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PERSPECTIVES

Applying Quality Improvement Science to Patient Safety: Strategies, Frameworks, and Sustainable Solutions

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Abstract: Healthcare is a constantly evolving field enriched by new technologies, medications, and treatment methods. However, these continuous innovations also introduce new complexities that can pave the way for medical errors to arise. As a result, quality of care and patient safety are always at stake, highlighting the imperative to set up processes to avoid errors in healthcare at any cost. This need for systematic approaches has led to the adoption of *Quality Improvement Science* (QIS), which deals with the early identification of problems and suggests ways to prevent them in a proactive manner. This study explores the principles of QIS as applied to patient safety, examining various approaches and proposing strategies to implement effective solutions. It further investigates methods for constant quality improvement, emphasizing the roles of technology and human resources in enhancing healthcare quality and patient safety. In particular, it studies how artificial intelligence (AI) strengthens information gathering and organization to provide practical insights. Furthermore, this study discusses the enablers and barriers to successful implementation of these quality improvement processes. Crucially, this paper provides a comprehensive and actionable framework for selecting appropriate QIS tools and indicators, developed through a structured synthesis of QIS literature and represented as decision flows that enable systematic care delivery problem identification and analysis.

Keywords: patient safety, risk management, quality improvement science, quality of care, healthcare sustainability

Introduction

The core of any healthcare endeavor is to provide safe and efficient patient care. This requires continuous evaluation to enhance patient experience and outcomes.[1] Additionally, high-quality care should be affordable and integrate the latest technology into its delivery model. Healthcare quality has, therefore, been a long-standing subject of discussion. For instance, in 2006, the World Health Organization (WHO) defined quality of care as "a process for making strategic choices in health systems".[2] Similarly, in 2013, the Institute of Medicine (IOM) defined healthcare quality as the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.[3] However, despite several initiatives aimed at improving healthcare quality and safety, these goals remain largely unmet. Challenges persist in reducing medical errors,[4] implementing evidence-based practice,[5] reducing healthcare disparities,[6] achieving care variation reductions (CVRs),[7] and eliminating redundant and wasted resources.[3]

Consequently, quality-related challenges in healthcare stem from overuse, underuse, and misuse. Overuse is a situation where potential harm from a healthcare product or service outweighs its benefits. Underuse is when a product or service that would likely provide a benefit was not provided, and misuse occurs when a product or service results in a preventable complication.[8] Hence, healthcare organizations need to adopt defined principles to address overuse, underuse, and misuse, thereby enhancing healthcare quality and patient safety. The management principles outlined by W. Edwards Deming offer a framework through which involved organizations can improve healthcare quality and safety without resource wastage.[6] This

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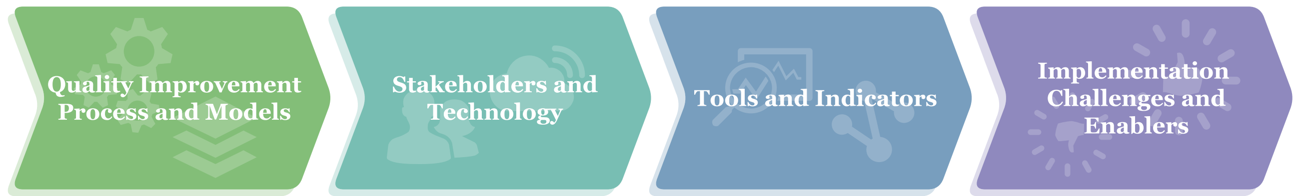

Figure 1 Roadmap outlining the progression of analysis on quality improvement science for patient safety.

highlights the increasing importance of the concept of *Quality Improvement Science* (QIS), also known as the *Science of Improvement*. QIS is a scientific endeavor driven by goals and outcomes, aiming to bring about sustained, affordable, and meaningful improvement in healthcare quality and safety. It aims to bridge the gap between best practices and actual care delivery, helping to identify and mend the lacunae in healthcare delivery.

