
CONTRIBUTIONS OF THE ELECTRONIC HEALTH RECORDS TO THE SAFETY OF INTENSIVE CARE UNIT PATIENTS: AN INTEGRATIVE REVIEW

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ABSTRACT: Integrative review publications that analyzed the contributions of electronic health records for patient safety in intensive care units. The survey was conducted in the databases CINAHL, MEDLINE and SciELO, using the keywords: electronic health records, information systems, nursing informatics, medical informatics, intensive care units, patient safety and security management. A total 64 articles were included and analyzed in two empirical categories: "Information systems and information technology: the electronic record for the continuity of nursing care", "decision support systems: contributions to patient safety" and "indicators of quality of care and patient safety from the records electronics". The studies pointed to contributions to continuity of care, decision making based on decision support systems and the creation of quality indicators and patient safety from electronic records.

DESCRIPTORS: Electronic health records. Information systems. Nursing informatics. Safety management. Intensive care units.

CONTRIBUIÇÕES DOS REGISTROS ELETRÔNICOS PARA A SEGURANÇA DO PACIENTE EM TERAPIA INTENSIVA: UMA REVISÃO INTEGRATIVA

RESUMO: Revisão integrativa que analisou nas publicações as contribuições dos registros eletrônicos em saúde para a segurança do paciente em unidades de terapia intensiva. A pesquisa foi realizada nas bases de dados CINAHL, MEDLINE e SciELO, utilizando os descritores: registros eletrônicos de saúde, sistemas de informação, informática em enfermagem, informática médica, unidades de terapia intensiva, segurança do paciente e gerenciamento de segurança. Foram incluídos 64 artigos, sendo analisados em três categorias: "sistemas de informação e informática em saúde: o registro eletrônico para a continuidade do cuidado de Enfermagem" e "sistemas de apoio à decisão: contribuições para a segurança do paciente" e "indicadores de qualidade do cuidado e de segurança do paciente partir dos registros eletrônicos". Os estudos apontaram como contribuições a continuidade do cuidado, a tomada de decisão baseada nos sistemas de apoio à decisão e a criação de indicadores de qualidade e segurança do paciente a partir dos registros eletrônicos.

DESCRIPTORIOS: Registros eletrônicos de saúde. Sistemas de informação. Informática em enfermagem. Gerenciamento de segurança. Unidades de terapia intensiva.

CONTRIBUCIONES DE LOS REGISTROS ELECTRÓNICOS PARA LA SEGURIDAD DEL PACIENTE EN CUIDADOS INTENSIVOS: UNA REVISIÓN INTEGRADORA

RESUMEN: Revisión integrativa que analizó en las publicaciones las contribuciones de los registros electrónicos de salud para la seguridad de los pacientes en unidades de cuidados intensivos. La investigación se realizó en las bases de datos CINAHL, MEDLINE y SciELO, utilizando las palabras clave: registros médicos electrónicos, sistemas de información, informática de enfermería, informática médica, unidades de cuidados intensivos, seguridad del paciente y gestión de la seguridad. Se incluyeron 64 artículos y se analizaron en dos categorías empíricas: "Los sistemas de información y tecnología de la información: el registro electrónico para la continuidad de los cuidados de enfermería", "sistemas de apoyo: las contribuciones a la seguridad del paciente" y "los indicadores de calidad de la atención y seguridad de los pacientes de los registros electrónica". Los estudios señalaron como contribuciones a la continuidad de la atención, la toma de decisiones basadas en los sistemas de soporte de decisiones y la creación de indicadores de calidad y seguridad de los pacientes de los registros electrónicos.

DESCRIPTORIOS: Registros electrónicos de salud. Sistemas de información. Informática aplicada a la enfermería. Administración de la seguridad. Unidades de terapia intensiva.

INTRODUCTION

Healthcare information is often associated with a set of data within useful and meaningful contexts. When information is adequately furnished for a specific purpose, it provides orientation, instruction and knowledge to health care professionals, thus empowering them to develop a plan of care and/or make decisions within a specific context.¹

In present days, the complexity of existing health care scenarios, especially those seen in Intensive Care Units (ICU), show an enormous amount of heterogeneous, scattered, detailed and unstructured data and information. Information is a core issue in the health care process; that is, the access to information regarding health care practices provides nurses with clinical evidence that sustains the nursing contributions toward patient outcomes. Therefore, it is possible to affirm that there is an essential connection between the access to information in terms of the nursing process and patient outcomes and safety.²⁻³

