Received: 26 July 2022 | Revised: 12 February 2023 | Accepted: 1 March 2023

DOI: 10.1111/jnu.12894

JOURNAL OF NURSING SCHOLARSHIP

Impact of standardized nursing terminologies on patient and organizational outcomes: A systematic review and meta-analysis

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Funding information
NANDA Foundation, Grant/Award Number: 5.20 (2018-2020)

Abstract

Aims: To explore the impact of 12 American Nurses Association recognized standardized nursing terminologies (SNTs) on patient and organizational outcomes.

Background: Previous studies reported an effect of SNTs on outcomes, but no previous frameworks nor meta-analyses were found.

Design: Systematic review and meta-analyses.

Review Methods: PubMed, Scopus, CINAHL, and OpenGrey databases were last consulted in July 2021. All abstracts and full texts were screened independently by two researchers. The review included primary quantitative studies that reported an association between recognized SNTs and outcomes. Two reviewers independently assessed the risk of bias and certainty of evidence for each meta-analyzed outcome using the "Grading of Recommendations, Assessment, Development and Evaluation" (GRADE) approach.

Results: Fifty-three reports were included. NANDA-NIC-NOC and Omaha System were the most frequently reported SNTs used in the studies. Risk of bias in randomized controlled trials and not-randomized controlled trials ranged from high to unclear, this risk was low in cross-sectional studies. The number of nursing diagnoses NANDA-I moderately correlated with the intensive care unit length of stay ($r = 0.38$; 95% CI = 0.31–0.44). Using the Omaha System nurse-led transitional care program showed a large increase in both knowledge ($d = 1.21$; 95% CI = 0.97–1.44) and self-efficacy ($d = 1.23$; 95% CI = 0.97–1.48), while a reduction on the readmission rate (OR = 0.46; 95% CI = 0.09–0.83). Nursing diagnoses were found to be useful predictors for organizational (length of stay) and patients' outcomes (mortality, quality of life). The GRADE indicated that the certainty of evidence was rated from very low to low.

Conclusions: Studies using SNTs demonstrated significant improvement and prediction power in several patients' and organizational outcomes. Further high-quality research is required to increase the certainty of evidence of these relationships.

Clinical relevance: SNTs should be considered by healthcare policymakers to improve nursing care and as essential reporting data about patient's nursing complexity to guide reimbursement criteria.

KEYWORDS
meta-analysis, nurses, nursing diagnosis, nursing process, outcomes, standardized nursing terminology, systematic review

INTRODUCTION

The nursing process is a scientific problem-solving method used by nurses to guide the delivery of holistic and patient-focused care (American Nurses Association, 2021). This approach to decision-making and care delivery engages the nurse and patient in an iterative six-step process that includes patient/environment assessment, generation of a clinical judgment (i.e., nursing diagnosis), evidence-based outcomes, mutually designed identification planning, implementation, and evaluation of care (Craven et al., 2019). Standardized nursing terminologies SNTs help nursing's contribution to care become visible and define patient responses and experiences in health and illness (American Nurses Association, 2021). A nursing diagnosis is useful in describing human responses to a health and related problem identified through the nursing assessment. Through planning and implementation, evidence-driven nursing interventions can be implemented, care outcomes can be evaluated, and the impact of nursing made visible using SNTs to document improvement of patient outcomes (Nibbelink & Brewer, 2018). The development of SNTs provides nurses with an opportunity to clearly and accurately document data that can guide nursing practice and effectively communicate nursing's unique contributions to improving the health of patients, families, communities, and other stakeholders (Jones et al., 2010). SNTs incorporate a commonly understood set of concepts to describe nursing phenomena of concern (i.e., nursing diagnoses) as well as identify nursing interventions, and patient outcomes to describe the impact of patient care delivery to stakeholders (Rutherford, 2008). To facilitate the documentation of nursing care and interoperability of nursing data between multiple concepts and nomenclatures, the American Nurses Association recognized 12 SNTs, of which NANDA-I represents the most used worldwide (Tastan et al., 2014).

SNTs can enhance the visibility and measurement of nursing's impact on patient care. However, limited integration of SNTs in documentation platforms, may make it difficult to accurately describe and evaluate nursing's contributions on patient and organizational outcomes (Johnson et al., 2018). Recent literature reviews support the positive impact that nursing terminologies can have on describing patient outcomes. Using SNTs in clinical practice can improve communication and enhance the delivery of high quality of care (Fennelly et al., 2021). Other authors note that the use of nursing diagnoses can predict patient and organizational outcomes and that nursing care plan based on nursing diagnoses can improve some outcomes (Sanson et al., 2017). To date, available evidence depicts only a partial understanding about the impact SNTs can have when used in clinical practice. It is critical that nurses work to integrate available evidence gained through research to effectively articulate nursing's impact on both patient and organizational outcomes.

AIM

The objective of this extensive systematic literature review was to document the impact of nursing care based on SNTs on patient and organizational outcomes in those facilities in which these terminologies are daily used to documented care. The research question was "What is the impact of using SNTs on patient and organizational outcomes?"

METHODS

Design

A comprehensive systematic review and meta-analyses were performed according to the Cochrane Handbook for Systematic Reviews of Interventions and reported according to the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) checklist (Appendix S1) (Higgins et al., 2022).

Eligibility criteria

All titles and abstracts of retrieved studies to be considered eligible for inclusion in this review had to: (1) clearly refer at least one of the 12 American Nursing Association accepted SNTs used to describe patient or organizational outcomes; (2) be available in full text; (3) be published in Italian or English languages; (4) use experimental, quasi-experimental, or observational designs; (5) include adult or pediatric patients; and (6) report an analysis of association between American Nurses Association-recognized SNTs and patient or organizational outcomes.

Searching strategies

A pilot search was performed using the study inclusion criteria to identify the most relevant keywords for the electronic search. PubMed,

Scopus, CINAHL, and OpenGrey databases were last searched on July 2021. Reference lists and citation searching were performed through Scopus database. Full texts were retrieved through the University Library System. All retrieved references were collected and managed using EndNote X9.3.3 for Macintosh (Clarivate Analytics, Philadelphia). The full search strings are available in the Online Appendix (S2).

Study selection and data extraction

After the removal of duplicated records, two researchers independently screened titles and abstracts for eligibility; then, full texts were accessed and assessed for inclusion. Data extraction for each included study was independently conducted by two investigators. Data extracted included: first author, year of publication, country, study design, setting, sample, standardized nursing terminology, modality of processing, outcomes, instrument, and follow-up. Study designs were checked against the "List of study design features" (Higgins et al., 2022). Any disagreement between investigators was solved by discussion with a third researcher until 100% agreement was reached.

Appraisal of study quality and risk of bias of individual studies

The "revised tool for assessing risk of bias in randomized trials" (RoB-2), the "risk of bias in non-randomized studies of intervention" (ROBINS-I), and the "checklist for analytical cross sectional studies" of the Joanna Briggs Institute (JBI) were used to assess the risk of bias (Sterne et al., 2016; Sterne et al., 2019). Experimental and quasi-experimental studies were graded as: "low risk" when all domains presented a low risk of bias, "moderate risk" when at least one domain raised concerns, and "high risk" when the results were at least severe for an individual domain (Higgins et al., 2022). The overall judgment about the risk of bias in cross-sectional studies was reached according to the following cutoffs: "low" if the percentage of answers scoring "yes" was >70%, "moderate" if "yes" scores counted 50%–69%, and "high" if "yes" scores were <49%. Two researchers independently appraised the methodological quality of studies included in the study sample and any disagreement among the assessors was solved by discussion with a third author until 100% agreement was reached. A risk of bias table was completed with item level and overall assessments using ROBVIS® software.

Summary measures and synthesis of results

Data were synthesized in both narrative and tabular forms. When at least two studies were homogeneous, data were meta-analyzed according to the recommendations provided by Higgins et al. (2022). Forest plots were created using STATA version 17.0 (StataCorp). Those studies having a serious/very serious risk of bias were not considered eligible for meta-analysis. The random-effect model was used as a conservative approach to account for different sources of variation among studies. Cohen's *d* and Pearson coefficient (*r*) were utilized for continuous outcomes while odds ratio (OR) for dichotomous effect sizes. For each effect size, the corresponding 95% CI, weight, and statistical significance were calculated. To verify and quantify the heterogeneity among studies the *Q*-test and I^2 were, respectively, calculated. A significant *Q*-test ($p \leq 0.05$) indicated the presence of heterogeneity. If "substantial" heterogeneity was detected, subgroup and sensitivity analyses were performed. Publication bias was graphically represented with funnel plots and tested for their asymmetry (Egger's linear regression, Begg and Mazumdar's rank correlation). Details about the thresholds utilized for interpreting study results is reported in the online Appendix (S3).

