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Standardized Nursing Diagnoses in a Surgical Hospital Setting: A Retrospective Study Based on Electronic Health Data

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Abstract

Introduction: In electronic health records (EHRs), standardized nursing terminologies (SNTs), such as nursing diagnoses (NDs), are needed to demonstrate the impact of nursing care on patient outcomes. Unfortunately, the use of NDs is not common in clinical practice, especially in surgical settings, and is rarely included in EHRs.

Objective(s): The aim of the study was to describe the prevalence and trend of NDs in a hospital surgical setting by also analyzing the relationship between NDs and hospital outcomes.

Methods: A retrospective study was conducted. All adult inpatients consecutively admitted to one of the 15 surgical inpatient units of an Italian university hospital across 1 year were included. Data, including the Professional Assessment Instrument and the Hospital Discharge Register, were collected retrospectively from the hospital's EHRs.

Results: The sample 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-I ND domain was safety/protection. The total number of NDs on admission was significantly higher for patient whose length of stay was longer. A statistically significant correlation was observed between the number of NDs on admission and the number of intra-hospital patient transfers. 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.

Conclusion: NDs represent the key to understanding the contribution of nurses in the surgical setting. NDs collected upon admission can represent a prognostic factor related to the hospital's key outcomes.

Keywords

surgery, electronic health records, standardized nursing terminologies, nursing diagnoses, patient outcomes, hospital length of stay, intra-hospital patient transfer, transfer to intensive care unit

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Introduction

Standardized nursing terminologies (SNTs), which are a common language used to maintain consistency between original information captured by nurses during their clinical practice and data recorded in nursing care plans, are necessary to demonstrate the impact of nursing care on patient outcomes across settings and sites (Zhang et al., 2021). However, this representation can be difficult because, unfortunately, the use of SNTs is not common in clinical practice (Tastan et al., 2014), and nursing activities are generally not sufficiently reported in electronic health records (EHRs) (Delaney, 2016; Thoroddsen et al., 2012). In these scenario, medical diagnoses and their groupings are usually used for

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the evaluation of health outcomes and for financial reimbursement of medical care by health systems, while nursing data are often not considered for these purposes (D'Agostino et al., 2017; Sanson et al., 2017; Sasso et al., 2017). For these reasons, health outcomes are usually considered to be exclusively related to medical data (Lavin et al., 2004; Welton & Halloran, 2005). Nevertheless, studies suggest that nursing has a distinct effect on patient hospital outcomes regardless of medical care, supporting the usefulness and need to use standardized nursing data such as nursing diagnoses (NDs) within EHRs, ensuring their availability for secondary uses (Delaney, 2016; Zhang et al., 2021). If the correlation between NDs and key health outcomes in hospital settings was strengthened, the documentation of NDs could become fundamental for health systems (Heslop, 2014; Sanson et al., 2017).

Review of the Literature

EHRs are a fundamental source of health data in a technological format that presents valuable aggregate information related to retrospective, simultaneous, and future patient care (Akhu-Zaheya et al., 2018; Dionisi et al., 2019). In the hospital setting, EHRs are primarily used by healthcare professionals to document the provision of care and to evaluate its outcomes by digitally registering clinical data and observations. This generates a large mass of data, which can be consulted and reused when necessary for different purposes (e.g., continuity of care or research) during and after clinical practice (Cristofori et al., 2022; Mellia et al., 2021).

In EHRs, when nursing process-based data are implemented, the patient's nursing assessment leads to the formulation of standardized NDs, which are complementary to medical documents across the continuum of care (D'Agostino et al., 2019). A ND can be defined as a "clinical judgement concerning a human response to health conditions/life processes, or vulnerability for that response, by an individual, family, group, or community" (Herdman & Kamitsuru, 2014). Literature suggests that implementing NDs in EHRs can lead to qualitative improvements to care and a better understanding of the impact of nursing on the care process and its outcomes (Guler et al., 2012; Sanson et al., 2017). The systematic identification of NDs improves knowledge regarding the prevalence and distribution of patient needs among different clinical settings and populations (D'Agostino et al., 2017). However, the use of NDs is not common in clinical practice, and they are seldom included in EHRs, making nursing care underrepresented and poorly recognized (Cocchieri et al., 2018; Shafiee et al., 2022). This makes it difficult to detect and quantify nursing care, its trends and its outcomes, especially in specific areas where these aspects are not yet fully emerged and described, such as the hospital surgical setting. For this purpose, several authors have focused on identifying the frequency of NDs in mixed settings (D'Agostino et al., 2017) or in specific groups of patients, such as oncology (Sanson et al., 2019) and intensive care patients (Castellan et al., 2016).

Surgery nursing care is usually poorly documented, insufficiently represented, and inconsistently included in the patient's pathways (Sondergaard et al., 2017). However, the role of nurses in identifying potential problems in patients (e.g., preoperative anxiety, postoperative acute pain, and risk for infection) is crucial for the planning and implementation of evidence-based nursing interventions based on consistent data such as NDs (Junttila et al., 2010; Monteiro et al., 2019). In addition, studies have shown that NDs are associated with patient and organizational key outcomes, such as hospital length of stay (LOS), in mixed settings (D'Agostino et al., 2017; D'Agostino et al., 2019); to our knowledge, little is known regarding this relationship in the surgical setting.

LOS is a common measure indicative of the quality of care (Lingsma et al., 2018). A postoperative increase in LOS is a dangerous condition for surgical patients, increasing their risk of both morbidity and mortality (Elsamna et al., 2021). Furthermore, prolonged LOS can result in improper use of health systems' human and economic resources (Caminiti et al., 2013). Previous studies have evaluated factors contributing to extended LOS in surgical patients, identifying several elements such as age and comorbidities (e.g., obesity and delirium) (Abeles et al., 2017; Chen et al., 2017), but the relationship between NDs and LOS in this setting has not yet been explored.

There is a lack of knowledge about the relationship between NDs and other outcomes, such as subsequent intrahospital patient transfers (IPTs) and patient transfers to the intensive care unit (ICU). IPTs are performed daily in hospitals due to organizational reasons, postoperative complications, or increased complexity of care (Vourc'h & Asehnoune, 2019). IPTs can be considered a health outcome as well as a dangerous aspect of hospital care that can undermine safety and carries inherent risks (Manataki et al., 2017). The relationship between IPTs and NDs is still unknown. In addition, when patients are transferred to ICUs, which are wards characterized by higher level of care and where most critical patients are monitored and treated after surgery (Tak Kyu et al., 2019), the hospitalization is often associated with worse outcomes and is directly related to a major use of hospital resources and a significant increase in overall hospital expenditure (Knight et al., 2018) not always balanced by hospital reimbursements.

The aim of the study was to describe the prevalence and trend of NDs in hospital surgical patients, evaluating the association between NDs and major diagnostic categories (MDCs), LOS, IPTs, and patient transfers to the ICU.