It should be highlighted that the clinical record must be objective, clear and thorough, in such a way that all healthcare team members who access such information can understand their context and meaning. In addition to guaranteeing the execution and sequence of adequate treatment, these records can provide the healthcare team with the ability to render knowledge-based care, considering both ethical and legal aspects.⁴ Moreover, the nursing clinical records are able to improve and support the safety of the patient, as well as provide information regarding the care and the daily actions involved in the nursing practice.⁵

Information and Communication Technologies (ICTs) have been widely used as a means of improving clinical records, in addition to supporting the development of a computerized nursing process because they allow for their integration into a logical data, information and knowledge structure and support the decision-making processes in nursing care.² The application of ICTs in the area of health care directly contributes toward the safety of the patient, as it has the potential to transform the work environment, the status and the quality of the care rendered, allowing procedures to be more accurate and efficient and promoting the reduction of human error risks.⁶

The issues associated with patient safety stand out as a serious health problem all around the world, as the risk and the occurrence of adverse

events/iatrogenesis has been escalating in all health care environments. This fact is mainly related to the ever-increasing number of therapeutic and diagnostic alternatives. It can be also observed that patients and relatives are at constant risk of becoming victims of preventable errors and/or adverse events, even in highly structured health institutions.⁷⁻¹⁰

Among the various health care areas, ICUs stand out as an environment in which the focus on patient safety is of immense importance, as patients admitted to these units tend to be more vulnerable to the occurrence of errors and adverse events due to the severity and gravity of their conditions, a higher frequency of pharmacologic and therapeutic interventions, and the use of multiple technological devices.¹⁰⁻¹² The severity and continuous fluctuation in the patient's health status reinforce the relevance of the need for support structures that can provide objective decision-making processes toward safer care.

In light of this scenario and the above-mentioned considerations, the following research question arose: "What are the contributions of electronic health records to the safety of Intensive Care Unit patients?" Besides motivating the search for specific knowledge regarding this issue in nursing publications, such an inquiry justifies the present study, as we understand that whenever visibility is given to the contributions of electronic health records, innovative and transforming aspects in nursing practices will be generated, especially in the area of patient safety.

Hence, this study aims to identify the major contributions of electronic health records in the area of patient safety in Intensive Care Units by means of reviewing the publications found in national and international journals.

METHODOLOGY

This thematic integrative review is a scientific update of publications issued between 2005 and 2010. The chosen period is justified by the intention of this study to analyze the most recent contributions of electronic health records in the area of the patient safety in ICUs.

Aiming to maintain scientific rigor, the phases of the proposed literature integrative review are grounded on a framework defined by a protocol previously elaborated by the researchers, namely: 1) selection of the research

question; 2) definition of inclusion criteria and sample selection; 3) representation of selected studies in table format, taking into consideration all common characteristics; 4) critical analysis of the findings, identifying differences and conflicts; 5) interpretation of results; and 6) a clear report on the evidence discovered.¹³

The applied search strategy used to identify and select appropriate studies was the bibliographic survey of publications indexed in the following databases: Medical Literature and Retrieval System Online (MEDLINE), Cumulative Index of Nursing and Allied Health Literature (CINAHL) and Scientific Electronic Library Online (SciELO). The MEDLINE and CINAHL databases were accessed through the links made available at the Porto Higher Nursing School portal, Portugal. The SciELO database was accessed through the portal of the Virtual Health Library (VHL).

The criteria adopted for the selection of articles were: all article categories (original research, literature reviews, systematic reviews, reflections, updates, experience reports, editorials, etc); articles with abstracts and full texts freely available for analysis; articles available in the Portuguese, English or Spanish languages; articles published between 2005 and 2010; and articles whose titles and/or abstracts contained the following descriptors: electronic health records; information systems; nursing computing; medical computing; and intensive care units associated with the descriptors "safety" and "safety management", as well as their respective English and Spanish translations. The resource used in the research was the "exact term" option; the articles that were indexed in more than one database were considered only once. Based on these criteria, 64 articles were selected for the analysis.

For the organization and tabulation of data, a detailed reading of each abstract/article was carried out; the process emphasized those articles that positively corresponded with the objective of the study. The researchers built a data collection instrument, which included: title, journal, country of study, year of publication, study category, study characteristic, adopted classification terminology/system, analysis method, thematic focus, and final considerations/conclusions.

Subsequently, the major contributions addressed in each article and that drew the researchers' attention were extracted. These contributions were compared and clustered according to content similarity, thus generating three analysis

categories, as follows: "health information and computing systems: the electronic record and the continuity of nursing care"; "decision-making support systems: contributions to the patient's safety"; and "care quality and patient's safety indicators based on electronic records".

