Indicators of effectiveness of nursing care in the dimension of patient safety

Indicadores de efectividad de la asistencia de enfermería en la dimensión seguridad del paciente

ABSTRACT

Objectives: to validate nursing care effectiveness indicators of patient safety dimension. Methods: quantitative survey, using the electronic Delphi sampling, with 52 participants selected by the Snowball sampling. Eight indicators were evaluated regarding the attributes: availability, reliability, simplicity, representativeness, sensitivity, comprehensiveness, objectivity, cost, utility, stability and timeliness. For validation, the minimum agreement criterion was 70%. Results: Cronbach's alpha (0.942) evidenced the high internal consistency among the attributes. The indicators fall with damage, hip fracture, and postoperative hip fracture, incidents related to equipment, incidents due to failures in patient identification, and pressure injury were validated in all attributes, and those of medication error and hand Hygiene were not validated. Conclusions: the validated indicators allow assessment of the effectiveness of hospital nursing care. Unavailability of data is an obstacle to monitoring patient safety.

Descriptors: Quality Indicators, Health Care; Effectiveness; Nursing Care; Patient Safety; Quality Management.

RESUMEN

Objetivos: validar indicadores de efetividad de la asistencia de enfermería hospitalaria en la dimensión seguridad del paciente. Métodos: estudio cuantitativo, tipo encuesta, mediante la técnica Delphi electrónica, con 52 participantes seleccionados por la técnica Bola de Nieve. Ocho indicadores fueron evaluados en función de los atributos: disponibilidad, confiabilidad, sencillez, representatividad, sensibilidad, alcance, objetividad, costo, utilidad, estabilidad y tempestividad. Para la validación, el criterio mínimo de concordancia fue del 70%. Resultados: el Alfa de Cronbach (0.942) evidenció la alta consistencia interna entre los indicadores. Los indicadores caían con daño, fractura de cadera, y fractura de cadera postoperatoria, incidentes relacionados con equipos, incidentes debido a fallos en la identificación del paciente, y lesiones por presión fueron validados en todos los atributos, y los de error de medicación y higiene de manos no fueron validados. Conclusiones: los indicadores validados permiten la evaluación de la efetividad asistencial de la enfermería hospitalaria. La indisponibilidad de datos es un obstáculo al monitorio de la seguridad del paciente.

Descriptores: Indicadores de Calidad de la Atención de Salud; Efectividad; Atención de Enfermería; Seguridad del Paciente; Gestión de la Calidad.

Original Article

Leila Soares Seiffert
ORCID: 0000-0002-8461-0361
Lillian Daisy Gonçalves Wolff
ORCID: 0000-0002-5152-4811
Maria Manuela Frederico Ferreira
ORCID: 0000-0003-4032-9911
Elaine Drehmer de Almeida Cruz
ORCID: 0000-0002-7686-6340
Alexandra Lunardon Silvestre
ORCID: 0000-0002-4899-1734

1Universidade Federal do Paraná, Curitiba, Paraná, Brazil.
2Escola Superior de Enfermagem de Coimbra, Coimbra, Portugal.

How to cite this article: Seiffert LS, Wolff LDG, Ferreira MMF, Cruz EDA, Silvestre AL. Indicators of effectiveness of nursing care in the dimension of patient safety. Rev Bras Enferm. 2020;73(3):e20180833. doi: http://dx.doi.org/10.1590/0034-7167-2018-0833

Corresponding author:
Leila Soares Seiffert
E-mail: leilaseiffert@gmail.com

EDITOR IN CHIEF: Dulce Aparecida Barbosa
ASSOCIATE EDITOR: Alexandre Balsanelli

Submission: 10-31-2018  Approval: 06-08-2019
INTRODUCTION

Patient safety has been part of the global health priority agenda since 2000, when an American report revealed the magnitude of errors in hospital care\(^\text{11}\). This is a relevant dimension of quality and, through indicators, measures risks of patient care\(^\text{2}\).