Methods

Design

A retrospective study was conducted at an Italian university hospital (1,558 beds) consisting of seven departments, 19 clinical areas, 250 inpatient units, and 38 operating rooms. We used the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Von Elm et al., 2014).

Sample

For the purposes of this research, all adult inpatients (≥ 18 years) consecutively admitted to one of 15 surgical inpatient units across 1 year were included in the study.

Exclusion Criteria

The exclusion criteria were patients with a short LOS (1 to 2 days) or patients admitted to day surgery units since these were considered as day hospital admissions—in these inpatient units LOS is established a priori—and therefore these admissions were not useful for the aim of our study, that is, association between NDs and LOS (Sud et al., 2017).

Data Collection

Data were collected retrospectively from the hospital EHRs from 1 January to 31 December 2018. Two databases were available and used: the first, the Professional Assessment Instrument (PAI) (D'Agostino et al., 2012) specifically used in our Hospital, and the Hospital Discharge Register (HDR) (Ministry of Health, 2008) commonly used in all Italian Hospitals. Data from these two databases were linked through a unique anonymous patient identifier by the data warehouse (deterministic linkage) (Zhu et al., 2015).

Data Collection Tool

The PAI is a clinical information system used by nurses to document the nursing process (D'Agostino et al., 2012). This system allows for the electronic collection of standard and essential data related to nursing care (e.g., nursing assessments, NDs, nursing interventions, and patient outcomes) and patients' sociodemographic data (e.g., gender and age) (Cocchieri et al., 2018; D'Agostino et al., 2019; Sanson et al., 2019). The PAI, through its integrated and validated clinical decision support system (Zega et al., 2014), supports nurses' decision-making process on the basis of the data collected during the nursing assessment, providing suggestions for the choice of NDs and related interventions/outcomes. These proposals can be accepted or rejected, thus preserving nurses' decision-making autonomy (D'Agostino et al., 2012). The PAI adopts the standardized NANDA-I taxonomy (Herdman et al., 2014), in which NDs are grouped into 13 domains of nursing practice (e.g., safety/protection, nutrition, comfort, and health promotion) and classified as problem-focused NDs, health-promotion NDs, risk NDs, and syndrome NDs according to their characteristics.

The HDR is a tool for collecting information related to each patient discharged from the hospital (Ministry of Health, 2008). HDR is useful for the analysis of personal data, hospitalization characteristics, and clinical features of patients. HDR adopts the International Classification of Diseases 9th edition with Clinical Modification (ICD-9-CM; Italian version 2007 based on the English version stored in https://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/ICD9-CM/2007/) for the coding of diagnoses and therapeutic procedures.

Variables Collected

For each patient included in the study, the following variables were collected and analyzed.

- *Sociodemographic characteristics* included variables related to gender, age, education, marital status, and the patient's provenance (classified as city, town, or rural area respectively on the basis of the number of inhabitants) (World Bank Group, 2020).
- *NDs* were identified and collected by nurses on patient admission (i.e., within the first 24 h of inpatient admission).
- *ND domains* are groups of NDs that share common attributes and characteristics (Herdman et al., 2014).
- *MDCs* are formed by dividing all possible principal ICD-9-CM medical diagnoses into 25 specific diagnosis areas. The medical diagnoses contained in each MDC correspond to a single organ system or etiology and are associated with a particular medical specialty. Each MDC differs from the others in the specific characteristics of the medical diagnoses it contains (Halloran & Kiley, 1987) and is influenced by the principal diagnosis reported in the HDR.
- *Hospital LOS* was defined by the period of hospitalization from the first day of admission at the hospital until the patient was discharged from the hospital or died. LOS is a key indicator for assessing the hospital's quality of care and planning capacity (Carter & Potts, 2014).
- *Prolonged LOS* is an inpatient stay that exceeds the expected LOS for a certain procedure (Lee et al., 2018), and it was defined as a stay above the 75th percentile of its distribution (Caccialanza et al., 2010).
- *IPT* is the number of transports of the patient between different healthcare teams or environments (Temsah et al., 2021) within the same facility for any diagnostic procedure while maintaining the continuity of medical care (Kulshrestha & Singh, 2016). The number of IPTs reported in this study considered multiple transfers directed to the same ward (such as retransfers) as a single transfer. For example, if a patient was transferred twice within the same ward, this was only counted once.
- *Patient Transfer to ICU* is defined as the occurrence of a transfer to a high-intensity ward after surgery to ensure

intensive treatment and post-operative monitoring (Tak Kyu et al., 2019).
- *Admission and discharge data* are represented by the modality of admission (planned admission vs from an emergency department) and the modality of discharge (transfer to another healthcare facility or hospital vs home discharge vs death).

Data Analysis

A quantitative data analysis was conducted using descriptive and inferential statistical methods. Tests of normality were used to assess the distribution of the variables. For normally distributed quantitative variables, results were expressed as mean values and standard deviations (SDs); otherwise, the median and the interquartile range (IQR) were reported. Qualitative variables were expressed as counts and percentages. NDs were classified by their clinical prevalence and were grouped by their domains (Herdman et al., 2014) to allow for further analysis, such as their comparison with MDCs. ND domains were counted each time an ND of that relevant domain was present. For the comparison between the different quantities and patterns of NDs among the different MDCs, we selected the MDCs with a prevalence greater than 15% and which included at least 70% of the population. Chi-squared was used to compare the proportions between two or more groups (e.g., frequency of NDs between MDCs). For each MDC, the absolute frequency and percentage for identified NDs and domains were indicated. To test the association between variables, Welch's (1947) and Yuen's (1974) *t*-tests were used when both the assumptions of normality and homogeneity of variance were violated. NDs were defined as high frequency (HF) NDs when they were characterized by a prevalence greater than or equal to 20% in the sample analyzed (D'Agostino et al., 2017). In order to compare the means of more than two groups (e.g., mean number of NDs among MDCs), one-way analysis of variance and Tukey–Kramer *post hoc* test were used when appropriate. Patients were divided into six categories using the 5th, 25th, 50th, 75th, and 95th percentiles of the total number of NDs as a cut-off, and the mean LOS was calculated for each category. For the study of significant associations between the number of NDs and LOS, a non-parametric correlation was performed, and Spearman's rank correlation coefficient was used to evaluate bivariate relationships involving ordinal variables (e.g., number of NDs and age; ND domains, and mean LOS). Statistical significance was set at $p < .05$. All tests were two-sided. All statistical analyses were conducted with the use of SPSS version 26 (IBM, New York, USA) and the R software package version 4.1.1 (R Development Core Team, 2021).

Table 1. Sociodemographic Characteristics of the Study Population ($N = 5{,}027$).

Variables	Descriptive statistics		
Gender	*N*	%	
Male	2,434	48.4	
Female	2,593	51.6	
Age (years) (mean, (SD); range)	60.21	15.27	18–98
Rural urban classification (*n* = 5015)			
City	2,256	45.0	
Town	1,185	23.6	
Rural area	1,574	31.4	
Education			
Less than high school	1,643	32.7	
High school	1,489	29.6	
University Degree	615	12.2	
No education	94	1.9	
Not declared	1,186	23.6	
Marital status (*n* = 5020)			
Married	2,832	56.4	
Single	670	13.3	
Divorced	259	5.2	
Widowed	326	6.5	
Not declared	933	18.6	

SD = standard deviation.

