Exploring the Definition of Clinical Radiography Leadership

Kerry O Dunn, EdD, R.T.(R)(M)

Purpose To develop a model of clinical leadership that encompasses the specialized technical skills and leadership behaviors exhibited by clinical radiography leaders.

Methods During this quantitative study, 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 and aggregated by dimension, with Pearson values greater than 0.3 indicating a moderate or strong relationship. The highest interdimensional correlation existed between dimensions 1 (patient care skills) and 2 (technical and radiographic skills) ($P = .715$), while exhibiting weak correlations to dimensions associated with clinical leadership behaviors. The confirmatory factor analysis revealed that a more global view of clinical leadership behaviors, in addition to patient care and technical skills, informed participants' view of clinical radiography leadership.

Discussion Participants viewed the technical aspect of their practice as the most salient, and survey items related to professional communication and using sound clinical decision-making skills correlated highly with the leadership behaviors exhibited and valued by clinical radiography leaders.

Conclusion By defining the clinical expertise, technical skills, and commonly practiced leadership behaviors that clinical radiography leaders encompass, other health care professionals will recognize the unique contribution that the radiologic science profession provides.

Keywords | *clinical competency, clinical leadership, collaborative leadership, health care leadership, medical imaging, radiography*

Although traditional models of leadership have been applied to the practice of health care, these models are considered incomplete because they fail to incorporate the technical aspects and skills required to practice in the clinical environment.[1-3] However, clinical leadership models allow for combining the technical skills required for clinical practice with the leadership behaviors demonstrated in the profession. In addition, although other health science disciplines might offer a generic definition of clinical leadership, this definition is not aligned with the practice of radiography or with the clinical expertise and clinical decision-making necessary to produce quality radiographs that lead to sound clinical diagnoses and treatment.

Clinical leadership is grounded in the theoretical framework of collaborative leadership and informed by the constructs of experiential learning and clinical supervision. Collaborative leadership is rooted in transformational leadership, distributed leadership, and clinical supervision. Clinical leadership is the clinical expertise, technical skills, and collaborative leadership practices necessary to work interprofessionally with other health care providers to make clinical decisions, care for patients, and perform radiography imaging examinations.[4-13]

In health care, there has been a shift toward collaborative models of leadership that allow for a more interprofessional view of leadership that permits individuals on the health care team to assume leadership roles throughout the patient care process.[4,5] Collaborative leadership involves more than the sum of individual contributions and instead views leadership from a holistic and team-centered perspective.[6]

Clinical leadership uses collaborative leadership as a 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 leads to a multidimensional approach when defining clinical leadership.[7,8] This multidimensional approach ultimately prepares individuals to assume clinical leadership roles, formal and informal, in their respective health care organizations.[8] Experiential learning is the placement of clinical learning and decision-making in the greater dimension of clinical leadership.[3,8-10] Experiential learning is a component that ties clinical supervision and mentoring to the theoretical framework of collaborative leadership and is an aspect of the multidimensional approach used to develop clinical leaders.[8] Clinical supervision has been defined as the structural support system that enables students to develop the requisite clinical knowledge and competence necessary to function in the profession.[11,12] A clinical learning support and mentorship model encourages clinical development and decision-making for students.[11] This model links the dual learning environments encountered in health care: the classroom where theory is practiced, and the clinical setting where knowledge and skills are applied.[13]

When radiographers function as clinical leaders, they exhibit increased levels of clinical expertise and clinical decision-making, which can positively affect patient imaging, diagnosis, care, and treatment. The inclusion of clinical leadership offers a framework that educators can use to create a paradigm shift from a technical career to a profession through the development of clinical leaders in the discipline. The purpose of this study is to explore a model of clinical leadership that more completely encompasses the technical skills and leadership behaviors exhibited by radiographers. Specifically, this study addresses the following research questions:

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

Methods

In the spring of 2021, the Georgia State University Institutional Review Board granted ethics approval for this study (IRB #H21505, Reference #364473). It employed a quantitative survey, the Clinical Radiography Leadership Survey (CRLS), to measure and examine clinical leadership practices most commonly performed by participants in radiography departments.

