# Integrated Knowledge Management (IKM) Volume 12

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# Part I. Healthcare Quality Improvement

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# 1. Healthcare Quality Improvement with IKM Terminology Knowledge Architecture (Tinkar)

## 1.1. Introduction

While Integrated Knowledge Management (IKM) and other content is explored in more detail in other volumes, the following areas are key components to healthcare quality improvement (QI).

**Healthcare QI** is a systematic and continuous action aimed at measurable improvements in healthcare services and the health status of targeted patient groups. [1] The National Academy of Medicine defines healthcare quality as the degree to which health services for individuals and populations increase the likelihood of desired health outcomes consistent with current professional knowledge. [2] QI seeks to standardize processes and structures to reduce variation, achieve predictable results, and improve outcomes for patients, healthcare systems, and organizations. It involves a combination of efforts from healthcare professionals, patients, researchers, and educators to make changes leading to better patient outcomes, system performance, and professional development. [3]

**IKM** in healthcare refers to the systematic management of knowledge resources, aimed at increasing access to available, accurate, and timely information. It incorporates a quality improvement approach comprising a multipart sequence and cycle, including data collection, storage, dissemination, review, analysis, and recommendations for improvement. [4] An IKM approach is intended to achieve institutional goals through continuous quality improvement, a focus on efficiency, collaboration, and transparency.

**Terminology Knowledge Architecture (Tinkar)** is an IKM framework designed to manage and standardize healthcare terminology. It ensures the consistency and accuracy of medical records, which is crucial for effective communication, treatment planning, and clinical decision making. Tinkar plays a vital role in data interoperability and accuracy, supporting healthcare organizations as they manage standard terminology modules, value sets, coding systems, local terms, and equivalence mappings.

Training healthcare staff is a critical component of healthcare QI and the healthcare delivery process. Healthcare professionals must be trained on patient safety and quality improvement methods to safely and effectively operate within increasingly complex work systems. Healthcare professionals must also meet and maintain professional standards set by their respective professional organizations and legislative and regulatory requirements. These standards are often updated, and training can ensure staff are aware of updated knowledge, best practices, and policies.

There are a wide range of stakeholders involved in the delivery of care and in the healthcare ecosystem, from physicians, laboratorians, nurses, support staff, policy makers, and more, who generate and share curated knowledge with each other. Organizing and relaying this information in an efficient and effective way is not a simple task. Often times, critical information and context is lost or distorted during data exchange within and between systems, resulting in incomplete or inaccurate knowledge. IKM aims to ensure systems maintain and communicate information without data loss as it flows between systems. Healthcare professionals rely on IKM to receive timely and correct information for their training.

This volume aims to explore the role of IKM and Tinkar in enhancing healthcare quality and how these systems can be integrated into healthcare settings to improve patient care, operational efficiency, and health policy. We provide insights into the implementation strategies and challenges of adopting IKM and Tinkar and highlight the impact of these systems on healthcare quality improvement.

# 1.1.1. Importance of IKM and Tinkar in Healthcare Quality Improvement

All healthcare organizations are continuously striving towards healthcare QI, a process used to identify and address healthcare disparities, to reduce harm and issues that may arise from administrative or technical errors. Inaccuracies or omissions in health records may lead to unintended and harmful effects to the patient. Improving upon certain processes can help mitigate these errors and have a positive impact on patients and healthcare providers.

IKM can help play a pivotal role in Healthcare QI through the following:

1. **Enhanced Clinical Decision-Making:** IKM can facilitate the flow and management of knowledge throughout its lifecycle. This process is crucial for informed clinical decision-making, which directly impacts patient care quality. [5]

2. **Standardized Healthcare Terminology:** Tinkar addresses the need for standardized terminology in healthcare. It ensures consistency and accuracy in medical records, which is fundamental for effective communication and treatment planning. [6]

3. **Evidence-Based Medical Practices (EBMP):** The integration of research evidence, clinical expertise, and patient preferences in clinical decision-making is a cornerstone of EBMP. IKM and Tinkar support this integration by managing both tacit and explicit knowledge, crucial for successful EBMP. [5]

4. **Operational Efficiency:** IKM and Tinkar support efficient knowledge management in healthcare and add significant value to diagnostic, decision-making, and treatment processes. Efficient knowledge management helps reduce medical errors caused by misdiagnosis or incorrect information. [6]

5. **Knowledge Sharing and Organizational Learning:** These systems foster a culture of knowledge sharing, leading to organizational learning. This aspect is vital for continuous improvement in healthcare practices and patient safety. [7]

6. **Healthcare Education:** The role of IKM in healthcare education is another critical component that can be used to improve patient outcomes, provider experience, and the efficacy and efficiency of IKM itself.

