

## Identification of Key Performance Indicators for a Tertiary Hospital using Delphi Technique

Eman M. Nagy<sup>1\*</sup>, Azza El Nouman<sup>1</sup>, Dalia Ahmed<sup>1</sup>, Rasha Essam Eldin Galal<sup>2</sup>, Walaa Ahmed Khairy<sup>1</sup>

<sup>1</sup> Department of Public Health and Community Medicine, Faculty of Medicine, Cairo University, Egypt.

<sup>2</sup> Department of Pediatrics, Faculty of Medicine, Cairo University, Egypt.

\*Corresponding author: Eman M. Nagy,

E-mail: [Eman.nagy@kasralainy.edu.eg](mailto:Eman.nagy@kasralainy.edu.eg)

### KEYWORDS

Delphi technique –  
Key Performance  
Indicators –  
Quality.

### ABSTRACT

**Background:** Performance indicators are critical tools for assessing and evaluating the operational and strategic effectiveness of an organization. A carefully selected set of performance indicators not only enhances the accuracy of evaluation but also significantly influences the quality of services delivered. The selection of appropriate performance indicators is a complex process that requires methodological rigor to ensure relevance, reliability, and validity. Among the various consensus-building techniques, the Delphi method is widely recognized for its effectiveness in facilitating expert agreement on indicator selection. This study aims to identify the actionable performance indicators for organizational performance measurement using the Delphi technique by engaging a panel of experts through multiple rounds of surveys and feedback.

**Methods:** A group of eight experts representing various organizational levels and experiences participated in a Two-round Delphi study to identify the most actionable indicators. The indicators were initially identified through a scoping review of existing literature and in-depth interviews with stakeholders. In the first round, the experts assessed indicators' importance and data collection feasibility using 7-point Likert scale. In the second round, they assessed the indicators' implementation using Yes/no scale.

**Results:** A primary list of 80 potential indicators covering different 13 domain and considering Donabedian's framework was generated. Of these, 12.5% focused on structural aspects, 42.5% on processes, and 45% on outputs/outcomes. After the first round, 50 indicators were selected based on their scores. After the second round, consensus reached with 31 indicators were selected to be implemented. This final list covered 8 domains with focus on for medication management (9 Indicators) and patient safety (6 indicators).

**Conclusion:** Reaching consensus is a fundamental step for selection of action indicators. The Delphi technique is an appropriate tool to reach consensus on selection of quality indicators at healthcare setting.

#### Highlights:

Delphi technique to reach consensus about performance indicators applied in a tertiary hospital.

### Background:

Measuring the health-care system's performance is necessary for identifying problems and finding changes in order to achieve efficient, equitable, and patient-centered outcomes <sup>[1]</sup>. Meticulous selection of indicators influences improving the quality of services. Indicators measure variations directly and indirectly and can be applied to accomplish internal and external goal <sup>[2]</sup>.

Quality Indicators (QIs) are quantifiable elements that concerned with evaluating healthcare system performance focusing on structures, processes, and outcomes of care <sup>[3,4]</sup>. Based on institute of Medicine frame work, indicators domains to measure are safety, patient centered, effectiveness, equity, efficiency and timely care <sup>[5]</sup>. Relevance to the chosen problem and field of application, feasibility, and reliability are all important characteristics of high-quality QIs. They must also be simple to comprehend for both clinicians and patients, changeable through behavior, attainable, and quantifiable with high validity <sup>[6]</sup>. QIs must be evidence-based and have a high association with actual care quality to assure content and construct validity <sup>[4]</sup>.

Performance indicators are measures of performance, based on standards determined through evidence-based academic literature or through the consensus of experts when evidence unavailable <sup>[4,6]</sup>. The Delphi study is a structured, iterative method used to gather expert opinions and reach consensus through a series of questionnaires or rounds. Originally developed during the Cold War to predict enemy attacks, it is now widely applied across various fields <sup>[7]</sup>.

Through a series of questionnaire survey rounds, typically two or three, the Delphi technique is a research method used to reach consensus. Information and findings are shared with panel members in between each round <sup>[6]</sup>.

Rounds are held until group consensus is reached [8]. It is a valuable strategy for instances when a lack of agreement or incomplete state of knowledge needs to be addressed by tapping and combining individual judgments preventing dominance by any single individual and ensuring a balanced consensus process [7]. Because of this, the Delphi is especially recognized for its capacity to manage and coordinate group communication [7, 9, 10]. One of the main reasons for the popularity enjoyed by the Delphi technique is that a large number of individuals across diverse locations and areas of expertise can be included anonymously, thus avoiding domination of the consensus process by one or a few experts [7-10]. This study aims to develop a priority quality indicators list for nephrology unit through reaching consensus using Delphi technique.