Development of the Survey Instrument

The CRLS consists of items about the technical skills required to practice radiography and the leadership behaviors commonly associated with clinical leadership. The survey included 30 items categorized into 8 dimensions:

- 1 – patient care skills
- 2 – technical and radiographic skills
- 3 – challenging the process
- 4 – inspiring shared vision
- 5 – enabling others to act
- 6 – modeling the way
- 7 – encouraging the heart
- 8 – global clinical leadership scale

Dimension 9 included demographic information.[5] Twenty-six items pertaining to skills and behaviors (dimensions 1-7) were surveyed using a Likert scale. Participants were asked to rate how important they considered the skill or behavior on a scale of 1 to 5, with 1 indicating not important and 5 indicating very important. The remaining 4 items were listed under dimension 8. Two items asked respondents whether they considered themselves to be clinical leaders and whether they demonstrated leadership skills in their practice. Possible responses to these items ranged from 1 (strongly disagree) to 5 (strongly agree). The other

2 items asked participants to list important technical skills and leadership behaviors not addressed in the survey.

The CRLS was derived from the Radiographers' Competence Scale (RCS) and the Clinical Leadership Survey (CLS).[14-18] The RCS was developed by Bodil Andersson to measure radiographers' professional competence and technical skill performance.[14] It was designed in 2 phases: development of the tool and evaluation of its psychometric properties.[14-16] The RCS is a 28-item Likert-scale questionnaire that measures the self-perceived competence of radiographers in clinical practice and has a strong internal consistency measurement (> 0.70).[14-16] The dimensions measured in the RCS correspond to dimension 1 (patient care skills) and dimension 2 (technical and radiographic skills) on the CRLS.[15]

The CLS was developed by Allison Patrick, Heather K Spence 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.[17] The CLS has a Cronbach α reliability coefficient of .86. Face validity was established by the research team, and content validity of the survey was evaluated by a panel of 6 experts chosen by the research team.[17] The CLS is a Likert-scale survey consisting of 15 items with categories that measure aspects of clinical nursing leadership.[17] The dimensions measured by the CLS correspond to dimensions 3 through 8 on the CRLS and are named similar to those on the CLS.[17]

To view the survey instrument, visit asrt.org/as.rt?uJKASM.

Participant Sample

The participant sample for this study was stratified across 4 categories: radiology directors, clinical preceptors, radiographers with experience in leadership roles, and radiography educators.[19] Study participants were purposively selected using membership rosters from the American Society of Radiologic Technologists (ASRT) and the American Registry of Radiologic Technologists (ARRT). Survey links were emailed from both agencies to the identified sample population.

Data Collection

Approximately 14 447 survey links were emailed to participants in the sampling frame to ensure a high response rate. The ARRT, a national credentialing agency, emailed the survey link to 4447 technologists credentialed in radiography. These individuals had previously identified their professional designation as a chief technologist, educational faculty, clinical preceptor, or director with the ARRT. The ASRT, the national professional organization, emailed the survey link to 10 000 technologists credentialed in radiography. All survey participants identified their professional designation in the demographic section of the CRLS. Included with each survey link emailed to participants was a letter explaining the nature of the research study, that participation in the study was voluntary, and that confidentiality will be maintained using a unique survey link for each participant.[15] Surveys were emailed in May 2021 and available for completion until July 2021. Consent was obtained in question 1 of the survey. No incentive was provided for participation.

Data Analysis

A confirmatory factor analysis of the data was conducted to confirm that all the intended leadership themes and technical skill assessments that form the CRLS were appropriately measured.[20] Data were correlated to each research question based on the individual survey items and the aggregated items of each dimension.[20] When examining correlations related to each dimension in clinical leadership, Pearson correlation coefficients greater than 0.3 were significant. Moderately correlated items possessed a Pearson correlation coefficient of 0.50 to 0.79. Highly correlated items exhibited a Pearson correlation coefficient of 0.80 to 1.00.