Indicators are quantifiable representations of structure, processes and results, and provide information expressed by events, rates or indices\(^\text{3-8}\). Even relevant, they are underutilized. The systematic effectiveness measurement of in-Hospital programs is not perceived\(^\text{4}\), with more frequent measurements related to the structure or processes.

Indicators of results or effectiveness refer to desirable or undesirable changes attributed to health care provided\(^\text{8}\). Although the results indicators are influenced by many factors, they are concrete and indispensable elements to measure the impact of health care\(^\text{2}\). Effectiveness is the degree level to which attainable improvements in health are achieved\(^\text{8}\). Thus, assistance is expected to be effective and safe, providing good results and good life quality to the individual and the community, and is based on the best evidence.

Nursing is highlighted as the largest workforce in Brazilian health area, answering for the majority of hospital care, with direct involvement in the conception, operationalization and evaluation of strategies to improve patient's safety\(^\text{9}\). Therefore, indicators for measuring nursing care effectiveness must correlate to the main dimensions of quality, such as safety and patient-centered care; and organizations should provide mechanisms to facilitate health professionals directly involved in assistance and managers to understand the concepts related to these indicators and their use in the hospital routine.

From the perspective of contributing to the quality and safety of health care, the Sistema de Notificações à Vigilância Sanitária (NOTIVISA - notification system for sanitary surveillance) was created. According to NOTIVISA, between 2014 and 2016, there were 63,933 incidents related to assistance, 417 (0.6%) fatal\(^\text{10}\). All public and private services, through its patient Safety Center, are responsible for notifications of incidents in Notivisa. Nursing adherence to internal notification is emphasized, although the safety culture in hospitals still requires maturity for professionals to feel safe when informing occurrences\(^\text{8}\).

It is found in the literature\(^\text{1,11-25}\) nursing care effectiveness indicators not validated by specialists with expertise in the study and/ or use of indicators in health practice. This study focuses on the following indicators: Fall with damage\(^\text{1,11-12,14-15,21,23-24}\), hip fracture\(^\text{15,22}\) and postoperative hip fracturing\(^\text{15}\), equipment-related incidents\(^\text{15}\), incidents due to failures in patient Identification\(^\text{13}\), pressure injury\(^\text{11,15}\), medication error\(^\text{11,13-14,16-20,26}\) and hand hygiene\(^\text{16-17}\).

The content validation of indicators of effectiveness of nursing care in the patient safety dimension demonstrates the extent to which these indicators express the planned results for a given nursing care. Thus, this validation can contribute to evidence indicators sensitive to nursing care, qualify assistance planning, and explain to patients the nursing team's contribution to the results of hospital care\(^\text{18}\).

As criteria to assess whether the indicators measure the nursing care effectiveness, attributes recognized in the literature can be used as desirable for a good indicator, such as: availability, reliability, simplicity, representativeness, sensitivity, comprehensiveness, objectivity, low cost, usefulness, stability and timeliness\(^\text{11-12,27-28}\).

OBJECTIVES

To validate nursing care effectiveness indicators in the patient safety dimension, considering their correspondence to the attributes availability, reliability, simplicity, representativeness, sensitivity, comprehensiveness, objectivity, low cost, usefulness, stability and timeliness.

METHODS

Ethical aspects

The study incorporated in its design the basic references of the resolution of National Health Council No. 466/2012, respecting the rights of participants, who agreed with the free and informed consent form (ICF). Their identities remain anonymous, and their identification is given by alphanumeric code, not causing harm or monetary and moral damage. Approval from the Research Ethics Committee of the Department of Health Sciences of the Federal University of Paraná.

Study design, location, and period

This is a cross-sectional, descriptive study, as a survey with a quantitative approach. The Delphi electronic technique was used, a method for systematic collection and aggregation of judgments informed by experts or specialists\(^\text{29}\), which desired the minimum consensus of 70% in answers in two rounds. Data collection was carried out from May 10 to September 19, 2017, Brazil.