## Methods:

The Delphi technique study executed through three steps:

*Step 1:* Expert panel selection.

*Step 2:* Literature review and generation of primary indicators list.

*Step 3:* Expert panel survey and scoring.

The study was conducted at Pediatric Nephrology Unit at Cairo University's tertiary hospitals. This unit provides medical and clinical services, including wards for hemodialysis and peritoneal dialysis, as well as an Intensive Care Unit (ICU). Additional support services include a water treatment facility, storage areas, and an on-site pharmacy.

### Step 1: Expert panel selection:

Expert panel members were invited in person to participate in the Delphi study based on their roles within the organizational hierarchy including varying levels of responsibility and expertise. They were approached to confirm their willingness to contribute in indicators' identification and selection, and all agreed to participate.

### Step 2: Literature review and generation of primary indicators list:

A preliminary indicators list was formulated based on:

- **Stakeholders'/Panel's perspective:** In-depth interviews were conducted with eight healthcare professionals using a semi-structured format, which included open-ended questions probed by Structure-Process-output model. This approach was designed to gather detailed insights and identify potential areas or weaknesses that could be measured.
- **Scoping literature review** through searching for peer reviewed available publications including hospital performance indicators [11]. This review was conducted using unified keywords "hospital Indicators, Quality performance measures" to identify the commonly used hospital indicators [12-16].

After the Preliminary Indicators List was created, it was reviewed to ensure its relevance and applicability to the processes and services within the nephrology unit. Following this verification, the list was refined into a shorter relevant Primary Indicators List. These indicators were then organized and categorized according to measurement domains.

### Step 3: Expert panel survey and scoring:

The indicator list was formulated into questionnaire form to be assessed against selected criteria. This questionnaire was distributed in a paper form to the expert panel, who were asked to complete it and return it for further analysis.

- **Round 1:**  
Primary indicators list was distributed. Each member of the expert panel evaluated every indicator based on its importance and the data collection feasibility using a 7-point Likert scale, where 1 represented "strongly disagree" and 7 represented "strongly agree." This resulted in a maximum of 14 points per indicator. The percentage score for each indicator was calculated by averaging the percentage scores provided by the 8 panel members. The cutoff point for selection in Round 1 was set at the median

percentage score of all indicators, which was 79.4%. Indicators scoring equal to or above 79.4% were accepted, while those scoring below this threshold were rejected. Following this process, a list of selected indicators (*Round 1 Selected Indicators List*) was compiled.

○ **Round 2:**

The list of indicators selected in Round 1 was redistributed to the expert panel to evaluate their agreement on implementation using a yes/no scale. The percentage score for each indicator was determined by the proportion of experts who responded "yes" for implementation. The cut off for Round 2 was established at the median score of all indicators in this round, which was 75%. Only indicators that received a "yes" response from  $\geq 75\%$  of the participants were retained. A refined list of selected indicators (*Round 2 Selected Indicators List*) was then created. Consensus was reached for the Round 2 selected indicators list which was subsequently submitted to the unit quality coordinator for implementation.

**Results:**

**Expert Panel:**

The expert panel was composed of eight members representing various hierarchical levels and responsibilities, as well as with different years of clinical experience. As shown in **Table (1)**, the panel included a diverse range of qualifications: five of the eight members held Medical Doctorate degrees in pediatrics, one was a pharmacist, and two were nurses.

**Table (1) : Expert Panel qualifications and responsibilities:**

Panelist	Qualifications	Role/Responsibility	Years of Experience
HA.	MD Pediatrics	Professor/ Hospital ICU Manager/ Quality Consultant	28 Years
SA.	MD Pediatrics	Professor/ Unit Manager	25 Years
RA.	MD Pediatrics	Professor/ Unit Deputy/ Unit Quality Coordinator	22 Years
YA.	MD Pediatrics	Associate Professor/Unit ICU Moderator	12 Years
MO.	MD Pediatrics	Lecturer/ Hemodialysis Service Moderator	12 Years
AY.	Bachelor Pharmacy	Unit Pharmacy Moderator	3 Years
GI.	School of Nursing	High Nurse	22 Years
SF.	School of Nursing	High Nurse	22 Years

**Literature review and generation of potential indicators list**

A preliminary list of 101 indicators was developed based on a scoping review and input from panel. Regarding the measurement items or areas suggested by the panel, the majority of participants (6 out of 8) recommended adding patient safety measures. Examples included the incidence of bed sores in ICU patients (5 out of 8), compliance with high-alert medication policies (4 out of 8), and the incidence of hospital-acquired Methicillin-Resistant Staphylococcus Aureus (MRSA) infections (4 out of 8).

