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Outcome Calculations Based on Nursing Documentation in the First Generation of Electronic Health Records in the Netherlands

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Abstract. Objectives. Previous studies regarding nursing documentation focused primarily on documentation quality, for instance, in terms of the accuracy of the documentation. The combination between accuracy measurements and the quality and frequencies of outcome variables such as the length of the hospital stay were only minimally addressed. Method. An audit of 300 randomly selected digital nursing records of patients (age of >70 years) admitted between 2013-2014 for hip surgery in two orthopaedic wards of a general Dutch hospital was conducted. Results. Nursing diagnoses: Impaired tissue perfusion (wound), Pressure ulcer, and Deficient fluid volume had significant influence on the length of the hospital stay. Conclusion. Nursing process documentation can be used for outcome calculations. Nevertheless, in the first generation of electronic health records, nursing diagnoses were not documented in a standardized manner (First generation 2010-2015; the first generation of electronic records implemented in clinical practice in the Netherlands).

Keywords. nursing documentation, outcome calculation, nursing process, orthopedic surgery, electronic health record.

1. Introduction

Studies addressing outcome calculations based on the Nursing Process Documentation (NPD) in electronic health records (EHRs) are inadequate [1], and the influence of nursing diagnoses on the length of stay (LOS) is unknown [2]. Reliable and valid analyses on the LOS as a dependent outcome variable rely on accurately documented nursing diagnoses, interventions, and background information for care planning and evaluations [3].

The explanatory power of documented nursing diagnoses can be calculated based on accurately stored nursing information in EHRs [4,5]. Accurate nursing (risk) diagnoses can be employed for early detection in care plans to prevent patients' health complications. Early interventions to solve issues in nursing diagnoses may positively effect hospital efficiency and, therefore, decrease hospital expenditures. Nursing care must be documented in a standardized nursing language for valid outcome calculations [5, 6]. Current developments of EHRs require the use of Standardized Nursing

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Language (SNL). SNL describes the literature-based Nursing Process [7], which is taught and implemented utilizing a standardized nursing language. It includes assessment, nursing diagnoses, nursing interventions, and nursing outcomes that are established in scientifically based nursing classifications [8].

Only on the basis of classification does the Nursing Process serve its purpose: an application of scientific knowledge being appropriate to the clinical patient situation that is defined and validated as concepts [9, 10].

2. Objectives

This study focused on the implementation of nursing documentation in EHRs in order to evaluate the explanatory power of nursing diagnoses on the LOS in hip fracture patients admitted for surgery in orthopedic hospital settings. The research question was: "What is the predictive power of nursing diagnoses documented in electronic health records on the depended variable Length of Hospital Stay (LOS)?"

3. Materials and Methods

A retrospective cross-sectional record audit was performed by using the D-Catch instrument for the assessment of nursing documentation in EHRs. Two independent data collectors performed the audit and came to a consensus on the scores based on the D-Catch guidelines [11]. The predictive power of nursing diagnoses on the LOS was subsequently calculated.

4. Sample and Population

An audit of 300 randomly selected digital nursing records of patients (age of >70 years) admitted between 2013-2014 for hip surgery in two orthopaedic wards of a general Dutch hospital was performed. Records were digitally archived and selected by digital blind random sampling based on record number. The sample was selected from an EHR software that is used in 50% (n= 45) of all Dutch hospitals (N= 90).

5. Data-analyses

With the D-Catch instrument, a total of 300 EHR's of elderly patients (age > 70) with hip fractures were examined. Measurements of nursing records according to the D-Catch variables were carried out in three phases: admission phase, post-operative phase, and the phase of discharge, i.e., the last day of a patient's hospital stay. Interrater reliability of the D-Catch instrument was calculated by using Cohen's weighted kappa. The Advanced Nursing Process documentation was subdivided into: a) documentation in score lists such as delirium scores, Visual Analogue Scales for pain measurement, SNAQ-scores for malnutrition, and scales for pressure ulcer measurements; and b) Nursing Process Documentation in free text. In the EHR software, no technical or content associations existed between score lists, nursing diagnoses, nursing information required the researchers to use the D-Catch instrument for nursing documentation auditing [11]. The aforementioned score lists and the documentation in free text analyzed the prevalence of nursing diagnoses in the postoperative phase by using consensus scores.

