Global Trends in Key Hospital Performance Indicators: A Decade of Research Insights (2014-2023)

Ilham Hariyadi [1*], Qurratul Aini [1]

Abstract

Background: Hospital Key Performance Indicators (KPIs) are essential metrics used to evaluate the quality of healthcare services, assess organizational efficiency, and support sustainable hospital operations. Despite the importance of KPIs in enhancing patient care and hospital management, there remain gaps in the comprehensive assessment and application of these indicators across various healthcare settings. Methods: This study employs a qualitative methodology with a bibliometric analysis to examine the trajectory of research on hospital KPIs from 2014 to 2023. A comprehensive literature review was conducted using the Scopus database, selecting 111 relevant documents based on specific keywords and criteria. The data was analyzed using VOSviewer software, focusing on Network Analysis, Overlay Visualization, and Density Visualization to map the development of KPIs in hospital research, identify key themes, and explore the evolution of these studies over the years. Results: Results from network and density analysis using VOSviewer identified four main clusters of research themes, including hospital management, quality of care, emergency services, and hospital discharge processes. Keywords such as "quality indicator" and "hospital management" were identified as emerging areas with potential for future research. Furthermore, citation analysis revealed that the most referenced studies focused on developing KPIs to enhance clinical pharmacy practice and holistic hospital management. Conclusion: The study underscores the growing global interest in hospital KPIs, with a notable concentration of research in specific areas like hospital efficiency, quality of care, and operational metrics. The analysis highlights key trends and identifies emerging research opportunities, particularly in the areas of quality indicators and hospital management practices. These insights are crucial for guiding future research and improving the implementation of KPIs in hospital settings to enhance patient care and operational efficiency.

Keywords: Key Performance Indicators (KPIs), Hospital Management, Healthcare Quality, Publication Trends, Scopus Database

Significance | This study determined global research trends on hospital KPIs, highlighting publication patterns, key contributors, and emerging focus areas.

*Correspondence.

Ilham Hariyadi, Master of Hospital Administration, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia
Email: Ilham.hariyadi.psc23@mail.umy.ac.id.

Introduction

Hospital Key Performance Indicators (KPIs) are quantifiable measures utilized to evaluate the caliber of healthcare services provided by hospitals and determine the overall efficiency of the organization. (Zhang et al., 2020). Hospitals, like other service providers, rely on their consumers (patients) to operate their company. (Aini, 2023a). Nevertheless, hospitals must also function in a manner that is environmentally and economically sustainable in order to flourish. Efficiently functioning hospitals not only

Author Affiliation.
[1] Master of Hospital Administration, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia

provide life-saving services but also play a crucial role in driving public health initiatives. (Ruangsomboon et al., 2023).

Overseeing a healthcare organization entails a highly intricate undertaking. Continuous innovation is essential for saving lives and enhancing patient comfort, in addition to the conventional techniques employed by companies. (Ngan et al., 2014). Measuring hospital indicators is a means of evaluating the current condition of the institution. By providing a comprehensive perspective, it has the ability to execute superior solutions and foster ongoing enhancement in all processes and activities. (Al-Jazairi & Alnakhli, 2021).

Evaluating the performance of healthcare providers is crucial on a global scale, particularly in settings like hospitals, due to their substantial influence on both health outcomes and economic factors. The World Health Organization (WHO) initiated an initiative in 2003 to assist hospitals in creating a structure for evaluating their performance. The project, referred to as PATH (Performance Assessment Tool for Quality Improvement in Hospitals), sought to create dimensions and indicators for evaluating hospital performance. (Levesque & Sutherland, 2020). Nevertheless, despite the identification of numerous hospital performance indicators, there are still certain deficiencies in their measurement and unresolved concerns regarding the dimensions under examination that require attention. For instance, certain dimensions are not adequately represented, and there is a need for improved monitoring in certain healthcare settings or clinical specializations. (Fujita et al., 2018; Kumpf et al., 2017).

Furthermore, some previous research is relevant to this topic. Research from (Gyedu et al., 2022) This text outlines the process of evaluating the level of accomplishment of key performance indicators (KPIs) in the initial assessment and management of injured individuals. The evaluation is conducted by impartial observers in district and regional hospitals in Ghana. The KPIs were executed with a high level of proficiency, however, certain components, such as oxygen saturation and internal abdominal hemorrhage assessment, should be conducted more frequently. Regular reassessments should be undertaken more frequently, particularly for individuals with severe injuries. In general, the quality of care for injured individuals in non-tertiary hospitals in Ghana might be enhanced by implementing a more organized and methodical approach. Later, research from (Fanaei et al., 2023)(Gnanaraj et al., 2023a)(Nabovati et al., 2023) assessed and ranked key performance indicators (KPIs) for hospital management dashboards based on the viewpoint of hospital managers. A total of 25 key performance indicators (KPIs) were established for the hospital management dashboard. These include metrics such as patient fall rate, waiting time for patients in the emergency department, patient satisfaction, total hospital revenue,

financial balance, bed occupancy rate, discharge by own consent, average length of stay, and personnel satisfaction.

Furthermore, research (Rahman et al., 2021) developed a service critical performance indicator framework for emergency departments in tertiary healthcare centers using the Fuzzy Delphi Method (FDM). This study proposes the utilization of FDM as a means to gather experts' viewpoints and achieve consensus in order to make a decision. Expert consensus has been established about the appropriateness of the pre-selected elements in the KPI set. As a result, the KPI set is now suitable for implementation in clinical settings, specifically in the emergency room. Meanwhile, research from (Alavi, N., Khawaja, A., Asif, M., Ejaz, A., Abeer, & Jaffar, 2021) Discovered the use of dashboards to enhance Key Performance Indicators in the clinical laboratory of a tertiary care hospital in Lahore. Enhancing KPI monitoring charts can be achieved by adhering to established protocols, utilizing laboratory information system dashboards, fostering collaboration among laboratory personnel, and providing comprehensive training for technicians and phlebotomists. This can guarantee the provision of high-quality laboratory services to ensure patient care and safety.

These previous studies primarily examined the assessment and management of injured individuals, hospital management dashboards, emergency department performance indicators, and the use of dashboards to enhance Key Performance Indicators in clinical laboratories of tertiary care hospitals. Nevertheless, there is no necessity to provide a thorough explanation of the progression of research on hospital key performance indicators. Hence, this study provides originality by centering the issue from that perspective. The objective of this study is to elucidate the trajectory of research on hospital key performance metrics between 2014 and 2023, as documented in the Scopus index.