Following a verification process that considered indicators’ applicability based on availability of services and processes in the unit, the Primary List of 80 potential indicators was generated. These indicators were categorized according to Donabedian’s framework—Structure, Process, and Outcome—as detailed in **Table (2)**. Out of the 80 indicators, 10 were classified as structure indicators, 34 as process indicators, and 36 as outcome indicators, representing 12.5%, 42.5%, and 45% of the total, respectively. These indicators were grouped into 13 measurement domains. The domains with the highest number of proposed indicators were patient assessment/medical records (12 indicators), medication management (11 indicators), and patient safety (10 indicators).

**Table 2: Types of proposed primary indicators per domain:**

Indicators' domains	Indicators' number per type			Total number / domain
	Structure	Process	Output/ outcome	
Managerial	2	0	2	4
Medication management	1	7	3	11
Infection control	0	1	5	6
Risk management	0	2	1	3
Patient safety	0	2	8	10
Emergency	0	4	1	5
Radiology	0	3	0	3
Nursing	4	3	1	8
Public / Patients relations	0	0	6	6
Patient assessment/ Medical File	0	8	4	12
Supply chain	1	1	1	3
Facility management & safety	0	3	4	7
Human resources	2	0	0	2
<b>Total</b>	<b>10 (12.5%)</b>	<b>34 (42.5%)</b>	<b>36 (45%)</b>	<b>80 (100%)</b>

**Expert panel survey and rounds:**

As summarized in **Table (3)**, out of 80 suggested indicators, 50 indicators were selected in round 1 while only 31 were reselected in round 2 representing more than third of total primary proposed indicators (38.7%). The highest selected indicators domain was medication management followed by infection control (81.8% and 66.6% out of total indicators per domain). On the other hand, risk management, emergency, radiology, facility management and human resources domains were totally excluded (*Detailed individual indicators selection across round 1 & 2; Supplementary data*).

**Table (3): Number of selected indicators per service domain through Round 1 & round 2.**

Domain	Indicators no per domain	R1 selected indicators no	R2 selected indicators no	R2 (final) selected indicators %
Managerial	4	4	2	50.0%
Medication management	11	9	9	81.8%
Infection control	6	6	4	66.6%
Risk management	3	0	0	0%
Patient safety	10	8	6	60.0%
Emergency	5	0	0	0%
Radiology	3	1	0	0%
Nursing	8	4	4	40.0%
Public/ Patients relations	6	3	1	16.6%
Patient assessment/ Medical File	12	6	4	33.3%
Supply chain	3	2	1	33.3%
Facility management	7	5	0	0%
Human resources	2	2	0	0%
<b>Total</b>	<b>80</b>	<b>50</b>	<b>31</b>	<b>38.7%</b>

The Consensus has been reached to the Round 2 (final) 31 indicators list (**Table 4**) representing 8 domains including medications, patients safety , infection control, nursing , patients file assessment, managerial, supply chain and public relations. Afterword this final list of the indicators was proposed to the quality head unit for implementation.

**Table (4): Final indicators list per domain:**

<b>Domain</b>	<b>Indicator name</b>
<b>Managerial</b>	<b>ICU bed occupancy rate</b>
	<b>Average length of stay</b>
<b>Medications</b>	<b>Percentage of improper preparation of high alert medications</b>
	<b>Percentage of improper labelling for high alert medications</b>
	<b>Percentage of improper replacement of high alert medication</b>
	<b>Percentage of proper administration of high alert medications</b>
	<b>Inventory stock</b>
	<b>Percentage of expired medications</b>
	<b>Percentage of compliance with hospital policy of storage of high alert medications</b>
	<b>Percentage of complete medication administration records</b>
	<b>Percentage of complete medication orders</b>
<b>Infection Control</b>	<b>Percentage of employees provided vaccination</b>
	<b>Percentage of Patients provided vaccination</b>
	<b>No. of staff needle stick injury</b>
	<b>Hospital acquired MRSA/1000 patient days</b>
<b>Patient Safety</b>	<b>Percentage of fall risk precautions done for high risk patients</b>
	<b>Percentage of complete nursing endorsement forms</b>
	<b>Percentage of complete physicians endorsement forms</b>
	<b>Percentage of patients identified with wrist band</b>
	<b>Percentage of patient falls with injuries</b>
	<b>Percentage of medical records forms identified with patient's identification card</b>
<b>Nursing</b>	<b>Nurse: patients ratio for wards</b>
	<b>Nurse: patients ratio for ICU</b>
	<b>Percentage of acquired bed sores in hospital</b>
	<b>Percentage of nurses training according to the training agenda</b>
<b>Public/patients Relation</b>	<b>Percentage of DAMA patients from ICU patients*</b>
<b>Patient assessment/ Medical File</b>	<b>Percentage of cases (in-patient) wherein care plan with desired outcomes is documented by physicians</b>
	<b>Percentage of medical records not having discharge summary</b>
	<b>Percentage of medical records having incomplete and/or improper consent</b>
	<b>Percentage of cases (in-patients) wherein care plan with desired outcomes is documented by Nurse</b>
<b>Supply chain</b>	<b>Percentage of stock outs</b>