Results

Sociodemographic Characteristics of the Study Population

The final study sample included 5,027 surgical inpatients; 80 patients were excluded. The mean patient age was 60.2 ± 15.27 (range: 18–98) years, and 51.6% were female. Most of the patients came from cities (45%). The most common level of education was less than high school (32.7%), and the majority were married (56.4%) (see Table 1).

Clinical Characteristics of the Study Population

Patients were primarily admitted to the hospital through planned admission (79.9%). The most representative MDCs were endocrine, nutritional, and metabolic system diseases and disorders (DDs) (21.9%); digestive system DDs (21.9%); hepatobiliary and pancreatic DDs (15.3%); and cardiocirculatory system DDs (15.2%). A total of 3,735 patients (74.3%), were included in these four MDCs. The mean hospital LOS was 8.29 ± 9.84 days (median: 5; IQR: 6). Prolonged LOS was found in 1,140 patients (22.7%). The most representative NANDA-I ND domain was safety/protection (*n* = 10,965; 34.8%), followed by activity/rest (*n* = 9,287; 29.4%), nutrition (*n* = 3,775; 12%), elimination and exchange (*n* = 3,531; 11.2%), coping/stress tolerance (*n* = 1,941; 6.2%), comfort (*n* = 1,501; 4.8%), perception/cognition (*n* = 225; 0.7%), self-perception (*n* = 153; 0.5%), health promotion (*n* = 127; 0.4%), and role relationships (*n* = 31; 0.1%). During hospitalization, 1,466 patients

(29.2%) were transferred, and 1,242 patients (24.7%) were transferred to the ICU after surgery. The main clinical characteristics of the study population are shown in Table 2.

ND Prevalence and Trends in the Study Year

Overall, 31,536 NDs were selected by nurses, corresponding to an average of 6.3 ± 4.3 NDs per patient (median: 5; range: 0–30). Of these, 18,371 were problem-focused NDs and 13,165 were risk NDs. Eleven HF-NDs were identified: risk for falls (70.6%), risk for infection (67.9%), risk for impaired skin integrity (44.9%), overweight (35.8%), risk for constipation (31.2%), impaired physical mobility (31.2%), acute pain (28.7%), activity intolerance (23.4%), risk for activity intolerance (21.9%), anxiety (21.2%), and imbalanced nutrition: less than body requirements (20.0%). The frequency distribution of the NDs is shown in Table 3.

Table 2. Main Clinical Characteristics of the Study Population (*N*=5,027).

Variables	Descriptive statistics			
Modality of admission	*N*	%		
Planned admission (or scheduled admission)	4,016	79.9		
From emergency department	1,011	20.1		
LOS (days) mean, (SD); median, (IQR)	8.29	9.84	5	6
Prolonged LOS				
≤9	3,887	77.3		
>9	1,140	22.7		
MDC				
Endocrine, nutritional & metabolic system DDs	1,100	21.9		
Digestive system DDs	1,099	21.9		
Hepatobiliary and pancreatic DDs	771	15.3		
Cardiocirculatory system DDs	765	15.2		
Respiratory system DDs	382	7.6		
Skin, subcutaneous tissue & breast DDs	229	4.6		
Musculoskeletal and connective system DDs	211	4.2		
Myeloproliferative diseases & disorders, poorly differentiated neoplasms	82	1.6		
Diseases and disorders of the nervous system	77	1.5		
Infectious & parasitic diseases, systemic or unspecified sites	71	1.4		
Injuries, poisonings & toxic effects of drugs	58	1.2		
Factors influencing health status & other contacts with health services	55	1.1		
Other	127	2.4		
IPTs				
None	3,561	70.8		
1	1,134	22.6		
2	268	5.3		
≥ 3	64	1.3		
Patient transfer to ICU				
Yes	1,242	24.7		
No	3,785	75.3		
Modality of discharge				
Died	18	0.4		
Transferred to another facility or hospital	654	13.0		
Home	4,355	86.6		

SD = standard deviation; IQR = interquartile range; LOS = length of stay; MDC = major diagnostic category; DDs = diseases and disorders; IPTs = intra-hospital patient transfers; ICU = intensive care unit.

The average distribution of NDs showed a stable trend throughout the year, without substantial changes related to the month or period. However, on the basis of the data analyzed, there was evidence of an increase in the overall average NDs by patient in October (mean: 6.90) and a decrease in July (mean: 5.80) (Figure 1). In addition, the previously identified HF-NDs were most frequently and consistently represented over the course of 4 months during the study year (January, March, April, and August); however, over the remaining 8 months, these HF-NDs did not show a consistent representation, being replaced in some cases by other HF-NDs, as shown in Table 4.

Frequency Distribution of the NANDA-I Domains Among MDCs

Safety/protection was the main represented ND domain for cardiocirculatory system DDs (83.3%; $p < .001$), digestive system DDs (95.3%; $p < .001$), and hepatobiliary and pancreatic DDs (96.4%; $p < .001$). In the MDC endocrine, nutritional, and metabolic system DDs, the most frequently represented ND domains were nutrition (80.4%; $p < .001$) and safety/protection (95%; $p < .001$).

Frequency Distribution of the NDs Among MDCs

Risk for infection was the most frequent ND used in cardiocirculatory system DDs and digestive system DDs, while risk for falls was the most frequently identified ND in the hepatobiliary and pancreatic DDs and endocrine, nutritional, and metabolic system DDs. The frequency distribution of the NDs among MDCs that had a prevalence higher than 15% and that covered a total of 75% of the sample is shown in Table 5.

Relationship Between NDs, ND Domains, and LOS

The number of NDs on admission was significantly higher in patients who experienced a prolonged LOS of more than 9 days (≤ 9 days: 5.70 ± 3.84; > 9 days: 8.22 ± 5.39), $F = 252.001$, $p < .001$). A longer LOS was significantly related to seven ND domains (health promotion, nutrition, elimination and exchange, activity/rest, perception/cognition, self-perception, and safety/protection; $p < .001$) and 24 NDs (Table 6).

Table 3. Frequency Distribution of the NDs ($N = 31{,}536$).