2. Literature Review

2.1 Key Performance Indicators in Hospital

Healthcare Key Performance Indicators (KPIs) are specific and measurable performance measures or metrics that enable the observation, analysis, optimization, and transformation of healthcare facility services. (Gyedu et al., 2022). KPIs, or Key Performance Indicators, are metrics employed to evaluate the attainment of an organization's strategic objectives. (Alfajri et al., 2021). These Key Performance Indicators (KPIs) assess the advancement of the facility and indicate the level of success achieved by the institution. Key Performance Indicators (KPIs) can be utilized to assess and benchmark a facility's performance against other similar facilities, thereby identifying specific areas that require enhancement. Administrators commonly monitor Key Performance Indicators (KPIs) over a period of time to gain insights into the historical progress of the facility and forecast future

patterns. The Key Performance Indicators (KPIs) can be derived from various areas of the organization, such as finance, patient care, employee satisfaction, and utilization of equipment. (De'Ath et al., 2022).

Healthcare Key Performance Indicators (KPIs) are crucial for effectively managing a wide range of facility information, such as patient care, hospital performance, and expenses. They have the ability to establish strategies for enhancing patient care services, ensuring optimal and sustainable hospital performance, and successfully managing expenses. Many facilities have the ability to save digital records and can extract and convert patient data into key performance indicators (KPIs). These KPIs can then be combined and arranged to generate detailed reports, which can be monitored on dashboards. Monitoring healthcare Key Performance Indicators (KPIs) can assist in establishing attainable objectives for organizational expansion or enhancement and tracking advancement towards these goals. (Gnanaraj et al., 2023b). It can help understand changing factors as the healthcare industry and market change. Administrators and practice directors frequently utilize Key Performance Indicator (KPI) tracking to inform their decision-making processes about hiring, facility management, budget adjustments, and the implementation of strategies aimed at enhancing patient outcomes. (Mahmodabadi et al., 2019; Zhang et al., 2020).

What it takes to choose hospital KPI Metrics: To initiate the development of a KPI monitoring program, the initial stage is to ascertain the key areas of significance within the firm. Hospitals, like any other business that aims to make a profit, need to monitor their financial situation, improve their operational methods, and create a healthy workplace for their staff. In order to distinguish itself from other healthcare providers, a hospital must also diligently track its influence on individuals' well-being and evaluate the caliber of its services. (Suriyawongpaisal et al., 2019).

The next stage in establishing a KPI monitoring program involves choosing many measures for each business domain. The optimal approach is to commence with modest actions. By doing so, you may appropriately assign resources to monitor each individual metric. A simple method to obtain a concise list of Key Performance Indicators (KPIs) is to arrange all recognized metrics in descending order based on their level of influence on the organization. The measurement of effect is subjective and differs among different hospitals. Despite having only a limited number of divisions, there is a wide array of hospital Key Performance Indicators (KPIs) available for selection, but choose the metrics that will impact the business most. KPIs provide a narrative about the hospital, but to ensure the narrative is comprehensive, it must incorporate certain crucial components. Identify the significant narratives of the hospital and allocate resources towards them, while giving less attention to less significant elements. The third and ultimate phase

in implementing a KPI monitoring program is the systematic monitoring and measurement of metrics. It is important to note that the act of selecting Key Performance Indicators (KPIs) alone does not ensure the success of a KPI program. In order to fully harness the capabilities of each key performance indicator for your hospital, it is imperative to measure them with precision and consistency. Hence, it is crucial to comprehend the resources employed in the KPI program prior to implementing it across different departments. (Suriyawongpaisal et al., 2019).

Hospital Key Performance Indicator (KPI) element: It is mandatory for all hospital KPIs to have a baseline. Initiating a Key Performance Indicator (KPI) program from the beginning or implementing a new metric is acceptable. Select a precise time and collect initial data for each Key Performance Indicator (KPI) of the hospital. These numbers will be compared to future Key Performance Indicators (KPIs). Analysis: The metrics should be thoroughly examined, and all patterns and tendencies should be discovered. This analysis is expected to elucidate any relationships and offer novel insights. It is imperative to examine the evidence objectively, without any preconceived notions or prejudices. Progress stems from an impartial comprehension of the present condition of the enterprise. Directive: It is necessary to take action on all key performance indicators (KPIs) in hospitals. The chosen key performance indicator (KPI) is not effective if it fails to motivate action. KPIs serve the function of identifying opportunities for maximizing and optimizing. Periodic review is a standard component of all Key Performance Indicator (KPI) projects. Its purpose is to provide visibility to the numerical data and demonstrate how it impacts decision-making. Engage all essential personnel in these evaluations, as this will enhance employees' feeling of responsibility and emphasize how their endeavors contribute to the hospital's triumph. (Rizk et al., 2014).

3. Material and Methods

This research employs a qualitative methodology utilizing a literature review approach. The literature review conducted a comprehensive analysis of the main performance metrics pertaining to the research problem. This literature research is a concise overview of a potentially extensive and varied compilation of literature covering many topics. (Munn et al., 2018). This study employs bibliometric methodology. Bibliometrics is a method used to analyze empirical data from published literature in order to identify trends of publication within a specific field of study. Researchers can utilize bibliometrics to assess the corpus of literature pertaining to their subject matter and discern significant themes.

Bibliometric studies have an extensive research background and have been employed to assess the publication performance on diverse subjects. Bibliometrics utilizes publishing records to

evaluate the state and advancement of a specific subject. The data sources in this study were taken from the Scopus database with the keywords "Key Performance" AND Hospital, with details (Title-Abs-Key ("Key Performance Indicators") And Title-Abs-Key (Hospital)) And Pubyear> 2014 And Pubyear <2024 And (Limit-To (Srctype, "J")) And (Limit-To (Pubstage, "Final")) And (Limit-To (Doctype, "Ar")) And (Limit-To (Subjarea, "Nurs") Or Limit-To (Subjarea, "Heal") Or Limit-To (Subjarea, "Plugs")) And (Limit-To (Language, "English")).

Furthermore, the consideration of using the Scopus database as a data source is considering that the Scopus database is the largest and most reputable database that world academics have recognized. The documents taken from the Scopus database are 111 documents taken from January 2014 to December 2023. In that period, the research topic of key performance indicators in hospitals became a big issue and a concern for world researchers. The following are the stages in collecting data and analyzing data.

Furthermore, the data analysis method in this research uses Vosviwer as a statistical tool. Some of the data analysis units in this research are Network Analysis, Overlay Visualization, and Density visualization. Network Analysis is used to visualize data or map concepts, keywords, and themes; Overlay visualization is used to capture the development of studies from year to year. Density visualization is used to map research studies that have been studied and map the novelty of the research.

4. Result and Discussion

4.1 Global Trends in Research Publications

A total of 111 documents on Key Performance Indicators in hospitals from 2014 to 2023 were obtained from the Scopus database. The data can be presented and examined to generate findings that are meaningful to the main objective of the study. Furthermore, the data will provide insights into the worldwide publication patterns regarding crucial performance indicators in hospitals.

The objective of this study is to comprehend the progression of the topic inside the global research landscape. The initial phase of this project will utilize the acquired data to chart these patterns, beginning with the number of publications per year, the sources of these publications, the contributions by different countries, the authors involved, and their connections. Figure 1 displays the annual count of document publications from 2014 to 2023 on Key Performance Indicators in Hospitals, as indexed by Scopus.

