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A Systematic Review of Quality Improvement Initiatives Led by Radiology Nurses in Diagnostic Imaging Services

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Abstract

Background: The diagnostic imaging department is a high-risk, complex setting with patient safety, operational efficiency, and patient experience as the priorities. Within this setting, the radiology nurse's role has transformed significantly from procedural to core coordination and leadership of quality improvement (QI).

Aim: This synopsis synthesizes literature between the years 2015 and 2025 to examine the extent, impact, and characteristics of QI activities driven or sponsored by radiology nurses.

Methods: A Systematic review of peer-reviewed articles was conducted. Top scholarly databases were used to conduct literature searches, and studies were included if they described nursing-led QI projects within diagnostic imaging and quantified outcomes.

Results: The findings demonstrate how evidence-based care by radiology nurses is important in closing four areas of high value: patient safety (i.e., reducing contrast reactions and falls), patient experience, operational effectiveness, and safety culture. These evidence-based approaches yield significant reductions in adverse events, higher levels of patient satisfaction, increased throughput, and cost savings. Standardized checklists, anticipatory risk analysis, and robust patient education are among common success factors, but pitfalls like role ambiguity and limited resources remain.

Conclusion: Radiology nurses are strong leaders of QI in imaging and not just implementers. Providing them with formal leadership training and clear role delineation is necessary for the establishment of service quality and safety. Further research should also quantify the return on investment of nursing-led QI and its role in emerging technologies like artificial intelligence.

Keywords: radiology nursing, quality improvement, patient safety, diagnostic imaging, interprofessional collaboration

1. Introduction

Diagnostic imaging services form the backbone of modern medicine, enabling accurate diagnosis, guiding therapeutic intervention, and disease evolution monitoring. The environment and technology of such services are becoming progressively sophisticated, with advanced modalities, an aging population of patients with complex comorbidities, and pervasive calls for efficiency and throughput (Khalid et al., 2024). In this fast-paced environment, the potential for patient harm—ranging from contrast media reactions and sedation complications to procedural errors and communication breakdowns—remains a source of concern (Nasr et al., 2025). In response to this, a robust quality improvement (QI) culture has evolved into not only a wish but a necessity for radiology departments worldwide.

The radiology nurse is uniquely positioned at the nexus of patient care, technical process, and departmental function. Traditionally seen as the ones to evaluate patients, give meds, and be present when procedures were being performed, their roles have burst forth. Radiology nursing today encompasses patient advocacy, care coordination, risk management, and leadership in developing and implementing safety policies (Alhajeri et al., 2017). This tracks with the overall healthcare movement towards value-based care, wherein volume and outcome, and patient experience are all equally relevant (Shah et al., 2025). Consequently, radiology nurses have transitioned from being passive in QI to being active initiators and

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leaders of activities that have a direct impact on departmental performance.

Although nursing's role within radiology is acknowledged, there is no holistic synthesis of the specific QI activities initiated by them. Other reviews have often focused on the technical imaging features or the contribution of radiologists to quality and safety. This systematic review aims to close this gap by critically analyzing the literature over the past decade (2015-2025) to answer the following questions: What types of QI initiatives are being implemented by radiology nurses? What measurable impacts have these initiatives had on patient safety, experience, and operational metrics? What are the common strategies, tools, and frameworks that are being applied? And what are the persistent barriers and facilitators to success? By elaborating on the significant role of radiology nurses in QI, this review aims to legitimize their leadership role and provide a guide for future studies and projects.

Methodology

The study employed systematic review methodology in seeking, evaluating, and synthesizing literature that was relevant. A search strategy was developed and executed in four major electronic databases: PubMed/MEDLINE, CINAHL, Scopus, and Web of Science. The search was limited to articles in the English language from January 2015 to December 2025 to achieve the latest evidence. Relevant key words and their Boolean operators were: ("radiology nurse" OR "imaging nurse" OR "diagnostic radiography nurse*") AND ("quality improvement" OR "patient safety" OR "patient experience" OR "clinical governance" OR "protocol" OR "checklist") AND ("diagnostic imaging" OR "computed tomography" OR "magnetic resonance imaging" OR "interventional radiology").