To undergo optimal healthcare QI, patients and healthcare professionals will need a thorough understanding of IKM and how IKM contributes to patient care. Education and training are important processes in the healthcare system that will help align the knowledge base of patients and healthcare professionals, and is needed to maintain quality patient care and to meet high quality healthcare standards. Training involves both the management and sharing of important and relevant information amassed from best practices, experience, and research. Proper training can ensure all individuals involved in delivery of care are up to date on the most relevant technology, skills, and processes. IKM is the systematic organization of knowledge and will play an important part in any well-developed training curriculum.

The implementation of IKM and Tinkar in healthcare settings is not just a technological upgrade but a strategic move towards a more efficient, accurate, and patient-centered healthcare system. IKM and Tinkar's role in standardizing healthcare terminology and enhancing knowledge management paves the way for improved healthcare quality, education, and patient outcomes.

# 1.1.2. The Importance of IKM and Tinkar in Healthcare Policy

Evidence informed decision making (EIDM), also known as Evidence Based Decision Making, is a process that uses the best available data (evidence) to form policies with the intent of providing the best possible

outcomes for those affected. Evidence and real-world data can originate from many sources, including EHRs and other healthcare systems, and can represent a variety of factors like context, public knowledge and opinion, implementation feasibility, and more. These types of information are broadly organized into the categories of scientific evidence, tacit evidence, and local and global evidence. Together these different types of evidence create the clearest picture and path towards drafting safe and effective policy. [8]

Major global health organization such as World Health Organization (WHO) and Center for Disease Control and Prevention (CDC) use the EIDM process to provide the public with clear and well-informed public health guidelines. The CDC process for guideline creation adapts standards from universal health organizations such as WHO, the U.K. National Institute of Clinical Excellence, the U.S. Institute of Medicine, the U.S. Preventative Task Force (USPTF), and the Community Preventive Services Task Force (CPSTF). CDC releases guidelines that are based on scientific evidence obtained through a systematic review of pertinent literature and fall into three categories: interim, standard, and update. Interim guidelines are usually developed during an emergency response when limited data is available. These interim guidelines rely heavily on expert opinion and emerging evidence, and evidence generated from sources outside of health settings. These guidelines are often updated due to the evolving nature of the evidence used. In these cases large amounts of "indirect" evidence including ethical perspectives, common sense, and feasibility will influence the guidelines. In these evolving emergency response situations, knowledge and data is less organized indicating a strong need for comprehensive and accurate IKM practices. [8-9]

Gathering strong evidence is only part of the effort needed to create effective policy; knowledge translation and integration of interventions is also an essential component. This is often known as the research-to-policy gap, and can affect any well-developed policy or guideline. Effective knowledge transfer is the key to successful implementation and policy outputs, and require training for all involved stakeholders. The standardization of healthcare data though IKM can facilitate better evidence, greater transparency, and ultimately more effective policies and guidelines. [8]

# 1.2. The Current State of Healthcare Quality

## 1.2.1. Challenges in Healthcare Quality Management

Despite the association between low-quality healthcare and significant mortality and economic impacts, especially in low- and medium-income countries, healthcare systems globally struggle to provide a consistent, standardized, and high-quality standard of care. Issues surrounding clinical workflows, the workforce, stagnant healthcare systems, and health equity all pose challenges that need to be addressed to improve the quality of care provided.