In Figure 2, you can see the development of studies on Key Performance Indicators. The data above shows that studies on Key Performance Indicators were widely studied in 2021. In that year, there were many studies in baselines and assessing the impact of KPIs (Al-Jazairi & Alnakhli, 2021), assessing the operations of Health care entities (Losier et al., 2021). We are developing Key

Performance Indicators using the Balanced Scorecard method (Alavi, N., Khawaja, A., Asif, M., Ejaz, A., Abeer, & Jaffar, 2021); (Victor & Farooq, 2021); (Tuangratananon et al., 2021). Then, in 2020, it was studied in terms of performance measurement and hospital support services (Souza et al., 2020); (Pishnamazzadeh et al., 2020a); (Aujirapongpan et al., 2020); (Zhang et al., 2020). In 2022, Key indicators affecting hospital efficiency (Gyedu et al., 2022), Key Performance Indicators in Quality, Safety, and Service (Allison et al., 2022), and management of hospital performance (Lai et al., 2022).

Furthermore, in 2023, Key Performance Indicators in hospitals are seen in terms of key performance indicators in hospital inventory management (Nabovati et al., 2023), Operations (Nabovati et al., 2023), Health Service Sustainability Performance Measurement (Rego et al., 2023); (Fanaei et al., 2023). These findings illustrate that this study is a significant concern in measuring hospital critical performance. It is understood that the importance of one of the key performance indicators is user satisfaction. User satisfaction is one of them through Health facilities and quality of service for patients, especially in hospitals.

Procedure Hospitals utilize Key Performance Indicators (KPIs) to assess their day-to-day operational performance. Hospitals can enhance their understanding of internal workflows, identify inefficient procedures, and adjust them as needed by closely monitoring operational Key Performance Indicators (KPIs). Firstly, the statistic of Patient Room/Bed Turnover in a hospital indicates the rate at which new patients are admitted and replace existing ones. This metric offers insights from two different perspectives: The level of effectiveness of the hospital's service quality. The patient room turnover rate is a measure of the average length of stay for each patient. It is crucial to thoroughly evaluate a limited number of cases to ensure that the level of care given to patients is sufficient and that they are not discharged prematurely while still in an unhealthy condition. Similarly, it is imperative to conduct a thorough examination of numerous patients to ensure that their needs are properly attended to, resulting in longer than necessary hospital stays. What is the level of efficiency and effectiveness of the room cleaning process? Cleaning has a crucial role in determining the rate at which patient rooms are prepared for the next patient. Efficiently cleaning and preparing the room for the next patient is crucial in order to optimize the hospital's revenue. Nevertheless, it is equally crucial to ensure strict adherence to high cleaning standards. The ramifications of cross-contamination among patients can be catastrophic. Hospitals must strive to have a constant and efficient turnover rate while upholding the quality of care. (Raitt et al., 2019).

The second key performance indicator (KPI) is the Bed Occupancy Rate, which offers valuable information on the availability of beds in the hospital. The measure is denoted as a percentage and is

computed using the subsequent formula: The bed occupancy rate is calculated by dividing the number of beds used by the total number of beds. Bed occupancy rates are commonly assessed at certain time intervals or classified by several departments to emphasize the seasonal patterns of disease. It is generally advisable to prevent high occupancy rates as they can result in staff burnout. Furthermore, it is imperative to conduct an investigation into the underlying factors contributing to the poor occupancy rates. An optimal bed occupancy rate ensures efficient utilization of hospital equipment and minimizes the burden on its staff. (Pishnamazzadeh et al., 2020b).

Thirdly, the metric of Medical Equipment Utilization focuses on the efficient use of equipment and the associated expenses of maintaining it. It is imperative for a hospital with a long-standing operation to regularly monitor its equipment. Medical breakthroughs occur on an almost daily basis, and as a result, medical equipment inevitably becomes obsolete. Implementing a system to monitor medical equipment would guarantee that the hospital's machinery meets the required standards and prevents any equipment from being neglected and unused. Many technologies have the potential to be reused or decommissioned and then sold. Failure to consider medical device use key performance indicators (KPIs) might result in increased maintenance expenses and inefficiency in the workforce. (Pishnamazzadeh et al., 2020b).

Figure 3 Provides information about the top 10 authors who make the greatest contributions based on the quantity of their research articles. The data indicates that the author requires additional focused and detailed research on essential measures of hospital performance. This is due to the fact that the publications of these authors are still evenly dispersed, specifically consisting of 2 papers. The exploration of key performance indicators in hospitals has shown gradual progress over the past decade, attracting the attention of several scholars worldwide and being documented in Scopus-indexed articles. Furthermore, it is evident that other nations have taken action in response to the examination of key performance indicators.

Figure 4 shows the countries with the highest contribution to research publications on hospital Key Performance Indicators. The United States is the country that studies Key Performance Indicators in hospitals the most. One of the most widely-used studies of critical issues for hospitals, physicians, and policymakers is unplanned postoperative readmissions. This issue is considered a quality and cost control metric (Verga et al., 2023).

Table 5 shows the journals that published the most research on Key Performance Indicators in hospitals from 2013 to 2023. Healthcare Switzerland was the most popular, publishing 2 documents. Annals of Pharmacotherapy, Archives of Hellenic Medicine, Australian Health Review, and BMC Cardiovascular Disorders had 1

document each. This list of articles can be a reference for researchers looking for references by source.

Table 1 displays the most referenced or cited articles. The citation analysis applied to the articles makes it possible to determine the primary references in studying Key Performance Indicators. The study by Fernandes et al., (2015) This essay has been extensively referenced by scholars and authors investigating this theme during the past decade. The primary objective of this study was to create key performance indicators (KPIs) at a national level in order to promote the progress of clinical pharmacy practice and enhance the quality of patient care. The study's findings revealed that eight candidate KPIs satisfied the consensus definition: (1) Conducting medication reconciliation upon admission, which includes obtaining the most accurate medication history, (2) Engaging in interprofessional patient care rounds, (3) Executing pharmaceutical treatment programs, (4) Addressing pharmaceutical treatment concerns, (5) Delivering disease and medication education directly to patients, (6) Delivering instructions on how to take prescribed medication after being discharged, (7) Conducting medication reconciliation following discharge, and (8) Engaging in proactive and integrated actions to directly care for patients.

The second most cited article by researchers on this theme is from (Si et al., 2017) entitled "Identifying Key Performance Indicators for Holistic Hospital Management with a Modified DEMATEL Approach." This study emphasizes the use of a multiple-criteria decision-making (MCDM) method to determine the most important performance indicators (KPIs) for comprehensive hospital management. The results showed that "accidents/adverse events," "nosocomial infections," "incidents/errors," and "several surgeries/procedures" were significantly influential indicators. In addition, the indicators "length of stay," "bed occupancy," and "financial measures" also play an essential role in the performance evaluation of healthcare organizations. The proposed decision-making approach is a reference for healthcare administrators to improve the performance of their healthcare institutions.