Inclusion criteria were: (1) primary research studies (quantitative, qualitative, or mixed-methods) or in-depth case reports; (2) diagnosis in a diagnostic imaging department (including CT, MRI, Ultrasound, Nuclear Medicine, and Interventional Radiology); (3) evidence of a QI initiative where a radiology nurse was clearly identified as a leader, coordinator, or lead driver; and (4) evidence of measurable outcomes. Excluded were studies that considered only the role of radiographers/technologists or radiologists in isolation from nursing, were editorials or opinion pieces with no original data, or did not offer adequate information on the nursing component in the QI process.

Of the 1,248 articles obtained by the initial database search, after duplicates were removed, 895 titles and abstracts were screened against the inclusion criteria. This yielded 78 articles to be reviewed in full text. 40 studies were ultimately found to meet all listed criteria and were included within this synthesis. Data from all the studies were summarized in a standard table, taking note of authors, year, study design, setting, QI focus, leadership role of nursing, description of intervention, key outcomes, and barriers/facilitators reported. The results were then analyzed thematically to establish overarching domains of nursing-led QI.

The Evolving Role of the Radiology Nurse: From Task-Based Care to Quality Leadership

The role of the radiology nurse has been significantly altered, diverging from its past, task-focused origins. Previous activity focused on patient care procedures such as starting intravenous lines, administering medication, and acquiring vital signs for procedures (Williamson, 2016). While these duties remain central, they no longer function as a subset of a much smaller group. The radiology nurse of today is now a clinical expert, teacher, risk manager, and patient advocate, requiring an increased skill set consisting of critical thinking, high-level communication, and leadership abilities (Sison & Rodelas, 2024).

This transformation is made possible by several factors. Growing patient acuity in the outpatient imaging population, the complexity of interventional procedures, and the increased focus on preventing hospital-acquired conditions have all elevated the level of the nursing profession (Polonsky, 2019). Professional organizations have also begun to officially establish and promote the extended scope of practice. For instance, the Association for Radiologic and Imaging Nursing (ARIN) has established standards and competencies based on the nurse's role in developing a culture of safety and launching performance improvement projects (Gill & Shanta, 2020). This professional responsibility is a stepping stone for nurses to move to formal QI leadership roles, often serving as chair or co-chair of departmental safety, sedation, or contrast management committees (Whitebird et al., 2021).

The conceptual shift is from the nurse as a facilitator of the imaging process to the nurse as an integrator and conductor of the entire patient experience through the imaging department, including pre-procedure assessment and preparation, intra-procedure management, and post-procedure follow-up and care. It is in this holistic context that nurses identify regions of deficits in care, recognize systemic danger, and are empowered to conceptualize, implement, and evaluate solutions—the essence of quality improvement (Alexander et al., 2022).

Areas of Quality Improvement Guided by Radiology Nurses

A review of recent literature shows that quality improvement (QI) activities by radiology nurses are diverse and effective, consistently addressing areas of highest risk and operational importance in diagnostic imaging. They can be categorically grouped into four primary, interconnected domains that further the safety, efficiency, and humanity of imaging services. The subsequent sections outline these areas, with particular examples of nursing leadership and their quantifiable outcomes, which are given in summary in Table 1.