Ratings of quality of evidence

The certainty of evidence was determined in five aspects of the GRADE approach (risk of bias, inconsistency, indirectness, imprecision, and publication bias), which classified the certainty of evidence in four grades (very low, low, moderate, and high) (Schünemann et al., 2008). Two reviewers independently assessed the certainty of evidence for each meta-analyzed outcome. The Grading of Recommendations Assessment, Development and Evaluation profiler Guideline Development Tool was utilized to produce the summarized findings (Higgins et al., 2022).

RESULTS

Results of the search

A total of 8276 records were retrieved through the four electronic databases and additional strategies. After duplicates removed, 5706 abstract was screened for eligibility. Two hundred and one full texts were assessed for inclusion. Finally, a total of 53 studies were included in the study sample and seven were meta-analyzed. The PRISMA flow diagram shows the literature searching process (Figure 1).

Characteristics of included studies

Details about the main characteristics of the included studies are reported in Table 1. Most of them were conducted in North America (33.96%), followed by Europe (26.42%), Asia (20.75%), South America (13.21%), and Turkey (5.66%). Most of the studies investigated adult participants (94.34%) through convenience (71.70%) or randomized sampling (28.30%). Over three quarters of studies (75.47%) were observational, while 22.64% were experimental or quasi-experimental (1.89%). The main investigated settings were hospitals (n = 30; 56.60%) and home care services (n = 13; 24.53%).

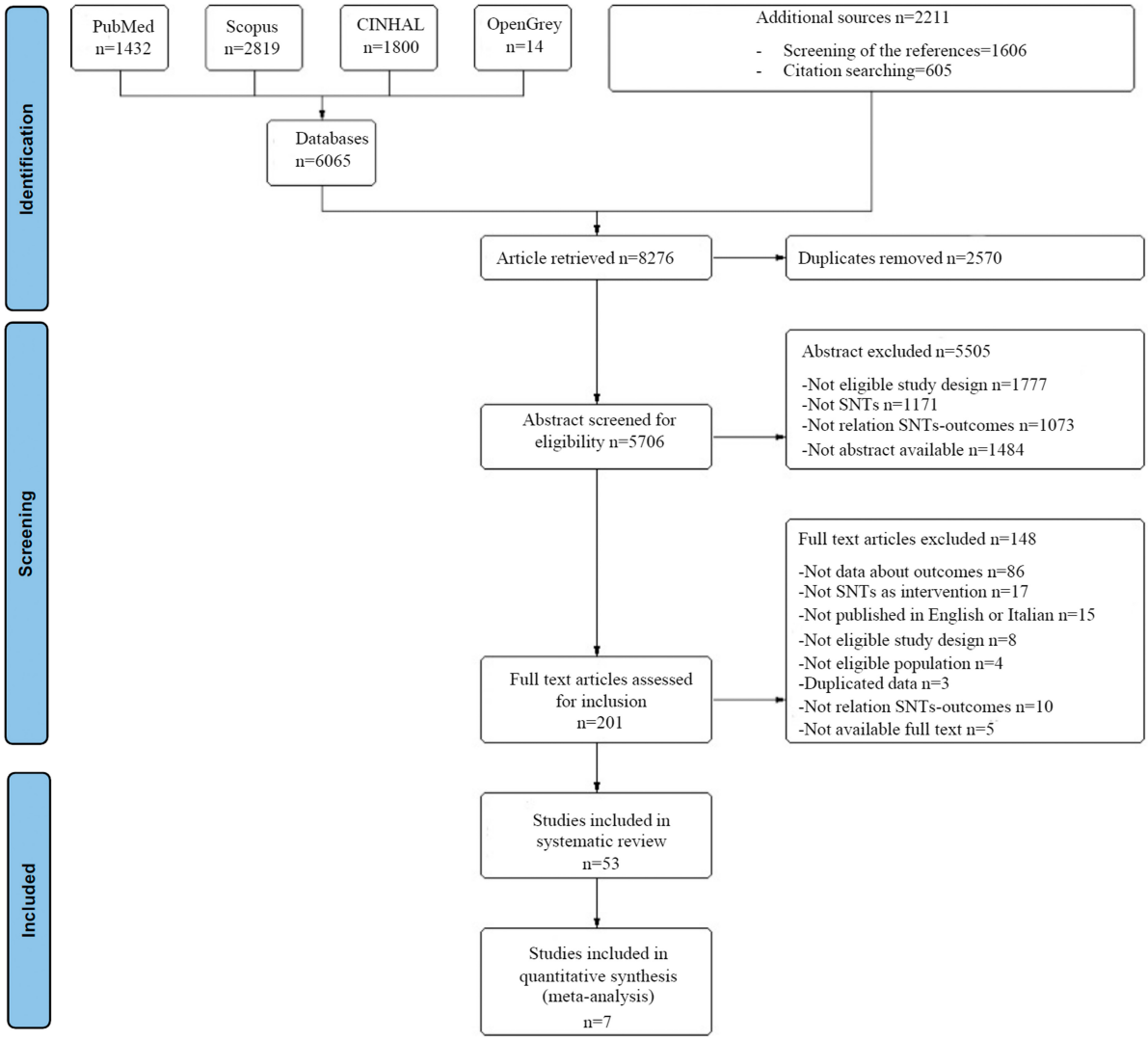

FIGURE 1 PRISMA flow diagram of included studies. SNTs: Standardized nursing terminologies.

Among the investigated terminologies (NANDA-I, NIC, NOC, Omaha System, ICNP, and NMDS) NANDA-I, NIC, NOC, and the Omaha System were the most investigated (66.04% and 32.08%, respectively). The most prevalent application modalities for SNTs were the "nursing care plans" based on SNTs (56.60%). These included "total number and types of nursing diagnoses" (30.19%), and "index or scores" (13.21%).

Risk of bias in included studies

Risk of bias in randomized and not-randomized controlled trials ranged mainly from high to unclear while that related to the cross-sectional studies was generally low. The most frequent concern related to the risk of bias in the randomized controlled studies was the "measurement of the outcomes." In nonrandomized studies, the "selection of the participants," "confounding," and "measurement of the outcome" emerged as the domains most frequently associated with possible risk of bias. Finally, the "exposure measured in a not valid and reliable way" was the domain mainly associated with the risk of bias in cross-sectional studies. Details about the risk of bias are reported in the Appendix S4a–c.

Outcomes and effectiveness of the SNTs

Data extracted from 53 articles were synthesized in narrative forms and tabular forms. Data about narrative results are summarized in Table 1, while a summary of organizational and patients' outcomes ordered by amount of evidence is available as Appendix S5.

Narrative results on organizational outcomes

SNTs and length of stay

The number of nursing diagnoses NANDA-I and Nursing Dependency Index (based on the total number of NANDA-I nursing diagnoses)

TABLE 1 Main characteristics of included studies.

