Assessment of diagnostic accuracy in nursing: paper *versus* decision support system

Avaliação da acurácia diagnóstica em enfermagem: papel *versus* sistema de apoio à decisão

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Abstract

Objective: To compare the degree of accuracy of certain nursing diagnoses, for nursing students in system decision support and paper-based records.

Methods: Cross-sectional descriptive study with a sample of 17 undergraduate nursing students. The data collection was conducted through forms of characterization of students and one clinical case, validated previously, for the indication of the system and paper-based diagnostic. The diagnostic accuracy was assessed by the Scale for Accuracy of Nursing Diagnoses (SAND) and non-parametric tests.

Results: There was statistical significance in the highly accurate diagnosis (p=0.013), when graduate students used the system for decision support, demonstrating the determination of more accurate diagnosis in clinical case studies.

Conclusion: The use of decision support systems favors the diagnostic accuracy of nursing and is inferred that it can support clinical reasoning of nursing students.

Resumo

Objetivo: Comparar o grau de acurácia dos diagnósticos de enfermagem determinados, por graduandos de enfermagem, em sistema de apoio à decisão e manuscrito.

Métodos: Estudo descritivo-exploratório com amostra de 17 graduandos de enfermagem. Realizada coleta de dados por meio de formulários de caracterização dos graduandos e de um caso clínico, validado previamente, para a indicação dos diagnósticos no sistema e manuscrito. Avaliada a acurácia diagnóstica por meio da Escala de Acurácia de Diagnósticos de Enfermagem (EADE) e de testes não paramétricos.

Resultados: Houve significância estatística nos diagnósticos altamente acurados (p=0,013), quando os graduandos utilizam o sistema de apoio à decisão, demonstrando a determinação de diagnósticos mais acurados em estudos de caso clínicos.

Conclusão: A utilização de sistemas de apoio a decisão favorece a acurácia diagnóstica de enfermagem e infere-se que pode apoiar o raciocínio clínico de graduandos de enfermagem.

Introduction

The patient record is a document that corresponds to the written memory of the person in care, which consists of identificatory, sociodemographic, clinical records, among others. This is essential in communication between the healthcare team and the patient, as well as for security, continuity, effectiveness and quality of care.[1]

Currently, the diversity of professionals involved in patient care and legal demands of maintenance and preservation of records, the volume of paper that needs to be stored reached dimensions difficult to manage, requiring large archiving capabilities.[2,3] Besides facilitating access to information and reducing the volume of stored paper, the Health Electronics Records (HER) can also contribute to the solution of clinical problems, when integrated into Decision Support Systems (DSS).

DSS are information systems created to improve clinical decision making. Individual patient characteristics are combined to a computerized knowledge base and algorithms generate specific recommendations for each patient. There are several ways to support the decision, including critical value alerts and suggestions for various care issues.[4]

The Electronic Documentation System of the Nursing Process from the Universidade de São Paulo (PROCEnf-USP®) is a clinical nursing DSS developed from technological production research involving professors and nurses from the Teaching Hospital of USP, with Computer Program registration in the Industrial Property Journal. The system allows the user (nurse or nursing student) to perform diagnostic hypotheses in the hospital. After the choice of nursing diagnoses that best characterize the situation of the patient, the user proceeds to the selection of the results, interventions and nursing activities, considering the resources (human, material and structural) available for the conduction of care.[5]

It is believed that PROCEnf-USP® can support clinical reasoning of nurses, because its structure is in accordance to the languages of NANDA International (NANDA-I), the Classification of Nursing Interventions (NIC) and the Classification of Nursing Outcomes (NOC), designated NNN (NANDA-I, NIC, NOC), and have the ability to sensitize diagnoses for the selection of nurses from patient assessment data through branched questionnaires, structured in 4 domains and 28 items.[5]

The PROCEnf-USP® can generate diagnostic suggestions from assessment data, clinical alerts and interpretation of data such as vital signs, oxygen saturation and body mass index, as well as evaluation of patient rating scales and pressure ulcers.[2]

This DSS has two environments, a professional, which includes the real documentation of clinical assessment of the patient data and an academic, which is intended to increase critical thinking and improve the diagnosis of nursing students thinking. The academic environment has the same characteristics of the work environment, allowing the creation of fictitious patients to encourage learning through simulation of clinical cases with the same characteristics of the real documents.[5]

Given the growing number of new DSS, we highlight the relevance of these systems to be rigorously evaluated prior to wide dissemination in clinical practice. The stages of the qualitative and quantitative assessment process of the systems are described in the literature, seeking the safety of clinical care and patient outcomes, as well as the influence of systems on professional performance.[4]

This research emerges from the questions: Does the PROCEnf-USP® system support undergraduate students in determining accurate nursing diagnoses? Are there differences in the degree of accuracy of certain diagnoses using the system or paper-based records?