Issues optimizing clinical workflows lead to inefficient practices, incomplete information, alert fatigue, and delays in care, which further compound and contribute to clinician dissatisfaction and turnover. Beyond suboptimal workflows, the healthcare workforce is an aging workforce that faces significant personnel shortages and burnout that were exacerbated by the COVID-19 pandemic, particularly in nursing, posing a primary concern to the delivery of care. Further impacting healthcare providers, rapid advancements in medical science and information outpace the ability of the actual healthcare systems to adapt. This poses a perpetual challenge to healthcare systems to stay up-to-date with emerging therapies, concepts, practices, and technologies.

Additionally, challenges with technology adoption are a major issue facing an already overburdened health system. While the use of advanced technology in healthcare workflows is meant to save time and improve efficiencies, it often leads to added stress, burnout, fatigue, and errors. Healthcare systems will need to find a way to upskill the workforce to lessen the technological burden, improve existing work systems, and alleviate the stress of a diminished talent pipeline. All of these challenges are bookended by patient safety, with issues like medication errors, diagnostic inaccuracies, and hospital-acquired infections (HAIs) continuing to pose significant challenges to healthcare quality. [10]

## 1.2.2. The Role of Data and Information Management in Healthcare Quality

Data and information management play a vital role in improving the quality of healthcare by ensuring the data used during decision making processes is of the highest quality and accuracy. This provides a clear representation of the patient's health and is critical for patient health management, research, and any other area that data is used. Proper data management entails accurately entering information into EHRs, which in turn helps improve clinical validity and can enable more accurate diagnosis, ultimately improving the quality of patient care. [11] Poor data management practices can lead to recurrent errors, associated injuries or deaths caused by issues like illegible paper-based records, a lack of trust in providers and the healthcare system as a whole, decreased visits, and other negative health impacts. Addressing poor data management practices is a vital aspect of a well-functioning healthcare ecosystem and can help support patient engagement and improve safety.

Properly managed data contributes to well-informed and evidenced based policies and decision making. High quality data management begins at the individual level, with good knowledge management practices leading to high quality population level health metrics. Large data sets with accurate and up-to-date data can provide researchers with insights into social determinants of health, populations trends, and both prevent poor health outcomes and promote better health decisions. Health policy is aimed at targeting the health of the population, and is built on a strong foundation of individual data points.

## 1.2.3. The Role of Healthcare Education in Healthcare Quality

Healthcare education can be broken down into two key components:

1. Training and education for providers, researchers, public health experts, and other professionals involved in the delivery, research, system maintenance, or study of patient care.

2. Education for patients to understand their conditions, treatments, preventative measures, and other aspects of their healthcare journey to promote healthy, voluntary behaviors that improve health outcomes.

Knowledge management structures and applications that support professional training and learning or the delivery of care include clinical decision support, patient care coordination, the use of new technologies like telehealth/telemedicine, and the sharing of state-of-the-art research on emerging conditions. IKM supports this version of healthcare education throughout the various stages of a healthcare professional's journey by integrating disparate knowledge into a singular source that is more accessible to the provider, reduces cognitive burden, fosters collaboration between organizations, lowers wait times by removing the need for providers to extensively search for information, and improves professional knowledge and patient care. Healthcare students (MD, RN, NP, PhD, Masters, etc.), providers, researchers, public health experts, and more can all benefit from more efficient and optimized information management, organization, and sharing. This type of healthcare learning not only facilitates improved diagnoses, treatment, communication, and patient outcomes, but also supports workflow and operation optimization, process improvement, and business outcomes for other professionals and organizations involved in patient care. [12, 13] For instance, Certified Nursing Assistants and other nursing home healthcare personnel were provided an interactive educational program regarding infection prevention and control (IPC). Following each module, IPC knowledge scores were recorded and showed significant improvement. Not only did this education improve healthcare knowledge for healthcare workers, but it also supported improvements to workflows, processes, and patient care by reducing multidrug-resistant organisms and infections in a high-risk community like nursing homes. [14]

Beyond training for healthcare professionals, healthcare education for patients is critical and its impact is well documented, resulting in significant health outcomes for prevention and control of obesity, reduction

of tobacco use in adolescents, and more. [15, 16] Low healthcare literacy can lead to lower overall health outcomes, misuse of medication, overall misunderstanding of health information, and longer wait times to seek treatment, which itself can compound health problems. By improving health literacy through expanded healthcare education, patients will have a better understanding of their diagnoses and will be able to make more informed decisions regarding their treatment. [17]

# 1.2.4. Opportunities to Improve Healthcare Quality

The Agency for Healthcare Research and Quality has highlighted three case studies that showcase efforts to improve a patient's healthcare experience and health outcomes by addressing performance issues and updating and implementing strategy and action plans. [18]

1. Improving Customer Service and Access in a Surgical Practice: A surgical practice implemented a six-step plan to enhance customer service and access, leading to improved patient experiences.