4.2 Networks, development trends, and research density

This assessment presents an analysis of the network and publication density of research on Key Performance Indicators in hospitals from 2013 to 2023. The analysis seeks to identify the keywords that are most correlated with the topic of Key Performance Indicators in Hospitals. This will enhance our comprehension of the occurrences that transpire in the academic realm, as evidenced by the dissemination of scholarly investigations pertaining to the subject matter. This analysis will also facilitate comprehension of the examination of Key Performance Indicators in hospitals pertaining to specific keywords. The purpose of the density analysis is to identify keywords that present a substantial potential for further investigation by researchers focusing on important performance metrics in hospitals. Density analysis is employed to determine the

frequency of discussion surrounding specific keywords, distinguishing between those that are extensively discussed and those that receive limited attention in relation to the given issue.

Figure 6 shows the network based on keywords from research on Key Performance Indicators in hospitals from 2013 to 2023 indexed by Scopus. Analysis using VOSviewer resulted in 4 clusters, each identified with a different color. This makes it easier to identify the network of keywords. Cluster 1 in red: key performance indicator, procedure, emergency ward, human experiment, hospital management, hospital pharmacy, Delphi study, pharmacist, and teaching hospital. Cluster 1 shows a discussion on hospital management with straightforward procedures. Then, cluster 2 is marked in green: health care personnel, patient care, standards, organization and management, quality indicators, health care quality, and hospitals. Cluster 2 discusses the quality standards of hospital services. Furthermore, cluster 3 is yellow: hospital discharge and tertiary care centers. Cluster 3 is a collection of discussions about hospital care services. Next, cluster 4 in blue: emergency service hospital, length of stay, treatment outcome, and age. Cluster 4 discusses emergency services in hospitals.

Table 2 shows which keywords are important in discussing Key Performance Indicators in Hospitals. Hospital and healthcare quality are the keywords with the highest occurrence and have the most vital relationship with research on Key Performance Indicators in hospitals. This explains that hospital and healthcare quality are the main concepts used as the basis for discussing the topic. Healthcare quality is determined by the number of healthcare days, as determined by several healthcare watchdogs (Nik Hisamuddin & Tuan Hairulnizam, 2022; Raitt et al., 2019). As an alternative to quality in other fields, quality evaluates how well something fits its intended use and how well the product is made. The goal of Preventive Health is to provide a robust and compassionate healthcare system to all those who need it, i.e., provide a good standard of living, identify and treat disease when possible, improve living standards, and so on (Lloyd et al., 2017; Nabovati et al., 2023). Researchers use a variety of quality measures to try to determine the quality of healthcare, including the amount of reduction or alleviation of disease identified by medical diagnosis, a decrease in the number of risk factors people have after preventive care, or surveys of health indicators in populations accessing certain types of care (Losier et al., 2021).

Several analytical frameworks for quality assessment have been developed to support strategic planning of growth measurement in both the public and private sectors. The most significant is the timeline created by the Institute of Medicine (IOM), which outlines the following goals for healthcare systems. First, peace: Avoiding harm to patients intended to help them. Second, Effective: Offering science-based services to everyone who can benefit and develop themselves is not limited to providing services that might help them

(i.e., identifying inefficient and judgmental users). Third, Patient-centered: Provide care to patients and caregivers regarding their personal preferences, needs, and preferences while ensuring that patient preferences cover all clinical procedures. Fourth, Timeliness: Reduce waiting times and delays, which sometimes impede the delivery of services and assistance. Fifth, Efficiency: Avoid wastage. This means avoiding waste of equipment, supplies, ideas, and energy. Sixth, Fairness: Provide equal treatment to all individuals regardless of race, ethnicity, geographic location, and socioeconomic status (Moons et al., 2019).

Furthermore, the quality of care serves as a crucial performance indicator for hospitals. The success of a hospital hinges on the high levels of patient satisfaction, regardless of the complexity of its operations or the accuracy of its financial records.

(Fanaei et al., 2023; Martinez et al., 2018) Various voluntarily chosen hospital key performance indicators (KPIs) have a direct impact on the quality of healthcare. Firstly, let's discuss medication errors: This hospital metric measures the proficiency of healthcare workers employed by the facility. It is important to constantly monitor this Key Performance Indicator (KPI) in order to detect patterns at an early stage and enable hospitals to identify and resolve the underlying cause of the problem. Medication errors encompass a wide range of errors that might have an impact on patientsMistakes might arise throughout the process of diagnosing a condition, prescribing medication, or giving the correct amount. Hospitals should aim to minimize this statistic. The pharmaceutical error Key Performance Indicator (KPI) is quantified as a percentage. It is calculated as follows: Medication error = (total number of wrong diagnoses + wrong medication + wrong dose) / total number of patients (Zhang et al., 2020).

Next, the rate of infections caused by hospitals: This key performance indicator (KPI) quantifies the level of safety provided to patients. Hospitals should prioritize the reduction of infection rates in order to enhance the quality of patient hospitalization and alleviate additional workload and stress on their staff. The hospital-acquired infection rate is quantified as a percentage. It is calculated using the following formula: Hospital-attributable infection rate = number of patients who contracted an infection during their hospital stay / total number of patients. Thirdly, the metric of patient waiting time is a crucial performance factor for hospitals that has a direct impact on patient satisfaction. Similar to the other hospital key performance indicators (KPIs) discussed in this section, patient waiting time is a hospital KPI that aims for a target of zero. As the waiting time decreases, the probability of customers returning to the hospital increases. To determine the patient waiting time, one should quantify the duration starting from the moment the patient checks in with the receptionist until they are seen by the doctor. The waiting time for patients can be computed for every department, including the emergency room (ER) and
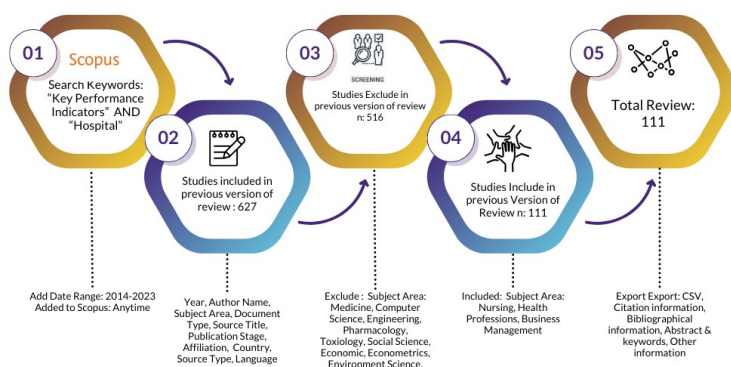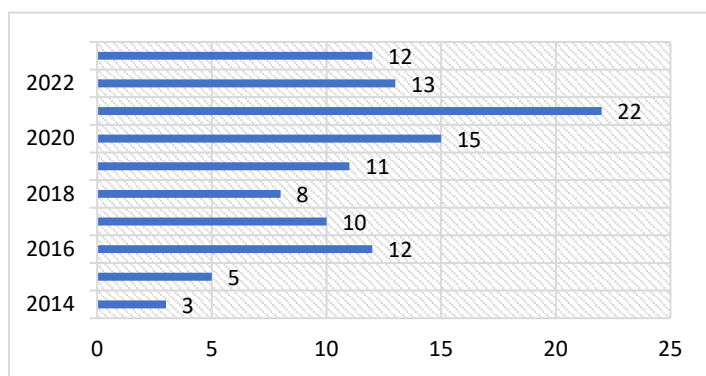
Figure 1. Data Collection Techniques

