates, 2017). The leadership behaviors listed on the CRLS are linked to common clinical leadership attributes, such as respecting, influencing, creativity, and supporting. These characteristics and behaviors are contained on the CRLS within dimensions 3-7. Specific items that are linked to these processes include reflective practices (Q14), practicing enthusiastic and engaged communication (Q16-17), developing cooperative relationships with colleagues and peers (Q20), and providing feedback to ensure patient-centered care and positive student educational experiences (Q23, 25).

Practical Implications

The findings from this study could begin a dialogue surrounding the need to advocate for and develop clinical radiography leaders within the profession. As such, a common definition for clinical radiography leaders should be developed and accepted by the profession in order to establish a professional identity within the healthcare field. Many radiographers feel as though their contributions to patient care, diagnosis, and treatment are overlooked and unappreciated.

With the establishment of a recognized definition for a clinical radiography leader, this could create a shift in this area. By defining the clinical expertise, technical skills, and commonly practiced leadership behaviors that are encompassed by clinical radiography leaders, other healthcare professionals would recognize the unique contribution that our profession provides.

Defining clinical leadership within radiography is only part of the solution. Based on the data collected during this study, there is a significant degree of radiographers that do not view themselves as clinical leaders. This can be problematic when advocating for our position and rightful recognition as healthcare professionals. Through the refining of clinical radiography leadership, more radiographers will hopefully embrace their roles are clinical leaders, as well as recognize the role that clinical leadership plays in providing high quality patient care and positive student educational experiences.

Secondly, clinical leadership competencies should be developed as a means of creating clinical radiography leaders within the profession. The United Kingdom has developed a competency framework that addresses common leadership competencies within a wide array of healthcare professions (NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010). However, in order to best propel the profession and radiography leaders forward, clinical leadership competencies should be grounded in the practice of radiography. Competencies that could be included, based on participant ranked scores on the CRLS and the lack of inclusive leadership education within the curriculum, are:

- Clinical expertise
    - Technical and radiographic skills
    - Clinical reasoning and decision-making skills
    - Interprofessional communication

    - Professional practice standards
- Leadership frameworks and constructs
    - Collaborative leadership practices
    - Transformational leadership practices
    - Distributed or shared leadership
    - Experiential learning construct

- Clinical supervision and mentoring
    - Motivation and encouragement
    - Emotional intelligence
    - Reflection, assessment, and feedback

Clinical radiography leaders have the potential to positively affect patient outcomes and care while also contributing to positive student clinical experiences through mentoring practices. By better equipping students and technologists with the knowledge and skills necessary to function effectively as clinical radiography leaders, they will be able to elevate the level of the profession while ensuring high quality patient care. Our profession is at a crossroads where we can choose to elevate ourselves or return to our vocational roots.

Policy Implications

Currently, only 45 out of 50 states require licensure of medical imaging professionals (ASRT, 2021a). This statistic speaks to the need to develop a more stringent approach to patient safety with regards to the use of ionizing radiation to diagnose or treat pathological processes in patients. Without the push to elevate our profession through the implantation of clinical leader-

ship competencies within the medical imaging curriculum, patient safety is put at risk. The national professional organization in radiologic sciences, the ASRT, believes that there should be federally established minimum standards of education for those practicing in medical imaging (ASRT, 2021b). In addition, they oppose unlicensed or uncertified individuals utilizing ionizing radiation in medical imaging or radiation therapy procedures, as this would constitute a breach of responsibility with respect to patient safety and radiation safety (ASRT, 2021b).

Clinical leadership competencies, such as those outlined by the NHS, provide a framework for educating and training medical imaging professionals (NHS Institute for Innovation and Improvement & Academy of Medical Royal Colleges and their Faculties, 2010). This study could contribute to the development of a clinical leadership competency framework that encompasses the patient care skills, technical skills, and leadership behaviors necessary to function as a clinical radiography leader. This clinical leadership competency framework would develop clinical radiography leaders with advanced clinical decision-making skills, while providing significantly higher levels of patient care and radiographic imaging performance.

Additionally, I believe that there is a need to update the practice standards for radiography to include specific clinical leadership competencies. These competencies could be collectively developed by professionals during the annual governance cycle through the ASRT. Currently, the practice standards for the profession are more technical in nature and define the scope of practice for medical imaging professionals (ASRT, 2021c). By incorporating clinical leadership competencies and behaviors into the profession's practice standards, clinical radiography leaders could be created using specific criteria and outcomes. These competencies will provide a framework for educators to build upon as they adapt program curricula to address this growing area of practice. Over time, clinical radiography leaders may begin to collaboratively develop a

stronger clinical leadership framework that utilizes competencies common across multiple healthcare disciplines as a means of improving patient care and outcomes.

Limitations

The primary limitation with this study was the low response rate related to specific items on the CRLS. When asked to rate their level of identification as a clinical leader, 136 participants rated their level of identification as 3 (neutral) or lower. This indicates that a significant proportion of participants failed to identify as clinical leaders. Further, 116 participants did not feel as though they exhibit clinical leadership behaviors in practice, as indicated by selecting a rating of 3 (neutral) or lower. Lastly, 19.7% of participants completed only the survey items related to the technical aspects of the profession but did not complete survey items related to clinical leadership behaviors. This low response to clinical leadership items on the CRLS indicates a limitation and could signify a need to revise the survey instrument to better align with professional behaviors. Combining two separate survey instruments to develop the CRLS could have led to the lower response rate as the clinical leadership items may not have aligned as strongly with the practice of radiography as they did within nursing. Additionally, revising the CRLS in future iterations to include more behaviors aligned with collaborative leadership could improve the response rate on this section, as well as on the entire survey.