\*DAMA; Discharge Against Medical Advice

The overall steps of indicators identification and selection process and each step outputs are shown in **Figure(1)**.

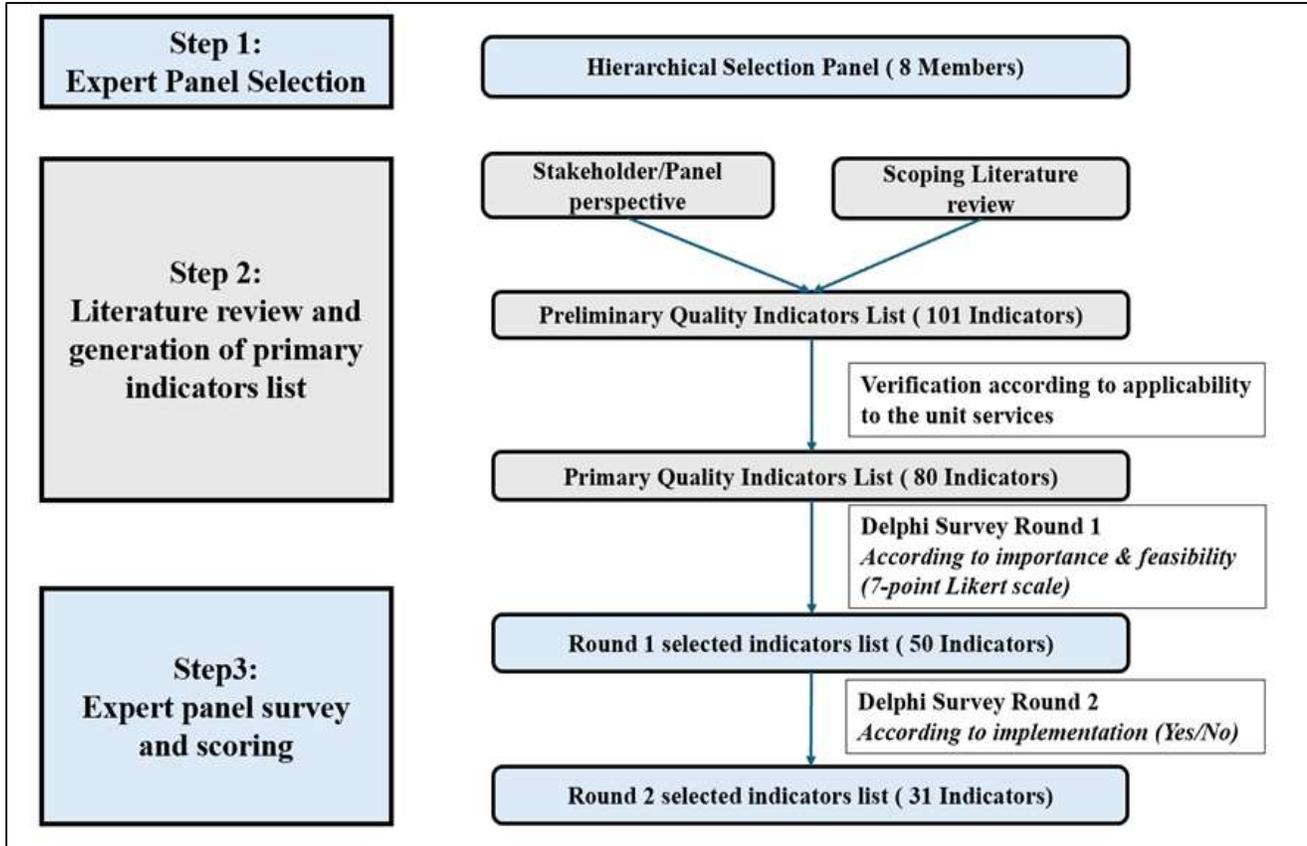


Figure 1: Overall indicators selection process.