According to the Institute for Healthcare Improvement (IHI), the science of improvement is an applied science that emphasizes innovation, rapid-cycle testing in the field, and spread in order to generate learning about what changes, in which contexts, produce improvements.[9] This applied science combines multidisciplinary expert knowledge with improvement methods and tools. Multidisciplinary teams draw experts from clinical science, systems theory, psychology, statistics, and other disciplines.[10] QIS applies across healthcare products, service providers, organizations, policymakers, and regulatory agencies. Thus, QIS plays a substantial and continuous role in improving quality and reducing cost throughout the entire spectrum of healthcare.[11] Given that improvement depends on trustworthy measurement and interpretation in care delivery, technological approaches for sensing, automation, and analytics are most effective when combined with human expertise. Accordingly, combining digital tools with patient-facing connections leads to more durable gains than either approach alone.

This study provides a detailed discussion on QIS, its role, and effective integration into the healthcare system for safety, timeliness, affordability, and continuous improvement. Building upon these foundations, this paper proposes a practical framework to guide healthcare professionals through the systematic application of QIS for patient safety. This proposed framework emerges from a structured analysis of quality improvement, as outlined in Figure 1. Furthermore, Figure 2 presents a high-level knowledge map visually interconnecting these concepts and highlighting the study's depth.

The remainder of this paper is organized as follows: Section 2 discusses foundational concepts, processes, and models of quality improvement. Section 3 identifies the roles of stakeholders and technology. Section 4 explores available tools and indicators. Section 5 addresses implementation challenges and enablers. Section 6 presents a detailed discussion of the framework's implications and challenges, and Section 7 concludes the study with key takeaways and future directions.

Background: Healthcare Quality Improvement

Effective quality provision requires clear and categorical definitions. Starting in 2001, the Institute of Medicine (IOM) emphasized patient-centered care as a key driver toward quality, highlighting its respect for patient values, preferences, and expressed needs; involvement of family and friends; assurance of physical comfort; provision of emotional support; coordination and integration; and informative, communicative, and educative aspects.[3] While patients are the direct recipients of healthcare, and thus a primary focus, healthcare quality encompasses many other attributes not directly patient-centric, as its definition has evolved over time. The Agency for Healthcare Research and Quality (AHRQ) defines QI as "doing the right things and doing them right", often associated with improved patient outcomes. This view of QI represents a more comprehensive indicator of quality compared to focusing solely on guideline-based therapies or safety.[12] Earlier research identified four attributes defining healthcare quality: effectiveness, safety, having a culture of excellence, and achievement of desired outcomes. Based on these attributes, researchers defined healthcare quality as "the assessment and provision of effective and safe care, reflected in a culture of excellence, resulting in the attainment of optimal or desired health".[13]

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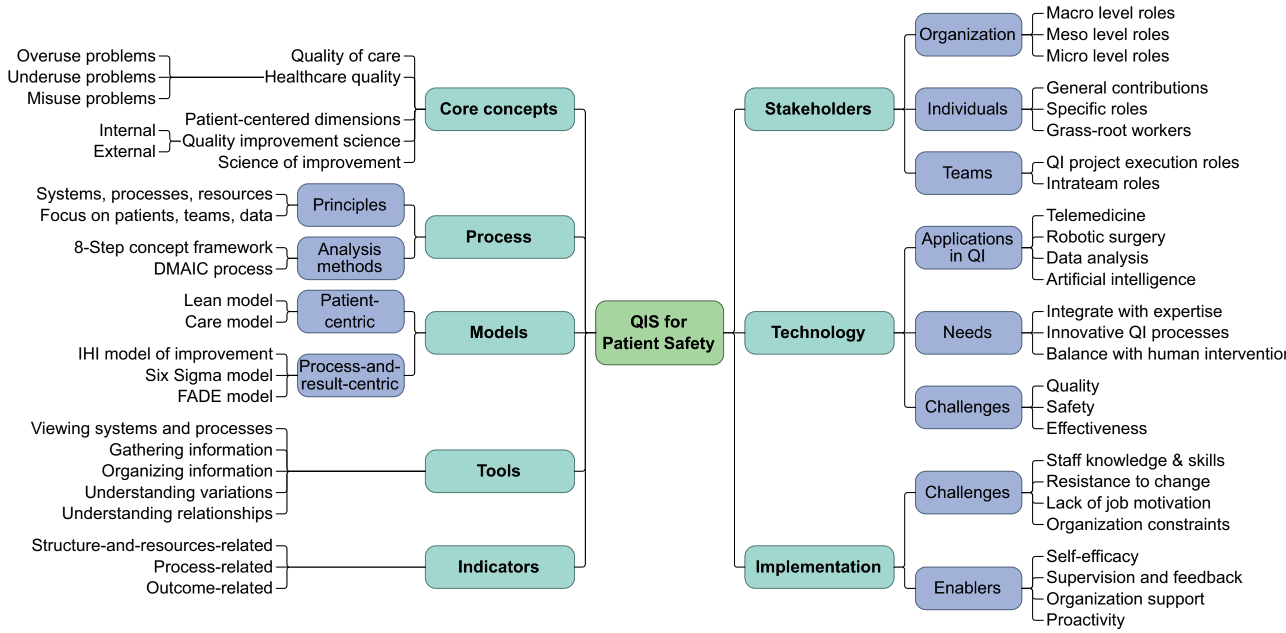