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
Akkus & Akdemir (2012), Turkey, RCT	Home care. Randomized sample of 45 patients with multiple sclerosis (IG: 21 Nurse-based home visiting care vs. CG: 24 usual care)	Nursing care plan based on NDs (NANDA-I)	*Pat*: Quality of Life (Multiple Sclerosis QOL 54 Scale Physical and Mental health composite). *Time*: 4 months	*Pat*: In the IG (vs. CG) higher increase in *Multiple sclerosis QOL physical component* mean score ($p = 0.02$). Significant change in the Multiple Sclerosis QOL *Role limitation because of emotional problems* ($p = 0.04$); insignificant difference for the *Multiple Sclerosis QOL mental component* ($p = 0.06$)
Gencbas et al. (2018), Turkey, RCT	Long-term care Nursing homes (n = 5). Randomized sample of 62 elderly women with incontinence (IG: 32 Nursing care plans using NNN linkages for 12 weeks vs. CG: 30 usual care)	Nursing care plans based on NDs, nursing interventions, and nursing outcomes (NNN linkage)	*Pat*: Incontinence QOL (I-QOL scale), incontinence severity (Incontinence Severity Index), incontinence symptom (Urinary Distress Inventory-6), and NOC incontinence scores. *Time*: 3 months	*Pat*: In the IG between before and after intervention, significant improvement of incontinence-QOL ($Z = 4.732$; $p < 0.001$), incontinence severity ($t = 6.745$; $p < 0.001$), and incontinence symptoms ($t = 9.002$; $p < 0.001$). Expected change greater than 0.5 points and significant ($p < 0.05$) in all the incontinence-related NOCs between pretest–posttest scores. No statistically significant difference between IG and CG in terms of incontinence severity, incontinence symptoms, and incontinence-QOL
Liu et al. (2020), China, RCT	Home care. Randomized sample of 88 adult patients with rheumatoid arthritis (IG: 44 Nurse-led OS Transitional Care Program for 4 weeks vs. CG: 44 routine care)	Nursing care plans based on NDs, and nursing interventions (OS)	*Pat*: Self-efficacy (ASES-8), Health status and physical function (Health Assessment Questionnaire-Disability Index). *Org*: Readmission. *Time*: T1: baseline; T2: 4 weeks, end of intervention; and T3: 8 weeks after discharge	*Pat*: Significantly higher self-efficacy in IG at T2 and T3 ($F = 1970.077$; $p < 0.001$). The functional disability scores of the IG and CG had significant between group differences of the eight dimensions and the total score ($p < 0.001$). *Org*: The readmission rates were not statistically significant in the two groups after 2 months ($p = 0.237$), but the rates in the IG were lower (IG: 8.0% vs. CG: 11.4%)
Liu et al. (2021), China, RCT	Hospital. Randomized sample of 124 adult patients hospitalized with retained double J ureteral stent after urinary calculus surgery (IG: 62 OS-based continuing care vs. CG: 62 Regular continuing care)	Nursing care plans based on NDs, and nursing interventions (OS)	*Pat*: Knowledge (awareness of knowledge regarding retained double J tube), Anxiety (SAS), Depression (SDS), Sleep quality (Pittsburgh Sleep Quality), QOL (SF-36), Postoperative complications, satisfaction (satisfaction survey scale). *Time*: 3 months after discharge (16 months)	*Pat*: In IG (vs. CG) improvements with significant: (a) higher knowledge awareness rate of retained double J ureteral stent (purpose, daily water consumption, exercise, urination, and extubation time) (all $p < 0.01$), (b) lower anxiety ($t = 5.146$, $p < 0.01$) and depression scores ($t = 5.718$, $p < 0.001$), (c) beneficial lower quality of sleep scores ($t = 6.098$, $p < 0.001$), (d) lower complication rate ($p < 0.05$), (f) higher scores in all aspects of QOL (all $p < 0.000$), and (e) higher satisfaction rate (all $p < 0.05$)

TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
Ning et al. (2021), China, RCT	Hospital. Randomized sample of 95 adult inpatients with lung cancer selected for chemotherapy (IG: 46 OS-based continuous nursing care vs. CG: 49 routine continuous nursing care after discharge)	Nursing care plans based on NDs, nursing interventions (OS)	*Pat*: Cancer-related fatigue (Cancer Fatigue Scale). *Time*: Four cycles of chemotherapy (13 months)	*Pat*: In the IG (vs. CG) after four cycles of chemotherapy, scores for total, physical, cognitive, and emotional fatigue were significantly lower ($p < 0.05$). Repeated "analysis of variance" showed significant differences in the time-dependent ($p < 0.001$) and intervention-dependent ($p < 0.001$) effects on fatigue score, as well as a significant interaction between time and intervention ($p < 0.001$)
Sampaio et al. (2018), Portugal, RCT	Hospital (psychiatry outpatient ward). Randomized sample of 60 adult psychiatric outpatients with ND *Anxiety* (IG: Nursing psychotherapeutic interventions vs. CG: usual care)	Nursing care plans based on NDs, nursing interventions, and nursing outcomes (NNN/ICNP)	*Pat*: NOC scores: Anxiety level, anxiety self-control. *Time*: 6 weeks	*Pat*: In the IG (vs. CG) higher improvement in the *Anxiety level* mean score ($p = 0.001$). *Anxiety self-control* improved significantly only on patients in the IG ($p = 0.001$). Considering each dimension of *Anxiety level* and *Anxiety self-control*, IG (vs. CG) had a significant gain in all of them ($p = 0.001$) except for the *Somatic anxiety* ($p = 0.053$). The effect size was very large (d = 1.11) for the *Anxiety level* and huge (d = 1.65) for the *Anxiety self-control*. In the multiple linear regression, being part of the IG predicted 22.8% of the posttest *Anxiety level* and the 40% of the posttest *Anxiety self-control*
Wong & Yeung (2015), China, RCT	Hospitals (n = 3). Randomized sample of 108 adult patients with stroke (IG: 54 Nurse-led OS transitional care program for 4 weeks vs. CG: 54 routine care; both groups: hospital-based physical training program)	Nursing care plans based on NDs, and nursing interventions (OS)	*Pat*: QOL (SF-36 PCS/MCS; World Health Organization QOL Spirituality, Religion and Personal Beliefs), patient satisfaction (Patient Satisfaction Questionnaire), functional performance (Modified Barthel Index), and depressive symptoms (CES-D). *Org*: Readmission, Emergency room visit. *Time*: T1: 4 weeks; T2: 8 weeks after discharge	*Pat*: The IG (vs. CG) had: (a) significant better between-group differences in health physical component summary ($F = 10.15$; $p = 0.002$) and mental component summary ($F = 8.41$, $p = 0.005$) domains, but only the "physical component summary" achieved a significant time × intervention interaction effect ($F = 7.73$, $p = 0.006$); (b) better measures of QOL ($F = 10.97$, $p < 0.001$), (c) higher satisfaction (T1: $Z = -8.01$; $p < 0.001$; T2: $Z = -8.38$, $p < 0.001$), (d) higher functional performance ($F = 5.32$; $p = 0.023$), and (e) lower depression scores (T1: $Z = -4.89$, $p < 0.001$; T2: $Z = -4.82$, $p < 0.001$). *Org*: At T2, the IG had: (a) lower hospital readmission rates (7.4% vs. 14.8%; $p = 0.358$, appreciable but no significant), (b) lower emergency room rates (1.9% vs. 13%; $p = 0.027$)

TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
Xiao et al. (2019), China, RCT	Hospital. Randomized sample of 141 adult patients with angina without interventional treatment (IG: 70 OS-based discharge guidance [transitional] + usual care vs. 71 CG: Usual care)	Nursing care plans based on NDs, nursing interventions, and nursing outcomes (OS)	*Pat*: Omaha KBS. *Time*: T1: admission; T2: 3 days before discharge; and T3: discharge (10 months)	*Pat*: The scores of the outcome measures differed significantly between IG and CG at all three time points and increased gradually. In the IG (vs. CG) from T2 to T3 significantly higher scores in knowledge ($t = 10.720$; $p < 0.001$), behavior ($t = 12.360$; $p < 0.001$), and the total score ($t = 11.700$; $p < 0.001$); while the improvement in status did not differ significantly ($t = 1.550$; $p = 0.123$)
Zhang et al. (2017), China, RCT	Home care. Randomized sample of 199 adult patients with coronary artery disease (IG: 100 Nurse-led Transitional Care Program using OS and Pender's model 1 week predischarge and 7 months post discharge + routine care vs. CG: 99 Nurse-led routine care)	Nursing care plans based on NDs, and nursing interventions (OS)	*Pat*: Blood pressure (DBP and SBP), glycemic (Fasting blood glucose), lipid (Total-cholesterol, HDL, LDL, and triglycerides), Weight (BMI) control; Knowledge scores for coronary artery disease, QOL (SF-36 PCS/MCS). *Time*: 7 months	*Pat*: The IG (vs. CG) had: (a) significant better clinical outcomes (SBP, $t = 5.762$, $p = 0.000$; DBP, $t = 4.250$, $p = 0.000$; fasting blood glucose, $t = 2.249$, $p = 0.027$; total cholesterol, $t = 4.362$, $p = 0.000$; triglycerides $t = 3.147$, $p = 0.002$; low density lipoprotein cholesterol, $t = 2.399$, $p = 0.018$; and BMI, $t = 3.166$, $p = 0.002$); (b) higher knowledge scores for coronary artery disease (total knowledge score, $t = -7.099$, $p = 0.000$), better physical health status ($t = -2.503$, $p = 0.014$), and mental health status ($t = -2.950$, $p = 0.004$)
Zhang et al. (2018), China, RCT	Home care. Randomized sample of 199 adult patients with coronary artery disease (IG: 100 Nurse-led Transitional Care Program using OS and Pender's model 1 week predischarge and 7 months post discharge + routine care vs. CG: 99 nurse-led routine care)	Nursing care plans based on NDs, and nursing interventions (OS)	*Pat*: Self-efficacy to implement health-promoting behaviors (Self Rated Abilities for Health Practices scale), Functional status and Quality of Life for angina (Seattle Angina Questionnaire) *Org*: Readmission. *Time*: 7 months	*Pat*: The IG (vs. CG) had greater self-efficacy to implement health-promoting behaviors ($t = -6.651$; $p = 0.000$), more angina stability ($t = -4.002$; $p = 0.000$), less angina frequency ($t = -2.913$; $p = 0.004$), more satisfaction with treatment ($t = -3.701$; $p = 0.000$), and better QOL ($t = -3.825$; $p = 0.000$). The difference in physical limitations was not significant between the two groups. *Org*: After 7 months, the IG showed a lower readmission rate, but this difference was not significant between the two groups (IG: 9% vs. CG: 17.2%; $p = 0.087$)