When examining the results of aggregated data from the survey items of 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 for radiography.[20] After confirmatory data analysis, a visual model of clinical leadership was created that incorporated technical skills and leadership behaviors contained in the CRLS.[18,20,21] The eigenvalue for each item on the CRLS also permitted the ranking of the technical skills and

leadership behaviors most closely aligned to this model of clinical radiography leadership.[18,20-22]

Results

This study sought to develop a model of clinical leadership that could be applied to the practice of radiography. This clinical leadership model encompasses the technical skills and leadership behaviors that clinical radiography leaders commonly exhibit. Using a quantitative survey, technical skills and leadership behaviors were examined in relation to the practice of clinical radiography leadership. This survey, the CRLS, asked participants to reflect on the various leadership behaviors and technical skills used as a clinical radiography leader. These behaviors and skills then were correlated to determine whether each dimension measured aligned with the practice of clinical radiography leadership as rated by the participants.

Four hundred thirty-two participants out of the acquired sample of 1056 completed the CRLS, a response rate of 40.9%. The participant sample was stratified across professional designation, location of clinical practice, and highest level of education (see **Table 1**).

A correlational analysis was conducted after data collection to measure the fit of the technical skills and leadership behaviors contained in the CRLS. The Cronbach α score for the 28-item CRLS was calculated as .902, which might be attributed to the internal consistency and reliability found in the original surveys from which the CRLS was derived. Participants were asked to rate their level of identification as a clinical leader and their demonstration of leadership behaviors in their clinical practice. The items then were analyzed based on the categorical stratifications of professional designation, area of clinical leadership practice, and highest level of education completed. The bar graphs in **Figure 1** display the level to which participants believed they demonstrated leadership behaviors in their practice as a radiographer. The bar graphs in **Figure 2** demonstrate study participants' self-identification levels as a clinical leader.

Table 1

Demographic Characteristics of Survey Participants

Professional designation[a]	n (%)
Radiology director	101 (31.9)
Educator	79 (24.9)
Preceptor	17 (5.4)
Radiographer	120 (37.9)
Location of clinical practice[b]	
University or college setting	82 (25.0)
Hospital	169 (51.5)
Imaging center	33 (10.1)
Other	44 (13.4)
Highest level of education[c]	
Doctoral degree	22 (6.8)
Master's degree	115 (35.4)
Bachelor's degree	97 (29.8)
Associate degree	66 (20.3)
Certificate or diploma	25 (7.7)

[a] *N = 317*
[b] *N = 328*
[c] *N = 325*

Research Question 1

Research question 1 addressed the commonly practiced clinical leadership behaviors of clinical radiography leaders. The scores from survey items related to demonstrated leadership behaviors ranged from 4.35 to 4.85 (see **Table 2**). Most notable was the disparity between the number of participants who perceived themselves as clinical leaders and those who demonstrated clinical leadership behaviors in their practice. Almost 90% of participants (296, 89.7%) considered themselves clinical leaders in their practice as a radiographer, while 95.8% (316) stated that they demonstrated leadership behaviors in their practice. Although this percentage appears high, 330 of the total 432 participants affirmatively answered the 2 items in the survey related to their own perceptions of being a clinical leader, meaning nearly 25% of the participants did not view themselves as clinical leaders or believe they demonstrated clinical leadership behaviors in their practice.

Research Question 2

Research question 2 addressed the common technical skills performed by radiographers that are associated with clinical radiography leaders. Participants rated