RESULTS AND DISCUSSION

From the MEDLINE database, 34 articles were selected for analysis; from CINAHL, 21 studies were selected, while nine articles were selected from the SciELO database, thus totaling 64 articles. It should be highlighted that 56.3% (36) of the publications were found in international journals and 43.7% (28) were located in national journals. As for the idiom of the studies, 56.3% (41) were found in the English language and 43.7% (28) of the articles were published in the Portuguese language; no Spanish publication was selected for the analysis.

The countries of origin of the studies were distributed as follows: Brazil, 45.3% (29); United States of America (USA), 28.1% (18); Australia, 6.2% (4); Belgium, Finland, United Kingdom and Canada, 12.4% (8), two studies per country; and Norway, Japan, Portugal, England and Italy, 8%, with one article per country.

As for the articles' year of publication, for the years 2005 to 2010 collected articles showed the following distribution, according to Table 1: 2005, 12.5% (8); 2006, 15.6% (10); 2007, 9.4% (6); 2008, 14.1% (9); 2009, 23.4% (15); and 2010, 25% (16).

Classification terminologies and/or systems were adopted in 19 studies (29.7%), as follows: CIPE®, 7.8% (5); NIC, 4.7% (3); ISO 18104 Norm, 3.1% (2); International Data Set - Essentials of Nursing, 3.1% (2); CIPESC®, 1.6% (1); NANDA, 1.6% (1); NOC, 1.6% (1); HL7, 1.6% (1); CID, 1.6% (1); open EHR, 1.6% (1); and SNOMED, 1.6% (1).

The articles were categorized according to the type of study and adopted methodology, as follows: 54.7% (35) qualitative studies; 39% (25) quantitative studies; and 6.3% (04) editorials. The employed methodological characteristic of the studies included the following distribution: descriptive, 64% (41); exploratory, 43.7% (28); technological productions, 7.8% (5); retrospective, 7.8% (5); cross-sectional, 1.6% (1); observational, 1.6% (1); correlational, 1.6% (1); prospective, 1.6% (1); survey, 1.6% (1); and cohort, 1.6% (1). It should be highlighted that several studies adopted more than one methodological characteristic.

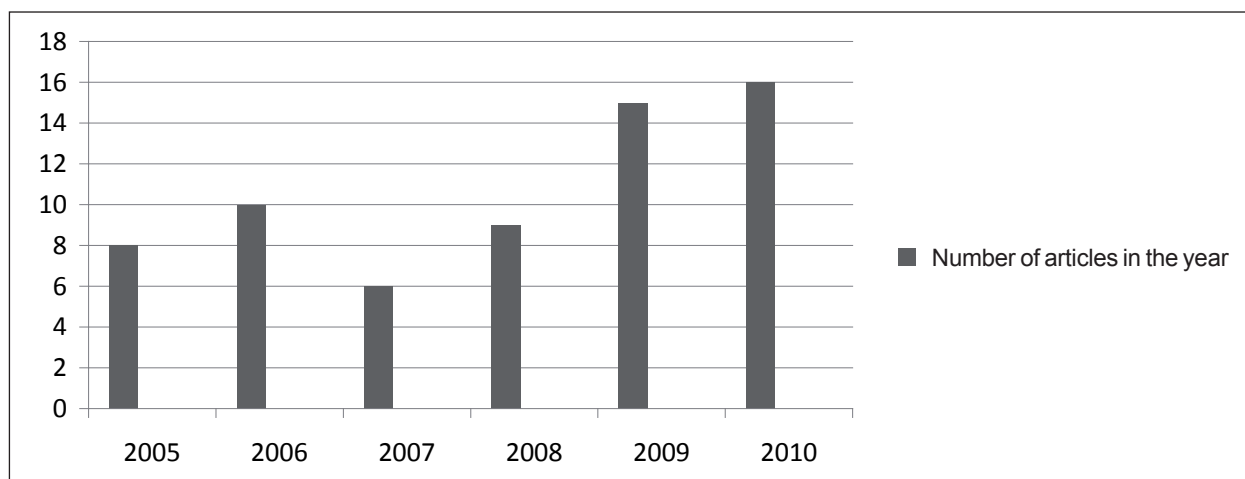


Table 1 - Number of analyzed studies published between 2005 and 2010 - MEDLINE, CINAHL and SciELO databases

The studies were also classified according to their publication categories, in the exact manner in which they were published in the journals: 60.9% (39) original research; 15.6% (10) literature reviews; 6.3% (4) reflections; 6.3% (4) editorials; 4.7% (3) systematic reviews; 3.1% (02) update articles; and 3.1% (2) experience reports.