Improving Patient Safety and Clinical Outcomes

The most evident area of radiology nursing QI is the explicit improvement of patient safety and minimization of avoidable clinical harm. Nurses take a driving role in proactive and reactive approaches to deal with the inherent danger of imaging exams. In the domain of safety of contrast media, nursing efforts have evolved from the mere administration phase to take up risk management in a holistic manner (Sage et al., 2023). Yusop et al. (2025), for instance, demonstrated that a nurse-implemented pre-procedure screening protocol for renal insufficiency and allergies produced a 45% reduction in inappropriate scans ordered for high-risk patients and prevented potential contrast-induced nephropathy. Moreover, for acute responses, Burford et al. (2023) illustrated that a nurse-led emergency response high-fidelity simulation training program greatly improved emergency response, decreasing time-to-administer adrenaline by 60% and improving staff confidence from 45% to 88%.

In analgesia and sedation safety, in particular in Interventional Radiology and pediatric imaging, nurses have standardized care so as to minimize risks. Pavone (2019) implemented a nurse-initiated "Sedation Safety Bundle" consisting of a pre-procedure checklist, standardized monitoring, and validated recovery scores, and yielded a 70% decrease in hypoxia events and a 50% decrease in recovery times. Similarly, Mastro (2017) reported an active approach wherein nurse-initiated family education and non-pharmacological distraction interventions reduced the need for procedural sedation in pediatric MRI by 25%, enhancing safety and family-centered care.

Patient safety is further applied to the physical environment, for which falls prevention is a primary concern. Radiology nurses have developed context-specific risk assessment tools and practices. Flug et al. (2018) documented a 65% reduction in patient falls over an 18-month period after implementation of a nurse-initiated protocol that dictated risk screening during check-in and required interventions like non-slip footwear and assisted transfer for patients identified as high risk. Finally, in infection prevention, the development of advanced interventional procedures has introduced strict guidelines. Alruqi (2025) recorded a 40% reduction in surgical site infections following the implementation of a nurse-administered evidence-based pre-procedure skin antisepsis bundle with the use of chlorhexidine gluconate (CHG).

Optimizing the Patient and Family Experience

Radiology nurses play a key role in transforming the patient experience from one that generates anxiety to one that is a positive care experience, which directly affects rates of satisfaction. They accomplish this by intervening formally, which targets the informational and psychological needs of patients. Formalized patient education programs, which start in nurses' offices, have best served the purpose of de-mystifying procedures. Singer et al. (2025) reported that an education program designed by nurses, presented in various formats, decreased cancellations due to anxiety by 30% and profoundly enhanced communication satisfaction scores.

In addition to education, nurses tackle procedural anxiety directly through creative comfort initiatives. Long et al. (2022) reported a multi-component "Patient Comfort Initiative" in an MRI center in which nurses introduced environmental modifications (e.g., ambient LED lighting, video goggles), guided imagery, and individual pre-scan time with a nurse. This intervention had a marked decrease in patient self-reported anxiety and a 15% increase in successful first-time scanning without the use of sedation. Underpinning these efforts is the groundwork for establishing compassionate communication and emotional support standardization. Alharbi et al. (2024) demonstrated that simple, nurse-led protocols ensuring transparent communication of results with a fixed point of contact minimized patient mistrust and overall dissatisfaction by a great deal.

Operational Efficiency and Workflow Improvement

Taking their frontline position, radiology nurses are uniquely poised to find and address workflow inefficiencies that create delays, increase expense, and infuriate staff. A primary strategy has been pre-procedure process standardization. Haigh (2024) described how a nurse-developed digital checklist for contrast-enhanced CT scans guaranteed that prerequisites (e.g., lab work, consent) were completed before the patient arrived, which decreased last-minute cancellations by 55% and improved on-time start rates by 20%.

Nurses are also the leaders in optimizing resource utilization. Contrast extravasation, where a nurse-driven protocol regularized conservative management, reduced 80% of unplanned referrals for plastic surgery and generated substantial cost savings, was pointed out by Ding et al. (2018). Nurses also apply systematic process improvement methodologies to optimize throughput and turnaround times. In an active CT department, Rachh et al. (2021) described a Lean project initiated by a nurse that reengineered the patient flow through parallel processing and role definition with a 25% reduction in room turnaround time and daily scanning capacity.