ND	ND domain	*N*	%	HF-ND
Risk for falls	Safety/Protection	3,547	70.6	Yes
Risk for infection	Safety/Protection	3,413	67.9	Yes
Risk for impaired skin integrity	Safety/Protection	2,257	44.9	Yes
Overweight	Nutrition	1,799	35.8	Yes
Risk for constipation	Elimination and Exchange	1,568	31.2	Yes
Impaired physical mobility	Activity/Rest	1,567	31.2	Yes
Acute pain	Comfort	1,445	28.7	Yes
Activity intolerance	Activity/Rest	1,178	23.4	Yes
Risk for activity intolerance	Activity/Rest	1,100	21.9	Yes
Anxiety	Coping/Stress Tolerance	1,068	21.2	Yes
Imbalanced nutrition: less than body requirements	Nutrition	1,004	20.0	Yes
Disturbed sleep pattern	Activity/Rest	990	19.7	No
Risk for injury	Safety/Protection	901	17.9	No
Fear	Coping/Stress Tolerance	819	16.3	No
Impaired urinary elimination	Elimination and Exchange	818	16.3	No
Dressing self-care deficit	Activity/Rest	789	15.7	No
Impaired walking	Activity/Rest	709	14.1	No
Bathing self-care deficit	Activity/Rest	677	13.5	No
Impaired swallowing	Nutrition	654	13.0	No
Toileting self-care deficit	Activity/Rest	653	13.0	No
Ineffective peripheral tissue perfusion	Activity/Rest	652	13.0	No
Constipation	Elimination and Exchange	621	12.4	No
Ineffective breathing pattern	Activity/Rest	442	8.8	No
Risk for aspiration	Safety/Protection	379	7.5	No
Impaired skin integrity	Safety/Protection	343	6.8	No
Deficient fluid volume	Nutrition	318	6.3	No
Fatigue	Activity/Rest	317	6.3	No
Feeding self-care deficit	Activity/Rest	213	4.2	No
Diarrhea	Elimination and Exchange	202	4.0	No
Perceived constipation	Elimination and Exchange	165	3.3	No
Disturbed body image	Self-Perception	153	3.0	No
Noncompliance	Health Promotion	127	2.5	No
Ineffective airway clearance	Safety/Protection	125	2.5	No
Acute confusion	Perception/Cognition	120	2.4	No
Bowel incontinence	Elimination and Exchange	83	1.7	No
Impaired memory	Perception/Cognition	56	1.1	No
Chronic pain	Comfort	56	1.1	No
Ineffective coping	Coping/Stress Tolerance	54	1.1	No
Chronic confusion	Perception/Cognition	49	1.0	No
Impaired social interaction	Role Relationships	31	0.6	No
Functional urinary incontinence	Elimination and Exchange	27	0.5	No
Urge urinary incontinence	Elimination and Exchange	22	0.4	No
Stress urinary incontinence	Elimination and Exchange	15	0.3	No
Reflex urinary incontinence	Elimination and Exchange	10	0.2	No

ND = nursing diagnosis; HF-ND = high frequency nursing diagnosis.

Relationship Between the Number of NDs and LOS

Six categories of NDs were created according to the percentiles of the total number of NDs (see Data analysis section), each corresponding to an aggregate number of NDs (0–1, 2–3, 4–5, 6–9, 10–14, and ≥ 15). A higher number of NDs on admission was associated with a higher LOS. The Siegel–Tukey *post hoc* analysis revealed that the total number of NDs was significantly higher for patient whose LOS was longer (Figure 2).

Relationship Between NDs and IPTs

A statistically significant correlation was observed between the number of NDs on admission and the number of IPTs

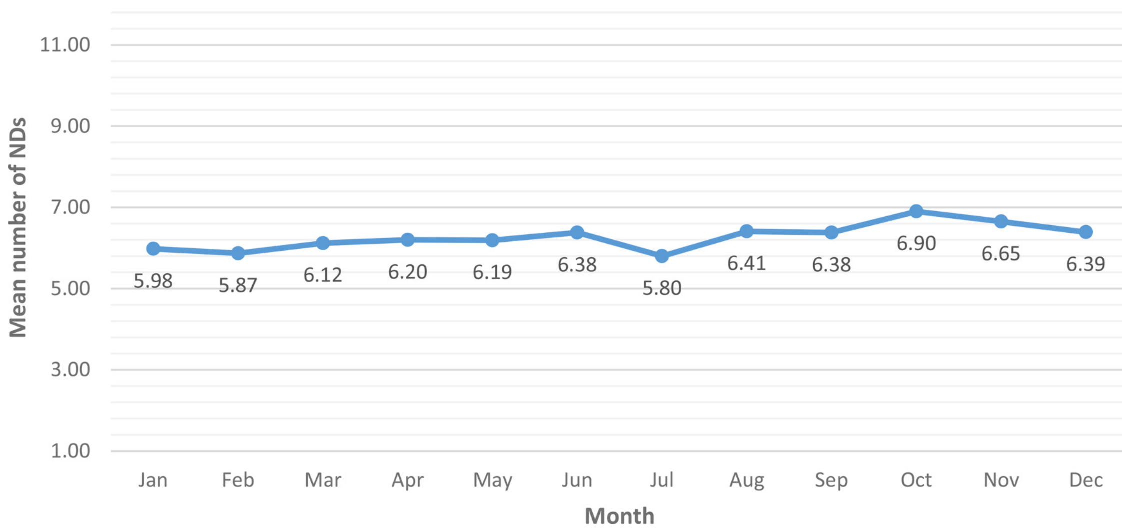

Figure 1. Trend of nursing diagnoses (NDs) in the study year.

($r = .181$, $p < .001$). A higher number of NDs on admission was correlated with a higher number of IPTs (Figure 2).

Relationship Between NDs and Patient Transfers to ICUs

The association between the number of NDs on admission and the patient's transfer to an ICU was statistically significant. The mean number of NDs on admission was higher for patients who were later transferred to an ICU (n = 1,242; NDs: 7.88 ± 5.32) compared to those who were not transferred (n = 3,785; NDs: 5.77 ± 3.89); $F = 303.227$, $p < .001$.

Discussion

This study aimed to describe the prevalence of NDs in adult hospital surgical patients and to analyze the relationship of these data with MDCs, LOS, and the total number of IPTs or patient transfers to ICUs. To our knowledge, this research question has yet to be described in the literature, and this is the first broad study based on a large sample identifying NANDA-I NDs in the surgical setting in Europe. In the past, a few studies in the literature have analyzed the prevalence of NDs in large samples. However, these studies considered mixed samples from surgical and medical settings (D'Agostino et al., 2017; D'Agostino et al., 2019; Feng & Chang, 2015; Halloran & Kiley, 1987; O'Brien-Pallas et al., 2010; Park et al., 2006; Welton & Halloran, 2005). Other studies on this topic only considered specialized surgical settings (da Rocha et al., 2006; Ferreira et al., 2014; Flanagan & Jones, 2009; Moreira et al., 2013; Nunes do Nascimento et al., 2020), smaller samples, or unspecified SNTs (Tuncbilek & Senol Celik, 2016).

Our data showed a broader use of NDs in the surgical setting. These results are likely related to the use of the clinical decision support system included in the PAI, which can improve the accuracy and completeness of the diagnostic process (Zega et al., 2014). International literature confirms that when nurses use specific systems designed to support nursing diagnostic choice, clinical practice regarding this aspect is more sustained, encouraged, and effective (Kurashima et al., 2008; Zega et al., 2014).