This lack of identification as clinical leaders and contingent of medical imaging professionals that do not view clinical leadership behaviors as an integral aspect of the profession demonstrates the need to develop clinical leadership competencies which would be taught within the curriculum. Avidity bias may also be considered a limitation with respect to this study and clinical leadership. The participants who responded to the survey may have had a bias which led them to highly rate clinical leadership behaviors.

Another limitation associated with this study was that it may not be representative of the entire population of clinical radiography leaders in the United States. Demographic information was collected related to geographical location, ethnicity, gender, professional designation, area of clinical practice, and the highest level of education. However, data were not equally stratified across each category. While broad conclusions may be drawn regarding the results of this study, they may not necessarily be representative of all radiographers in the United States. To better accomplish this, a more focused study should be conducted that is able to stratify response equally across the various demographic categories. Lastly, it would be interesting to compare data based upon the participants' years of clinical practice. This information could provide rich data relative to clinical leadership and the profession.

Suggestions for Further Research

This study is hopefully the impetus for future research related to the construct of clinical leadership that is more strongly situated in the practice of radiography. As illustrated by the data collected in the CRLS, there seems to be a lack of identification as clinical leaders in the radiography profession. Future research could focus on examining this lack of identification and determine methods for instilling clinical radiography leadership as a professional pillar of practice. These competencies could encompass leadership behaviors that are aligned with collaborative leadership practices or clinical supervision and mentoring. Once clinical leadership has been instilled as a professional construct, competencies related to clinical radiography leadership will need to be developed and instituted within educational curricula. By incorporating clinical radiography leadership competencies into educational curricula, educators will be better able to equip students with the tools necessary to function as leaders within the profession. Additionally, this will necessitate a more refined survey instrument that addresses distinct competencies and skills essential to serving as a clinical radiography leader.

Other areas of further research could focus on the connection between clinical radiography leadership and mentoring. Many aspects of clinical leadership behaviors align with the practice of mentoring. Research related to the tie between clinical leadership and mentoring could provide insight related to the effect of clinical radiography leaders on student clinical experiences. Studies such as this could establish competencies and best practices that lead to a more positive student experience in the clinical environment, as well as improved clinical care.

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APPENDIX

Clinical Radiography Leadership Survey (CRLS)

Instructions: In your role as a clinical radiography leader, you are being asked to reflect on various leadership behaviors and technical skills that you may use in practice. Below are statements describing a wide range of leadership behaviors and technical skills. Please read each statement carefully and rate each statement based on the importance of that skill or behavior when functioning as a clinical radiography leader.

Please rate the importance of the following:

1 = Not Important 2 = Slightly Important 3 = Moderately Important 4 = Important 5 = Very Important

Dimension 1: Patient Care Skills

1. Obtaining an appropriate patient clinical history.
2. Ensuring patient identification prior to initiating the exam.
3. Professionally communicating and providing instructions to the patient during the exam.
4. Observing and monitoring the patient throughout the exam.
5. Practicing ALARA and providing appropriate radiation protection methods during the exam.

Dimension 2: Technical and Radiographic Skills

6. Competently manipulates all radiographic and imaging equipment.
7. Adapts the radiographic exam to the patient's condition.
8. Utilizes sound clinical decision-making skills.
9. Selects appropriate technical factors for the exam being performed.
10. Produces diagnostic quality radiographic images.
11. Evaluates and critiques the radiographic image for pertinent anatomy and pathology.

Dimension 3: Challenging the Process

12. When I am concerned about the patient's or student's well-being, I take risks by questioning orders and treatments.
13. I am able to provide evidence-based rationale for my clinical decisions.
14. I engage in reflective practice and try to understand what went well and what did not.

Dimension 4: Inspiring Shared Vision

15. I negotiate with and support members of the interdisciplinary health-care team to help patients and students achieve positive outcomes.

16. I am enthusiastic and engaged when communicating with patients and students to achieve positive outcomes.

17. I engage in meaningful conversations with colleagues to foster our ability to provide patient-centered care and student educational opportunities.

Dimension 5: Enabling Others to Act

18. I actively listen to colleagues' diverse points of view.

19. I establish therapeutic relationships with patients and students that are based on trust.

20. I develop cooperative relationships with my peers and colleagues.

Dimension 6: Modeling the Way

21. I do my best to follow through on the promises and commitments that I make.

22. I try to ensure we work towards achievable goals, make concrete plans, and establish measurable objectives in achieving clinical outcomes.

23. I am committed to patient-centered care and positive student educational experiences.

Dimension 7: Encouraging the Heart

24. I publicly acknowledge my colleagues who exemplify commitment to professional values.

25. I provide positive feedback to colleagues when their actions contribute to the well-being of patients and students.

26. I find ways to celebrate colleagues' accomplishments.

Dimension 8: Global Clinical Leadership Scale

Please rate the extent to which you agree with the following:
1 = Strongly Disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly Agree

27. I consider myself a clinical leader in my practice.

28. I demonstrate leadership behaviors in my practice.

29. Please list any technical skills that you feel are important as a clinical radiography leader that have not been addressed in this survey.

30. Please list any leadership behaviors that you feel are important as a clinical radiography leader that have not been addressed in this survey.

Dimension 9: Demographic Information

Gender:

Female
Male
Prefer not to answer

Ethnicity:

White
African American
American Indian or Alaskan Native
Asian
Native
Hawaiian or Pacific Islander
Other ethnicity
Prefer not to answer

Geographical Location:

Select state

Professional Designation:

Radiology Director
Educator
Preceptor
Radiographer

Area of Clinical Practice:

University or College
Hospital
Imaging Center
Other

Level of Highest Education:

PhD or EdD
Master's Degree
Baccalaureate Degree
Associate's Degree
Certificate or Diploma

Adapted from:

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