2. Improving Hospital Inpatient Nursing Care: A large acute care hospital successfully implemented a plan to improve the emotional support provided to inpatients by nursing staff, enhancing patient care quality.

3. Improving Performance for Health Plan Customer Service: A health plan employed quality improvement methods to enhance customer service for its members, demonstrating the impact of targeted initiatives on service quality.

Similarly to these case studies, IKM can have a positive effect on clinical decision making, patient care and coordination, and research and development by allowing the harmonization of information between systems. However, IKM also plays an important role in healthcare education and training. The benefits of a well curated IKM training program can benefit both patient care and employee satisfaction and retention, which effectively leads to better patient care. Comprehensive training programs are more critical than ever as more complex technology is introduced into the workflow. Many healthcare organizations are facing critical staffing shortages and are expanding their pool of candidates via telehealth. However, this strategy alone cannot alleviate the need for a technologically prepared workforce. Instead of looking to hire new talent with relevant skills, organizations can train their current staff in the necessary skills. IKM can support the transfer, management, and retrieval of information from different parts of the healthcare system to create a robust training program to upskill current staff. [19]

Training requires active participation and buy in from both the healthcare administration and employees. It is important that both understand the benefit of training and upskilling: a well-run organization that is successful with satisfied employees, lessened burnout, greater retention, and better patient care and patient experience.

# 1.2.5. Health Policy Case Studies

The Division of Health Care Quality and Outcomes (HQO), as part of the Department of Health and Human services (HHS), is responsible for evaluating policies related to health care quality. The Office of the Assistant Secretary for Planning and Evaluation (ASPE) supported HHS during the COVID-19 pandemic by providing population level analyses of Social Determinants of Health (SDOH). The insights gathered by the Office of the Assistant Secretary for ASPE highlighted the need for standardized data elements to better understand the pandemic and its effects. They developed a report that demonstrated that SDOH are risk factors for COVID-19 and that more research needed to be done to better understand this connection. This type of evidence based reporting is critical for policy making; it provides a thorough review of evidence and highlights opportunities for improving the standardization of data elements and healthcare quality. [20]

While accurate and standardized health data is a key component of health policy, it also heavily relies on data and information from numerous other stakeholders and industries. The Secretary's Advisory Committee on National Health Promotion and Disease Prevention Objectives is a Federal advisory committee

that makes recommendations to HHS to improve public health. One focus is Healthy People 2030, a ten year plan to improve health outcomes and the well-being of people in the United States. In their Report #5, the committee outlines how participation from stakeholders in every sector of the economy can help drive better health outcomes to achieve the Health People 2030 goals. [21]

# 1.3. Future Implementation Strategies

Implementing IKM and Tinkar in healthcare organizations will involve several key steps. The first step is an assessment of current systems to evaluate existing knowledge management and data systems to identify gaps and areas for improvement. It is important to involve key stakeholders, including healthcare providers, Information Technology (IT) professionals, and administrators, to ensure alignment and support. Our team can also prepare healthcare systems for the implementation of IKM and Tinkar by developing a strategic plan that outlines the goals, timelines, resources, and responsibilities for implementing IKM and Tinkar. Training and education should be provided for healthcare professionals and IT staff on the new systems and processes to ensure the success of the implementation. Throughout the implementation, thorough and continual testing of the new systems will need to take place to ensure they meet the required standards and are user-friendly. As the process evolves, continuous monitoring of the systems is necessary to measure effectiveness and make necessary adjustments.