(Continues)

TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
Zhao et al. (2020), China, RCT	Hospital. Randomized sample of 194 adult patients with chronic kidney disease undergoing peritoneal dialysis (IG: 97 OS-based continuing nursing program vs. CG: 97 routine care)	Nursing care plans based on NDs, and nursing interventions (OS)	*Pat*: Nutritional score (Subjective Global Assessment scores), Anthropometric parameters (BMI, triceps skin-fold thickness, mid-arm muscle circumference, and handgrip strength), biochemical parameters (Hemoglobin, albumin, pre-albumin, and total cholesterol) *Time*: 6 months	*Pat*: In the pre-dialytic patients, after the IG significant improvements in their nutritional status with a higher proportion of well-nourished patients (Subjective Global Assessment scores improved from 6.19% to 29.90%, $\chi^2 = 18.441$, $p < 0.001$) also when compared after 6-month with the CG (29.90% vs. 9.28%, $\chi^2 = 13.090$, $p < 0.001$). Other nutritional indicators (mean BMI, triceps skin-fold thickness, mid-arm muscle circumference, handgrip strength, hemoglobin, albumin, and pre-albumin) increased in the IG and after 6 months were higher than those in the CG ($p < 0.05$). No significant changes for total cholesterol between the two groups ($p > 0.05$)
Zhuang et al. (2021), China, RCT	Hospital. Randomized sample of 127 children with epilepsy (IG: 65 OS-based continual nursing care + regular out-of-hospital guidance after discharge vs. CG: 62 regular out-of-hospital guidance after discharge)	Nursing care plans based on NDs, and nursing interventions (OS)	*Pat*: Psychological status (Anxiety [SAS], Depression [SDS]), self-esteem, feeling of inadequacy, QOL (QOL Scale for Children with Epilepsy) *Time*: T1 (pre): discharge; T2 (post): 3 months post discharge	*Pat*: Children with epilepsy in the post-intervention of the "*OS-based continual nursing care*" (in comparison to the post-intervention of the CG) showed significant improvements with: (a) lower anxiety ($p < 0.05$) and depression scores ($p < 0.05$) (b) higher scores of self-esteem ($t = 4.201$; $p < 0.000$), (c) lower self-deficiency ($t = 3.538$; $p < 0.001$), and (d) higher scores in all five QOL dimensions ($p < 0.000$)
Wei et al. (2019), China, NRCT	Hospitals (n = 3). Convenience sample of 358 adult outpatients with newly diagnosed type 2 diabetes mellitus (IG: 179 OS-based integrated nursing management model + routine care vs. CG: 179 routine care)	Nursing care plans based on NDs (OS)	*Pat*: Glycemic control (2 h postprandial blood glucose levels; fasting blood glucose), QOL for diabetes, and knowledge for diabetes *Time*: 6 months	*Pat*: In the IG (vs. CG) at 6 months significantly superior (all $p < 0.01$) values in blood glucose levels (Fasting blood glucose: $t = -9.218$; $p = 0.000$; 2 h postprandial blood glucose levels: $t = -11.972$; $p = 0.000$), QOL for diabetes ($t = 16.243$; 0.000), and diabetes knowledge ($t = -15.094$; $p = 0.000$)
Lunney et al. (2004), USA, CBA	Schools (n = 4). Randomized sample of 220 schoolchildren (IG: 103 using NNN vs. CG: 117 no NNN)	Nursing care plans based on NDs, nursing interventions, and nursing outcomes (NNN)	*Pat*: Health self-concept (Child Health Self Concept scale), coping (Schoolagers Coping Strategies Inventory), effectiveness, and health behaviors (HODY) *Time*: 9 months	*Pat*: For all 220 children (using or not NNN), the number of coping strategies significantly increased (md = 0.98 ± 3.7, $p = 0.0003$), but there were no significant changes in health self-concept, coping frequency and effectiveness, or health behaviors

TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
Cardenas-Valladolid et al. (2012), Spain, PCS	Primary health-care centers (n = 31). Convenience sample of 23,488 patients over 30 years of age with type 2 diabetes mellitus (two groups: Standardized nursing care plans [SNCP]: 5168; Usual nursing care (UNC): 18,320)	Nursing care plans based on NDs, and nursing Interventions (NANDA-I, NIC)	*Pat*: Glycemic (HbA1c), blood pressure (DBP), lipid (LDL-cholesterol), and weight (BMI) control *Time*: T1: baseline; T2: 12 months; T3: 18 months; and T4: 24 months (2 years)	*Pat*: After adjusting for baseline parameter values, age, sex, type of treatment, and physical inactivity, all parameters (except HbA1c) were lower, but a significant reduction was only observed with DBP results (but adjusted reduction of DBP of little clinical relevance). At T4, after adjusting for baseline parameters, the SNCP showed greater differences for control value of DBP, HbA1c, LDL-cholesterol, and BMI but only reached statistical significance for HbA1c ($p = 0.01$). In the SNCP (vs. UNC), a greater proportion of patients with baseline HbA1c ≥ 7 decreased this value below 7% (16.9% vs. 15%; $p < 0.01$). The logistic regression model was adjusted (by type of treatment, age, and gender) and the SNCP demonstrated a favorable trend toward target control (OR = 1.11; 95%CI = 0.99–1.24; $p = 0.06$)
Castellan et al. (2016), Italy, PCS	Hospital. Convenience sample of 100 adult patients in ICU	Total number and types of NDs (NANDA-I)	*Pat*: Intensive care unit mortality *Org*: Intensive care unit LOS *Time*: 4 months	*Pat and Org*: Nineteen NDs were significantly related with mortality or LOS in bivariate analyses. *Pat*: The number of such NDs was a significant independent predictor of ICU mortality ($\beta = 1.049$; OR = 2.855; 95%CI = 1.536–5.306; $p = 0.001$). The logistic regression model explained 66.1% ($\chi^2 = 35.268$; $R^2 = 0.661$; $p < 0.001$) of the variance in ICU mortality. *Org*: In the multiple linear regression model ($R^2 = 0.254$; $p < 0.001$), the number of such NDs explained 29.7% of the variance in LOS ($\beta = 0.297$; 95%CI = 0.028–0.136; $p = 0.003$)
D'Agostino et al. (2017), Italy, PCS	Hospital. Convenience sample of 2283 medical and surgical adult patients	Total number of NDs and types of NDs (NANDA-I)	*Pat*: Hospital mortality *Org*: Hospital LOS *Time*: 6 months	*Pat*: The number of NDs was significantly higher in patients who died compared with those who survived to hospital discharge (survived: 4.3 ± 4.2; died: 8.5 ± 7.4; $t = -5.413$; $p < 0.001$). Considering six categories of patients, a higher number of NDs on admission was strongly and linearly related to higher mortality (ρ=1.00; $p < 0.001$). Thirty NDs (68.2%) were significantly related with higher mortality. *Org*: Strong direct relationship between the number of NDs on admission and hospital LOS (ρ=1.00; $p < 0.001$). Twenty-five NDs (56.8%) were significantly related with longer hospital LOS. *Pat and Org*: Twenty-three NDs (52.3%) were significantly related to both LOS and mortality

(Continues)

TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
D'Agostino et al. (2019), Italy, PCS	Hospital. Convenience sample of 2190 medical and surgical adult patients	Total number of NDs (NANDA-I)	*Org*: Hospital LOS, Hospital LOS deviation *Time*: 6 months	*Org*: After controlling for sociodemographic, clinical, and hospital organizational variables, the first multiple regression model explained the 33% of the variance in LOS (number of NDs: $\beta = 0.15$; $p < 0.001$); the second model explained 10% of variance the LOS deviation (number of NDs: $\beta = 0.19$; $p < 0.001$). Number of NDs on admission: strong independent predictor of LOS and LOS deviation
Halloran & Kiley (1987), USA, PCS	Hospital. Convenience sample of 1288 adult medical (n = 641) and surgical (n = 599) patients	NDI based on total number of 127 equally weighted NDs (NANDA-I)	*Org*: Hospital LOS *Time*: (5 months)	Org: The correlations (*r*) of the NDI with LOS in medical and surgical cases were 0.688 and 0.668, respectively. The regression model explained 50.8% of the variation in LOS ($F = 664.94$; $p < 0.001$). The NDI explained the 45% of the variation, while the DRG weight the 5.8%
Helberg (1994), USA, PCS	Home care. Convenience sample of 236 elderly patients	Total number of NDs (OS)	*Org*: Number and length (days) of nursing visits *Time*: from 3 days to 3 weeks	*Org*: Significant correlations (all $p < 0.001$) between number of NDs and both nursing visits ($r = 0.24$) and length of nursing stay ($r = 0.21$). The two hierarchical regression models (predictors: sociodemographic variables, medical conditions, and nursing dependency) explained 20% of variance of number of visits and 20% of variance of number of days of home care nursing service. In these models, nursing dependency (containing nursing problems, nursing care requirements, physical, ADL, Instrumental ADL, and coping ability) accounted for an additional 7% of variance ($p = 0.003$) of number of visits, while for an additional 5% of variance ($p = 0.02$) on the number of days of home care nursing service
Lemos et al. (2020), Brazil PCS	Hospital. Convenience sample of 28 adult patients with heart failure or diabetes mellitus with ND of *Ineffective Health Management*	Nursing care plans based on NDs, nursing interventions, and nursing outcomes (NNN)	*Pat*: Knowledge (NOC knowledge Scores) *Time*: 4 days (21 months)	*Pat*: Patients showed an improvement of the score of the nursing outcome *Knowledge*: *Heart Failure Management* (pre: 2.05 ± 0.28 vs. post: 2.54 ± 0.30; $p = 0.002$) and *Knowledge*: *Diabetes Management* (pre: 2.61 ± 0.55 vs. post: 3.21 ± 0.57; $p = 0.000$)
Mello et al. (2016), Brazil, PCS	Hospital (palliative care unit). Convenience sample of 13 adult palliative cancer patients with ND of *Acute pain* or *Chronic pain*	Nursing care plans based on NDs, nursing interventions, and nursing outcomes (NNN)	*Pat*: NOC scores: Pain level, comfort status, personal well-being, client satisfaction, sleep, vital signs, will to live, and pain control. *Time*: 5 days	*Pat*: Statistical differences were observed between the first and last assessment in the following indicators and outcomes: *Reported pain* and *Length of pain episodes* in the *Pain level* outcome; *Social relationships* in the *Personal well-being* outcome; *Respiratory rate* in the *Vital signs* outcome; and describes causal factors in the *Pain control* outcome.

TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
Morales-Asencio et al. (2009), Spain, PCS	Home care sites (n = 4). Convenience sample of 247 participants (129 patients, 118 caregivers)	Nursing care plans based on NDs, and nursing outcomes (NANDA-I, NOC)	*Pat*: Patient mortality, patient satisfaction (Satisfad©) *Org*: Number of nursing visits, institutionalization *Time*: 34 months	*Pat*: Significant association between patient mortality and ND *Anxiety* in caregivers (RR: 2.08; 95%CI: 1.26–3.42; $p = 0.012$). No relation was observed for patient satisfaction. *Org*: A regression model (predictors: NDs NANDA-I and nursing outcomes NOC of patients and caregivers, age, sex, functionality, and cognitive status) explained 40.4% of the variance in the number of nursing visits ($p = 0.033$); only one ND, *Risk for caregiver role strain*, contributed significantly ($\beta = 0.548$, $p = 0.005$). No relation was observed between the presence of NDs (such as *Impaired mobility*, *Deterioration in skin integrity*, *Risk of falls*, *Caregiver anxiety*, *or Strain in the caregiver role*) and institutionalization
O'Brien-Pallas et al. (2001), Canada, PCS	Home care. Convenience sample of 751 adult patients	Total number of NDs and types of NDs (OS)	*Org*: Number and length (average visit time) of nursing visits *Time*: 9 months	*Org*: A first hierarchical regression model: explained 47% ($F = 28.94$; $p < 0.001$) of the variance in the average visit time; this variance was explained by client demographic characteristics (6%), agency characteristics (6.4%), agency behavior (3.6%), environmental complexity factors (20.5%), adequacy of treatment time (1.3%), and medical and NDs (14.7%; $p < 0.001$). Significantly longer visits for patients with one or more NDs, while shorter ones for those with NDs in the *Nutritional-metabolic* Functional health patterns. A second regression model (with the same predictors) explained 35.6% ($F = 15.76$; $p < 0.001$) of the variance in the number of nursing visits; NDs explained 1.4% ($p < 0.05$) in this model
O'Brien-Pallas et al. (2002), Canada, PCS	Home care. Convenience sample of 751 adult patients	Total number of NDs, and types of NDs (OS)	*Pat*: QOL (SF-36 Health Status), Omaha KBS *Time*: admission–discharge	*Pat*: Significantly different scores ($p < 0.05$) were observed between home admission and discharge for Omaha rating scales (Knowledge–Behavior, Status) and for six on the eight SF-36 subscales. A regression model explained 40.9% ($F = 4.85$; $p < 0.01$) of the variance in *SF-36 social functioning* QOL; the number of NDs accounted for 17% ($p < 0.01$) of the variation
Luz Rodríguez Acelas et al. (2020), Brazil, PCS	Hospital. Convenience sample of 24 postoperative surgical adult patients with ND of *Acute pain*	Nursing care plans based on NDs, and nursing outcomes (NANDA-I, NOC)	*Pat*: NOC scores: Pain level *Time*: 4 days	*Pat*: A significant difference was found between the first and last evaluations for the outcome *Pain level* (day 1: 4.61 ± 0.26 vs. day 4: 4.76 ± 0.16; $p = 0.03$)

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TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
Sanson et al. (2019), Italy, PCS	Hospital. Convenience sample of 2301 medical and surgical adult patients	NDI based on total number of NDs (NANDA-I)	*Pat*: Hospital mortality *Time*: 6 months	*Pat*: Compared to the first logistic regression model (adjusted for patient's age, sex, and modality of hospital admission), the addition of the NDI increased the explained variance in mortality by 19.9%, whereas the explained variance increased by 56.2% when level of comorbidity (Charlson Comorbidity Index), and nursing (NDI) and medical condition (APR-DRG weight) were included. This last model was nearly highly accurate (c = 0.89, 95%CI: 0.87–0.92)
Schein et al. (2005), Canada, PCS	Hospital (n = 1) + community health centers (n = 2). Convenience sample of 175 community dwelling frail older adult patients (Intervention: Home call and home visit every 6 weeks)	Nursing care plans based on nursing problem and nursing interventions (NIC)	*Pat*: QOL (SF-36), ADL, Instrumental ADL *Org*: Hospital admission, emergency department admission *Time*: 10 months	Adjusted association (controlled for sex, age, self-reported health, and nurse care manager) was used. *Pat*: Older frail people who received NIC *Coping assistance* had a small beneficial but not clinically important increase (0.85 point difference) in Instrumental ADL, while no association with ADL. Regarding to the SF-36 scales, a contradictory negative association was found between *Coping assistance* and *General health*, *Role-emotional*, and *Mental health score*. No significant associations with the other SF-36 concepts. *Org*: No association in hospitalization and emergency department admissions
Amad Pastor et al. (2017), Spain, BA	Community mental health. Convenience sample of 12 adult women with ND of *Anxiety* (5 NIC)	Nursing care plans based on NDs, nursing interventions, and nursing outcome (NNN)	*Pat*: NOC Anxiety self-control *Time*: 6 months	*Pat*: The intervention showed a significant increase in the score of the NOC result *Anxiety self-control* between before the after the intervention both in mean (22.5 ± 3.22 vs. 37.8 ± 7.119) and in median values (21 vs. 37.5; $Z = -2.98$; $p = 0.003$)
Azzolin et al. (2013), Brazil, BA	Home care sites (n = 2). Convenience sample of 23 adult patients with decompensated heart failure (First home visit: 23; fourth home visit: 20)	Nursing care plans based on NDs, nursing interventions, and nursing outcomes (NNN linkage)	*Pat*: NOC: Compliance behavior, symptom control, activity tolerance, energy conservation, family participation in professional care, and fluid balance. *Time*: 6 months	*Pat*: Of the NOC selected, all showed a significant increase ($p < 0.001$) between the first and the fourth home visit, except for *Fluid balance* and *Family participation in professional care* where a no significant increase was observed

TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
Azzolin et al. (2015), Brazil, BA	Home care sites (n = 2). Convenience sample of 23 adult patients with decompensated Hearth Failure (First: home visit 23; fourth home visit: 20)	Nursing care plans based on NDs, nursing interventions, and nursing outcomes (NNN)	*Pat*: Knowledge (Knowledge Questionnaire, and NOC knowledge Scores) *Time*: 6 months	*Pat*: Patients showed an improvement between first and fourth home visit in the *Knowledge of heart failure* (69.1 ± 19.1 vs. 87.4 ± 8.70; $p < 0.001$), NOC *Knowledge*: *Medication* (2.27 ± 0.14 vs. 3.55 ± 0.16; $p < 0.001$), and NOC *Knowledge*: *Treatment Regimen* (2.33 ± 0.13 vs. 3.59 ± 0.14; $p < 0.001$). The correlation between the Knowledge Questionnaire and the NOC scores was strong at the first home visit ($r = 0.7$; $p < 0.01$), but weak and not significant at the fourth home visit
da Silva et al. (2015), Brazil, BA	Hospital. Convenience sample of 21 orthopedic patients underwent Total Hip Arthroplasty with ND *Impaired physical mobility* (pre: 21; post: 15)	Nursing care plans based on NDs and nursing outcomes (NANDA-I, NOC)	*Pat*: NOC scores: Body positioning: self-initiated, mobility, Knowledge: prescribed activity, fall prevention behavior, Pain level. *Time*: 4 days	*Pat*: Significant improvements of NOC *Body Positioning*: *self-initiated* ($p < 0.001$), *Mobility* ($p < 0.001$), *Knowledge*: *prescribed activity* ($p < 0.035$), and *Fall Prevention Behavior* ($p < 0.001$) scores between first and final evaluations ($p < 0.001$), while not significant improvement for *Pain level* ($p = 0.265$)
da Silva et al. (2019), Brazil, BA	Hospital. Convenience sample of 101 postoperative surgical adult patients with ND of *Ineffective airway clearance* (3 NIC: *Cough enhancement*; *Ventilation assistance*; and *Airway management*)	Nursing care plans based on NDs, nursing interventions, and nursing outcomes (NNN)	*Pat*: NOC indicators of airway patency (respiratory status): Dyspnea with mild exertion, dyspnea at rest, respiratory rate, depth of inspiration, accessory muscle use, accumulation of sputum *Time*: 4 days	*Pat*: NIC interventions contributed significantly to airway patency of patients: (a) NIC *Cough enhancement*: 61% less compromised *Respiratory rate* (PR = 0.390; $p = 0.005$) and twice more compromised *Adventitious breath sounds* (PR = 2.209; $p = 0.021$); (b) NIC *Ventilation assistance*: less compromised *Ability to clear secretions* ($p = 0.009$; PR = 0.143), *Respiratory rate* (PR = 0.435; $p = 0.034$), and *Depth of inspiration* (PR = 0.445; $p = 0.040$); (c) NIC *Airway management*: about 85% less chances of *Accumulation of sputum* (PR = 0.151; $p = 0.036$) and about 86% less chances of *Adventitious breath sounds* (PR = 0.148; $p = 0.047$). Indicators that improved significantly: *Dyspnea with mild exertion* ($p = 0.029$), *Dyspnea at rest* ($p < 0.001$), *Respiratory rate* ($p = 0.042$), *Depth of inspiration* ($p = 0.039$), and *Accessory muscle use* ($p = 0.003$)
Erci (2012), Turkey, BA	Home care. Convenience sample of 76 adult women from an urban primary health-care center	Nursing care plans based on NDs and nursing interventions (OS)	*Pat*: QOL (Burckhardt et al., 1989), health promotion lifestyle profile (Walker et al., 1987). *Time*: 4 months	*Pat*: Using OS intervention on the women lead between pretest and posttest to a significant improvement of the health promotion lifestyle profile (112.6 ± 18.2 vs. 125.8 ± 19.4; $p < 0.001$), while a no statistical improvement in QOL (80.3 ± 15.9 vs. 86.2 ± 9.6; $p > 0.05$)

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TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
Laguna-Parras et al. (2013), Spain, BA	Hospital. Convenience sample of 291 hospitalized mental health patients with ND of *Disturbed sleep pattern* (NIC *Sleep enhancement*)	Nursing care plans based on NDs, nursing interventions and nursing outcomes (NNN)	*Pat*: Sleep quality (Oviedo Sleep Questionnaire; NOC sleep scores) *Time*: admission–discharge	*Pat*: Using NIC *Sleep enhancement*, significant improvement in sleep satisfaction (md = 1.921 ± 1.781; $p < 0.001$), insomnia (md = −7.590 ± 10.995; $p < 0.001$, hypersomnia (md = −1.479 ± 3.829; $p < 0.001$), and NOC sleep scores (md = 2.483 ± 0.841; $p < 0.001$) between admission and discharge. Results attributable to the NIC *Sleep enhancement* were not influenced by the consumption of psychoactive medication at admission and/or discharge
Company-Sancho et al. (2017), Spain, XS	Primary health care. Convenience sample of 582,171 adults from general population aged over 50 years	Total number of NDs (NANDA-I)	*Org*: Costs *Time*: (12 months)	*Org*: *Multivariate analysis*: A first linear regression model (predictors: sociodemographic variables) explained 13.7% variability of the logarithm of the full costs. If the presence and number of NDs were added to this model, the explanatory capacity reached was 19.77% ($R^2 = 0.1977$; $p < 0.0001$). *Bivariate analysis*: Significant association ($p < 0.001$) between the mean expenditure and presence (2365.49 €) or otherwise (1299.29 €) of a ND. The expenses increased when a ND was made (ρ=0.37; $p < 0.001$), this relationship was not linear with a more rapid growth initially (1 ND = 2.22 vs. 10 NDs = 6.52 times higher patient's cost)
Halloran (1985), USA, XS	Hospital. Convenience sample of 1167 medical and surgical adult patients	Total number and type of 37 NDs (NANDA-I)	*Org*: Nursing workload (Rush-Medicus classification checklist). *Time*: (4 months)	*Org*: A regression model considering both DRG and the 37 NDs as independent variables explained 60.3% ($p < 0.0001$) of the variance in the nursing workload; of this variance, NDs explained 45%, while DRG the 15%
Hays (1992), USA, XS	Home care. Randomized sample of 237 adult patients	Total number and types of 44 NDs (OS)	*Org*: Hours of direct nursing care (nursing resource consumption) *Time*: (6 months)	*Org*: In the four regression models, the NDs OS significantly (all $p = 0.001$) predicted direct hours of nursing care, respectively: all NDs OS (26%), actual NDs OS (21%), and number of NDs OS (16%, R^2 Adjusted = 0.16; $p = 0.0001$); while the nursing intensity explained the 10% of the amount of variation in resource consumption
Juve-Udina et al. (2017), Spain XS	Hospitals (n = 8). Randomized sample of 107 adult medical surgical patients who experienced a cardiac arrest (with vs. without SOND)	Nursing care plans based on NDs (NANDA-I)	*Pat*: Hospital mortality. *Org*: Transferred to intensive care unit, continuity of care at floor. *Time*: (4 years)	From the e-chart in the 4 years, in the SOND group (vs. group without SOND), the proportion of patients: *Pat*: Who died was significant lower (59% vs. 86.2%; $p < 0.001$). *Org*: Transferred to ICU (22.2% vs. 5.8%; $p = 0.001$) and kept in the ward (18.7% vs. 7.9%; $p = 0.035$) were significant higher

TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
Lee et al. (2002), Taiwan, XS	Hospital. Convenience sample of 194 adult patients from two respiratory intensive care units	Total number of NDs and types of NDs (NANDA-I)	*Org*: Intensive care unit LOS, transfer status *Time*: (6 months)	*Org*: Only one ND, *Hyperthermia*, accounted for 3% of the variance in the ICU LOS ($p < 0.05$). When this ND was added to a stepwise regression model (predictors: age, Acute physiology and chronic health evaluation score, and number of NDs), only the total number of NDs (13%; $p < 0.01$) and Acute physiology and chronic health evaluation score (3%; $p < 0.05$) significantly explained the variance in the ICU LOS. Patients with a higher number of NDs NANDA-I had a longer ICU LOS ($r = 0.35$; $p < 0.01$). None of the NDs or the number of NDs had any significant effects on transfer status
Marek (1996), USA, XS	Home care. Convenience sample of 317 adult patients	Total number of NDs and types of NDs (OS)	*Org*: Hours of nursing care, Number of nursing visits *Time*: (18 months)	*Org*: A hierarchic regression model (predictors: demographic variables—age < 65, primary payer insurance-, mental, musculoskeletal, endocrine medical diagnoses, and NDs) explained 18% of the overall variance in the hours of nursing care ($p < 0.01$); this variance was significantly explained by age < 65 (1%), medical diagnoses (8%), and NDs (9%). A second hierarchic regression model (considering the same variables) significantly explained 16% of the overall variance in the number of home care nursing visits ($p < 0.01$); this variance was significantly explained by private insurance (3%), medical diagnoses (6%), and NDs (7%)
Naughton et al. (1999), USA, XS	Post-acute Geriatric Evaluation and Management Unit. Convenience sample of 154 geriatric patients	NSI score based on 34 specific NDs (NANDA-I)	*Org*: Discharge outcome (return to the Community) *Time*: Not reported	*Org*: The NSI was found to have a statistically significant relationship with the discharge outcome (RR = 1.75; 95%CI = 1.48–2.06). The final logistic regression model (predictors: NSI, individual "severe" items from the Cumulative Illness Rating Scale, age, and social support) predicted 87.7% of the observed discharge outcome

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TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
O'Brien-Pallas et al. (1997), Canada, XS	Hospital. Convenience sample of 1435 pediatric and adults patients in medical, surgery, and specialty units	NDs categorized according to Gordon's Functional Health Patterns (NANDA-I)	*Org*: Nursing workload (Project Research in Nursing 80 instrument—direct care estimate). *Time*: (113 days)	*Org*: A stepwise regression model (predictors: age, Canadian Case Mix Grouping, LOS, NDs, Functional Health Patterns, Unit Factor scales, and nursing unit categories) explained 60% ($F = 18.49$, $p < 0.001$) of the variance in the nursing workload; this variance was explained by NDs patterns (21%), age (9%), Case Mix Grouping (19%), LOS (5%), unit factor scales (3%), and nursing unit (3%). A positive linear relationship was noted between the number of NDs selected within each Functional Health Patterns (except *Coping-stress tolerance*) and the average workload
O'Brien-Pallas et al. (2010), Canada, XS	Hospitals (n = 6). Convenience sample of 1198 cardiac and cardiovascular diseases patients	Total number of NDs (NANDA-I)	*Org*: Hospital LOS deviation *Time*: (6 months)	*Org*: The hierarchical logistic regression model with predictors to nurse (e.g., nurse–patient ratio), patient (e.g., number of ND, medical consequences), and unit level (e.g., unit type, skill mix, autonomy, and resource adequacy) showed that longer than expected LOS was 13% more likely for each additional ND (OR = 1.13, $p \leq 0.05$)
Onori (2013), USA, XS	Hospital. Convenience sample of 445 adult nonpsychiatric patients with a primary diagnosis of type 2 diabetes mellitus	Total number of NDs and types of NDs (NANDA-I)	*Org*: Hospital LOS, intensive care unit LOS *Time*: (3 years)	*Org*: *Total number of NDs*: the multiple regression model (predictors: gender, age, marital status, insurance type) explained 44.1% of the variance in LOS (number of NDs, only significant predictor, $p < 000.1$) and 15% of the variance in ICU LOS. Number of ND had significant (all $p < 0.0001$) correlations with hospital LOS ($r = 0.67$; strong and positive) and ICU LOS ($r = 0.39$; moderate). Positive association between number of NDs and LOS ($\beta = 0.59$; $p < 0.0001$), so for every additional ND, the LOS increased by 0.59 days. *Specific types of NDs*: the final regression model (considering only eight NDs) explained 26.6% ($F = 14.33$, $p < 0.0001$) of the variance in LOS; six NDs were significant predictor of LOS (*Skin impairment*, *Constipation*, *Diversional activity deficit*, *Self-care deficit*, and *Pain* and *Depression*), while age, gender, marital status, and financial class were not as important

TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
Paans et al. (2016), Netherland, XS	Hospital. Convenience sample of 300 elderly surgical patients admitted in two orthopedic wards	Total number of NDs and types of NDs (NANDA-I)	*Org*: Hospital LOS *Time*: (1 year)	*Org*: In the regression model (considering also medical diagnoses and medical treatment), NDs *Impaired tissue perfusion* (*wound*), *Pressure ulcer*, and *Deficient fluid volume* had significant influence on LOS. The number of NDs documented in the electronic health record also had a positive significant influence on LOS
Park et al. (2019), USA, XS	Community. Convenience sample of 676 Latina mothers (age: 14–52 years)	Nursing care plans based on NDs, nursing interventions, and nursing outcomes (OS)	*Pat*: Omaha KBS *Time*: admission–discharge	*Pat*: Improvement in KBS. Between the four OS intervention approaches, mothers who received intervention *Approaches*, *three* had the most improvement and highest final scores in *Knowledge* and *Behavior* (all $p < 0.001$), while mothers who received intervention *Approaches*, *two* had the most improvement and highest final scores in *Status* ($p < 0.001$)
Pérez Rivas et al., 2016, Spain, XS	Primary health-care centers (n = 34). Convenience sample of 379,601 adult patients from 34 primary health-care centers ("NNN group," nurses that used the nursing process using NNN; vs. "No NNN group")	Nursing care plans based on NDs, nursing interventions, and nursing outcomes (NNN)	*Pat*: Glycemic (HbA1c), blood pressure (DBP and SBP), and lipid (total cholesterol) control *Org*: Pharmaceutical (drug) costs, Coverage of promotion and prevention service. *Time*: (3 years)	*Pat*: The "NNN group" had: (a) better glycemic (HbA1c ≤ 7: 66.7% vs. 60.3%; $p < 0.01$), blood pressure (SBP <140 and DBP <90: 53.3% vs. 50.6%; $p < 0.01$), and lipid (total cholesterol ≤200 mg/dL: 39.4% vs. 35.6%; $p < 0.05$) control; (b) better values in the most recent measurements documented in the electronic health record for HbA1c (6.81 ± 1.6 vs. 7.00 ± 1.7; $p < 0.01$) in patients with diabetes mellitus, DBP (77.6 ± 9.6 vs. 78.6 ± 9.5; $p < 0.01$) in patients with hypertension, and total cholesterol (213.5 ± 44.1 vs. 218.2 ± 43.4; $p < 0.01$) in patients with hypercholesterolemia. *Org*: The "NNN group" had: (a) a lower pharmaceutical drug costs in ≥45 years ($p < 0.01$); (b) a greater health-care coverage of promotion and prevention services in all the age area ($p < 0.01$) except for the "influenza vaccination of high-risk groups <65 years"