This study hypothesized that the PROCEnf-USP® supports undergraduates to establish nursing diagnoses with a higher degree of accuracy compared to the paper-based records.

A diagnosis is accurate when it reflects the real patient's condition or when it adapts the case to clinical conditions. In the same situation, we can identify highly accurate and other low accuracy diagnoses.[6] The diagnostic accuracy must be contemplated in nursing education to enable future professionals to establish useful

references to defining the role of diagnosticians. Having reliable and valid methods to evaluate the accuracy of nursing diagnoses will advance knowledge about the diagnostic process and increase the reliability of clinical studies on nursing diagnoses.[7]

Given the above, this research contributes to the awakening of the need for integration of information and communication technologies in the training of nurses, emphasizing the important aspects of the nursing process in a problematical, critical, constructive and interactive way.

In this context, this study aimed to compare the degree of accuracy of certain nursing diagnoses, for nursing students, in PROCEnf-USP® system and paper-based records.

Methods

This is a descriptive and exploratory study with a quantitative approach, the population was composed by undergraduate students in nursing at a Public University in São Paulo State, who attended the subject Administration in Nursing. Inclusion criteria in the study were: paper-based records' filling and PROCEnf-USP® the analysis of the clinical case proposed in the activity.

The subject in question deals with the topic of health information systems and is offered in the seventh semester of the undergraduate course. In 2013, 53 students attended the course and 25 agreed to participate in the study by signing the Informed Consent Form. Considering the inclusion criteria, 17 undergraduate students were included in the study sample.

Data collection was carried out between April and August 2013. For the characterization of the students' profile, an instrument was used with sociodemographic questions, prior contact with the contents of nursing diagnoses and nursing process during undergraduate studies, prior contact with electronic documentation systems and one question on the preference of the student and the determination of its diagnoses in PROCEnf-USP® and paper-based records. A lecture was given by the professor who worked the content and discussions on HER and DSS, as well as the implementation process of PROCEnf-USP® at the Teaching Hospital of USP. To determine the diagnosis in the system was available login and individual passwords, NANDA-I 2012-2014 classification books for free consultation, in order to determine nursing diagnoses in the system and on paper.

Regarding data collection in the diagnostic accuracy, a case study related to the health of the adult and the elderly was used, and its "gold standard" for determining diagnoses was prepared by experts and validated in a previous study.[7]

In the paper-based record, the data collection instrument had columns for the indication of the nursing diagnosis, defining characteristics, risk factors and related factors being determined by these students in free text format. On the PROCEnf-USP® Record students should follow the steps: answer the patient's assessment questionnaires as the data of the Case Study, including defining characteristics, risk factors and related factors indicating the nursing diagnoses, or select nursing diagnoses sensitized by the system. Through this record, then, it was possible to trace the determination of the diagnostic system in each undergraduate student related to the Case Study, identifying if the diagnosis had been indicated by the student or from the system's suggestion.

Students performed the analysis of the Case Study in the room during the discipline. To measure the degree of accuracy of nursing diagnoses developed by graduate students on paper and PROCEnf-USP®, the Scale for Accuracy of Nursing Diagnoses (SAND) version 2 was used.[8] SAND varied from zero to 13.5 and the nursing diagnoses categories score: zero=null accuracy; 1=low accuracy; 2 to 5.5=moderate accuracy; and 9 to 13.5=high accuracy. The assessment of the diagnostic accuracy of students was carried out by one of the researchers of the study.