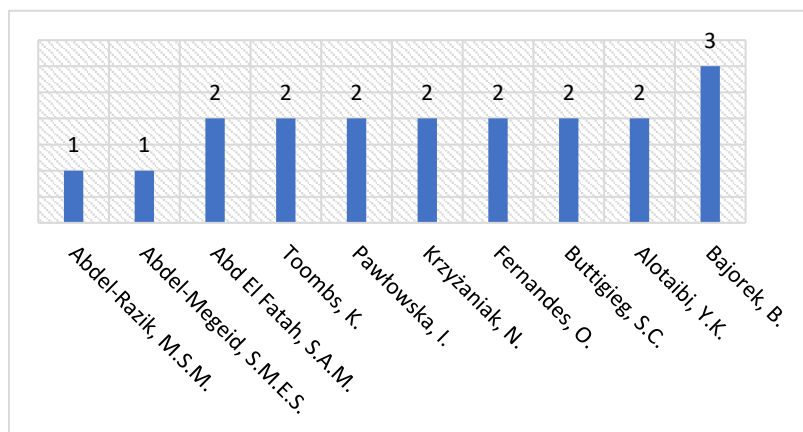**Figure 2.** Publication by Year (Key Performance Indicators 2014-2023)
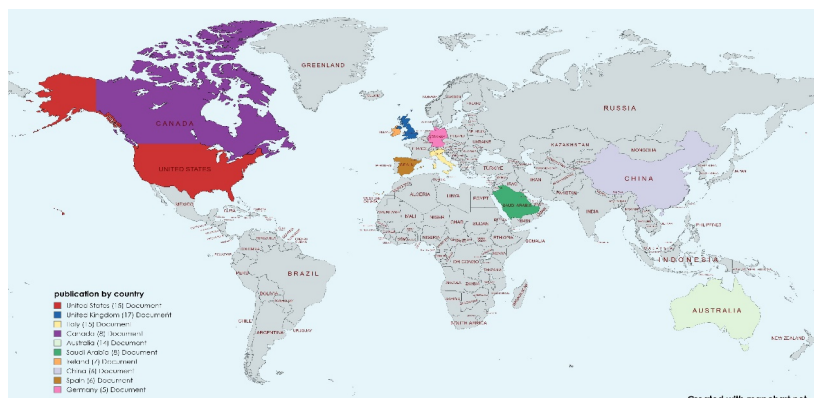

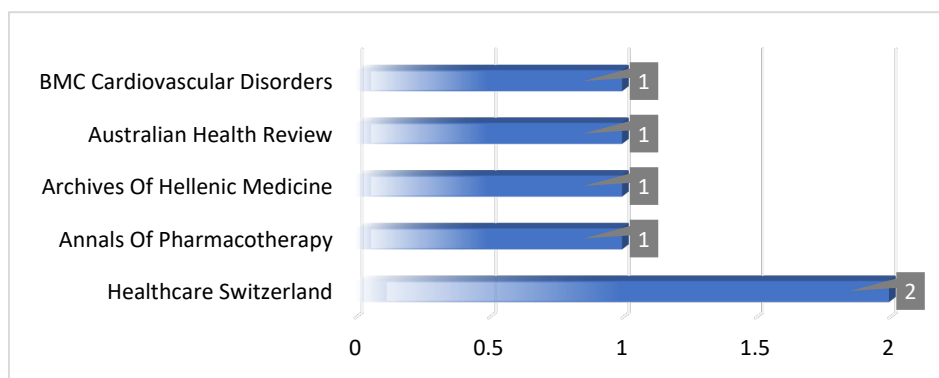**Figure 3.** Author Contribution

Figure 4. Top Countries Contribution

Figure 5. Top 5 Source for Publication in Key Performance Indicators

Table 1. Most Article

| No	Article title	Author(years)	Source	Cited
1	Formulation of Clinical Pharmacy KPIs for Hospital Pharmacists Through a Modified Delphi Method	(Fernandes et al., 2015)	Annals of Pharmacotherapy 49(6), pp. 656-669	73
2	Key performance indicator identification for integrated hospital management using a modified DEMATEL methodology	(Si et al., 2017)	International Journal of Environmental Research and Public Health 14(8),934	54
3	An Electronic Patient Flow Dashboard at Johns Hopkins Hospital: Utilizing the Donabedian Model to Communicate Key Performance Indicators	(Martinez et al., 2018)	Journal of Medical Systems 42(8),133	30
4	A Hospital Resilience Assessment Model Based on the Concurrent Evaluation of Key Performance Indicators Using System Dynamics	(Pishnamazzadeh et al., 2020b)	Perioperative Care and Operating Room Management 20,100118	15
5	Identifying hospital management's main performance metrics using a protracted, cautious language debate method	(Zhang et al., 2020)	Healthcare (Switzerland) 8(1),7	12
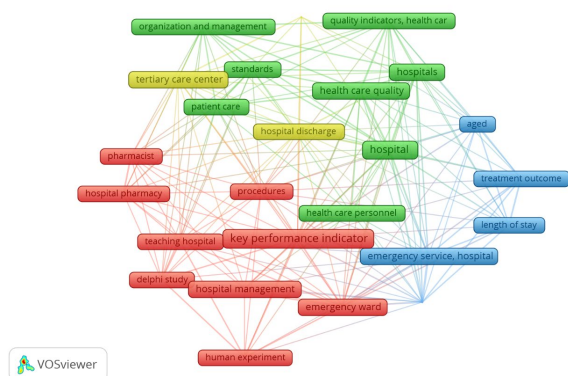
Figure 6. Network Visualization

Table 2. Important keywords

No	Keywords	Occurences	Total Link Strenght
1	key performance indicator	4	48
2	Hospital	4	44
3	Health care quality	4	44
4	emergency ward	4	43
5	Hospital emergency service	3	43
6	Hospital management	3	43
7	Patient care	3	42
8	Quality indicator health care	3	42
9	Organization and management	3	42
10	Procedure	3	41