## Discussion:

For the current study, engaging unit key persons through in-depth interview or selection of key performance indicators (KPI) was beneficial for their cooperation and for ensuring sustainability and compliance as mentioned in previous study that involving stakeholders is highly one of quality improvement challenges that is recommended to handle [17]. Proposal and selection of new set of indicators were accomplished in this study using Delphi technique. Delphi technique is one of the most widely used methods to reach consensus in selecting indicators for health care settings. The main advantage for using Delphi technique is avoidance of domination of one or experts to the whole selection process [7]. To the researcher's best knowledge, only few studies in Egypt used Delphi technique in healthcare related research areas [18-20]. None of these studies were concerned with selecting performance indicators.

For the current study, Delphi expert panel 8 members were selected based on hierarchy position including both authorized personnel, quality expertise, clinicians and nurses. Previous study expert panel was defined as those who can make a significant contribution to the process, have the greatest degree of authority, and are committed and interested [21]. Other studies, expert panels were selected according to managerial and professional different specialties and different experiences. It has been stated that the heterogeneity of stakeholders adds relevance and strength to concepts created using formal consensus process [8,22,23].

Primary Delphi indicators list included different indicators categories according to Donabedian model (Structure-process- Outcome) covering 13 service domains such as managerial, infection control, patient safety,

patient assessment and medical records, human resources and patient/public relations. the highest proposed indicators numbers belonged to patient assessment/ medical files, medication management and patient safety domains (12, 11 and 10 respectively). These domains are in common with potential domains previously used which included utilization, patient safety, infection control patient satisfaction and documentation compliance. These domains reflect different values as accessibility, compliance to documentation policies, services performance, and quality of care [24].

In the current study, consensus /selection cut off level was determined as median score of indicators percent scores for both round one and two, indicators were selected when achieved a higher or equal score to the median as similar to recent study that used the median score as cut off level [25]. Other studies used different cut off level as preset 70 % agreement as cut off level [26,27], while others used 75 % agreement as cut off level [20,22].

Systemic review for Delphi studies stated that number of rounds for Delphi technique range from 2 to 3 rounds [7]. The current study reached consensus after two rounds. Similar studies reached consensus by 2 rounds [21, 26], while others reached consensus through 3 rounds [23].

Based on the results of current Delphi technique, 31 indicators were selected out of 80 proposed indicators. The selected indicators were covering medication management, managerial & supply chain, infection control, patient safety, nursing and patient assessment. While in another study, out of 43 proposed indicators, 32 indicators were selected followed by steering group discussion specifying 8 indicators to start implementation with [23]. Another study developed generic nursing indicators set concluded that 17 indicators out of 92 indicators were selected using modified Delphi method [28]. The selected indicators covered patient centered care domain such as communication and consent, evaluation of communication skills, rehabilitation and waiting time. Recent study aimed to determine indicators of nursing care performance by identifying structures, processes, and outcomes that are relevant, feasible, and have the potential for benchmarking in Swiss acute hospitals showed that 12 indicators were selected out of 21 proposed indicators [21, 29].

It is worth mentioning that Health Information and Quality Authority (2013) clarified that, evident and not complex indicators definition should be included to ensure that it is accurately realized by those responsible for collecting the data. Additionally, it confirmed that the minimum data set must be determined as the data needed to be collected for each indicator, which was accomplished in the present study through defining the data sources for both nominators and denominators as well as updating and generating new checklists and forms for data collection [30].

## **Conclusion:**

Proposal and selection of new essential KPIs for performance monitoring was executed using Delphi technique, consensus was reached after 2 rounds resulting in selecting 31 indicators out of 80 proposed indicators list.

For any performance improvement project, it is recommended to engage stakeholders and internal staff in decision making and suggested plan of action will facilitate the implementation process and maintain their dedication & responsibility. Using Delphi technique as an effective tool to reach consensus for new indicators selection as it ensures respecting each individual opinion.

## **Conflict of interest:**

Authors declare no conflict of interest.