Figure 2 Comprehensive knowledge map illustrating the key concepts of quality improvement science in patient safety.

QI can be internal or external. Internal QI focuses on the clinician-patient relationship, aiming to increase patient and provider satisfaction by simplifying procedures, reducing costs, and enhancing medical care, care delivery, workplace morale, and productivity. External QI, conversely, emphasizes clinician education, health policies, accreditation, and certifications for benchmarking quality care.[8] Healthcare organizations and practices utilize both forms of QI through quality control and quality assurance measures, to implement, measure, and improvise, forming the integral basis of QIS.

Quality Improvement Process

Though the QI process varies by need, it should align with available systems, processes, and resources, prioritizing patients, team involvement, and generated data.[14] Healthcare delivery relies on specific clinical guidelines, comprising multiple steps. Accordingly, healthcare organizations are effectively clinical microsystems that involve providers and patients.[15] Choosing and implementing QI projects in healthcare can be challenging, particularly when a QI process is initiated in response to an adverse event or patient complaint. Such incidents trigger urgent stakeholder meetings to identify rapid improvement measures and prevent recurrence. However, whenever possible, QI projects should be prioritized based on urgency and *impact*, or *feasibility* and *need* criteria.

Most healthcare organizations now incorporate some quality checks into their systems. However, evidence shows that despite these measures, some aspects of patient care improve while others worsen. This highlights the importance of identifying specific quality attributes that require prioritized focus,[13] and analyzing the success or failure of various quality improvement efforts. Earlier research provided an eight-step concept analysis framework for examining health-care quality: concept selection; aim and purpose of analysis; uses; quality attributes; constructing a model case; expanding the concept to similar and related cases; identification of antecedents and consequences; and defining the empirical referents.[16]

Another method for analyzing the quality is the five-phase Define, Measure, Analyze, Improve, Control (DMAIC) process.[17] In the first step, the QI activity is defined, including its purpose, goals, and patient requirements. Next, performance of the QI activity is measured using various processes and analysis methods. Subsequently, a root cause analysis identifies failures and defects, after which the QI process is improved through different approaches. The final step establishes a quality control plan.[18]

Table 1 Comparative Characterization of QI Models in Healthcare

Category	Model	Primary Focus	Guiding Principle	Methodology
Patient-centric	Lean Model	Waste reduction	Maximize value	Value stream mapping; continuous flow
	Care Model	Disease management and prevention	Patient-provider interactions	Promote patient engagement
Process-and-result-centric	IHI Model for Improvement	Iterative improvement	Learn as you go	PDSA cycles
	Six Sigma Model	Process optimization	Data-driven; minimize variation	DMAIC and DMADV
	FADE Model	Structured process improvement	Problem-solving; monitored execution	FADE steps

AI applications are increasingly supporting patient care and quality improvement by enabling automated process monitoring and large-scale analysis of unstructured clinical information, thereby facilitating timely, patient-centered decisions.[19]

Models of Quality Improvement

The next challenge is to select the suitable QI model according to the need. All have several common characteristics such as setting the right goals; charting a structured path to achieve them cost-effectively, efficiently, and in a timely manner; ensuring accountability for roles in healthcare delivery; applying scrutiny and analysis; maintaining a constant improvement cycle; and upholding transparency.[12] There are five primary types of improvement models: two are patient-centric in their approach, and three are process-and-result-centric. A summary of these models, including their primary focus, methodology, and guiding principles, is presented in Table 1.