Interprofessional Collaboration and Safety Culture

The ultimate success of any QI initiative hinges on the culture of the department, and radiology nurses are frequently drivers of enhanced interprofessional collaboration and psychological safety. They encourage structured communication to prevent errors. Dahiya et al. (2025) illustrated that

after nurses implemented required pre-procedure "timeouts" and post-procedure debriefings in the IR suite, staff-reported psychological safety and team perceptions increased by 35%. Additionally, nurses are central in creating a "Just Culture," conducting safety huddles and root cause analyses to shift attention away from person-blame toward system-based learning and improvement (Chau, 2024). This cultural output is most pivotal to creating a context in which continuous quality improvement can thrive. Table 1 and Figure 1 provide the prominent quality improvement initiatives led by radiology nurses, by domain, with noted targeted interventions, leadership roles, and documented outcomes

Figure 1: Domains of Radiology Nurse-Led Quality Improvement (QI) Initiatives

Table 1: Summary of Key Quality Improvement Initiatives and Documented Outcomes

QI Domain	Specific Initiative	Nursing Leadership Role	Key Outcomes	Exemplary Study
Patient Safety	Nurse-driven contrast-induced nephropathy (CIN) prevention protocol	Developed & implemented a renal risk assessment and hydration protocol.	45% reduction in inappropriate scans for high-risk CKD patients.	Lambert et al. (2017)
Patient Safety	Simulation training for acute contrast reactions	Led the design and execution of high-fidelity simulation drills for staff.	60% faster adrenaline administration; staff confidence increased by 43%.	Burford et al. (2023)
Patient Safety	Sedation Safety Bundle	Created and championed a standardized bundle for assessment, monitoring, and recovery.	70% decrease in hypoxia events; 50% reduction in recovery time.	Pavone (2019)
Patient Safety	Pediatric sedation reduction program	Led initiative using non-pharmacological techniques (education, distraction).	25% reduction in sedation requirements for pediatric MRI.	Mastro (2017)
Patient Safety	Falls Prevention Protocol	Developed a department-specific falls risk assessment and intervention plan.	65% reduction in patient falls over 18 months.	Flug et al. (2018)
Patient Exp.	Structured MRI education program	Created multi-format educational materials and delivery system.	30% reduction in anxiety-related cancellations; improved satisfaction.	Singer et al. (2025)
Patient Exp.	Patient Comfort Initiative (MRI)	Led environmental and procedural changes to reduce anxiety.	Decreased anxiety scores; 15% increase in first-time scan success.	Long et al. (2022)
Operational Efficiency	Digital pre-procedure checklist	Designed and integrated a digital checklist into the electronic health record.	55% reduction in last-minute cancellations; 20% improvement in on-time start.	Haigh (2024)
Operational Efficiency	Lean process improvement for CT throughput	Facilitated value-stream mapping and workflow redesign.	25% reduction in room turnaround time.	Rachh et al. (2021)
Safety Culture	Implementation of team time-outs & debriefs	Championed the adoption of structured communication tools in the IR suite.	35% increase in staff-reported psychological safety and teamwork.	Dahiya et al. (2025)

Foundational Strategies, Tools, and Frameworks for Successful QI

The success of radiology nurses' quality improvement (QI) projects is not an accident but

instead the outcome of the purposeful application of established methods of improvement and tools. These models provide a framework for movement from problem identification to implementation, measurement, and sustaining of a solution. The most ubiquitous of these is the Plan-Do-Study-Act (PDSA) cycle, appreciated for its iterative and pragmatic structure. This method allows the nurse leaders to pilot change on a small scale, for example, testing out a new patient education brochure in one patient population, getting fast feedback, refining the approach, and then progressively rolling out implementation, thereby minimizing risk and maximizing chances of success (Kelly & Cronin, 2015).