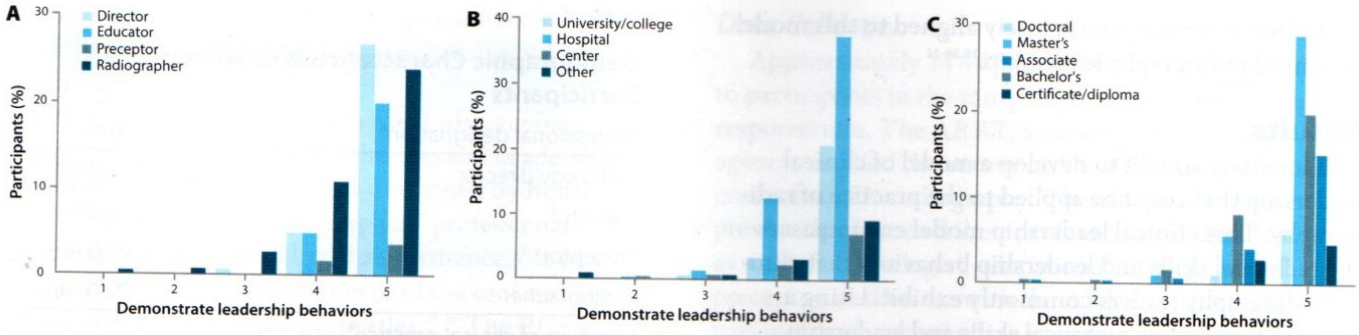

Figure 1. *Graph showing the degree to which participants believed they demonstrate leadership behaviors in their practice as a radiographer by professional designation (A), area of clinical practice (B), and level of highest education (C). Scale of rating: 1 = strongly disagree, 2 = disagree, 3 = Neutral, 4 = Agree, 5 = strongly agree. Figures courtesy of the author.*

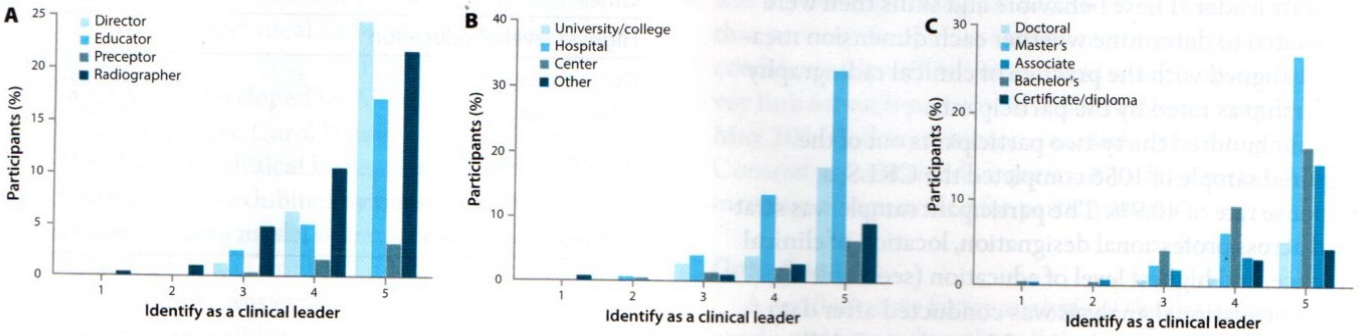

Figure 2. *Graph showing the degree to which participants identified as a clinical leader by professional designation (A), area of clinical practice (B), and level of highest education (C). Scale of rating: 1 = strongly disagree, 2 = disagree, 3 = Neutral, 4 = Agree, 5 = strongly agree. Figures courtesy of the author.*

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 associated with the practice of radiography as more salient to their practice, with mean scores ranging from 4.82 to 4.97 (see **Table 3**).

Correlations Between CRLS Dimensions

When examining correlations related to each dimension in clinical leadership, Pearson correlation coefficients greater than 0.3 were considered significant. Pearson correlation coefficients with significance levels of .01 and .05 are displayed in **Table 4**. When examining the dimensions related to leadership behaviors for research question 1, several dimensions exhibited moderate-to-strong correlations. The strongest correlation existed between D4 and D5, with a Pearson coefficient of 0.70. Based on the data examined, there was a high correlation between D1 (patient care skills) and D2 (technical and radiographic skills). This correlation aligns strongly with the statistical analysis conducted for research question 2. Study participants ranked the survey items in dimensions 1 and 2 as more salient with respect to their role as a clinical radiography leader, with mean scores for items contained in these 2 dimensions ranging from 4.82 to 4.97. Dimensions 1 and 2 exhibited weak correlations to the dimensions associated with leadership behaviors. This lack of a strong link between the more technical aspect