Patient-Centric Quality Improvement Models

Lean Model

This model is based on the patient's perspective, mapping the value stream from patient needs. It emphasizes how value flows to the patient cost-effectively and in a timely manner.[12]

Care Model

This model promotes high-quality disease management and prevention by focusing on fundamental aspects of care. It engages patients in their own care and facilitates active interactions between patients and healthcare providers.

Process-and-Result-Centric Quality Improvement Models

The IHI's Model for Improvement

Developed by Associates of Process Improvement (API) and based on W. Edwards Deming's work,[9] this model facilitates QIS application by defining the improvement aim, designing a specific idea and plan, and outlining measurement strategies. Small tests are then planned and executed, with lessons applied to larger test cycles, leading to effective and safely implementable solutions.[20] Plan-Do-Study-Act (PDSA) cycles are the backbone of QI in healthcare. QI teams analyze extensive data to design these cycles, which involve repeated validity tests to adapt and implement the QI model effectively. Each cycle assesses the success of the intervention, continuing until a successful intervention is ready for implementation. Rapid cycle improvement (RCI) offers a more practical, real-time approach to testing QI changes. This method involves conducting several small, interlinked PDSA cycles concurrently within a physician practice to assess various care aspects, such as scheduling, diagnostics, and medication, allowing for improved quality and easy progress tracking. In larger hospitals, these cycles can be implemented physician-wise or department-wise.[21]

Six Sigma Model

The DMAIC approach is integral to the Six Sigma model.[17] This model also uses the DMADV (Define, Measure, Analyze, Design, Verify) methodology for developing new processes.[22]

FADE Model

The FADE QI model involves four broad steps:[23] Focus on the process to be improved; Analyze the data collected; Develop action steps for improvement; and Execute the action plans and evaluate and monitor the QI measure to ensure success.

Stakeholders and Technology

Organization

Micro, meso, and macro healthcare systems, and all individuals involved in healthcare delivery, bear responsibility for providing quality care safely, efficiently, and timely.[24] At the macro level, national health systems contribute toward QI through regulatory systems, national policies and priorities, financing, and accreditation. At the meso level, hospitals advance QI by improving structures, cultures, practices, systems, processes, and strategies. They achieve this by recruiting, supporting, and retaining an efficient workforce; building quality- and safety-centric work processes; optimally utilizing generated data; and ensuring readily available technical resources to support improvement. At the micro-levels, organizational teams and departments focus on communication, competence, clinical and care models, professional work, and relational issues to contribute to QI.[11] QI teams can brainstorm and analyze root causes of problems, assess their impact, plan successful QI initiatives, analyze results, and implement them. Various techniques like graphs, affinity diagrams, Pareto charts, storyboards, and voting can be employed. Practice Facilitators (PFs) and QI coaches can facilitate these brainstorming sessions. Initiatives starting at the micro-level can significantly impact meso and macro levels.[8]

Individuals

Individuals contribute to QI by focusing on patient orientation, building competency, improving work quality, sharing responsibility with managers, and fostering a cooperative work environment.[25] Patients and the broader community also contribute by providing valuable feedback, which healthcare organizations and providers can use to enhance care delivery and experience.[26] Frontline personnel doing grass-root work often possess the best solutions for further improvement. Effective communication among team members and easy connectivity with project leaders are vital for engaging the team, facilitating better solutions, and effectively achieving QI goals.[27]

Teams

For effective execution of a QI project, a team requires Specific, Measurable, Attainable, Relevant, and Time-bound (SMART) goals. Consequently, every QI project typically includes an expert lead and a project manager. The Expert provides subject matter guidance. The team leader, usually the project manager, plays a significant role in building a strong, purposeful team. A good team leader empowers everyone to work towards the goal and holds them accountable for their contributions.[8] While there is no absolute rule regarding team size, a group of 5 to 15 members usually works effectively. Very small teams often face resource crunch, whereas overly large teams complicate execution and coordination. Nevertheless, no team can be effectively managed and channeled toward a QI goal without dedicated, committed leadership and fully accountable members.[8]