To counter more complex, cross-departmental workflow problems, radiology nurses are increasingly using advanced techniques like Lean and Six Sigma, often in collaboration with institutional quality improvement departments. Lean philosophy, directed towards eradicating waste (e.g., patient waiting time reduction or wasted staff motion), and Six Sigma, with its data-driven approach to eliminating process variation and defects, provide an ample toolkit for system change. Aakre et al.'s (2010) initiative, which utilized Lean's value-stream mapping to improve CT suite throughput dramatically, is an excellent illustration of this advanced application.

Regardless of the umbrella model employed, the most consistently used pieces of equipment within the radiology nurse's QI toolset are checklists and standardized protocols. They have been "championed" in healthcare by leaders like Atul Gawande and have served to "hardwire" safety and consistency into high-risk procedures. By breaking down evidence-based guidelines into specific, verifiable procedures for pre-procedure verification, contrast administration, and moderate sedation, checklists are effective at reducing reliance on fallible human memory and avoiding omission of essential action, thereby preventing common errors directly (LaValley, 2022; Almutairi, 2025). Underlying all these activities is their foundation in evidence-based decision making. Effective nurse leaders closely track metrics—everything from patient satisfaction scores and adverse event rates to cancellation rates and adherence to guidelines—using such data not only to measure effect, but also to develop a compelling, evidence-based case for change that wins over peers as well as administrators (Shah et al., 2025).

Barriers and Facilitators to Nursing Leadership in QI

Although the value of their efforts is eminently illustrated, QI leadership-seeking radiology nurses are confronted with a well-documented array of problems that discourage effort and creativity. Chief among these is role ambiguity within traditional hierarchical structures. In some environments, the nurse's vision of being a strategic QI leader is not always embraced, and initiatives continue to be perceived as the exclusive property of physicians or senior management, and this tends to keep the nurse's role isolated and narrow their authority (Ghamdi & Saleh, 2022). This is usually further compounded by a severe shortage of available time and resources. Nurses are typically asked to plan, implement, and evaluate QI projects in addition to their regular full-time clinical patient assignments, which leads to initiative fatigue, burnout, and ultimately, project abandonment (Acauan et al., 2021). Also, the human element of change presents a significant barrier in the form of built-in resistance from others who are accustomed to tried-and-true traditions, so nurses must spend a lot of energy managing change (Abraham et al., 2023). Finally, an educational hurdle barrier is inadequate QI science education; without formal education in methodologies, data analysis, and change management principles, even the most conscientious nurses may not be certain and ready to develop and execute sound, measurable projects (Morse & Warshawsky, 2021).

Alternatively, literature provides some key facilitators that can assist radiology nurses and advance their QI projects. The most essential is evident executive and administrative support. When hospital and department leadership provide not just words of encouragement but tangible resources—such as protected non-clinical time, a budget for the project, and official delegating authority—it confirms the nurse leader's role and provides the critical infrastructure for success (Wallace & Wallace, 2022). Top-down support is best when complemented by a robust culture of interprofessional collaboration and respect for each other. Interventions flourish in environments where radiologists, technologists, and nurses share a common mental model of patient safety goals and recognize themselves as colleagues in the quality improvement process (Dahiya et al., 2025). Investment in the professional development of nurses in the form of formal Quality Improvement training and mentorship is yet another powerful facilitator, equipping them with technical expertise and leadership skills to manage complex projects with ease (Kelly & Cronin, 2015). Lastly, creating areas to gather and acknowledge achievement is not a hollow gesture. By sharing the results and lessons learned from nursing-led QI, departments are able to create momentum, validate the work of their staff, stimulate continuing innovation, and build a virtuous circle of ongoing improvement (Nunnally et al., 2024). Table 2 highlights usual barriers (Barriers) against facilitators (Facilitators) in core organizational domains.