Population or sample

The sample selection was intentional. All those who fulfilled the inclusion criteria were invited to participate in the research: being Brazilian and having professional experience or scientific production related to health indicators in hospitals. The exclusion criterion was the non-completeness of 90% of the answers.

Study protocol

We used snowball sampling for recruitment of participants\(^\text{30}\). From a list of 20 authors of articles related to health indicators and 20 individuals with experience in the use of indicators in their professional practice, we identified those that corresponded to one or more inclusion criteria, which was confirmed by analyzing their Lattes currricula. The preliminary contact occurred via electronic messages. With each contact, a possible participant recommended others, and so on. We obtained 176 possible participants.

Each one received an invite to participate. To those who accepted it, we sent an access link to the electronic platform Survey Monkey and the questionnaire, after consent to the electronic ICF. Participated in the first round 52 specialists, 43 in the second, all identified by the letter P, followed by a cardinal number, respecting the order of submission of completed instrument to the researcher.
Authors recommend that, to verify the content validity, a panel of experts is used to assess how much the indicator satisfies certain requirements. Thus, with an approach based on objectivity and scientific neutrality, it is possible to evaluate whether the indicator or a group of indicators represent the situation or the phenomenon studied.

Participants were asked to evaluate the indicators of effectiveness raised in the literature, based on the indicator’s technical data sheet of the elaborated by Seiffert for the present study. Each indicator sheet contained its name, definitions, purpose/use, estimate method, measure type/unit of, assessment method, including collection and origin of data, frequency which it would be measured with and references. The patterns for indicators’ content validation were specified in the attributes shown in Chart 1, which were backed up by the literature.

The survey consisted of 96 questions with five-level Likert-scale answer options: “I totally disagree”; “I partially disagree”; “I do not disagree or agree”; “I partially agree”; “I totally agree”. A minimum of 70% of agreement was stipulated between the answers in relation to all attributes (Chart 1) for the validation of each indicator, per round, estimated by the sum of percentages of answers “totally agree” and “partially agree”.

**Chart 1 – Desirable attributes used as a standard for content validation of nursing care effectiveness indicators**

| Attribute               | Specification                                                                 |
|-------------------------|-------------------------------------------------------------------------------|
| Availability            | Easy obtainment of data for its structuring.                                  |
| Reliability             | Original sources and reliable data collection and processing methods.         |
| Simplicity              | Easy estimative from basic information, understanding or interpretation.      |
| Representativeness      | It faithfully represents what it proposes to measure.                          |
| Sensitivity             | It distinguishes occasional variations in the trend of situation, in a given area, with reflections on its result. |
| Scope                   | It synthesizes as many conditions or factors as possible that affect the situation to be measured. |
| Objectivity             | Clarity in measuring objective.                                              |
| Low cost                | Favorable relationship between costs of obtaining data and benefits arising from its use. |
| Utility                 | Provides decision-making.                                                     |
| Stability               | The measurement series allows for consistent monitoring and comparisons.       |
| Timeliness              | Structured with current and timely information to use.                        |

Source: Elaboration of the authors based on D’innocenzo et al., National School of Public Administration, Commitment to Hospital Quality Program and Agency for Healthcare Research and Quality.

**Analysis of results and statistics**

Data analysis was performed using uni and bivariate descriptive statistics. The Survey Monkey provided agreement percentages between first round answers. All answers were inserted in the Statistical Package for the Social Sciences (SPSS), version 22, to assess the validation after the two rounds. Cronbach’s alpha coefficient was used to analyze the internal consistency and the difference of panelists’ opinion in both rounds, in addition to the Spearman’s C-ratio for correlation analysis between the attributes.

Among the specialists, 65.38% were nurses; 15.38% doctors; 9.62% pharmacists; 5.77% administrators; and 3.85% were other professionals. Regarding the degree, 36.64% were graduated; 36.64% Masters; 26.92% Doctors; and 5.77% studied post-doctorate.