Health information and computing systems: the electronic record and the continuity of the nursing care

Studies that examine the written and descriptive notes entered in the patients' records by nurses reveal that, in addition to a lack of quality and logical sequence, the health records do not provide objective data toward the full comprehension of the patient's clinical condition; moreover, they do not show an adequate procedure to address the patient's needs. Notes are often inconsistent, illegible, subjective and lacking in content, thus making it difficult to assess the nursing care provided.¹⁴⁻¹⁶

One of the major challenges to be overcome by nursing is the effective and qualified implementation of the clinical record, making it more complete, detailed and integrated with the records/information sharing systems of other health care professionals.^{1,4,17-22} The nurses must ensure that their need for information and knowledge is met. This huge task, allied with the need to guarantee the continuity of nursing care, and consequently the patient's safety, can be achieved through the integration of information and computing systems, by means of the resources made available by the ICTs.

Information and computing systems can augment and assist the onerous daily task of

organizing and managing an ever-increasing amount of information, providing all and any data nurses might need for the development of their care plans in real time²³, and allowing them to electronically capture technical and scientific data that are necessary to the ethical and legal support of patients and society.²⁴

Several studies support this perspectives and add new possibilities, such as: improvement of practice environments, direct care, patient results and satisfaction; reduction in the time spent on documentation and clinical record keeping; development and improvement of clinical reasoning skills and judgment; inclusion of nurses in intensive care processes; promotion of clinical discussions among colleagues and the multidisciplinary team; support of the continuous search for information aimed at generating evidence-based care; and guarantee of the continuity of nursing care.^{17,19,21,25-34}

However, in order to provide nurses with the ability to carry out the documentation of rendered care processes, studies point to the need to standardize data entries included in the electronic health record, as well as recover and analyze information by means of a vocabulary that standardizes the clinical terms of the care practice. The standardization of these clinical terms must meet specified criteria such as validity, specificity, data recovery and ease of communication, and must be presented in a way that supports the understanding, knowledge and intuition of the professionals.³⁴⁻³⁶

In 2003, the International Organization for Standardization (ISO) elaborated the "Reference Terminology Model for Nursing", which they

named ISO 18104. In addition to accommodating several terminologies and classifications most frequently used by nurses for patient data recording, ISO 18104 also facilitates the combination of nursing terms with other health standards/terminologies, aiming to promote the necessary integration of information systems.³⁵⁻³⁶

In this sense, it is fundamental to standardize and identify the minimum data set required to provide sufficient and necessary health care information. In nursing practice, the data collected in the Nursing Process record can and must be standardized, thus facilitating nursing actions and decision-making processes, as well as developing research and assisting in the production of information aimed at assessing the continuity, quality and results of the health care rendered to patients.^{18,19,34,36-39}

In light of this reality, information and computing systems, allied with a minimum data set and/or classification terminology/system, stand out as innovative, necessary and readily available resources that are able to improve and strengthen nursing care, as well as guarantee its continuity, especially in ICUs. The advancement and enhancement of information technologies and information systems provide several possibilities to be explored in the health and nursing area, and also in the information management process, such as the introduction of new tools that can empower decision-making processes and the production of care quality indicators in the quest for better performance through the achievement of superior results in health care practice.^{2,4,18,21-22,40-41}

Decision-making support systems: contributions to patient safety

The analysis of the studies revealed that the use of structured electronic records based on a brief summary of data and/or classification systems/terminologies can contribute to the construction of systems that are able to provide full support to health care clinical decision-making processes.^{19,42-44}

The Decision-making Support Systems (DSS) are those systems that integrate an active knowledge base grounded on the use of data/information regarding the patient toward generating specific advice/recommendations geared toward a specific need. Besides making the DSS available, the electronic health records provide professionals with specific knowledge, as well as

with smartly filtered and real time information, thus improving the professional's individual caregiving performance toward patients and the health of populations at large.⁴²⁻⁴⁷

Studies point out several positive aspects related to the patient care profile when health professionals make use of the DSS in their work environment. Among them we highlight: enhanced professional performance; greater patient safety; and improvement of the quality and efficiency of health care. These aspects can be achieved by means of the DSS, as they are able to indicate/suggest/optimize clinical diagnoses, treatment plans, alert systems, disease management systems, reduction of errors/adverse effects related to medications, need for lab and/or imaging exams, available time for the provision of direct care, faster information processing, and adherence/application of the most effective treatment through evidence guidelines, among several others.⁴⁰⁻⁴⁸

As the most effective scientific instrument in this area, the DSS should be employed, massively distributed and applied by health professionals, aiming at the continuous improvement of their knowledge and the patient's safety.^{40,45} In this perspective, the DSS bring about three enormous challenges to be met: improve the efficacy of suggested orientations/interventions; elaborate new recommendations/interventions; and disseminate both the existing knowledge and the interventions, based on the guidelines of clinical best practices.⁴⁴