Table 2

Descriptive Statistics of Survey Items Related to Leadership Behaviors

Dimension 3 – challenging the process	N	M (SD)	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)	−1.62
I am able to provide evidence-based rationale for my clinical decisions.	343	4.62 (0.64)	−1.90
I engage in reflective practice and try to understand what went well and what did not.	343	4.61 (0.65)	−2.25
Dimension 4 – inspiring shared vision			
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)	−1.89
I am enthusiastic and engaged when communicating with patients and students to achieve positive outcomes.	343	4.73 (0.53)	−2.35
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)	−1.93
Dimension 5 – enabling others to act			
I actively listen to colleagues' diverse points of view.	343	4.57 (0.63)	−1.45
I establish therapeutic relationships with patients and students that are based on trust.	343	4.59 (0.62)	−1.70
I develop cooperative relationships with my peers and colleagues.	342	4.71 (0.54)	−2.26
Dimension 6 – modeling the way			
I do my best to follow through on the promises and commitments that I make.	343	4.85 (0.39)	−2.96
I try to ensure we work toward achievable goals, make concrete plans, and establish measurable objectives in achieving clinical outcomes.	343	4.62 (0.62)	−2.02
I am committed to patient-centered care and positive student educational experiences.	342	4.85 (0.40)	−3.08
Dimension 7 – encouraging the heart			
I publicly acknowledge my colleagues who exemplify commitment to professional values.	343	4.56 (0.73)	−2.15
I provide positive feedback to colleagues when their actions contribute to the well-being of patients and students.	343	4.63 (0.65)	−2.37
I find ways to celebrate colleagues' accomplishments.	342	4.35 (0.87)	−1.47

of radiography and specific leadership behaviors was reinforced throughout the data analysis.

Discussion

Based on the findings of this study, participants highly rated the technical and radiographic skills associated with the practice of radiography. Although 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 evident that the technical aspect of their practice was the most salient. A visual model of clinical radiography leadership was developed from the data that incorporates the leadership behaviors demonstrated and the technical skills performed by clinical radiography leaders. Findings showed an overlap between the participants' perceived leadership behaviors and the technical skills used in the practice of radiography. CRLS items related to professional communication and using sound clinical decision-making skills correlated highly with the leadership behaviors exhibited by clinical leaders and the technical skills valued in a clinical radiography leader.

Based on the data collected from the CRLS during this study, a developing clinical leadership model was

Table 3

Descriptive Statistics of Survey Items Related to Technical Skills

Dimension 1 – patient care skills	N	M (SD)	Skewness
Obtaining an appropriate patient clinical history.	428	4.83 (0.55)	−4.08
Ensuring patient identification before initiating an examination.	431	4.97 (0.26)	−12.56
Professionally communicating and providing instructions to the patient during the examination.	431	4.90 (0.39)	−5.08
Observing and monitoring the patient throughout the examination.	429	4.88 (0.41)	−4.63
Practicing ALARA (as low as reasonably achievable) and providing appropriate radiation protection methods during the examination.	429	4.85 (0.49)	−4.05
Dimension 2 – technical and radiographic skills			
Competently manipulating all radiographic and imaging equipment.	429	4.84 (0.45)	−3.61
Adapting the radiographic examination to the patient's condition.	429	4.86 (0.43)	−4.13
Utilizing sound clinical decision-making skills.	428	4.88 (0.41)	−4.49
Selecting appropriate technical factors for the examination being performed.	427	4.83 (0.5)	−3.95
Producing diagnostic quality radiographic images.	429	4.91 (0.38)	−5.97
Evaluating and critiquing the radiographic image for pertinent anatomy and pathology.	429	4.82 (0.49)	−3.28

Table 4

Correlations Between Clinical Leadership Dimensions (D1-D8)