Implementing IKM and Tinkar in healthcare settings can face several challenges. Many organizations face difficulties implementing new processes simply due to resistance to change. Addressing resistance by involving staff in the planning process and clearly communicating the benefits can help reduce the amount of resistance. Another reason workers may be hesitant to change is their perception of the difficulties in adapting to new technology. Ensuring robust IT support to manage technical issues related to system integration and data standardization can help mitigate this reluctance. As well as IT support, ongoing training will help workers adapt to the new environment. Providing comprehensive training to help staff adapt to new systems and processes, as well as upskilling can ensure adherence. Beyond preparing the workforce for any changes in their workflow, it is vital to implement strong data security measures to protect patient information and comply with regulations.

## 1.3.1. Implementing IKM into Healthcare Education

As IKM efforts continue, its use and integration into education for providers, other healthcare professionals, and patients is paramount. Using the following best practices, IKM can enhance patient outcomes, professional knowledge, adoption of new solutions, and overall workflows and processes.

- **Participant Involvement**: Ensure critical stakeholders are involved throughout the design, testing, iterative improvement, and implementation of IKM-led education.

- **Comprehensive Planningand Program Development**: Healthcare education should be designed with a holistic plan that includes needs and resource assessments, thorough research and evaluation, identification of target audiences and timelines, and comprehensive information sharing through IKM solutions.

- **Integration with Target Community**: IKM solutions, and the healthcare education they support, should be integrated with the target audiences. Healthcare education for patients should be designed and shared with patients at appointments or telehealth appointments, at school, at laboratories, and other settings where healthcare is delivered. Provider and healthcare professional learning should be provided at the point of care through clinical decision support tools, at professional schooling and hands-on training, and more.

- **Creation of Lasting Impacts**: IKM should aim to making lasting and impactful changes to healthcare education that lead to meaningful changes in health-related behavior. Education should be designed to alter healthcare workflows, processes, or treatment based on the latest research and information sharing and patients should change their behavior, thinking, and interactions with their healthcare journey. [22]

Studies show that multidisciplinary and interdisciplinary knowledge is lacking in higher-education. [22] IKM offers a unique opportunity to support education development in the interdisciplinary field of healthcare by sharing knowledge from a wide range of resources and disciplines. Proper integration of IKM can improve healthcare education for both healthcare professionals and patients by addressing emerging trends and topics in real-time like COVID-19, universal health coverage, public health education, and an adequate health workforce. IKM fosters the integration of knowledge from a wide array of sources, and trainings will be continuously updated to reflect evolving knowledge. A benefit of implementing IKM into trainings is the ability to simplify the coordination of different sources of knowledge. [23]

## 1.3.2. Implementing IKM into Healthcare Policy

Drafting and developing policy is a multiphase processes that generally includes the following steps:

1. Problem Identification: Identify how the problem at hand impacts population health

2. Policy Analysis: Evaluate potential policies to identify the optimal solution

3. Strategy and Policy Development: Define how the policy will work and adoption strategies

4. Policy Enactment: Follow processes to pass policy

5. Policy Implementation: Implement the processes, tools, or recommendations into action

This is a process cycle that requires continual process improvement, stakeholder engagement, and iterative education. IKM plays a critical role in each stage of policy development, including standardization of health data that is collected and analyzed during the problem identification stage, management and utilization of real-world data to support policy analysis, identification and representation of key performance indicators and outcome measurements during policy implementation, and more. IKM lends itself to the collection and management of high quality health data, which is critical for understanding the root of the problem, who is affected, and the extent to which the problem is impacting stakeholders. IKM provides policy makers with a clear picture of the problem, real-world data and trends, and high quality data to help policy makers target highly impacted populations, and help solve the most pressing issues. [24]

# 1.4. Measuring the Impact on Healthcare Quality

Several key performance indicators (KPIs) and metrics can be utilized to measure the impact of IKM and Tinkar, and healthcare training and education on healthcare quality:

1. *Patient Outcomes:* Metrics such as readmission rates, patient recovery times, adverse event rates, and complication rates.

2. *Operational Efficiency:* Indicators like average length of hospital stay, time to treatment, and resource utilization rates.

3. *Data Accuracy and Consistency:* Performance measures like the reduction in data discrepancies and errors in patient records.