The data collected were entered into an Excel® spreadsheet program and processed in the statistical package SPSS version 17. The Wilcoxon nonparametric test was used to compare two paired samples (paper-based and PROCEnf-USP®) and it took into account the magnitudes of the differences and their

Table 1. Comparison of the degree of accuracy of nursing diagnoses indicated by nursing students in the PROCEnf-USP® and paper-based systems (n=17)

Degree of accuracy of nursing diagnoses	Paper-based		PROCEnf-USP®		p-value
	Med	(Min-Max)	Med	(Min-Max)	
Null accuracy	1.5	(1.0-5.0)	1.5	(1.0-4.0)	0.916
Low accuracy	0	(0-0)	0	(0-0)	-
Moderate accuracy	1.0	(0-4.0)	2.0	(0-4.0)	0.361
High accuracy	1.0	(0-4.0)	3.0	(0-15)	0.013

Med -Median; Min - Minimum; Max - Maximum

signals. The Power of the test was also performed to test the sample size and indicate the probability of detecting a real difference between the proportions set out in the study. The power test indicated that the sample composed by 17 subjects is representative and has 74% chance to detect significant differences, if indeed any, between the groups of students who answered all the case studies in PROCEnf-USP® and paper-based systems.

Extracted from the dissertation "*Avaliação de acurácia de diagnósticos de enfermagem em sistemas de documentação eletrônica*" from the Graduation Program in Managing in Nursing of the School of Nursing from Universidade de São Paulo, 2014.

The study was registered in *Plataforma Brasil* under the Certificate of Presentation for Ethics Assessment (CAAE) 0037.0.196.196-11.

Results

A total of 17 nursing students with a mean age of 22 years, predominantly female (92%), which had already taken specific subjects on nursing diagnoses during undergraduate studies (64%) exposed to theoretical/practical contact to nursing diagnoses during supervised training (60%), with the nursing process during undergraduate studies (84%) and a DSS (62.5%).

Comparing the nursing diagnoses elaborated in PROCEnf-USP® and paper-based systems, according to the Wilcoxon test, there was no statistical difference in the determination of high accuracy diagnosis (p=0.013), demonstrating that the diagnoses determined support PROCEnf-USP® have a higher degree of accuracy (Table 1).

In the analysis of the Case study, a total of 17 students from the total of 245 nursing diagnoses, among these, diagnoses freely given (paper-based and PROCEnf-USP®) and suggested by PROCEnf-USP®. It is noteworthy that most of the diagnoses that had high accuracy were suggested by the DSS of the PROCEnf-USP®. The distribution of diagnoses on paper and PROCEnf-USP® according to the degree of accuracy is shown in table 2.

Table 2. Nursing diagnoses identified by students in PROCEnf-USP® and manuscript, according to the degree of accuracy (n=245)

Nursing diagnoses	Degree of accuracy				Total
	Null accuracy	Low accuracy	Moderate accuracy	High Accuracy	
PROCEnf-USP					
Student determination	51	0	9	17	77
System suggestion	35	0	9	17	77
Paper-based					
Student determination	80	0	12	16	108
Total	166	0	23	56	245

At the end of the activity, we asked students' preference in determining the diagnosis, PROCEnf-USP® or paper-based systems, 52% of students indicated they had greater facility to determine diagnostics with the paper-based system.

Discussion

The use of DSS in Nursing education can foster the development of cognitive skills such as clinical reasoning, problem solving and decision making in nursing. Studies show a positive assessment and student satisfaction with the use of simulated clinical scenarios, considering

them useful for the involvement of the student in clinical learning.[9]

The DSS and nursing diagnoses, when used for education and to assess the diagnostic accuracy of the student or his clinical reasoning, can offer benefits to student learning, a more objective assessment of the professor, research development and the process of development of clinical reasoning of the student.[10]

The application of these systems in education is in line with Curriculum Guidelines for Nursing Undergraduate courses in Brazil, focusing on critical and reflective training of nurses, and able to seek and use new knowledge to the development of professional practice.[10] A study in which a model of decision support was applied to the nursing diagnoses education, and it has shown that they can support clinical reasoning teaching in an innovative way and provide a more objective assessment of clinical reasoning and diagnostic accuracy for the student.[11]

The contribution of PROCEnf-USP® in teaching, using simulations in the laboratory, allows the undergraduate student to intervene in the nursing field of knowledge, using clinical judgment and standardized language, linking it to the professional field.