Clinical leadership dimensions	D1	D2	D3	D4	D5	D6	D7	D8
Patient care skills (D1)	1	0.72[a]	0.33[a]	0.40[a]	0.34[a]	0.31[a]	0.20[a]	0.16[a]
Technical and radiographic skills (D2)	0.72[a]	1	0.38[a]	0.43[a]	0.33[a]	0.33[a]	0.22[a]	0.12[b]
Challenging the process (D3)	0.33[a]	0.38[a]	1	0.57[a]	0.53[a]	0.44[a]	0.44[a]	0.23[a]
Inspiring a shared vision (D4)	0.40[a]	0.43[a]	0.57[a]	1	0.70[a]	0.62[a]	0.50[a]	0.32[a]
Enabling others to act (D5)	0.34[a]	0.33[a]	0.53[a]	0.70[a]	1	0.62[a]	0.53[a]	0.31[a]
Modeling the way (D6)	0.31[a]	0.33[a]	0.44[a]	0.62[a]	0.62[a]	1	0.52[a]	0.33[a]
Encouraging the heart (D7)	0.20[a]	0.22[a]	0.44[a]	0.50[a]	0.53[a]	0.52[a]	1	0.26[a]
Global clinical leadership scale (D8)	0.16[a]	0.12[b]	0.23[a]	0.32[a]	0.31[a]	0.33[a]	0.26[a]	1

[a] *Correlation is significant at the .01 level (2-tailed).*

[b] *Correlation is significant at the .05 level (2-tailed).*

created. Participant data demonstrated that clinical radiography leadership is the amalgamation of leadership behaviors and technical skills used as a radiography professional. Further, there is a blending of both aspects of clinical practices, especially related to professional communication and sound clinical decision-making processes. As data were analyzed and correlated, results showed that radiography leaders find the application of technical and radiographic skills to be most important when defining clinical radiography leadership. **Figure 3** 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 importance placed on the technical aspect of the profession by radiography leaders. In addition, the items linked to technical, radiographic, and patient care skills that participants most strongly valued were 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, these dimensional constructs have been added peripherally to the area of leadership behaviors in Figure 3 to demonstrate their importance as rated by participants.

Dimensions 1 and 2 address the clinical radiography leaders' patient care and technical and radiographic skills. These dimensions contained clinical leadership items that addressed clinical expertise, technical skills, and collaborative practices among health care providers.[7,8,17,23-30] This combination of clinical expertise, specialized knowledge and skills, and collaborative leadership practices are leveraged when clinical radiography leaders make clinical decisions, provide patient care, and perform radiography examinations, and that defines clinical leadership in radiography.[7,14,17,23-25,27,28,30-34]

Limitations

There was a low response rate related to clinical leadership behaviors on the CRLS. This low response could signify a need to revise the survey instrument to better align with professional behaviors. Another limitation associated with this study is that it might not be representative of the entire population of clinical radiography leaders in the United States. Demographic information was collected related to geographic location, ethnicity, sex, professional designation, area of clinical practice, and highest level of education. However, data were not equally stratified for each category. Although broad conclusions might be drawn regarding the results of this study, they might not necessarily be representative of all radiographers in the United States. To better accomplish this, a more focused study should be conducted that can stratify responses equally in the various demographic categories.

Conclusion

The findings from this study could begin a dialogue surrounding the need to advocate for and develop clinical radiography leaders in the profession. Therefore, a standard definition for clinical radiography leaders should be developed and accepted by the profession to establish a professional identity in the health care profession. Many radiographers might feel their contributions