The Cronbach’s alpha was 0.942, demonstrating that, in the set, the answers to the attributes for each indicator have high internal consistency. The Spearman’s ratio, used to obtain the evaluation of the relationship intensity between the attributes of each indicator, showed a positive correlation of all attributes among each other. This result allows to infer that the validated indicators are adequate to measure the impact of nursing care in hospital assistance in patient safety dimension.

**Chart 2 – Hospital nursing care effectiveness Indicators in patient safety dimension: Agreement rates of experts’ answers and validation**

| Indicators                                                                 | Agreement rates of experts’ responses regarding the correspondence of indicators to the attributes surveyed | Validation |
|---------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|------------|
| Incidents due to patient identification failures                           | Timeliness (88.47%); objectivity and usefulness (88.46%); Other attributes above 75%                   | Yes        |
| Pressure injury                                                            | Timeliness (98.09%); usefulness (98.08%); objectivity and representativeness (96.15%); Other attributes above 82.69% | Yes        |
| Hip fracture in hospitalized patients                                       | Simplicity regarding the ease of calculation (90.38%); Simplicity in the interpretation of the indicator (88.46%); objectivity (88.46%); Other attributes above 73.07% | Yes        |
| Hip fracture postoperatively                                               | Simplicity related to the ease of estimative (75.00%); stability and sensitivity (74.74%); Other attributes above 70.59% | Yes        |
| Falls with damage                                                          | Usefulness and stability (94.23%); Simplicity regarding the ease to estimate (92.31%); simplicity in understanding (92.16%); Other attributes above 76.92% | Yes        |
| Serious equipment-related incidents                                        | Timeliness (82.64%); objectivity and usefulness (78.85%); Other attributes above 78.84%                  | Yes        |
| Multimodal hand hygiene strategy                                          | Usefulness (92.31%); representativeness and timeliness (82.70%); stability (80.77%); availability (53.68%); Other attributes above 71.58% | No         |
| Medication error                                                           | Objectivity (90.40%); usefulness (88.46%); availability (67.37%); other attributes above 74.74%          | No         |

Chart 2 presents the agreement rates between the attributes for each indicator evaluated and, in Chart 3, participants main comments and suggestions for the non-validated indicators.
Medication errors are relevant because they result in longer patient permanence in the hospital, increased risk of death and hospital costs. Low notification and absence of incident records related to dispensation, prescription and administration steps are still common[16,20].

Although the medication error indicator was not validated because it did not reach the minimum consensus regarding the availability attribute in the two rounds, the other attributes reached such consensus among panelists, ranging from 76.92% to 90.40%. The attributes that obtained higher agreement were objectivity (90.40%), usefulness (88.46%) and representativeness (86.55%), showing that this indicator corresponds to its objective and subsidizes a coherent decision-making with what should be measured.

Appropriately, the participants suggested reinforcement of medication error reporting systems due to low detection when there is no harm to the patient; and patient inclusion, since notifications can be originated by communication of errors detected by the patient or relatives to the health team[19].

Incidents with medication-related damage are those that occur most frequently in hospitalized patients, and about 25% of them are preventable. Medicament therapy chain is extensive, involves logistics focused on supply, prescription, dispensing, preparation and administration, which makes the identification of errors even more complex. It is possible that errors in this chain are related to systemic latent conditions[17].

However, the management of this indicator is closely related to nursing, since most medication errors occur in the administration phase, whose attribution is almost exclusive to this professional[18]. The absence of records in incidents related to dispensation and prescription stages is also common[19-20]. Therefore, strategies to increase data availability for this indicator aims the reinforcement of safety culture, implementation and stimulus to adherence to protocols to prevent medication errors, and incentive to notify Incidents.