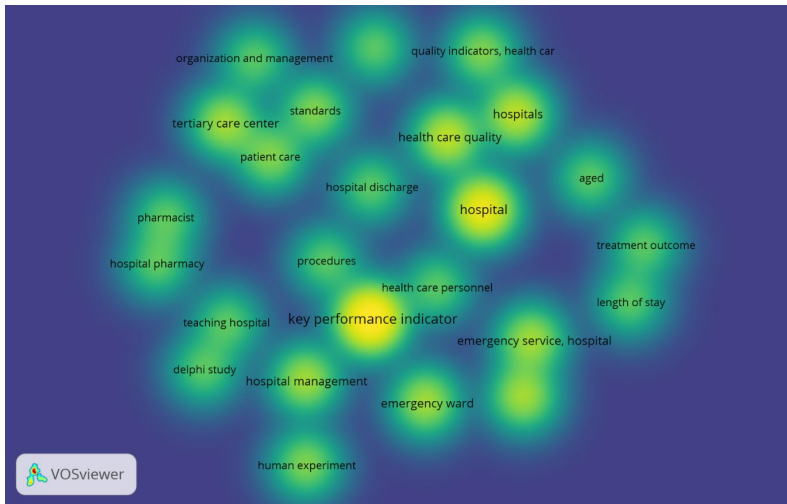**Figure 7.** Overlay visualization
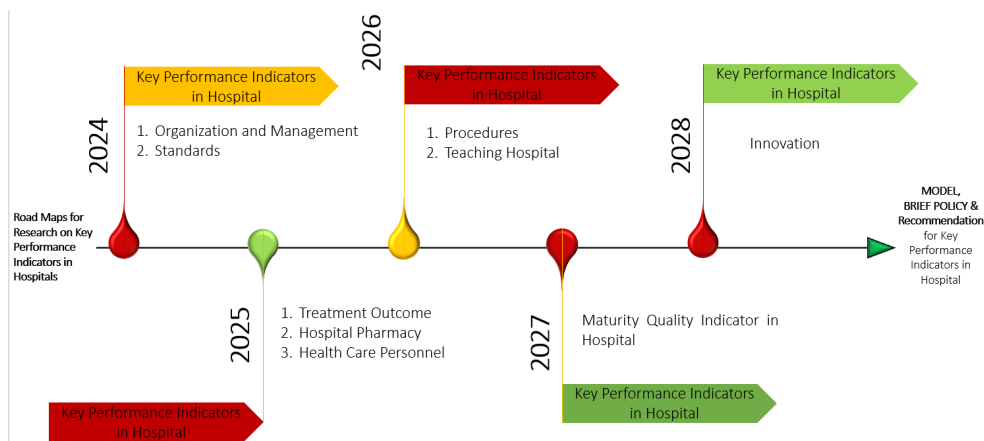
Figure 8. Density visualization

Figure 9. Research Roadmap on Key Performance Indicators in Hospitals

urgent care. Additionally, it can be analyzed and tracked over specific time intervals such as quarters, months, or even hours to gain valuable information on the periods of highest activity in the hospital. Hospitals can utilize this information to make necessary modifications to their workforce. (Al-Jazairi & Alnakhli, 2021).

The fourth statistic is the Staff to Patient Ratio, which indicates the level of healthcare staff availability in the facility. This key performance indicator (KPI) is determined by dividing the total count of healthcare staff who are now available by the total number of patients. The staff to patient ratio is calculated by dividing the number of healthcare personnel by the number of patients. The objective of monitoring this Key Performance Indicator (KPI) is not to attain specific goals. It is important to consistently monitor and assess this hospital parameter for any fluctuations or variations. It is beneficial to establish a correlation between this Key Performance Indicator (KPI) and other metrics that measure the quality of service in order to identify patterns. To illustrate, in the event of a sudden decline in the ratio of staff members to patients between July and August, ascertain whether there is a corresponding rise in patient waiting time or occurrences of medication errors. By answering these intriguing questions, you will be able to determine the most suitable operating range for your facility. (Ortiz-Barrios et al., 2020).

Additionally, with relation to the Key Performance Indicators for Public Health in Hospitals. Hospitals have a crucial role in sustaining and promoting public health throughout the community. (Aini, 2023b). Hospitals will strive to enhance the accessibility of initiatives aimed at eradicating diseases or managing outbreaks. (Aini, 2018). Hospital indicators, also called hospital KPIs (key performance indicators), measure processes, activities, and strategies in hospitals and other institutions in the health sector. Performance indicators require several attributes to help the administration improve outcomes. These attributes should be Measurable, Reproducible, Feasible, Valid, Timely, Sustainable, Relevant, Understandable. In practice, the hospital's indicators should fit the business strategy, be achievable, numerically measurable, and be understandable to managers and employees. Numbers help to know bed occupancy rates, quality of service, speed of diagnosis, business resilience, and more to assess whether your actions are delivering the best results (Al-Jazairi & Alnakhli, 2021; Suriyawongpaisal et al., 2019).

Figure 7 shows the trend of research in the period 2014-2023 on Key Performance Indicators in hospitals indexed by Scopus. In 2017, research on Key Performance Indicators in hospitals mostly took the perspective of procedures, pharmacists, and hospital pharmacies. Then, in 2018-2019, research on Key Performance Indicators in hospitals took the viewpoint of healthcare quality, patient care, healthcare personnel, hospital discharge, hospital management, emergency ward, etc. Finally, in 2021-2023, research

on Key Performance Indicators in hospitals shifted to discussing emergency service hospitals, human experiments, age, and key performance indicators.

Figure 8 displays the density of research topics on Key Performance Indicators in hospitals based on keywords published in 2014-2023 and indexed by Scopus. Density from Vosviewer can show which keywords have been discussed and which have not. The density of keywords can be recognized by the words highlighted in yellow; the denser the keywords surrounded by yellow, the more studies that use that point of view as the focus of discussion. On the contrary, if the yellow color is not very dense on the keywords, it has yet to be discussed too much in the research. Therefore, the keyword can be used as a new thing in further study.

Figure 8 shows that the words quality indicator, hospital management, procedure, organization and management, and health care personnel are new findings, and these keywords still have an excellent opportunity to be the focus of discussion to become a novelty of future research. Details can be seen in the following explanation.

5. Conclusion

This study concludes that publications in the 2014-2023 time span indexed by Scopus have increased yearly. This illustrates that academics or researchers pay significant attention when discussing this research topic. This increase in attention can be related to the importance of health facilities in maintaining the quality of their services for patients, especially in hospitals. Furthermore, Hospital and healthcare quality are the keywords with the highest occurrence and have the most vital relationship with research on Key Performance Indicators in hospitals. This explains that hospital and healthcare quality are the main concepts used as the basis for discussing the topic. Quality indicators, hospital management, procedures, organization and management, and health care personnel are keywords that still have an excellent opportunity to be the focus of discussion and become a novelty of future research. Furthermore, although this study has successfully explained the development of research in the last decade, there are limitations to this study, namely that it only uses one source of data from the Scopus database. Hence, it is advisable for future study to utilize alternative databases, such as Web of Science or Pubmed, in order to acquire a more extensive dataset.

Author contributions

I.H. conceived the study, developed the hypothesis, and performed data analysis. I.H. also wrote the manuscript, including the introduction, methods, and discussion sections. Q.A. contributed to data collection, literature review, and manuscript revisions. Both authors read and approved the final manuscript.