Technology

Technology is revolutionizing healthcare delivery and has resulted in new healthcare delivery microsystems. Telemedicine, for instance, connects clinicians and patients, proving valuable in diagnosis and decision-making. Technology also plays a vital role in enabling robotic surgery, facilitating extensive data analysis for modeling diagnosis, treatment, and prevention approaches, and utilizing AI to identify patients at risk and improve their diagnosis and management.[19] However, a pressing need exists to integrate engineering and technology knowledge with healthcare expertise. This integration brings new challenges for delivering quality healthcare safely and effectively. Given the constant innovation in this area, there is an urgent need for innovative QI processes that balance technology and human intervention. Therefore, QI processes that integrate both are essential, giving QIS a pivotal role in the evolving telemedicine and technology-driven healthcare sector.

Framework for Tools and Indicators

Once a QI model is selected, specific tools are deployed for its implementation. These tools are required as healthcare professionals, who are often tasked with implementation, may not have adequate specialized training and expertise. Thus, these tools serve to train professionals in various QIS aspects.[9] Table 2 summarizes essential QI tools, their categories, descriptions, and uses. The selection prioritizes tools that are well documented in the QI literature, applicable in healthcare delivery, and span all QI phases and data modalities.

Given that the QI process is based on systems, processes, activities, and outcomes, quality improvement indicators are similarly categorized by structure, resources, processes, and outcomes.[42] These indicators are summarized in Table 3, although more tools and methods may also be incorporated based on the needs and requirements of a specific healthcare setting.

The proposed framework in Figure 3 employs a decision flow diagram that guides the selection of QI tools and indicators. It mirrors the typical stages of a QI cycle by separating problem understanding, data collection, and data analysis. The first phase emphasizes problem framing and process visualization. The second phase commits to what is

Table 2 Summary of Some QI Tools, Their Category, Description and Uses

Category	Tool	Description	Use of Tool
Viewing Systems and Processes	Flow Diagram	A table or a matrix aligns the steps in a QI process from beginning to end and shows their interdependence.	Graphically presents a process; identifies non-added value activities.[28]
	Process Mapping	Maps and interlinks guideline delivery steps within the clinical microsystem to provide timely, effective, efficient, and safe patient-centric care.	Visualizes complex process delivery and determines its step-by-step flow, timing, handoffs, and outputs.[15]
Gathering Information	Survey	Provides immediate feedback, permitting rapid learning and completion of PDSA cycles; easy to use.	Relies on using standardized and tested data collection approaches.[29]
	Object Detection and Monitoring	Employs machine vision-powered sensors to collect high-quality process data on a large scale.	Detects events and tracks their progress for automating data gathering.[30]
Organizing Information	Affinity Diagram	Organizes brainstorming session output; generates, organizes, and consolidates information related to a process or problem.	Brainstorming sessions to better understand the discussed topic.[31]
	Cause and Effect Diagram	Identifies all root contributors to a problem and how they contribute; facilitates root cause analysis and effective solutions.	Structures brainstorming sessions and sorts ideas into useful categories.[8]
	Matrix Diagram	Arranges data to understand relationships for decision-making; shows the relationship strength and roles of parties or measurements.	Shows the relationship between two, three, or four information groups.[32]
	Tree Diagram	Visualizes the structure of a problem, plan, or any opportunity of interest.	Breaks down broad categories into increasingly finer levels of detail.[33]
	Force Field Analysis	Summarizes the forces supporting or hindering change.	Compares the positives and negatives of a situation; reflects openly on the underlying root causes.[34]
	Semantic Analysis	Processes unstructured text data using natural language processing (NLP) and large language models (LLMs) to categorize fields and reveal trends.	Analyzes data such as clinical notes, feedback, survey responses based on semantics; identifies hidden problems; quantifies qualitative data.[35]

(*Continued*)

Table 2 (Continued).