Regarding the nurses, the obstacles to report medication errors and almost incidents in hospital environments were explored in a systematic review covering the period from 1981 to 2015. Organizational barriers, such as culture, non-friendly notification system, managerial behavior and emotional factors, such as fear of consequences and burden of responsibility, were associated with low notification[30].

As contributors of patient safety, nurses need education and qualification in error management. The organization is responsible for developing a culture of learning with errors, without blaming and punishing, as well as adopting anonymous, effective, uncomplicated and efficient reporting systems, besides providing support by managers, providing open feedback to Nurses[30].

Additionally, “automated methods to identify incidents through electronic registers” enhance the overcoming of methodological biases related to retrospective studies in medical records, for more accurate data obtaining that favors the use of validated indicators to measure the incidence of failures, errors and omissions related to medications[30].

Other indicators were validated. Patient’s identification is fundamental to prevention of errors in the actions of nursing care, such as medication and procedures in general. This indicator aims to account for the number of incidents due to patient’s identification failures. The results indicate that, although the

| Indicators | Comments and Suggestions |
|------------|--------------------------|
| Multimodal hand hygiene strategy | Comments: Techniques for obtaining data require time (P02, P51); it is difficult to execute (P06, P31, P16); measuring missed opportunities requires specific surveillance (P06, P36). Suggestion: studying different ways of collecting lost opportunities for hand cleaning (P44); Help of multimers - sectors audited with checklist (P30); Using of sampling stratified by sectors and professionals, non-identifiable observers, registering professionals behavior(P17). |
| Medication error. | Comments: This type of error is difficult to detect when it does not cause damage, (P16, P17, P32, P36). Suggestion (to improve detection): Improvement of notes in medical records and reports of pharmacy production (P45); Computerization of medical records, management, logistics and medication administration (P08, P37, P48, P51); Institutional stimulus to increase incident notifications (P10, P16, P27, P35); especially near-miss and undamaged incidents (P10, P35, P45); patient inclusion(P08); perform pharmaceutical technical analysis of prescriptions (P26, P33). |

**DISCUSSION**

The present study provides managers with information to select indicators validated by specialists, aimed at capturing how much the results of nursing care processes in the hospital meet the improvement of patient’s safety.

We highlight the participants’ distrust in relation to the sources of data collection since, in Brazilian reality, medical records are incomplete or omit International Classification of Diseases’ diagnoses[34].

Two out of eight indicators were not validated: “institutional adherence to the multimodal strategy of hand hygiene” and “medication errors”. The non-validation resulted from consensus lower than 70% in the availability attribute, denoting that the data to structure these indicators are not easy to obtain.

In relation to the indicator “institutional adherence to the multimodal strategy of hand hygiene”, hospitals often use the measurement of liquid soap and alcohol, which enables the indirect evaluation of adherence – constituting, therefore, as an indicator of process, and not of effectiveness[16]. However, the multimodal strategy is more extensive than just measuring the consumption of products, because it implies changes in the system, with infrastructure provision, professionals education, evaluation and feedback on performance and results, workplace reminders, and institutional security climate dimensioning[17]. These multiple approaches add complexity to the indicator and make data obtaining more laborious and costly, which may explain why it was not validated by the specialists. After analyzing the suggestions of panelists (Chart 3), a composite indicator was elaborated addressing these various practices to measure adherence to the multimodal strategy in the institution.
systems, the poor quality of administrative records, the partially to become routine in professional practice. The culture, strongly linked to managerial actions, and requiring time by hospitals arose only in 2013(26), demanding changes in safety indirect identification and notification of incidents. However, the indicators and the need for complete and correct assistance and tracheostomy, renal therapy and bronchoscopy(22).

12.05% to equipment and devices needed for the procedure, such as intravenous infusion and monitoring, mechanical ventilation of these incidents and the expressive use of devices in nursing care. The usefulness of this indicator is backed by the frequency of these indicators and the expressive use of devices in nursing care.