## References

- [1] Sharma A, Prinja S, Aggarwal AK. Comprehensive measurement of health system performance at district level in India: Generation of a composite index. *The International Journal of Health Planning and Management*. 2019;34(4): e1783-e99.
- [2] Information H, Authority Q. Guidance on developing key performance indicators and minimum data sets to monitor healthcare quality. HIQA Dublin; 2013.
- [3] Kötter T, Blozik E, Scherer M. Methods for the guideline-based development of quality indicators--a systematic review. *Implementation Science*. 2012; 7:1-22.
- [4] McCabe A, Nic An Fhailí S, O'Sullivan R, Brenner M, Gannon B, Ryan J, et al. Development and validation of a data dictionary for a feasibility analysis of emergency department key performance indicators. *International Journal of Medical Informatics*. 2019; 126:59-64.
- [5] Braspenning J, Hermens R, Calsbeek H, Campbell S, van der Wees P, Grol R. Indicators for quality and safety of care. *Improving patient care: The implementation of change in health care*. 2020:131-54.
- [6] Braithwaite J, Hibbert P, Blakely B, Plumb J, Hannaford N, Long JC, et al. Health system frameworks and performance indicators in eight countries: a comparative international analysis. *SAGE open medicine*. 2017; 5:2050312116686516.
- [7] Boulkedid R, Abdoul H, Loustau M, Sibony O, Alberti C. Using and reporting the Delphi method for selecting healthcare quality indicators: a systematic review. *PloS one*. 2011;6(6): e20476.
- [8] Shawahna R. Quality indicators of pharmaceutical care for integrative healthcare: a scoping review of indicators developed using the Delphi technique. *Evidence-Based Complementary and Alternative Medicine*. 2020;2020.
- [9] Spranger J, Homberg A, Sonnberger M, Niederberger M. Reporting guidelines for Delphi techniques in health sciences: A methodological review. *Zeitschrift für Evidenz, Fortbildung und Qualität im Gesundheitswesen*. 2022; 172:1-11.
- [10] Powell C. The Delphi technique: myths and realities. *Journal of advanced nursing*. 2003;41(4):376-82.
- [11] Munn Z, Peters MDJ, Stern C, Tufanaru C, McArthur A, Aromataris E. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Medical Research Methodology*. 2018;18(1):143.
- [12] Breyer JZ, Giacomazzi J, Kuhmmer R, Lima KM, Hammes LS, Ribeiro RA, et al. Hospital quality indicators: a systematic review. *International Journal of Health Care Quality Assurance*. 2019;32(2):474-87.
- [13] Indicators AQ. Guide to patient safety indicators. Rockville, MD: Agency for Healthcare Research and Quality. 2003.
- [14] Danchaivijitr S, Rongrungruang Y, Pakaworawuth S, Jintanothaitavorn D, Naksawas K. Development of quality indicators of nosocomial infection control. *J Med Assoc Thai*. 2005;88(Suppl 10): S75-82.
- [15] Fujita KA-O, Moles RJ, Chen TF. Quality indicators for responsible use of medicines: a systematic review. (2044-6055 (Electronic)).
- [16] Mellor J, Overton CE, Fyles M, Chawner L, Baxter J, Baird T, et al. Understanding the leading indicators of hospital admissions from COVID-19 across successive waves in the UK. (1469-4409 (Electronic)).
- [17] Dixon-Woods M, McNicol S, Martin G. Ten challenges in improving quality in healthcare: lessons from the Health Foundation's programme evaluations and relevant literature. *BMJ quality & safety*. 2012;21(10):876-84.
- [18] Sun C, Dohrn J, Oweis A, Huijter HAS, Abu-Moghli F, Dawani H, et al. Delphi survey of clinical nursing and midwifery research priorities in the eastern Mediterranean region. *Journal of nursing scholarship*. 2017;49(2):223-35.