4. *StaffSatisfactionandEngagement:* Surveys and feedback mechanisms to gauge the impact on healthcare providers' workflow and job satisfaction. [25]

Evaluating the effectiveness of IKM and Tinkar requires a robust data analysis to assess the changes in healthcare delivery and outcomes before and after implementation. Gathering user feedback from healthcare professionals and IT staff on the usability and impact of solutions is a helpful tool when evaluating

effectiveness, as well as regular quality audits to ensure that the solutions are being used effectively and are contributing to continuous healthcare improvement. Lastly, comparative studies comparing performance with similar healthcare organizations that have not implemented IKM and Tinkar can be used to identify the success of the implementation.

Looking ahead, continuous improvement in healthcare quality will likely focus on several emerging trends in healthcare. Advanced data analytics will leverage big data and predictive analytics for proactive healthcare management; Personalized Medicine will utilize patient-specific data to tailor treatments and interventions; Integration of Emerging Technologies (IoET) will incorporate tools like Artificial Intelligence (AI), machine learning, and IoET devices into healthcare systems to enhance decision-making and patient monitoring. Shifting the focus to patient engagement, the healthcare process experience, and regular training and education will ensure that both patients and providers are centered in the process and healthcare professionals are up-to-date with the latest technologies and practices in healthcare quality improvement. [26]

# 1.5. Implementation Considerations

While this volume focuses on the prospective benefits and impact of IKM, the following list explores potential challenges with IKM implementation. While this list is not exhaustive, it is important to acknowledge and understand potential challenges to improve implementation and adoption.

1. **Usability and User-Centered Design**: IKM and the IKM reference implementation are heavily reliant on technology and electronic communication. While technology is an essential part of both modern healthcare and IKM, it is critical that human factors engineering and human-centered design remain a driving force in the design of IKM and personal interactions continue during delivery of patient care.

2. **Scalability and Continuous Updates**: Optimizing the implementation of IKM across the healthcare system will require careful consideration. There are a diverse array of healthcare settings, all with their own technological infrastructures, resource availabilities, and unique challenges. Scaling IKM to incorporate new and emerging concepts, such as terminology standards or new best practices, will also require continuous process improvement and refinement. This process must be managed efficiently to maintain the accuracy of IKM systems and the healthcare data it represents.

3. **Cost Implications and Integration with Existing Systems**: IKM implementation will require financial investments from institutions in the form of updated technology, training, and support for end-users. Healthcare systems will also need to ensure that IKM can seamlessly integrate with existing systems, which can be complex and could cause disruptions. Application Program Interfaces (API) and data quality validation harnesses are examples of tools that could be provided to reduce the financial and resource burdens on healthcare systems.

4. **Data Overload**: IKM and IKM reference implementations will handle vast amounts of data. It is important that end-users are not overburdened with unnecessary information and data. Data should be filtered to ensure that only relevant, pertinent, and actionable information is presented.

# 1.6. Conclusion

This volume has explored the integration and potential impact of IKM and Tinkar in healthcare quality and education improvement. Both IKM and Tinkar play a crucial role in enhancing healthcare quality by improving decision-making, standardizing care processes, ensuring data accuracy, optimizing healthcare professional and patient education, and providing strong building blocks for health policy. Successful implementation requires a strategic approach, including stakeholder engagement, training, continuous monitoring, and the development of well refined key performance indicators that are collaboratively developed with various stakeholder groups.

Overcoming challenges such as resistance to change, technical barriers, and data security concerns is essential for effective implementation but can be proactively mitigated with industry best practices. It is recommended that healthcare organizations embrace technological advancements, foster a culture of continuous learning, prioritize data security and privacy, and engage in collaborative efforts to maximize the benefits of IKM and Tinkar in healthcare. Patients and providers can achieve a higher quality of healthcare through curated trainings and educational programs enhanced by the benefits of IKM. In conclusion, the integration of IKM and Tinkar holds significant potential for advancing healthcare quality and health policy. By embracing these technologies and addressing associated challenges, healthcare organizations can improve patient outcomes, enhance operational efficiency, and pave the way for a more dynamic and patient-centered healthcare system. [27]

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