The indicator of falls is recommended worldwide. In the present study, the indicator of falls with damage identification was shown to the participants, because it is sensitive to the measurement of nursing care effectiveness. Due to the low incidence, the California Nursing Outcomes Coalition accounts for the number of falls with damage for every thousand patients per day (24). Given the importance of notification of hip fracture between hospitalized and postoperative patients, and also of falls with damage, hospitals can use an indicator consisting of the three indicators instead of a simple indicator, extending their comprehensiveness(25).

Regarding the indicator of serious equipment-related incidents, the interaction with the clinical engineering service can intensify the technovigilance and favor the identification of causes and prevention of incidents, resulting in training programs to avoid such incidents and in opportunity for producers to make their products safer(25). The usefulness of this indicator is backed by the frequency of these incidents and the expressive use of devices in nursing care.

Of the incidents considered critical occurring in 90 months in an intensive care unit (ICU) for adults in England, 30% were caused by equipment(23,41). In the United Kingdom, 564 critical incidents were reported in the ICU in 13 years, involving 94 types of equipment; 12.41% were related to the use of beds, mattresses and chairs, and 12.05% to equipment and devices needed for the procedure, such as intravenous infusion and monitoring, mechanical ventilation and tracheostomy, renal therapy and bronchoscopy(22).

Results indicate dependence of obtaining data to estimate the indicators and the need for complete and correct assistance records, as well as the use of effective systems of direct and indirect identification and notification of incidents. However, the legislation that obliges the systematic notification of events by hospitals arose only in 2013(26), demanding changes in safety culture, strongly linked to managerial actions, and requiring time to become routine in professional practice.

The fragility in obtaining reliable data in health is also related to absence of integration between management information systems, the poor quality of administrative records, the partially computerized records or with handwritten records, and limited scope in the coding of diagnoses related to iatrogenesis(22).

In addition to the computational infrastructure, there is the user interface with the system. Nurses are users of hospital systems, data feeders and collectors for assistance and managerial indicators. Some factors interfere with the effectiveness of nurse-computer interaction, such as software configuration errors, inadequate workflow, lack of time, inadequate number of professionals and lack of knowledge about indicators(12). Strategies such as use of algorithms and configuration of warnings for alarming data can minimize the unavailability of data needed to estimate indicators, allowing nurses to act in timely, performing effective and safe care for the patient.

**Study limitations**

The study was based on experts’ judgement on indicators attributes approached and, due to the peculiar subjectivity peculiar of survey, it is considered possible to have some bias in results. However, the minimum criterion of 70% of agreement between the specialists for indicator validation and the very high internal consistency confer reliability to results. As additional elements to results’ reliability we consider the careful selection of specialists, according to their experience in studies and/or use of health indicators, and self-analysis as to their contribution to the present study.

**Contributions to nursing field**

The validated indicators allow the evaluation of the health effectiveness care in hospital nursing. The adaptation of these indicators to hospital practice facilitates the monitoring of nursing efforts aimed at patient safety, with reduction of harmful incidents.

**CONCLUSIONS**

Validate nursing care effectiveness indicators in patient safety dimension, were evaluated considering their correspondence to the attributes availability, reliability, simplicity, representativeness, sensitivity, approach, objectivity, low cost, usefulness, stability and timeliness. Indicators were validated in relation to all attributes: “Fall with damage”; “Hip fracture”; “Postoperative hip fracture”; “Equipment-related incidents”; “Incidents due to failures in patient identification”; and “pressure injury”.

“Medication error” indicator and the one related to the multimodal hand hygiene strategy were not validated because of the availability of data to be structured. However, given its relevance to measure nursing care effectiveness in patient safety dimension, strategies that reinforce the safety culture, identification and reporting systems of incidents, and the computerization of records assistance, among others, are measures that should be implemented by hospitals so these indicators can be used systematically.

**FUNDING**

Funding Source: Leila Soares Seiffert – Coordination of Improvement of Higher Education Personnel (Capes; Scholarship of the sandwich doctoral program abroad).
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