- [19]El Miedany Y, Abu-Zaid MH, El Gaafary M, El Naby MMH, Fathi N, Saber HG, et al. Egyptian consensus on treat-to-target approach for osteoporosis: a clinical practice guideline from the Egyptian Academy of bone health and metabolic bone diseases. *Egyptian Rheumatology and Rehabilitation*. 2021; 48:1-16.
- [20]Naghi M, Salem MR. A modified Delphi study for the development of a leadership curriculum for pediatric oncology. *Asian Pacific Journal of Cancer Prevention: APJCP*. 2021;22(5):1659.
- [21]Koch D, Kutz A, Conca A, Wenke J, Schuetz P, Mueller B. The relevance, feasibility and benchmarking of nursing quality indicators: A Delphi study. *Journal of advanced nursing*. 2020;76(12):3483-94.
- [22]Wood L, Bjarnason GA, Black PC, Cagiannos I, Heng DYC, Kapoor A, et al. Using the Delphi technique to improve clinical outcomes through the development of quality indicators in renal cell carcinoma. *Journal of oncology practice*. 2013;9(5): e262-e7.
- [23]Madsen MM, Eiset AH, Mackenhauer J, Odby A, Christiansen CF, Kurland L, et al. Selection of quality indicators for hospital-based emergency care in Denmark, informed by a modified-Delphi process. *Scandinavian journal of trauma, resuscitation and emergency medicine*. 2016; 24:1-8.
- [24]Khalifa M, Khalid P. Developing Strategic Health Care Key Performance Indicators: A Case Study on a Tertiary Care Hospital. *Procedia Computer Science*. 2015; 63:459-66.
- [25]Van den Bulck SA, Vankrunkelsven P, Goderis G, Van Pottelbergh G, Swerts J, Panis K, et al. Developing quality indicators for chronic kidney disease in primary care, extractable from the Electronic Medical Record. A Rand-modified Delphi method. *BMC nephrology*. 2020; 21:1-10.
- [26]Hernández-Borges AA, Pérez-Estévez E, Jiménez-Sosa A, Concha-Torre A, Ordóñez-Sáez O, Sánchez-Galindo AC, et al. Set of quality indicators of pediatric intensive care in Spain: Delphi method selection. *Pediatric Quality & Safety*. 2017;2(1): e009.
- [27]Veugelers R, Gaakeer MI, Patka P, Huijsman R. Improving design choices in Delphi studies in medicine: the case of an exemplary physician multi-round panel study with 100% response. *BMC Medical Research Methodology*. 2020; 20:1-15.
- [28]Uphoff EP, Wennekes L, Punt CJ, Grol RP, Wollersheim HC, Hermens RP, et al. Development of generic quality indicators for patient-centered cancer care by using a RAND modified Delphi method. *Cancer nursing*. 2012;35(1):29-37.
- [29]Star S, Russ-Eft D, Braverman MT, Levine R. Performance Measurement and Performance Indicators: A Literature Review and a Proposed Model for Practical Adoption. *Human Resource Development Review*. 2016;15(2):151-81.
- [30]Authority H. Guidance on developing key performance indicators and minimum data sets to monitor healthcare quality. Ireland: Health Information and Quality Authority. 2010.

**Supplementary Data:**

*Detailed individual indicators selection (80 indicators of the primary list) across round 1 and round 2:*

Domain	Indicator name	Round 1		Round 2	
		Indicator % score	Selected	Indicator % score	Selected
Managerial	No. of low risk mortality cases	79.46%	Yes	25%	No
	ICU bed occupancy rate	89.29%	Yes	100%	Yes
	Average length of stay	84.82%	Yes	100%	Yes
	Inpatient volume	89.29%	Yes	50%	No
Medication	Percentage of compliance with anti-stress prophylaxis	64.29%	No	---	---
	Percentage of improper Preparation of high alert medications	82.14%	Yes	75%	Yes
	Percentage of improper labelling for high alert medications	79.46%	Yes	75%	Yes
	Percentage of improper Replacement of high alert medication	79.46%	Yes	75%	Yes
	Percentage of proper Administration of high alert medications	81.25%	Yes	87.50%	Yes
	Inventory stock	94.64%	Yes	100%	Yes
	Percentage of compliance with VTE prophylaxis*	70.54%	No	---	---
	Percentage of expired medications	89.29%	Yes	100%	Yes
	Percentage of compliance with hospital policy of storage of high alert medications	88.39%	Yes	87.50%	Yes
	% of complete administration records	89.29%	Yes	87.50%	Yes
% of complete medication orders	82.14%	Yes	100%	Yes	
Infection Control	Staff hand hygiene compliance rate	81.25%	Yes	50%	No
	%of employees provided vaccination	81.25%	Yes	87.50%	Yes
	%of Patients provided vaccination	83.04%	Yes	100%	Yes
	No. of staff needle stick injury	83.04%	Yes	100%	Yes
	Hospital acquired MRSA*/1000 patient days	82.14%	Yes	100%	Yes
	Hospital acquired infection rate	80.36%	Yes	62.50%	No
Risk	No. of OVRs*	44.64%	No	---	---
	% of near misses reported	67.86%	No	---	---
	No. of sentinel events reported, collected and analyzed within the defined time frame	58.93%	No	---	---
Radiology	TAT of Ultrasound*	56.25%	No	---	---
	% of compliance to critical results reporting	68.75%	No	---	---
	% of adherence to safety precautions by employees working in diagnostics	79.46%	Yes	50%	No
Patients safety	% of fall risk precautions done for high risk patients	81.25%	Yes	87.50%	Yes
	Percentage of awareness of verbal orders	70.54%	No	---	---
	Average time for reporting critical results	80.36%	Yes	12.50%	No
	Percentage of patient falls	79.46%	Yes	50	No
	Percentage of documented critical values in patient's file with action taken	76.79%	No	---	---
	Percentage of complete nursing endorsement forms	79.46%	Yes	87.50%	Yes
	Percentage of complete physicians endorsement forms	79.46%	Yes	87.50%	Yes
	Percentage of patients identified with wrist band	83.93%	Yes	75%	Yes
	Percentage of patient falls with injuries	84.82%	Yes	100%	Yes
Percentage of medical records forms identified with patient's identification card	92.86%	Yes	100%	Yes	
Emergency	Bicarb. Misuse	50.00%	No	---	---
	Atropine misuse	58.04%	No	---	---
	Average response time	75.00%	No	---	---
	Average CPR cycle time*	64.29%	No	---	---
	Completeness of CPR form	67.86%	No	---	---
Nursing	No. of restraint patients according to the guidelines	73.21%	No	---	---
	No. of restraint with injury	73.21%	No	---	---
	Nurse: patient ratio for wards	80.36%	Yes	100%	Yes
	Nurse: patient ratio for ICU	87.50%	Yes	100%	Yes