Care quality and patient safety indicators in electronic health records

The analyzed studies revealed that when electronic health records are structured around a minimum of data/nursing terminologies, they are able to contribute to the construction of care quality and safety indicators.^{8,49-58}

The indicators point to measurable results to be proven, revealed or presented. They are aimed at analyzing the conditions of the process and the services based on their comparison with established standards, as well as verifying errors and deviations toward improving the quality of care.^{49-51,59} The correlation between health quality and health services can be established by means of the measures used to help describe an existing situation, as well as through the assessment of changes or trends over a period of time, including the quantitative and qualitative assessment of the performed health actions.⁶⁰

Within this context, electronic health records become relevant and highly credible sources of information in following up achieved quality and service levels. However, it is worth highlighting that the professionals must focus on the quality of the records/documents and guarantee the adoption of a methodology that supports the trustworthy collection of data in order to establish the quality (or lack of quality) of assessed indicators.^{49,60}

In recent years, several indicators were developed without reference, validity and/or feasibility within the various health system contexts, resulting in inadequate, inconsistent, repeated or conflicting indicators in some areas and their total exclusion in others.⁵⁰

In this sense, six phases were proposed to prioritize the development of health quality indicators, namely: 1) identification of the problem for which the indicator measure is necessary (i.e., disease databases, type of patient, adopted treatment modality, general problems, professionals involved); 2) identification of the perspective of the indicator to be measured; 3) focus on the transition points in the health care system, including attention to quality and safety indicators that encompass all the phases of the patient's life process; 4) identification of the indicator corresponding to the addressed problem(s); 5) prioritization of the selection and action of the indicators; and 6) test of the indicator.⁴⁹ It is relevant to consider that whenever quality and safety indicators are developed, the cultural variations, clinical practice, availability of the information systems and the capacity of the healthcare institutions to implement an effective and efficient monitoring system should be taken into account.⁸

The quality of the provided care can be assessed by technical, educational, environmental-structural and ethical indicators, particularly in ICUs. In these environments, the indicators can be positively reflected in several aspects, such as: more recognition, visibility and professional respect; better informed healthcare teams; higher occupancy rates and bed turnover; lower admission time; waste control and cost rationalization; improvement of the quality of care; enhancement of patient and family satisfaction levels; and greater patient safety, among others.⁵⁰

Other equally relevant indicators related to care quality are the Patient Safety Indicators (PSI), initially introduced in 2003 by the Agency of Healthcare Research and Quality (AHRQ) and the National Healthcare Disparities Report (NHDR),

both from the United States of America. The PSIs are a set of measures that represent adverse events resulting from the patient's experience throughout their exposure to the health care system, allowing for a global variation scenario of the quality of health care.⁶¹

There is widespread consensus among world health organizations/services concerning the need to reduce patient injuries/adverse events. It is believed that certain technological changes, such as the implementation of electronic reporting systems and the sensitization of health professionals toward safety issues, can improve the safety of patients' environments. In this perspective, PSIs can be utilized to assess and prioritize local and national initiatives, generating actions that may include: 1) review and synthesis of best-practice databases grounded on scientific literature; 2) working with the multiple disciplines and departments involved in caring for surgical patients in order to redesign care giving processes based on best practices, emphasizing coordination and collaboration profiles; 3) assessing information technology solutions; and 4) implementing measures toward improving the performance and the rendering of accounts.⁶¹

The safety indicators established by the AHQR aim to guarantee the patient's safety, as they address the creation of operational systems and processes geared towards minimizing the possibility of errors and maximizing the probability of intercepting error/adverse events prior to their occurrence.⁶¹

The investment in the development and improvement of information systems by the adoption of measures that orient the construction of effective monitoring programs is, therefore, an essential action in ensuring the production of quality information and indicators, as well as decision-making processes and patient safety.⁸

FINAL CONSIDERATIONS

The analyzed studies in this review showed that electronic health records must be based on a minimum summary of data and/or information and grounded on classification terminologies/systems. The adoption of structured processes evidence that electronic records can promote the continuity of nursing care, as the patient's data/information are available at any time, in real time.

The thorough, detailed electronic data record, as well as the employment of the DSS, can

contribute to the production of information that can provide professionals with the best decision-making process; moreover, such procedures can improve patient care quality and safety.

In this perspective, the inclusion of the DSS and the quality and safety indicators achieved by electronic health records can represent an effective strategy toward the promotion of care quality and patient's safety, especially in ICUs.

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