Multivariate logistic regression analysis explored independent explanatory factors for the LOS. The independent variables included: medical diagnoses (co-morbidities), medical treatment, and nursing diagnosis. The dependent variable was the length of the hospital stay. Less than 25 total rates of medical diagnoses, co-morbidities, medical treatments, and nursing diagnoses were excluded from the analysis. There are 21 explanatory variables and 262 cases included for further analysis. Thirty-eight cases were excluded as the information in the record was not feasible to use for final analysis.

Bayesian Model Averaging was used for variable selection by averaging the best models in the model class according to approximate posterior model probability. The counts of the number of days hospitalized forms the response which is modeled by Poisson regression including a dispersion parameter for increasing variance. After controlling for other explanatory variables, the exponent of the estimated parameters are interpreted as the rate ratio which is the expected number of days hospitalized considering the diagnosis related to the number of days hospitalized without the diagnosis.

6. Ethical considerations

The ethic committee of the hospital approved the research plan. To guarantee patients' anonymity, nursing documentations were anonymized and coded.

7. Results

In most records, the admission and the discharge documentation were incomplete or did not exist, and explanatory power calculations based on admission or discharge data were not possible. The nature of nurses' documentation in the current EHR's is narrative and unstructured with numerous redundancies. However, post-operative nursing diagnosis documentation was determined to be feasible for use as a final analysis.

Results are calculated from modeling the days hospitalized with Poisson regression in terms of the estimated parameters, their standard errors (SE), t-value, significance measured by the p-value, the rate ratio, and their 95% Confidence interval (Table 1).

Analyses of electronically stored nursing diagnosis documentation revealed the prevalence of post-operative nursing diagnoses that had a positive significant influence on the LOS. The most prevalent nursing diagnoses were: Nausea, Acute pain, Deficient fluid volume, Imbalanced nutrition less than body requirements, and Impaired skin integrity (pressure ulcer). The number of nursing diagnoses documented in the EHR also had a significant influence on the LOS; however, documented medical treatments had no significant influence. Co-morbidities documented in medical diagnoses related to the LOS were ascertained to significantly influence those patients experiencing cardiac disease, stroke, and diabetes.

8. Discussion

New knowledge is required regarding the effects of SNL implementation, education, and training on the quality of the outcome documentation; more important is to know if SNL has an influence on actual care quality and patient outcomes.

It is unknown if SNL, assisted by computer tools, has an influence on actual care quality and patient outcomes [10, 11]. To evaluate nursing outcomes, controlled experimental studies are suggested. New studies on nursing-sensitive patient outcomes should focus on teaching nurses how to use SNLs in practice and compare documentation of the findings of EHRs with nurses' perceptions and experiences.

Nursing diagnoses demonstrated having explanatory power on the LOS, and the prevalence of nursing diagnoses was strongly related to the LOS. Yet, the assumption

is that the Nursing Process with valid assessments, evidence-based nursing diagnoses, interventions, and nursing-sensitive patient outcomes based on SNL has not yet been entirely implemented in the current generation of EHR's. One of the difficulties for nurses is how to make the transfer from their own reasoning process related to the assessment of the patient into SNL, which defines patient care needs as nursing diagnoses, nursing interventions, and nursing-sensitive patient outcomes, as the documentation systems do not provide SNLs. Studies addressing effects of the use of SNL by nurses in clinical practice are lacking, therefore, it is ambiguous whether using SNL applied to Nursing Process documentation in the EHR leads to improved patient outcomes, therefore, it is an important topic for future research.

					RR		
	Estimate	SE	t-value	P-value	Estimate	CLL	CLR
(Intercept)	1,2688	0,3657	3,47	6,00E-04	3,5567	1,7312	7,2595
Age Impaired tissue perfusion	0,0103	0,0043	2,3788	0,0181	1,0104	1,0018	1,019
(wound)	0,3423	0,0768	4,46	0,0000	1,4082	1,2091	1,6338
Pressure ulcer	0,2607	0,0808	3,2261	0,0014	1,2979	1,1059	1,5183
Deficient fluid volume	0,3464	0,0899	3,8546	1,00E-04	1,414	1,1828	1,6826
Diabetes	0,214	0,0672	3,1848	0,0016	1,2386	1,0843	1,4111
Dementia	-0,1984	0,0782	-2,5378	0,0118	0,8201	0,7021	0,9539

Table 1. Results from modeling days hospitalized by Poisson regression in terms of the estimated parameters, their standard errors (SE), t-value, significance measured by p-value, the rate ratio, and their 95% Confidence interval.

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