Domain	Indicator name	Round 1		Round 2	
		Indicator % score	Selected	Indicator % score	Selected
	Percentage of nursing turnover	74.11%	No	---	---
	Percentage of acquired bed sores in hospital	86.61%	Yes	100%	Yes
	Percentage of nurses training according to the training agenda	81.25%	Yes	75%	Yes
	Percentage of nursing absenteeism	72.32%	No	---	---
PR	Outpatients complaints rate	63.39%	No	---	---
	Outpatient satisfaction index	65.18%	No	---	---
	Inpatients complaints rate	79.46%	Yes	62.50%	No
	Inpatient satisfaction index	79.46%	Yes	62.50%	No
	% of DAMA patients from ICU patients*	86.61%	Yes	75%	Yes
	% of DAMA patients from inpatients	71.43%	No	---	---
Patient assessment/ Medical File	Percentage of Duplicated Medical Record Number for the same patient	66.07%	No	---	---
	Average time for initial physician assessment of emergency patients	69.64%	No	---	---
	Average time for initial nursing assessment of ICU patients	71.43%	No	---	---
	Average time for initial nursing assessment of indoor patients	71.43%	No	---	---
	Average time for initial physician assessment of ICU patients	67.86%	No	---	---
	Average time for initial physician assessment of indoor patients	73.21%	No	---	---
	% of cases wherein screening for nutritional needs is documented	92.86%	Yes	62.50%	No
	% of cases (in-patient) wherein care plan with desired outcomes is documented by physicians	90.18%	Yes	87.50%	Yes
	Percentage of missing records	96.43%	Yes	50%	No
	Percentage of medical records not having discharge summary	98.21%	Yes	100%	Yes
	Percentage of medical records having incomplete and/or improper consent	100%	Yes	100%	Yes
% of cases (in-patients) wherein care plan with desired outcomes is documented by Nurse	79.46%	Yes	75%	Yes	
HR	Staff absenteeism rate	91.07%	Yes	62.50%	No
	Staff turnover	83.04%	Yes	37.50%	No
Supply chain	Percentage of drug & consumables delivered within the agreed with the supplier time frame	80.36%	Yes	37.50%	No
	Percentage of stock outs	92.86%	Yes	87.50%	Yes
	percent of vendors compliance to the storage standards in their intern stores	76.79%	No	---	---
Facility management and safety	Average weight of hazardous waste per month	37.50%	No	---	---
	Number of workers not using suitable PPE	91.07%	Yes	37.50%	No
	Number of staff without ID/total number of staff monthly	87.50%	Yes	50%	No
	% of staff trained on fire safety /month	79.46%	Yes	62.50%	No
	% of security observations from the monthly audit	77.68%	No	---	---
	incidence of employee injuries due to hospital environmental reason	93.75%	Yes	50%	No
	% of resolved failures of medical equipment's/month	93.75%	Yes	62.50%	No

\*VTE stands for venous thromboembolism, MRSA stands for Methicillin-resistant Staphylococcus aureus, OVR stands for Occurrence Variance Reporting, TAT stands for Turnaround time, CPR stands for Cardiopulmonary Resuscitation, DAMA stands for Discharge