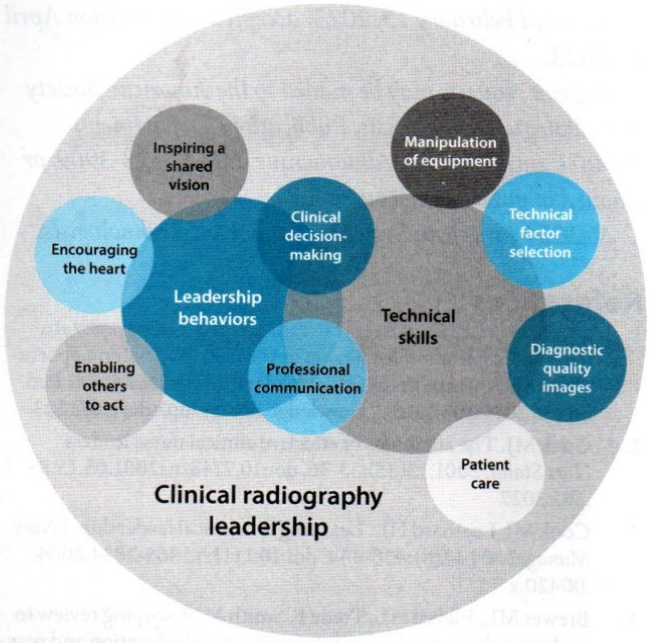

Figure 3. *Venn diagram illustrating the correlation between leadership behaviors and technical skills that compose clinical radiography leadership. Figure courtesy of the author.*

to patient care, diagnosis, and treatment are overlooked and unappreciated. Based on the data collected during this study, a substantial number of radiographers do not view themselves as clinical leaders; this can be problematic when advocating for their position and rightful recognition as health care professionals. Through the refining of clinical radiography leadership, the author hopes that more radiographers will embrace their roles as clinical leaders and recognize the role that clinical leadership has in providing high-quality patient care and positive student educational experiences. Establishing a recognized definition of a clinical radiography leader could create a shift in this area. When the clinical expertise, technical skills, and commonly practiced leadership behaviors that clinical radiography leaders encompass are defined, other health care professionals will recognize the unique contribution that the profession provides.

Kerry O Dunn, EdD, R.T.(R)(M), is radiography senior lecturer for Georgia Southern University in Savannah.

Received February 13, 2023; accepted after revision April 11, 2023.

Reprint requests may be mailed to the American Society of Radiologic Technologists, Publications Department, 15000 Central Ave SE, Albuquerque, NM 87123-3909, or emailed to publications@asrt.org.