Our research showed a stable trend of ND distribution across the 12 months of data collection, with a decrease in July and an increase in October. The research group assumes that the variations in the average number of NDs might be attributed simply to the characteristics of patients or could be related to professional factors. For example, a possible contributing factor likely related to the lower trend evidenced in July could be nurses' unfamiliarity with diagnostic reasoning and the use of NDs (Lee, 2005; Muller-Staub et al., 2008) due to a many new hires during this time. Previous studies have found a relationship between attitudes towards NDs and the behavior of using NDs in professional nursing practice worldwide (D'Agostino et al., 2016). Nurses with a more positive attitude towards NDs are more likely to use it (Lumillo-Gutierrez et al., 2019). Unfortunately, information and data on nurses' attitudes were not considered in this study, and therefore, it was not possible to investigate or confirm such hypotheses. The results highlighted by our research could be deepened in dedicated research examining the factors that intervene in trend changes or for analyzing the impact of the number of NDs on the quality of care and health outcomes.

The most identified NDs in our study were problem focused, and this result is similar to previous literature reports conducted on large mixed samples (Castellan et al.,

Table 4. Frequency Distribution of HF-NDs per Month in the Study Year ($N = 31{,}536$).

	Month																							
	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
ND	*N*	Rank	*N*	Rank	*N*	Rank	*N*	Rank	*N*	Rank	*N*	Rank	*N*	Rank	*N*	Rank	*N*	Rank	*N*	Rank	*N*	Rank	*N*	Rank
Risk for falls	319	**1**	271	**2**	308	**1**	318	**1**	335	**1**	298	**2**	292	**1**	175	**2**	316	**1**	340	**1**	350	**1**	225	**1**
Risk for infection	299	**2**	288	**1**	297	**2**	292	**2**	320	**2**	301	**1**	273	**2**	186	**1**	292	**2**	335	**2**	331	**2**	199	**2**
Risk for impaired skin integrity	207	**3**	156	**3**	201	**3**	179	**3**	217	**3**	195	**3**	165	**3**	127	**3**	195	**3**	214	**3**	242	**3**	159	**3**
Overweight	154	**4**	128	**5**	175	**4**	153	**5**	180	**5**	161	**4**	145	**4**	79	**6**	179	**4**	163	**5**	165	**4**	117	**4**
Risk for constipation	139	**5**	140	**4**	156	**5**	160	**4**	181	**4**	146	**5**	137	**5**	107	**4**	163	**5**	169	**4**	70		0	
Impaired physical mobility	134	**6**	120	**6**	133	**6**	151	**6**	164	**6**	142	**6**	117	**6**	86	**5**	146	**6**	156	**6**	145	**6**	73	**9**
Acute pain	112	**7**	107	**7**	103	**7**	116	**7**	150	**7**	121	**7**	111	**7**	74	**7**	139	**7**	146	**7**	158	**5**	108	**5**
Anxiety	92	**8**	80	**10**	102	**8**	91	**10**	94	**9**	88		91	**8**	62		88	**11**	111	**10**	91		78	**8**
Imbalanced nutrition: less than body requirements	91	**9**	93	**8**	87	**10**	104	**8**	102	**8**	93	**9**	85	**9**	55		76		99		83		36	
Activity intolerance	91	**10**	74		96	**9**	99	**9**	81		91	**10**	80	**11**	69	**8**	119	**8**	141	**8**	144	**7**	93	**6**
Risk for activity intolerance	90	**11**	78	**11**	86	**11**	90	**11**	90	**10**	95	**8**	82	**10**	68	**9**	98	**10**	113	**9**	128	**8**	82	**7**
Fear	85		71		71		71		85		88		67		32		67		59		70		53	
Disturbed sleep pattern	77		85	**9**	65		88		87	**11**	90	**11**	62		56		104	**9**	103	**11**	109	**10**	64	**10**
Risk for injury	70		65		64		68		70		55		57		63	**10**	80		101		126	**9**	82	**7**
Impaired walking	69		51		63		73		76		68		63		50		73		91		32		0	
Impaired urinary elimination	64		75		65		72		84		86		68		52		73		73		59		47	
Dressing self-care deficit	58		50		65		61		61		58		47		54		69		101		108	**11**	57	**11**
Impaired swallowing	55		54		55		55		65		61		50		16		61		65		71		46	
Bathing self-care deficit	54		50		58		58		47		55		44		43		50		84		91		43	
Toileting self-care deficit	52		51		64		55		55		56		43		33		44		78		80		42	
Ineffective peripheral tissue perfusion	47		43		56		63		51		64		53		19		65		63		75		53	
Ineffective breathing pattern	37		44		31		26		37		36		39		18		54		44		52		24	
Constipation	34		58		47		61		64		47		56		37		51		46		68		52	
Risk for aspiration	31		26		34		29		29		26		27		22		38		41		46		30	
Impaired skin integrity	30		17		27		24		32		37		19		14		25		43		52		23	
Deficient fluid volume	27		23		35		20		29		34		22		21		27		31		25		24	
Fatigue	25		21		28		27		22		17		21		24		35		40		37		20	
Diarrhea	20		14		12		18		24		21		16		11		19		18		14		15	
Feeding self-care deficit	19		21		17		17		18		17		13		11		14		20		31		15	
Disturbed body image	18		8		10		10		11		9		14		7		13		11		13		29	
Bowel incontinence	13		11		4		9		4		9		6		5		7		7		0		8	
Ineffective airway clearance	13		4		16		8		20		23		7		7		8		11		7		1	
Acute confusion	12		9		6		16		19		10		18		4		14		9		3		0	
Noncompliance	10		7		8		15		9		10		9		9		15		16		13		6	
Chronic pain	9		7		4		2		4		1		7		3		4		5		7		3	
Chronic confusion	8		3		1		4		4		3		6		3		2		7		4		4	
Perceived constipation	7		5		6		15		19		13		14		10		17		19		24		16	
Urge urinary incontinence	5		1		2		1		0		2		1		4		1		0		4		1	
Impaired social interaction	5		0		0		3		0		1		8		2		5		4		2		1	
Impaired memory	4		4		1		6		5		7		5		7		4		6		4		3	

(continued)

Table 4. Continued.

	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Functional urinary incontinence	3	1	1	0	2	2	6	1	6	2	2	1
Stress urinary incontinence	3	0	1	1	3	0	1	0	1	2	2	1
Ineffective coping	2	5	1	5	4	7	5	6	5	6	5	3
Reflex urinary incontinence	1	0	1	2	1	1	0	0	1	1	2	0

High-frequency nursing diagnoses are given in bold.
ND = nursing diagnosis; HF-NDs = high frequency nursing diagnoses.

Table 5. Frequency Distribution of NDs Among MDCs.