Discussion

This systematic review irrevocably demonstrates radiology nurses to be change agents of such enormity and quality and safety drivers of diagnostic imaging. The decade-long data show a clear trend: when radiology nurses are given the freedom to lead, they yield concrete, positive results on the

quadruple aim of improving patient experience, population health, cost, and healthcare providers' work-life. The activities range across the full gamut of care, from pre-procedure risk reduction to post-procedure follow-up, underscoring their complete impact.

Table 2: Barriers and Facilitators to Radiology Nurse-Led QI Projects

Category	Barriers	Facilitators
Structural & Cultural	- Hierarchical medical culture undermining nursing leadership. - Lack of a formal QI structure within the department. - "This is how we've always done it" mentality.	- Strong, visible support from department chair and administration. - A pre-existing, blameless safety culture. - Interprofessional committees with shared governance.
Resource-Related	- No protected non-clinical time for QI work. - Lack of budget for training or project implementation. - Inadequate data infrastructure for measurement.	- Dedicated FTE for nursing QI leadership. - Access to internal QI consultants or departments. - Integrated EHR tools for data extraction and reporting.
Knowledge & Skills	- Lack of formal training in QI methodologies (PDSA, Lean). - Limited experience in data analysis and presentation. - Unfamiliarity with change management principles.	- Institutional sponsorship for QI certification programs. - Mentorship from experienced QI leaders. - Access to templates and toolkits for project management.
Communication & Team Dynamics	- Resistance from colleagues fearing increased workload. - Poor communication leading to misalignment of goals. - Silos between different professional groups (e.g., techs vs. nurses).	- Early and continuous engagement of all stakeholders. - Use of structured communication tools (e.g., SBAR, huddles). - Transparent sharing of goals, progress, and results.

One of the prominent observations is the strategic use of human factors design and standardization. Nurses' interventions, such as checklists, protocols, and bundles, are effective interventions because they simplify complicated processes, reduce cognitive workload, and create consistent systems that are immune to human failure (Lambert et al., 2017; Werthman et al., 2021). Furthermore, their concurrent consideration of both hard clinical metrics (e.g., infection rates) and soft human metrics (e.g., anxiety levels of patients) reflects the unique, patient-centered voice that nursing brings to radiology's technical field (Sadigh et al., 2017; Long et al., 2022).

Nevertheless, the persistent existence of challenges like role ambiguity and resource deficiency indicates systemic undervaluing of this possibility. To allow for the best possible use of this resource by healthcare organizations, there needs to be a paradigm shift. Nurses in radiology must be brought into the leadership and governance structures of imaging departments formally. This includes creating dedicated QI leadership positions for nurses, providing them with authority and resources needed, and making investments in their professional development through education at higher levels in QI science and leadership (Johnson & Anzai, 2021; Evans, 2025).

Future studies should build on the synthesized results reported here. More multi-center randomized controlled trials must be done to provide higher-level evidence of support for specific nursing-led interventions. Economic evaluations quantifying the ROI on radiology nursing QI position funding would be a powerful advocacy strategy. Also, as AI starts to become integrated in imaging processes, investigating the domain of the radiology nurse in the effective, safe, and ethical deployment and surveillance of AI technologies is an exciting new area for QI (Han et al., 2024).

Conclusion

Overall, the past ten years have given strong evidence that the radiology nurse is a crucial leader in the pursuit of better quality and safer diagnostic imaging care. Their front-line position, supported by their patient advocacy and clinical expertise, allows them to identify strong gaps and create potent, long-lasting solutions. The literature reviewed documents their success in improving safety measures, enriching patient experience, streamlining operational efficiency, and developing team culture. To disregard this potential is to forego a valuable asset. The challenge and the threat to imaging departments is the purposeful breaking down of barriers and the deliberate establishment of an environment whereby radiology nurses are empowered, trained, and enabled

to take charge. In so doing, the diagnostic imaging profession can continue to evolve not only in its technological capabilities but also in its unwavering commitment to exceptional patient care.

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