Category	Tool	Description	Use of Tool
Understanding Variations	Run Chart	Studies variation in data over time to under- stand the impact of changes on measures.	Tracks data over time to assess performance and patterns; assesses whether changes result in improvement.[36]
	Control Chart	Differentiates between special and common causes of variation.	Depicts graphically whether sampled processes are meeting their intended specifications.[37]
	Pareto Chart	Focuses on areas of improvement with the greatest impact.	Visually analyzes data sets related to a specific problem or issue.[38]
	Frequency Plot (Histogram)	Helps understand location, spread, shape, and patterns of data.	Graphically displays data for easy interpretation; shows data frequency, centering, variation, and shape.[39]
Understanding Relationships	Scatterplot	Analyzes the relationships between two variables and tests for possible cause-and-effect.	Validates the relationship between causes and effects; helps understand the causes of poor performance.[40]
	Two-way Table	Helps understand cause-and-effect for qualitative variables.	Organizes the data and tease out relationships between variables. [41]

Table 3 Examples of Indicators Related to Structure, Process, and Outcome

Indicator	Description	Use Cases
Structure-and-resources-related	Assesses factors, resources and attributes of the setting influencing the delivery of quality care services.[42]	• Assign physiotherapists or dieticians to specific hospital units. • Access to specialized units, eg, stroke unit. • Access to specialized diagnostic technology, eg magnetic resonance imaging (MRI) scan. • Revision of clinical care guidelines and its revision schedule.
Process-related	Assesses and evaluates the performance of what the healthcare provider did for a patient.[42]	• Measure proportion of patients with myocardial infarction receiving thrombolysis. • Measure proportion of diabetic patients given regular foot care. • Measure proportion of patients treated according to disease-specific care guidelines. • Measure proportion of patients seen by a specialist within 24 hours of referral.
Outcome-related	Assesses and measures the quality of care and services.[42]	• Track intermediate indicators of care such as lab results. • Monitor end results of a disease-specific care, eg, morbidity, mortality, quality of life, patient satisfaction.

measured and why, while remaining agnostic about specific analytic methods. The third phase aligns analytic choices with data character and monitoring intent, and it differentiates trend tracking from stability assessment and diagnosis from prioritization.

The structure of the decision flows in forward and return paths that protect against uninformed decisions. For example, the flow ensures that the understanding of the problem is sufficient before moving to the data collection stage. Additionally, depending on the type and shape of the collected measurements, the flow suggests utilizing a sequence of specific analysis tools for time-series, quantitative, categorical, and text-based data. Individuals such as nurses and service leads apply scoping tools and structuring diagrams to converge on a problem statement. At later stages, a multidisciplinary team performs data

