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Titolo tesi: Analysis of nursing documentation in the hospital setting: understanding the complexity of care through a Nursing Minimum Data Set

ABSTRACT

BACKGROUND Today, the real impact of nursing documentation on public health is a recognized factor. Through nursing records, nurses can demonstrate the decisions taken during their professional activity and the outcomes related to those decisions in organised technological systems called electronic health records (EHRs). Even if the spread of EHRs has made great progress in the last 25 years, the challenges of adoption by health facilities still persist and the nursing contribution related to their contents remains a partially explored concept. Despite the literature identifies a mix of positive evidences related to their use, they are yet to be implemented in many clinical settings and, where implemented, nursing data contained in EHRs is still often lacking and incomplete, leading to a partial understanding of the complexity of care. Nurses have the potential to contribute to the description of the patient's complexity of care in different hospital settings by registering data in EHRs using various recognized and shared standardized nursing terminologies (SNTs) or coding systems. The Nursing Minimum Data Set (NMDS) promotes the systematic description of nursing, making operational a limited and powerful series of standardized data representative of its main components, such as the nursing diagnoses (NDs). However, the use of NDs is infrequent in clinical practice and the scarcity of nursing data collected, correctly encoded with SNTs and stored in EHRs is an existent issue. Additionally, in clinical practice, a big part of nursing information is captured and documented in a narrative format. These unstructured data, could contain useful information and the methods of synthesizing, interpreting and making narrative data consistent such as SNTs could be difficult to implement, resulting in most data being lost. Scientific literature, to support researchers in addressing this issue, has provided useful and functional strategies. Actually, the favored method for examining the congruence between non-standardised nursing data and SNTs is called cross-mapping. Cross-mapping is a strategy for comparing languages used in clinical practice with existing SNTs, by defining their semantic similarity or their differences. In this scenario, healthcare organizations worldwide and contemporary research emphasize the importance of an accurate nursing documentation as it has a key impact on health outcomes, the effectiveness of health systems and the quality of data available for research purposes. However, literature has reported the widespread presence of low-quality nursing records, stressing the importance of research on factors associated with the accuracy of nursing documentation, which, if detected and modulated, could improve the quality of available data and the understanding of the complexity of care.

AIMS AND OBJECTIVES OF THE PhD The aims of the doctoral research program were to 1) describe the prevalence and trend of NDs in hospital surgical patients, evaluating the relationship between NDs and key hospital outcomes, such as the hospital length of stay (LOS), the total number of intra-hospital patient transfers (IPTs) and patient transfers to intensive care units, respectively; 2) identify unstructured free-text nursing activities recorded by nurses in EHRs with natural language processing (NLP) techniques and to map these nursing activities into standard nursing activities using the String Metric-assisted Assessment of Semantic Heterogeneity (SMASH) cross-mapping method; 3) analyse the accuracy of nursing documentation in the hospital setting and, in particular, the effects of the Primary Nursing (PN) care delivery model on the accuracy of nursing documentation.

METHODS Three studies were designed and realized to implement the aims of this doctoral thesis. For the first objective, a retrospective study was conducted. All adult inpatients consecutively admitted to one of the 15 surgical inpatient units of an Italian university hospital across 2018 were included. Data, including the

Professional Assessment Instrument (PAI), which through its validated clinical decision support system allows for the electronic collection of NDs based on NANDA International taxonomy, and by the Hospital Discharge Register, which is a tool for collecting information related to each patient discharged from the hospital, were collected retrospectively from the hospital's EHRs. A quantitative data analysis was conducted using descriptive and inferential statistical methods. For the second objective, a retrospective study using NLP techniques with the SMASH unidirectional cross-mapping strategy, was conducted. The unstructured free-text nursing activities recorded through the PAI system in the Medicine, Neurology and Gastroenterology inpatient units in an Italian university hospital were collected for 6 months in 2018. Data were analyzed by three phases: a) text summarization component with natural language processing (NLP) techniques, b) a consensus analysis by four experts to detect the category of word stems, and c) cross-mapping with SMASH. The SMASH method calculated the string comparison, similarity and distance of words through the Levenshtein distance (LD), Jaro-Winker distance and the cross-mapping's cut-offs: map [0.80-1.00] with < 13 LD, partial-map [0.50-0.79] with <13 LD and no map [0.0-0.49] with >13 LD. For the third objective, a pretest-posttest-follow-up design was used. The study was conducted from August 2018 to February 2020 in eight surgical and medical wards in an Italian university hospital. The PN was implemented in four wards (study group), while in the other four, the Team Nursing was practised (control group). Nursing documentation accuracy was evaluated through the D-Catch instrument. From the eight wards, 120 nursing documentations were selected randomly for each time point (pre-test, post-test and follow-up) and in each group. Altogether, 720 nursing documents were assessed.

RESULTS Our first study included 5,027 surgical inpatients. There was a mean of 6.3 ± 4.3 NDs per patient. The average distribution of NDs showed a stable trend throughout the year. The most representative NANDA ND domain was safety/protection. The total number of NDs on admission was significantly higher for patient whose LOS was longer. A statistically significant correlation was observed between the number of NDs on admission and the number of IPTs. Additionally, the mean number of NDs on admission was higher for patients who were later transferred to an intensive care unit compared to those who were not transferred. In our second study, 491 patient records were assessed. 548 different unstructured free-text nursing activities were recorded by nurses. 451 unstructured free-text nursing activities (82.3%) were mapped to standard PAI nursing activities, 47 (8.7%) were partial mapped, while 50 (9.0%) were not mapped. This automated mapping yielded recall of 0.95%, precision of 0.94%, accuracy of 0.91%, F-measure of 0.96. The F-measure indicates good reliability of this automated procedure in cross-mapping. Our third study showed that the PN and Team Nursing models exhibited significant differences in mean scores for documentation accuracy: assessment on admission, nursing diagnosis, nursing intervention and patient outcome accuracy. No differences between the two groups were found for record structure accuracy and legibility between the posttest and follow-up.

CONCLUSION Through this doctoral thesis, we demonstrated that the implementation of a SNT -such as the NANDA International taxonomy- in a clinical nursing information system -as the PAI- can contribute to the description of the hospitalized surgical patient. We showed that NDs collected upon admission can represent a prognostic factor related to the hospital's key outcomes. We have shown that NLP techniques with SMASH cross-mapping are a functional and valuable strategy that translates what nurses commonly document and produce daily in free-text format into standardised data. Through this process, it is possible to consider data that would otherwise have been lost, not translated or reused properly, ultimately increasing the overall understanding of the complexity of care. In addition, our research team has shown that the accuracy of available data is modulated by the nursing care delivery model in use. We have shown that, compared to Team Nursing model, PN has an overall positive effect on the accuracy of nursing documentation and that this persists over time. This has an important implication because the study of nursing documentation based on more accurate data improves the quality of information, broadens knowledge of the relationship between nursing care and the outcomes of care, leading to a deeper final understanding of the complexity of care.



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Keywords: Electronic health records, Standardised nursing terminologies, Nursing diagnoses, Patient outcomes, Cross-mapping, Interoperability of healthcare data, Accuracy of nursing documentation, Nursing care delivery model.