	Cardiocirculatory system DDs			Digestive system DDs			Hepatobiliary and pancreatic DDs			Endocrine, nutritional & metabolic system DDs			*p-value**
ND	*N*	%	Rank	*N*	%	Rank	*N*	%	Rank	*N*	%	Rank	
Risk for infection	484	63.3	1	873	79.4	1	598	77.6	2	765	69.5	2	<.001
Risk for impaired skin integrity	446	58.3	2	478	43.5	4	302	39.2	3	492	44.7	5	<.001
Risk for falls	413	54.0	3	868	79.0	2	635	82.4	1	904	82.2	1	<.001
Impaired physical mobility	339	44.3	4	450	40.9	5	276	35.8	6	49	4.5		<.001
Activity intolerance	320	41.8	5	258	23.5	9	136	17.6		69	6.3		<.001
Anxiety	302	39.5	6	219	19.9		191	24.8	10	95	8.6		<.001
Risk for activity intolerance	294	38.4	7	276	25.1	8	134	17.4		50	4.5		<.001
Overweight	279	36.5	8	240	21.8		243	31.5	8	635	57.7	3	<.001
Dressing self-care deficit	275	35.9	9	176	16.0		63	8.2		14	1.3		<.001
Risk for constipation	274	35.8	10	503	45.8	3	292	37.9	4	95	8.6		<.001
Risk for injury	264	34.5		185	16.8		80	10.4		45	4.1		<.001
Bathing self-care deficit	209	27.3		154	14.0		67	8.7		19	1.7		<.001
Impaired walking	204	26.7		155	14.1		51	6.6		24	2.2		<.001
Toileting self-care deficit	195	25.5		147	13.4		64	8.3		53	4.8		<.001
Disturbed sleep pattern	192	25.1		161	14.6		157	20.4		184	16.7	7	<.001
Fear	149	19.5		242	22.0	10	143	18.5		123	11.2	10	<.001
Acute pain	122	15.9		297	27.0	7	287	37.2	5	353	32.1	6	<.001
Ineffective peripheral tissue perfusion	116	15.2		178	16.2		134	17.4		44	4.0		<.001
Imbalanced nutrition: less than body requirements	111	14.5		365	33.2	6	262	34.0	7	45	4.1		<.001
Constipation	79	10.3		226	20.6		139	18.0		49	4.5		<.001
Risk for aspiration	75	9.8		106	9.6		25	3.2		56	5.1		<.001
Fatigue	67	8.8		58	5.3		32	4.2		34	3.1		<.001
Impaired urinary elimination	60	7.8		230	20.9		197	25.6	9	153	13.9	8	<.001
Impaired skin integrity	46	6.0		64	5.8		27	3.5		125	11.4	9	<.001
Feeding self-care deficit	45	5.9		47	4.3		17	2.2		8	0.7		<.001
Ineffective breathing pattern	37	4.8		91	8.3		70	9.1		61	5.5		<.001
Perceived constipation	32	4.2		36	3.3		32	4.2		17	1.5		.002
Deficient fluid volume	30	3.9		97	8.8		81	10.5		24	2.2		<.001
Noncompliance	21	2.7		33	3.0		19	2.5		10	0.9		.005
Diarrhea	20	2.6		73	6.6		22	2.9		14	1.3		<.001
Disturbed body image	16	2.1		26	2.4		10	1.3		14	1.3		.153
Acute confusion	12	1.6		25	2.3		11	1.4		7	0.6		.017
Ineffective coping	12	1.6		8	0.7		4	0.5		5	0.5		.038
Impaired swallowing	11	1.4		48	4.4		17	2.2		522	47.5	4	<.001
Ineffective airway clearance	9	1.2		44	4.0		48	6.2		7	0.6		<.001
Impaired social interaction	9	1.2		4	0.4		3	0.4		2	0.2		.017
Chronic pain	7	0.9		9	0.8		11	1.4		5	0.5		.165
Impaired memory	5	0.7		20	1.8		9	1.2		4	0.4		.005
Chronic confusion	5	0.7		14	1.3		6	0.8		2	0.2		.026
Bowel incontinence	4	0.5		49	4.5		10	1.3		2	0.2		<.001
Functional urinary incontinence	2	0.3		6	0.5		3	0.4		1	0.1		.290
Stress urinary incontinence	2	0.3		1	0.1		2	0.3		3	0.3		.775
Reflex urinary incontinence	2	0.3		2	0.2		4	0.5		0	0		.120
Urge urinary incontinence	1	0.1		6	0.5		0	0		3	0.3		.122

ND = nursing diagnosis; MDCs = major diagnostic categories; DDs = diseases and disorders.
* Chi-squared test.

2016; D'Agostino et al., 2017). Nevertheless, the three most frequently identified NDs in our sample were risk NDs, demonstrating the valuable role of nurses in surgical risk assessment and prevention for establishing a standard of safety and quality of care. This was confirmed in the study by Rembold et al. (2020), who showed how identification

Table 6. NDs Related With Hospital Length of Stay (LOS).

ND	LOS						
	Pts without NDs *N*; mean (SD)			Pts with NDs *N*; mean (SD)			*p*-value*
Imbalanced nutrition: less than body requirements	4,900	7.75	8.4	1,004	10.46	13.7	*p*<.001
Overweight	3,228	9.01	10.7	1,799	6.99	7.8	*p*<.001
Deficient fluid volume	4,709	7.95	8.9	318	13.28	18.2	*p*<.001
Impaired swallowing	4,373	8.70	9.5	654	5.52	11.1	*p*<.001
Constipation	4,406	8.05	9.4	621	9.98	12.2	*p*<.001
Perceived constipation	4,862	8.18	9.3	165	11.55	18.9	*p*<.001
Risk for constipation	3,459	7.07	7.1	1,568	10.97	13.6	*p*<.001
Diarrhea	4,825	8.07	8.9	202	13.58	21.8	*p*<.001
Bowel incontinence	4,944	8.15	9.3	83	16.54	24.7	*p*<.001
Impaired urinary elimination	4,209	8.12	8.9	818	9.17	13.6	*p*<.001
Stress urinary incontinence	5,012	8.30	9.8	15	5.47	1.8	.073
Urge urinary incontinence	5,005	8.29	9.8	22	8.91	7.2	*.981*
Reflex urinary incontinence	5,017	8.28	9.8	10	14.40	14.4	*.027*
Ineffective peripheral tissue perfusion	4,375	7.77	8.4	652	11.80	15.8	*p*<.001
Impaired physical mobility	3,460	7.04	7.6	1,567	11.04	13.0	*p*<.001
Disturbed sleep pattern	4,037	7.85	8.5	990	10.09	13.8	*p*<.001
Feeding self-care deficit	4,814	7.98	8.85	213	15.32	21.5	*p*<.001
Bathing self-care deficit	4,350	7.38	7.6	677	14.11	17.47	*p*<.001
Toileting self-care deficit	4,374	7.53	8.05	653	13.35	16.8	*p*<.001
Dressing self-care deficit	4,238	7.25	7.4	789	13.89	16.7	*p*<.001
Risk for infection	1,614	7.14	7.3	3,413	8.83	10.7	*p*<.001
Impaired skin integrity	4,684	8.15	9.1	343	10.16	16.1	*p*<.001
Risk for impaired skin integrity	2,770	7.29	7.5	2,257	9.52	11.9	*p*<.001
Ineffective airway clearance	4,902	8.28	9.8	125	8.78	9.6	*p*<.001
Impaired memory	4,971	8.22	9.5	56	14.25	22.4	*p*<.001
Impaired social interaction	4,996	8.29	9.8	31	8.23	5.0	*.300*
Chronic confusion	4,978	8.27	9.8	49	9.76	7.3	*.669*
Acute confusion	4,907	8.10	9.2	120	16.13	22.0	*p*<.001
Anxiety	3,959	8.02	9.6	1,068	9.27	10.4	*.333*
Fear	4,208	8.26	9.7	819	8.44	10.5	*.210*
Activity intolerance	3,849	7.20	7.4	1,178	11.84	14.6	*p*<.001
Acute pain	3,582	8.33	9.8	1,445	8.19	9.8	*.580*
Chronic pain	4,971	8.28	9.8	56	8.73	7.1	*.734*
Disturbed body image	4,874	8.22	9.5	153	10.41	16.4	*p*<.001
Risk for activity intolerance	3,927	7.20	7.4	1,100	12.18	14.9	*p*<.001
Ineffective breathing pattern	4,585	8.21	9.7	442	9.10	10.9	*.053*
Fatigue	4,710	7.93	8.7	317	13.56	19.3	*p*<.001
Impaired walking	4,318	7.49	8.1	709	13.17	16.0	*p*<.001
Ineffective coping	4,973	8.23	9.5	54	13.28	22.8	*p*<.001
Noncompliance	4,900	8.13	9.5	127	14.33	17.7	*p*<.001
Risk for injury	4,126	7.32	7.7	901	12.72	15.5	*p*<.001
Risk for falls	1,480	7.28	7.5	3,547	8.71	10.6	*p*<.001
Risk for aspiration	4,648	7.77	8.3	379	14.66	19.9	*p*<.001