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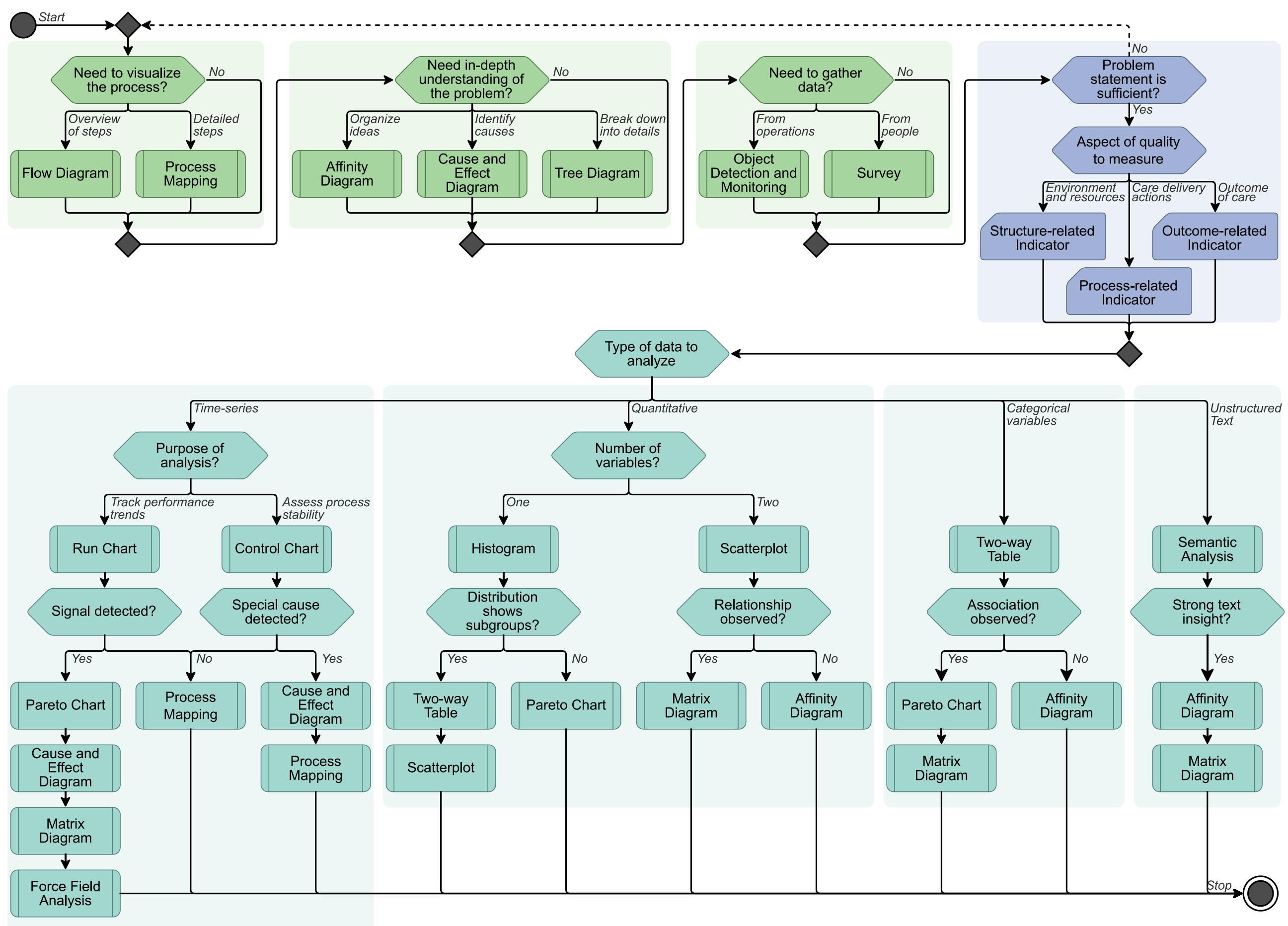

Figure 3 Decision flow diagram for selecting quality improvement tools and indicators. The flow comprises green, blue, turquoise stages for problem understanding, data collection, and data analysis, respectively.

collection by selecting the indicators, sensing plan, and assigning a measure lead who ensures data collection feasibility and screening. The teams also perform data analysis using prioritization tools to rank contributors, in addition to small-scale PDSA cycles that let the team leader ensure decisions advance only when the problem is understood and measurements are trustworthy. Throughout the stages, practice facilitators and QI coaches assist individuals and teams toward successful execution of the QI process.

Implementation Challenges and Enablers

Despite the tremendous potential of various QI tools to improve healthcare, their implementation faces numerous challenges. Key challenges include:

1. **Limited staff knowledge and skills**. A study[43] found that QI implementation assistants reported limited educational backgrounds among some healthcare staff, which impeded skill and knowledge acquisition. They also noted that increased workload and implementation difficulties stemmed from challenges with staff receptiveness and skill development.
2. **Resistance to change**. Resistance to change can significantly hinder effective QI tool implementation, particularly during preliminary stages.[43] The staff in the study were unenthusiastic about attending professional training, citing a lack of interest and rigid thinking patterns. Furthermore, several nurses perceived no practical difference between current practices and QI offerings, which limited their interest to follow new instructions.

3. **Lack of job motivation**. Some of the study participants[43] viewed their roles merely as jobs, thus placing little importance on learning new QI tools. They also reported that a lack of team cohesion diminished their motivation to excel in new quality methods.
4. **Organizational constraints**. Participants in the study consistently identified constraints such as resource scarcity, limited funding, poor team management, inadequate facilities, and time scarcity as major organizational barriers.[43] Some reported that limited time made it difficult to perform duties and adhere to care protocols. Additionally, a lack of human resources, or staff shortages, was cited as another significant barrier to supporting QI tool implementation.