References

Aini, Q. (2018). Motivation, commitment and leadership skill in affecting performance hospital managers. Journal of Social Sciences Research, 4(12), 707–710. https://doi.org/10.32861/jssr.412-707-710

Aini, Q. (2023a). Bibliometric and visual analysis of global research: Hospital inpatient satisfaction. Jurnal Aisyah : Jurnal Ilmu Kesehatan, 8(2), 909–916. https://doi.org/10.30604/jika.v8i3.1990

Aini, Q. (2023b). Human Resource Performance in Hospital: A Bibliometric Study. Jurnal Aisyah : Jurnal Ilmu Kesehatan, 8(2), 511–518. https://doi.org/10.30604/jika.v8i2.1961

Al-Jazairi, A. S., & Alnakhli, A. O. (2021). Quantifying Clinical Pharmacist Activities in a Tertiary Care Hospital Using Key Performance Indicators. Hospital Pharmacy, 56(4), 321–327. https://doi.org/10.1177/0018578719897074

Alavi, N., Khawaja, A., Asif, M., Ejaz, A., Abeer, & Jaffar, R. (2021). Dashboard utilization for improvement in Key Performance Indicators (KPI) in Clinical Laboratory of Tertiary Care Hospital, Lahore Pakistan. BMJ Leader, 7(3), 168–174. https://doi.org/10.1136/leader-2021-000568

Alfajri, A., Handayani, S. D., & Dewi, A. (2021). Development of Performance Indicators Based on The Balanced Scorecard Method For Clinics in Surakarta. Jurnal Aisyah : Jurnal Ilmu Kesehatan, 6, 247–254. https://doi.org/10.30604/jika.v6is1.796

Allison, S., Bastiampillai, T., Looi, J. C. L., Copolov, D., & Lakra, V. (2022). Real-world performance of Victorian hospitals during the COVID-19 lockdowns. Australasian Psychiatry, 30(2), 239–242. https://doi.org/10.1177/10398562221079281

Aujirapongpan, S., Meesook, K., Theinsathid, P., & Maneechot, C. (2020). Performance evaluation of community hospitals in Thailand: An analysis based on the balanced scorecard concept. Iranian Journal of Public Health, 49(5), 906–913. https://doi.org/10.18502/ijph.v49i5.3207

De'Ath, H. D., Nagendram, S., Smith, E., Ramadan, M., Veeramootoo, D., & Singh, S. (2022). A high-volume ERCP service led by surgeons is associated with good outcomes and meets national key performance indicators: results from a British district general hospital. Surgical Endoscopy, 36(8), 6016–6023. https://doi.org/10.1007/s00464-021-08978-x

Fanaei, S., Zareiyan, A., Shahraki, S., & Mirzaei, A. (2023). Determining the key performance indicators of human resource management of military hospital managers; a TOPSIS study. BMC Primary Care, 24(1). https://doi.org/10.1186/s12875-023-02007-7

Fernandes, O., Gorman, S. K., Slavik, R. S., Semchuk, W. M., Shalansky, S., Bussières, J.-F., Doucette, D., Bannerman, H., Lo, J., Shukla, S., Chan, W. W. Y., Benninger, N., MacKinnon, N. J., Bell, C. M., Slobodan, J., Lyder, C., Zed, P. J., & Toombs, K. (2015). Development of Clinical Pharmacy Key Performance Indicators for Hospital Pharmacists Using a Modified Delphi Approach. Annals of Pharmacotherapy, 49(6), 656–669. https://doi.org/10.1177/1060028015577445

Fujita, K., Moles, R. J., & Chen, T. F. (2018). Quality indicators for responsible use of medicines: a systematic review. BMJ Open, 8(7), e020437. https://doi.org/10.1136/bmjopen-2017-020437

Gnanaraj, J., Kulkarni, R. G., Sahoo, D., & Abhishekh, B. (2023a). Assessment of the Key Performance Indicator Proposed by NABH in the Blood Centre of a Tertiary Health Care Hospital in Southern India. Indian Journal of Hematology and Blood Transfusion, 39(2), 308–316. https://doi.org/10.1007/s12288-022-01563-9

Gnanaraj, J., Kulkarni, R. G., Sahoo, D., & Abhishekh, B. (2023b). Assessment of the Key Performance Indicator Proposed by NABH in the Blood Centre of a Tertiary Health Care Hospital in Southern India. Indian Journal of Hematology and Blood Transfusion, 39(2), 308–316. https://doi.org/10.1007/s12288-022-01563-9

Gyedu, A., Quainoo, E., Nakua, E., Donkor, P., & Mock, C. (2022). Achievement of Key Performance Indicators in Initial Assessment and Care of Injured Patients in Ghanaian Non-tertiary Hospitals: An Observational Study. World Journal of Surgery, 46(6), 1288–1299. https://doi.org/10.1007/s00268-022-06507-y

Kumpf, O., Braun, J.-P., Brinkmann, A., Bause, H., Bellgardt, M., Bloos, F., Dubb, R., Greim, C., Kaltwasser, A., Marx, G., Riessen, R., Spies, C., Weimann, J., Wöbker, G., Muhl, E., & Waydhas, C. (2017). Quality indicators in intensive care medicine for Germany - third edition 2017. German Medical Science : GMS e-Journal, 15, Doc10. https://doi.org/10.3205/000251

Lai, J. H. K., Hou, H., Edwards, D. J., & Yuen, P. L. (2022). An analytic network process model for hospital facilities management performance evaluation. Facilities, 40(5–6), 333–352. https://doi.org/10.1108/F-09-2021-0082

Levesque, J.-F., & Sutherland, K. (2020). Combining patient, clinical and system perspectives in assessing performance in healthcare: an integrated measurement framework. BMC Health Services Research, 20(1), 23. https://doi.org/10.1186/s12913-019-4807-5

Lloyd, G. F., Singh, S., Barclay, P., Goh, S., & Bajorek, B. (2017). Hospital pharmacists' perspectives on the role of key performance indicators in australian pharmacy practice. Journal of Pharmacy Practice and Research, 47(2), 87–95. https://doi.org/10.1002/jppr.1156

Losier, M., Doucette, D., Fernandes, O., Mulrooney, S., Toombs, K., & Naylor, H. (2021). Assessment of Canadian Hospital Pharmacists' Job Satisfaction and Impact of Clinical Pharmacy Key Performance Indicators. Canadian Journal of Hospital Pharmacy, 74(4), 370–377. https://doi.org/10.4212/cjhp.v74i4.3201

Mahmodabadi, A. D., Langarizadeh, M., Mehrjardi, M. H. M., & Emadi, S. (2019). Development of managerial key performance indicators for a hospital pharmacy digital dashboard. Iranian Journal of Pharmaceutical Research, 18(4), 2124–2130. https://doi.org/10.22037/ijpr.2019.1100822

Martinez, D. A., Kane, E. M., Jalalpour, M., Scheulen, J., Rupani, H., Toteja, R., Barbara, C., Bush, B., & Levin, S. R. (2018). An Electronic Dashboard to Monitor Patient Flow at the Johns Hopkins Hospital: Communication of Key Performance Indicators Using the Donabedian Model. Journal of Medical Systems, 42(8). https://doi.org/10.1007/s10916-018-0988-4

Moons, K., Waeyenbergh, G., Pintelon, L., Timmermans, P., & De Ridder, D. (2019). Performance indicator selection for operating room supply chains: An application of ANP. Operations Research for Health Care, 23. https://doi.org/10.1016/j.orhc.2019.100229

Munn, Z., Peters, M. D. J., Stern, C., Tufanaru, C., McArthur, A., & Aromataris, E. (2018). Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. BMC Medical Research Methodology, 18(1), 1–7.