ND = nursing diagnosis; LOS = length of stay; Pts = patients; SD = standard deviation.
*Yuen-Welch Test.

of the risk factors of clinical practice enables implementation of interventions to prevent or reduce complications during surgical recovery. Eleven NDs were identified as HF-NDs in our sample. Flanagan and Jones (2009) were the only other authors who previously investigated the concept of prevalence relative to HF-NDs in a surgical patient. However, their study did not use NANDA-I taxonomy, did not consider the NDs present at hospital admission, and did not specify the threshold of attention for considering a common ND to be an HF-ND due to the different method adopted. These divergences make any comparison with our study arduous.

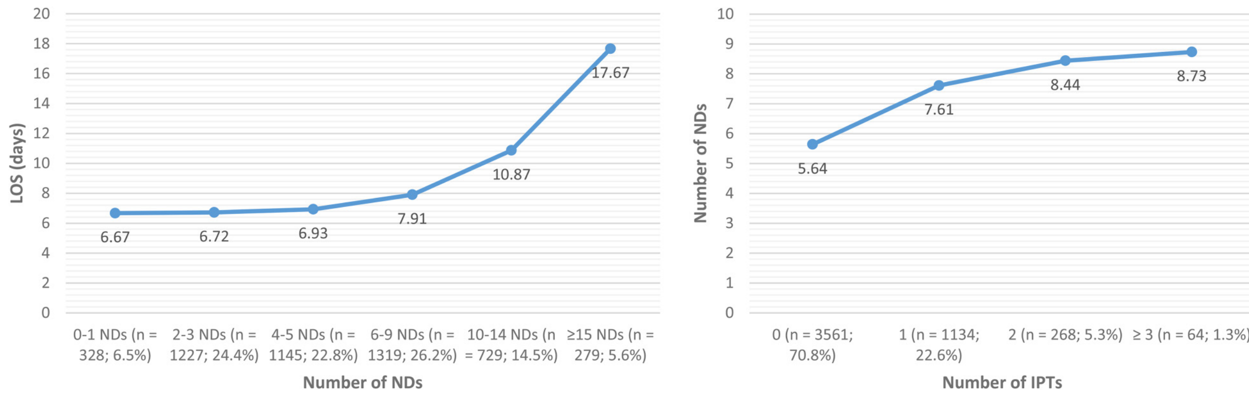

Figure 2. Relationship between the number of NDs and LOS and between NDs and IPTs.
NDs = nursing diagnoses; LOS = length of stay; IPTs = intra-hospital patient transfers.

A study by D'Agostino et al. (2017) sought to describe HF-NDs using medical and surgical subgroups. The general prevalence of their HF-NDs differed from those of our study, indicating a different distribution of these NDs. However, that study did identify four HF-NDs (risk for infection, risk for constipation, anxiety, and impaired physical mobility) also present in our patients. Moreover, risk for falls, which represented the most frequently highlighted HF-ND in our study, was not considered an HF-ND in a D'Agostino et al.'s study (2017), with the exception of the thoracic surgical ward. A possible interpretation of this result could be related to a different prevalence of HF-NDs in distinct surgical settings, indicating patients' divergent needs based on the surgical specialty. Future studies could analyze the concept of HF-NDs in individual specialties to highlight connecting and contrasting elements. It could be interesting to discover the role of these HF-NDs in relation to negative outcomes such as mortality, thus analyzing their role as predictors of these events.

Additionally, we studied the prevalence of NDs identified at hospital admission grouped by ND domain. Our results are in line with those of D'Agostino et al. (2017), as their first seven most frequent ND domains are the same highlighted by our results and cover almost the entire population analyzed. This aspect implies a potential shared role of nursing domains in mixed medical and surgical populations.

Our study highlighted a high prevalence of the ND risk for falls. This selection denotes the particular attention paid by nurses to the problem of falls, a crucial aspect of risk prevention, which is one of the most important goals for safety and high-quality standards of care (James et al., 2014; Olvera-Arreola et al., 2013; Rodziewicz et al., 2022). By detecting this ND, which seems to be a predominant characteristic of surgical patients, nurses may implement a plan of care for and preventive measures against this adverse event (Aliaga et al., 2018; Luzia Mde et al., 2014). Other primary NDs that emerged in our study were related to principal dilemmas concerning surgical patients, such as infections, skin integrity, excessive weight, constipation, mobility, and pain. These problems are well-described and emphasized in the literature due to their HF during the perioperative period (Celik et al., 2015; Chen et al., 2021; Galdeano et al., 2003; Grindel & Grindel, 2006; Havey et al., 2013; Subramanian et al., 2016). The ND anxiety was also identified in this study as an HF-ND, and this has been confirmed by several studies in the literature that have identified that surgical patients are commonly and strongly affected by this condition (Assis et al., 2014; D'Agostino et al., 2017; Hintistan et al., 2016; Monteiro et al., 2019). Anxiety is a response to a particular situation or circumstance, often anesthesia and surgery itself (Eberhart et al., 2020; Ruiz Hernandez et al., 2021), that could cause psychological distress and increase the risk of serious complications (Sanson et al., 2018).