Regarding the diagnostic accuracy assessment, this study showed that nursing students were superior in determining highly accurate level of diagnostics using the PROCEnf-USP® system when compared to the diagnosis indicated manually (paper-based).

It is believed that the incorporation of this type of system in the academic environment enables the development of active methods with the use of educational technology from the perspective of autonomous, critical and reflective teaching, to support and implement the teaching of clinical reasoning in nursing.

The PROCEnf-USP® was developed with the active participation of nurses and nursing faculty, combined with continuous theoretical and practical improvement of the nursing process of HU-USP, which is believed to have contributed to the favorable results obtained in the research evaluation of the system conducted.[2,5]

In a previous study, the PROCEnf-USP® was assessed for its quality standard requirements ISO/IEC 25010 and the results indicated that the characteristic "Functional Adequacy" reached the quality required for the necessities considered in the assessment of nursing professors, clinical and surgical doctors, among other units, and computer experts. It was evident that, from a functional point of view, the PROCEnf-USP® is a tool that meets the needs of users, and enable the execution of Nursing Process based on scientific knowledge.[2]

In Brazil, the area of electronic documentation of the nursing process is marked by systems that can be presented only as a typing of its corresponding paper-based from a check list of diagnoses without the adoption of standardized language.

Authors state that a structured documentation provides more meaningful and reliable nursing data in comparison to the free documentation.[12] According to these recommendations, the PROCEnf-USP® has a standardized system of language, and minimum nursing data that are set to essential data, which are documented in nursing care.[2,5]

In the study, 245 diagnoses indicated by the students, 166 (86 [PROCEnf-USP®] and 80 [paper-based]) had zero accuracy, that is, 68% of diagnoses. Phenomena like this are foresee in the literature, which in one clinical situation can be identified as highly accurate diagnoses and in another as low accuracy, which is accomplished by the complexity and subjectivity of nursing diagnoses.[6]

Accurate documentation of data and clinical information is one of the quality-based nursing care requirements. Documentation is important for continuity of care, to develop clinical knowledge, to improve clinical communication, to support judgments, to ensure safety and to manage the nursing care.[13]

Based on the findings of this study, we suggested that the PROCEnf-USP® can support nursing undergraduate students to establish nursing diagnoses and foster a high degree of accuracy compared to the diagnoses indicated manually.

Regarding the preference of students to determine the paper-based diagnosis, compared to soft-

ware, it may be considered as an expected result, since most of the students had their first contact with the software during the research and had little ability to use HER and DSS. It is believed that with PROCEnf-USP® usage time, undergraduate students will acquire skills and competencies for their management, and understanding the complexity of data and system information.[14]

Therefore, it is important to adopt learning mechanisms that encourage users to build technological knowledge and own standardized language training and professional practice.[2,15]

It is considered that in Brazil, most nurses have basic skills on computer, unaware of the potential use of some technologies, although this resource is a great ally to the daily clinical and managerial practice of nurses.[16]

Clearly, the ultimate technological advancement, learning about computer science in nursing and the development of these skills should be included in the training, approaching the professional training of new technologies in the nursing work process. [2] Initiatives such as Technology informatics Guiding Education Reform (TIGER) today outline basic computer skills, informational and management to be developed by nurses, we highlight a Brazilian study from this matrix presenting the essential skills for nurses in the management[17] and these could be also applied to the use of DSS and HER.

Concerning the limitations of this study, we suggest, for future studies, a higher number of students and Case Studies in the research and replication in a clinical setting, with nurses in order to examine whether similar results would be observed.

Conclusion

This study demonstrated a statistically significant difference in diagnosis with high diagnostic accuracy determined by undergraduate students in PROCEnf-USP® compared to the paper-based system. It is concluded that the PROCEnf-USP® system supports undergraduates to establish nursing diagnoses with a higher degree of accuracy compared to pa-

per-based diagnosis, contributing to the innovation of technology and adoption in the clinical reasoning in nursing education.

Collaborations

Peres HHC, Jensen R and Martins TYC collaborated with the study design, analysis, data interpretation, manuscript writing, relevant critical review of the intellectual content and final approval of the version to be published.

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