Nabovati, E., Farrahi, R., Sadeqi Jabali, M., Khajouei, R., & Abbasi, R. (2023). Identifying and prioritizing the key performance indicators for hospital management dashboard at a national level: Viewpoint of hospital managers. Health Informatics Journal, 29(4). https://doi.org/10.1177/14604582231221139

Ngan, T.-L., Wong, E. T.-H., Ng, K. L.-S., Jeor, P. K.-S., Law, M. Y.-Y., & Lo, G. G. (2014). Key performance indicators for comparing the performance of portable radiography: Direct digital radiography versus conventional machine computed radiography - A study in a Nonacute hospital. Journal of Medical Imaging and Radiation Sciences, 45(2), 105–114. https://doi.org/10.1016/j.jmir.2013.08.004

Nik Hisamuddin, R., & Tuan Hairulnizam, T. K. (2022). Developing Key Performance Indicators for Emergency Department of Teaching Hospitals: A Mixed Fuzzy Delphi and Nominal Group Technique Approach. Malaysian Journal of Medical Sciences, 29(2), 114–125. https://doi.org/10.21315/mjms2022.29.2.11

Ortiz-Barrios, M., Gul, M., López-Meza, P., Yucesan, M., & Navarro-Jiménez, E. (2020). Evaluation of hospital disaster preparedness by a multi-criteria decision making approach: The case of Turkish hospitals. International Journal of Disaster Risk Reduction, 49. https://doi.org/10.1016/j.ijdrr.2020.101748

Pishnamazzadeh, M., Sepehri, M. M., & Ostadi, B. (2020a). An Assessment Model for Hospital Resilience according to the Simultaneous Consideration of Key Performance Indicators: A System Dynamics Approach. Perioperative Care and Operating Room Management, 20(April), 100118. https://doi.org/10.1016/j.pcorm.2020.100118

Pishnamazzadeh, M., Sepehri, M. M., & Ostadi, B. (2020b). An Assessment Model for Hospital Resilience according to the Simultaneous Consideration of Key Performance Indicators: A System Dynamics Approach. Perioperative Care and Operating Room Management, 20. https://doi.org/10.1016/j.pcorm.2020.100118

Rahman, N. H. N. A., Yaacob, N., Noh, A. Y. M., Bakar, M. A. A., Rahman, A., Fauzi, M. H., & Kamauzaman, T. H. T. (2021). Determination of service key performance indicators for emergency departments of teaching hospitals in malaysia: A fuzzy delphi method. Medical Journal of Malaysia, 76(6), 792–798.

Raitt, J., Hudgell, J., Knott, H., & Masud, S. (2019). Key performance indicators for pre hospital emergency Anaesthesia - A suggested approach for implementation. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 27(1). https://doi.org/10.1186/s13049-019-0610-x

Rego, I. B., Coelho, S., Semedo, P. M., Cavaco-Silva, J., Teixeira, L., Sousa, S., Reis, J., Dinis, R., Schmitt, F., Afonso, N., Fougo, J. L., Pavão, F., Baptista Leite, R., & Costa, L. (2023). 360 Health Analysis (H360)—A Comparison of Key Performance Indicators in Breast Cancer Management across Health Institution Settings in Portugal. Current Oncology, 30(7), 6041–6065. https://doi.org/10.3390/curroncol30070451

Rizk, M. M., Zaki, A., Hossam, N., & Aboul-Ela, Y. (2014). Evaluating laboratory key performance using quality indicators in Alexandria University hospital clinical chemistry laboratories. Journal of the Egyptian Public Health Association, 89(3), 105–113. https://doi.org/10.1097/01.EPX.0000453262.85383.70

Ruangsomboon, O., Surabenjawongse, U., Jantataeme, P., Chawaruechai, T., Wangtawesap, K., & Chakorn, T. (2023). Association between cardiopulmonary resuscitation audit results with in-situ simulation and in-hospital cardiac arrest outcomes and key performance indicators. BMC Cardiovascular Disorders, 23(1). https://doi.org/10.1186/s12872-023-03320-w

Si, S.-L., You, X.-Y., Liu, H.-C., & Huang, J. (2017). Identifying key performance indicators for holistic hospital management with a modified DEMATEL approach. International Journal of Environmental Research and Public Health, 14(8), 934.

Souza, T. A., Roehe Vaccaro, G. L., & Lima, R. M. (2020). Operating room effectiveness: a lean health-care performance indicator. International Journal of Lean Six Sigma, 11(5), 987–1002. https://doi.org/10.1108/IJLSS-12-2017-0141

Suriyawongpaisal, P., Kamlungkuea, T., Chiawchantanakit, N., Charoenpipatsin, N., Sriturawanit, P., Kreesang, P., & Thongtan, T. (2019). Relevance of using length of stay as a key indicator to monitor emergency department performance: Case study from a rural hospital in Thailand. EMA - Emergency Medicine Australasia, 31(4), 646–653. https://doi.org/10.1111/1742-6723.13254

Tuangratananon, T., Julchoo, S., Phaiyarom, M., Panichkriangkrai, W., Pudpong, N., Patcharanarumol, W., & Tangcharoensathien, V. (2021). Healthcare providers' perspectives on integrating NCDs into primary healthcare in Thailand: a mixed method study. Health Research Policy and Systems, 19(1). https://doi.org/10.1186/s12961-021-00791-1

Verga, M., Viganò, G. L., Capuzzo, M., Duri, C., Ignoti, L. M., Picozzi, P., & Cimolin, V. (2023). The digitization process and the evolution of Clinical Risk Management concept: The role of Clinical Engineering in the operational management of biomedical technologies. Frontiers in Public Health, 11. https://doi.org/10.3389/fpubh.2023.1121243

Victor, S., & Farooq, A. (2021). Dashboard visualisation for healthcare performance management: Balanced scorecard metrics. Asia Pacific Journal of Health Management, 16(2), 1–11. https://doi.org/10.24083/APJHM.V16I2.625

Zhang, L., Liu, R., Jiang, S., Luo, G., & Liu, H.-C. (2020). Identification of key performance indicators for hospital management using an extended hesitant linguistic dematel approach. Healthcare (Switzerland), 8(1). https://doi.org/10.3390/healthcare8010007