In contrast to these challenges, several enablers support the successful implementation of QI tools in healthcare settings:

1. **Self-efficacy**. Clinical nurses in the study[43] stated that when a challenge or doubt was encountered, they sought out evidence-based methods, such as consulting literature or online resources. This greatly stimulated their motivation to overcome difficulties and improved their capabilities and confidence.
2. **Supervision and feedback**. Many participants highlighted the importance of administrative supervision and feedback. Some nurses proposed assigning experienced and skilled staff as site champions within each care unit to mentor and provide encouraging feedback to other staff, often referred to as mentees.[43]
3. **Organizational support**. Organizational support is an additional enabler for QI tool implementation, especially for achieving sustainable development. Most study participants believed that a supportive learning environment and adequate resources were essential for successful implementation. Online training was also considered an effective and flexible method to alleviate barriers to specialized training, such as cost, scheduling, and training site availability.[43]
4. **Proactivity**. Several studies confirm the importance of proactivity and motivation for behavior change, highlighting proactivity as fundamental for establishing a positive QI implementation process.[44] Healthcare organizations can further enhance participant proactivity by establishing incentive mechanisms.[43]

Discussion

Although organizational QI processes are integral to improving quality, they vary significantly across departments and between organizations with similar objectives. Moreover, there is often no clarity within organizations regarding which processes to prioritize. The involvement of different stakeholders at various stages of a QI process results in differing opinions, conflicting needs, and inconsistent evaluation expertise. For instance, PFs are not always available to coach healthcare professionals, while doctors and nurses are often too busy and lack incentives to learn QIS principles. Additionally, resource availability influences implementation for QI enablers, low-resource healthcare systems often rely on affordable training and site champions, whereas high-resource systems draw on formal programs and dedicated funding for staff training. Consequently, QI applicability also varies by national context, as differences in governance, regulation, and accreditation influence healthcare delivery priorities, tool adoption, indicator selection, and the pace and sustainability of implementation across countries.

QIS is experiencing rapid technological and functional growth to meet the ever-increasing demand for high-quality and safe healthcare. There is an urgent need to educate and train organizations and healthcare providers about the various aspects of QIS. QI must be a continuous and sustained process, requiring constant monitoring and adaptation to achieve optimal outcomes. Integrating various healthcare stakeholders under a single QI platform is essential to facilitate the exchange of expertise, ideas, and technology. QI facilitators represent an upcoming field that needs to be integrated into organizational structures to provide QI training and oversee the identification and implementation of QI processes. QIS is positioned to play a pivotal role in improving healthcare delivery and patient safety in the future.

AI can strengthen these efforts by expanding the applicability of data collection and analysis. To ensure trustworthy adoption, technologies must be introduced through small PDSA cycles to continuously assess its impact and the stability of processes. While integrating evolving technologies into traditional processes can enable patient-centered improvements, they require active attention to preserve measurement validity and process continuity. AI in particular has inherent drawbacks such as bias in unscreened data, nondeterministic performance, and limited explainability.

Conclusion

This paper addressed the crucial need for effective application of QIS in enhancing patient safety within the healthcare landscape. The study proposed a comprehensive framework designed to guide healthcare professionals through the systematic implementation of QIS. Beyond developing the framework, the study thoroughly investigated the established concepts, processes, and models in QI. Furthermore, it explored the critical roles of various stakeholders and the significant influence of technology, particularly AI, in driving quality initiatives. The paper also detailed a practical guide for effectively selecting tools and indicators throughout the QI cycle, in addition to identifying key challenges and enablers impacting the successful QI implementation efforts. The structured analysis demonstrates that the systematic application of QIS can empower healthcare professionals in improving patient safety, especially when it is integrated into the stakeholder QI platforms and adopted by dedicated QI facilitators. Such successful application enables sustainable identification, analysis, and resolution of quality issues, leading to a culture of continuous improvement in healthcare quality. Future research may extend the framework with pilot implementations that evaluate the effectiveness of the decision-flow paths and develop practical toolkits and role-specific training curricula.

Disclosure

The author(s) report no conflicts of interest in this work.

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