References

1. Bloom RC. Leading the way in radiography: radiography students' perceptions of leadership in the field, leadership opportunities, and themselves as future leaders. *Theses Diss.* Published online 2014:303. http://knowledge.library.iup.edu/etd/1223
2. Cook MJ. The attributes of effective clinical nurse leaders. *Nurs Stand.* 2001;15(35):33-36. doi:10.7748/ns2001.05.15.35.38.c3027
3. Cook MJ, Leathard HL. Learning for clinical leadership. *J Nurs Manag.* 2004;12(6):436-444. doi:10.1111/j.1365-2834.2004.00420.x
4. Brewer ML, Flavell HL, Trede F, Smith M. A scoping review to understand "leadership" in interprofessional education and practice. *J Interprof Care.* 2016;30(4):408-415. doi:10.3109/13561820.2016.1150260
5. Iachini AL, DeHart DD, Browne T, Dunn BL, Blake EW, Blake C. Examining collaborative leadership through interprofessional education: findings from a mixed methods study. *J Interprof Care.* 2019;33(2):235-242. doi:10.1080/13561820.2018.1516635
6. Eva N, Wolfram Cox J, Tse HHM, Lowe KB. From competency to conversation: a multi-perspective approach to collective leadership development. *Leadersh Q.* Published online 2019:14. doi:10.1016/j.leaqua.2019.101346
7. Careau E, Biba G, Brander R, et al. Health leadership education programs, best practices, and impact on learners' knowledge, skills, attitudes, and behaviors and system change: a literature review. *J Healthc Leadersh.* 2014;6:39-50. doi:10.2147/JHL.S61127
8. Leigh JA, Wild J, Hynes C, et al. Transforming community services through the use of a multidimensional model of clinical leadership. *J Clin Nurs.* 2015;24(5-6):749-760. doi:10.1111/jocn.12668
9. Beard C, Wilson JP. *Experiential Learning: A Practical Guide for Training, Coaching, and Education.* 4th ed. KoganPage; 2018.
10. Waller L, Reitz M, Poole E, Riddell PM, Muir A. Experiential learning as preparation for leadership: an exploration of the cognitive and physiological processes. *Leadersh Organ Dev J.* 2017;38(4):513-529. doi:10.1108/LODJ-03-2015-0057
11. Lyth GM. Clinical supervision: a concept analysis. *J Adv Nurs.* 2000;31(3):722-729. doi:10.1046/j.1365-2648.2000.01329.x
12. Snowdon DA, Sargent M, Williams CM, Maloney S, Caspers K, Taylor NF. Effective clinical supervision of allied health professionals: a mixed methods study. *BMC Health Serv Res.* 2019;20(1):2. doi:10.1186/s12913-019-4873-8
13. Lopes Monteiro Da Cunha CMDS, Morais De Carvalho Macedo AP, Fernandes Ferreira Vieira IFG. Nursing students' perceptions of training processes in clinical supervision contexts. *Percepciones Los Estud Enferm Sobre Los Procesos Form En El Contexto Enseñ Clínica.* 2017;4(12):65-73. doi:10.12707/RIV16072
14. Andersson BT. *Radiographers' Professional Competence: Development of a Context-Specific Instrument.* Jönköping University; 2012. Accessed November 30, 2019. http://urn.kb.se/resolve?urn=urn:nbn:se:hj:diva-19717
15. Andersson BT, Christensson L, Fridlund B, Brostrom A. Development and psychometric evaluation of the radiographers' competence scale. *Open J Nurs.* 2012;2:85-96. doi:10.4236/ojn.2012.22014. P.
16. Andersson BT, Christensson L, Jakobsson U, Fridlund B, Broström A. Radiographers' self-assessed level and use of competencies-a national survey. *Insights Imaging.* 2012;3(6):635-645. doi:10.1007/s13244-012-0194-8
17. Patrick A, Laschinger HKS, Wong C, Finegan J. Developing and testing a new measure of staff nurse clinical leadership: the clinical leadership survey. *J Nurs Manag.* 2011;19(4):449-460. doi:10.1111/j.1365-2834.2011.01238.x
18. Dunn K. *Exploring a Model of Clinical Leadership Grounded in Radiography: Developing Clinical Radiography Leaders.* Georgia State University; 2022. doi:10.57709/28953931
19. Dillman DA, Smyth JD, Christian LM. *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method.* 4th ed. John Wiley & Sons, Incorporated; 2014.
20. Hoy WK, Adams CM. *Quantitative Research in Education: A Primer.* 2nd ed. SAGE Publications, Inc.; 2016.
21. Hays D, Singh A. *Qualitative Inquiry in Clinical and Educational Settings.* The Guilford Press; 2012.
22. Rahn M. Factor analysis: a short introduction, part 1. The analysis factor. Published September 10, 2012. Accessed December 7, 2020. https://www.theanalysisfactor.com/factor-analysis-1-introduction/
23. Chappell KB, Richards KC, Barnett SD. New graduate nurse transition programs and clinical leadership skills in novice RNs. *J Nurs Adm.* 2014;44(12):659-668. doi:10.1097/NNA.0000000000000144
24. Fewster-Thuente L, Velsor-Friedrich B. Interdisciplinary collaboration for healthcare professionals. *Nurs Adm Q.* 2008;32(1):40-48. doi:10.1097/01.NAQ.0000305946.31193.61
25. Hendry JA. Are radiography lecturers, leaders? *Radiography.* 2013;19(3):251-258. doi:10.1016/j.radi.2013.01.004
26. Kutz M. Necessity of leadership development in allied health education programs. *Internet J Allied Health Sci Pract.* 2004;2(2). doi:10.46743/1540-580X/2004.1045
27. Lovegrove M, Long P. Are radiographers prepared for the clinical leadership challenge? *Radiography.* 2012;18(4):230-231. doi:10.1016/j.radi.2012.08.002
28. Mannix J, Wilkes L, Daly J. Attributes of clinical leadership in contemporary nursing: an integrative review. *Contemp Nurse.* 2013;45(1):10-21. doi:10.5172/conu.2013.45.1.10
29. Pepin J, Dubois S, Girard F, Tardif J, Ha L. A cognitive learning model of clinical nursing leadership. *Nurse Educ Today.* 2011;31(3):268-273. doi:10.1016/j.nedt.2010.11.009