In addition, our study provides a picture of nursing complexity across different MDCs. The prevalence of NDs was different in each MDC identified, and based on our results, a different patient complexity of care within each MDC can be assumed. However, our results do not show the same tendency as those of D'Agostino et al. (2017), who first studied this aspect. The high prevalence of hepatobiliary and pancreatic DDs in our study present a notable complexity of care compared to D'Agostino et al. (2017). Conversely, their finding of high respiratory DDs did not present important relevance in our study. The difference highlighted in terms of complexity could refer to and depend on the typology of the patients considered, that is, medical or surgical, and their clinical characteristics and comorbidities. Another feature that can lead to different results between studies is the data collection period. A study with a longer period may have significantly different results compared to a study with a shorter data collection period. This finding suggests the importance of understanding the factors involved in the definition of the complexity of care within each MDC given the limited literature on this topic.

Our study showed a strong association between the NDs identified on admission and some key outcomes. A greater number of NDs was related to a prolonged LOS (> 9 days) in a surgical setting, and this result is consistent with the results of other studies (Castellan et al., 2016; D'Agostino et al., 2017; Sanson et al., 2019). The analysis of the total number of NDs detected by nurses at hospital admission could provide useful information for nurses and health policymakers to determine in advance the nurse staffing and material resources needed to ensure the quality of care throughout the patient's hospitalization. However, our results must be interpreted with care, and the risk of postoperative complications must not be excluded *a priori* in patients who have a short LOS characterized by a small number of NDs identified on admission. Future studies could investigate the correlation between postoperative complications and the type and characteristics of NDs identified on hospital admission.

We also found that a higher number of NDs identified on admission was associated with a greater chance of the patient being transferred to other wards during hospitalization. Escobar et al. (2011) showed a similar dynamic attributable to medical diagnoses; when there was a greater number of pre-existing medical diagnoses over the 12-month period preceding hospitalization, the risk of being transferred was higher. It is well-known that IPTs have an intense impact on nursing workload, with worrying implications for patient safety and continuity of care, such as falls, increased LOS, medication errors, hospital-acquired infections, and mortality (Blay et al., 2017; Boncea et al., 2021; Park et al., 2016; VanFosson et al., 2017). Knowing this significant correlation in advance could be useful for nurses to plan care and timely implementation of activities, thus improving the quality of the organization and patient safety in surgical departments. Further studies are necessary to confirm this finding in larger samples and other clinical settings.

Finally, we also investigated the correlation between the number of NDs and transfers to ICUs after surgery. We found that patients transferred to an ICU tended to present with more NDs than those who were not transferred to an ICU, and this is the first time that a study has found this correlation. Knowing this relationship in advance could be a key aspect of care planning, improving patient health outcomes, preventing some known adverse effects of ICU hospitalization (e.g., pain, anxiety, agitation, and post-traumatic stress disorder-related syndromes) and anticipating interventions (Jeitziner et al., 2011; Khouli et al., 2011; Markwart et al., 2020; Williams & Leslie, 2008). Thus, a condition characterized by a greater number of NDs is attributable to clinical conditions characterized by a greater complexity of care. The higher the number of NDs, the higher the complexity of care, as established by international literature in the general hospital setting (D'Agostino et al., 2017; Halloran & Kiley, 1987). Patients with multiple NDs would thus be more at risk of clinical deterioration and its consequences (e.g., prolonged LOS), as happens in the ICU. Until now, only some medical indexes, such as the Modified Early Warning Score (Subbe et al., 2001) or the National Early Warning Score formulated by the Royal College of Physicians, has been used to measure clinical deterioration and therefore the risk of being admitted to the ICU. However, based on our findings, NDs could be used for the same purposes. The evidence produced by our findings could be explored in larger populations, among patients from different care settings (e.g., medical patients) or to analyze the role of NDs as predictors of ICU hospitalization.

Strengths and Limitations

Our research is the first to describe the NDs of multiple surgical specialty patients across an entire calendar year. The nurses who completed the initial assessment and produced the data used for this scientific work can be considered experienced users because at the time of data collection, they had already been using the PAI system for 6 years. The association of NDs with the total number of IPTs and patient transfers to ICUs had never been tested before, making these results a pioneer in this new research subject. However, our study had some limitations. We did not evaluate the diagnostic ability of the nurses before collecting the data. Poor diagnostic confidence among nurses could represent a bias. However, our results were achieved more easily thanks to the use of the PAI and its integrated and validated clinical decision algorithm (Zega et al., 2014), which guided nurses in the selection of NDs.

Implications for Practice

- NDs, which represent the clinical judgement of nurses, are key to understanding the contribution of nurses in the surgical setting.
- Using EHRs comprised of SNTs can improve the understanding of the complexity of care in the surgical setting.
- Nurses, nursing manager, and health policy makers should consider NDs, their trends, and their relationships with LOS and IPTs to ensure the organization's safety and quality of care.

Conclusion

EHRs and SNTs such as NDs are used to describe the complexity of surgical care. This research confirms that the number of NDs collected upon admission can represent a prognostic factor for the LOS and are related to the risk of IPTs or ICU transfer. This conclusion highlights the pivotal role of nurses in the preoperative assessment of surgical patients and in the timely identification of their care needs through NDs. Although NDs have proven to be a valuable clinical tool for measuring surgical patients' complexity of care, other variables should also be considered for the overall description of this aspect. This research effort could be conducted in new studies considering the non-standardized notes documented by nurses in EHRs. In particular, these data could be rich in standardizable information (Vanalli et al., 2022), which could be useful for completing the overall description of the patient undergoing surgery. The essential requirements for future research on this topic are the use of accurate nursing documentation, an expression of quality, safety, completeness, and reproducibility (Cocchieri et al., 2022). These strategies can be used to identify the overall impact of the patients' complexity of care.

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Availability of Data and Materials

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Contributions

MC, AC, FD, and MM made substantial contributions to conception and design as well as acquisition, analysis, and interpretation of the data. MC, AC, and FD were involved in drafting the manuscript. MZ and VZ were involved in revising it critically for important intellectual content and in obtaining final approval of the version to be published.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics Approval and Consent to Participate

The study was conducted according to the principles of good clinical practice and the Declaration of Helsinki and in compliance with current regulations. The research did not hinder the clinical practice. Before the study was conducted, a research protocol was made and submitted to the Catholic University of Sacred Heart Ethics Commitee, which approved the research project (Prot.2841/20). For research purposes, each potential participant was informed about the objectives, methods, sources of funding, any conflicts of interest, institutional affiliations of the researchers, the expected benefits and potential risks of the study, and the inconvenience that the study could have produced. All participants gave informed consent to participate in the study. Written informed consent was sought via a cover letter explaining the purpose of the study and the voluntary nature of participation in accordance with current legislation on the protection of privacy. All data were encoded and processed anonymously to protect the privacy of patients at all stages of the study. All methods were performed in accordance with the regulations of the Institutional Review Board of the University.

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