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TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
Rosenthal et al. (1992), USA, XS	Hospital. Convenience sample of 14,183 adult medical and surgical patients (14,183 for the development phase; 7302 for the testing phase)	NSI score, based on 34 specific NDs, were categorized into seven hierarchical strata (NANDA-I)	*Pat*: Hospital mortality *Org*: Hospital LOS *Time*: (14 months)	*Pat*: *Development phase*: number of NDs on admission was highly related ($p < 0.001$) to in-hospital mortality. *Testing phase*: in a multiple logistic regression model, the NSI was an independent predictor of mortality ($p < 0.001$). The NSI was as accurate in predicting mortality as the MedisGroups (AUROC = 0.814 ± 0.016 vs. 0.845 ± 0.015; $p = 0.12$). The NSI and the MedisGroups together (AUROC = 0.880 ± 0.014), were more accurate ($p < 0.01$) than either measure alone. *Org*: The NSI was an independent predictor of LOS ($p < 0.001$) in a multivariate analysis, adjusting for DRG. Variance in LOS was explained by NSI for 7.4%, by MedisGroups for 3%, while by NSI and MedisGroups together for 9.9%
Rosenthal et al. (1995), USA, XS	Hospital. Convenience sample of 5347 adult medical and surgical patients with musculoskeletal diagnoses	NSI, based on 34 specific NDs, were categorized into six hierarchical strata (NANDA-I)	*Pat*: Hospital mortality *Org*: Discharge to nursing homes, Hospital charges, Hospital LOS *Time*: Not Reported	*Pat*: Admission NSI predicted in-hospital mortality (AUROC = 0.809 ± 0.033). In a multiple logistic regression model (adjusting for DRG-specific mortality, age, race, sex, marital status, and type of health insurance), each of the six NSI hierarchical strata were associated with a 2.5-fold difference in the risk of death ($R^2 = 0.93$; $p < 00001$). *Org*: Admission NSI predicted nursing home discharge (AUROC = 0.733 ± 0.020). In regression models (adjusted for age, race, sex, marital status, and health insurance), each of the six NSI hierarchical strata was associated with a 1.6-fold difference in the risk of nursing home discharge ($R^2 = 0.49$; $p < 0.0001$), and a 1.8-fold difference in the risk of being a DRG outlier ($R^2 = 0.54$; $p < 0.0001$). The NSI explained 9.8% of the variance in hospital charges and 8.8% in LOS ($p < 0.001$)
Smith (1994), USA, XS	Hospital. Randomized sample of 50 adult patients with HIV/AIDS	Total number of NDs (NANDA-I in a NMDS)	*Org*: Hospital LOS *Time*: (7 months)	*Org*: Statistically significant and moderate correlation between the hospital LOS and number of NDs generated both from staff nurse and researcher ($r = 0.37$, $p = 0.01$; $r = 0.35$, $p = 0.01$, respectively). In a regression model, patient acuity and number of NDs explained 25% of the variance in hospital LOS ($F = 16.72$; $p < 0.00001$); the number of NDs explained 7% of the variance ($\beta = 0.28$; $p = 0.0002$)

TABLE 1 (Continued)

Author, year, country, and design	Setting. Sample (IG: Intervention group vs. CG: Control group)	Modality of processing (standardized nursing terminologies)	Patient and organizational outcome (measurements) and follow-up time (length of the study)	Key results
Welton & Halloran (2005), USA, XS	Hospital. Convenience sample of 75,743 adult nonpsychiatric patients	Summary score of 61 s NDs: ratio "daily presence of NDs/number of hospital days" (NANDA-I)	*Pat*: Hospital mortality *Org*: Intensive care unit LOS, hospital LOS, hospital charges (costs), and discharge to nursing homes. *Time*: Not reported	*Pat and Org*: In regression models, all relationships between the independent variables (DRG, APR-DRG, and NDs) and the five outcome variables were significant ($p < 0.001$). *Pat*: The addition of NDs to existing DRG or APR-DRG models improved the explained variance of hospital mortality from 115.9 to 146.4%, respectively. The "Summary score" was highly accurate (ND: c = 0.9530). *Org*: The addition of NDs to existing DRG or APR-DRG models improved the explained variance of ICU LOS, hospital LOS, hospital charges, and discharge to nursing homes from 27.5 to 146.4%
Zeffiro et al. (2020), Italy, XS	Community nursing-led unit. Convenience sample of 904 adult patients	Total number and type of NDs (NANDA-I)	*Org*: Community nursing-led unit LOS *Time*: (6 years)	*Org*: The final regression model (predictors: marital status, admission in community nursing-led unit after hospital discharge, discharged to home, NDs: *Impaired urinary elimination and impaired memory*, nursing activities: *Assessment and monitoring of nutritional/hydration conditions and advanced wound care*) explained 16.8% ($R^2 = 1.68$) of the variance in LOS >20 days. The risk increased by 20% for every additional identified ND (OR = 1.209, 95%CI 1.082–1.352; $p = 0.001$) of the LOS >20 days in the community nursing-led unit

Note: Design: RCT, Randomized controlled trial; NRCT, Non-randomized controlled trial; PCS, Prospective cohort study; BA, Before-and-after-comparison; XS, Cross sectional study. *Standardized Nursing Terminologies*: ICNP, International Classification for Nursing Practice; NANDA-I, NANDA-International; NIC, Nursing Interventions Classification; NMDS, Nursing Minimum Data Set; NNN, NANDA-I, NOC, and NIC; NOC, Nursing Outcomes Classification; OS, Omaha System. *Frequent terms*: APR-DRG, All Patient Refined-Diagnosis Related Group; DRG, Diagnosis Related Group; ICU, Intensive care unit; ND, nursing diagnosis; NDI, Nursing Dependency Index; NSI, Nursing Severity Index; SOND, Surveillance Oriented Nursing Diagnosis. *Outcomes*: ADL, Activities of Daily Living; ASES-8, Arthritis Self-Efficacy Scale-8; BMI, Body Mass Index; CES-D, The Center for epidemiological Studies for Depression Scale; DBP, Diastolic Blood Pressure; HbA1c, Glycated Hemoglobin; HDL, High Density Lipoprotein; HODY, How Often Do You?; KBS, Knowledge, Behavior, Status; LDL, Low Density Lipoprotein; LOS, Length Of Stay; QOL, Quality of Life; SAS, Self-rating Anxiety Scale; SBP, Systolic Blood Pressure; SDS, Self-rating Depression Scale; SF-36, Medical Outcomes Study 36-item Short-Form Health Survey (MCS& PCS, Mental & Physical Component Summary). *Statistics*: AUROC, area under the Receiver Operating Characteristics curve; md, mean difference; OR, Odds Ratio; PR, Prevalence Ratio; RR, Relative Risk.

was positively correlated with hospital length of stay in different patients' populations (D'Agostino et al., 2017; Halloran & Kiley, 1987; Onori, 2013; Smith, 1994). In a study by Onori (2013), results indicated that every additional nursing diagnosis NANDA-I identified was linked to an increase in the length of stay by 0.59 days. In addition, the number of nursing diagnoses NANDA-I (or nursing diagnosis-derived indexes) was a predictor of hospital length of stay or better predictor of length of stay than medical data, such as Diagnosis Related Groups (DRGs), All Patient Refined-DRGs, or MedisGroups (D'Agostino et al., 2019; Halloran & Kiley, 1987; Paans et al., 2016; Rosenthal et al., 1992; Welton & Halloran, 2005).

Similarly, the addition of nursing diagnoses NANDA-I to existing DRGs or All Patient Refined-DRGs models significantly increased the explained variance of intensive care unit and hospital length of stay (Welton & Halloran, 2005). Nursing diagnoses NANDA-I were also a strong independent predictor of "deviation length of stay" (i.e., the difference between the effective length of stay and the DRGs-specific national expected average hospital length of stay) (D'Agostino et al., 2019). Longer than expected length of stay was more likely associated with each additional nursing diagnosis NANDA-I in both a hospital setting (O'Brien-Pallas et al., 2010) and a community nursing-led unit (Zeffiro et al., 2020).

SNTs and amount of nursing care

NANDA-I nursing diagnoses were associated or significantly predictive for the nursing workload in hospital medical and surgical setting (Halloran, 1985; O'Brien-Pallas et al., 1997), while both NANDA-I and OS nursing diagnoses were associated or significantly predictive for the length and/or number of nursing care visit in home care (Hays, 1992; Helberg, 1994; Marek, 1996; Morales-Asencio et al., 2009; O'Brien-Pallas et al., 2001).

SNTs and discharge dispositions

Admission nursing diagnoses NANDA-I indexes (Nursing Severity Index; summary score of 61 nursing diagnoses) when added to existing DRGs or All Patient Refined-DRGs helped explain the variance in discharge to nursing homes (Welton & Halloran, 2005), and were predictors of discharge both from hospital to nursing homes and return to the community from a "post-acute geriatric evaluation and management unit" (Naughton et al., 1999; Rosenthal et al., 1995). Significant positive association was observed between Nursing Severity Index (based on 34 nursing diagnoses NANDA-I) and return to the community from a "post-acute geriatric evaluation and management unit" (Naughton et al., 1999).

"Surveillance-oriented nursing diagnoses" are "clinical judgments about the ongoing status of an individual (or group) at risk for progression to severe harm or life-threatening conditions" and are focused on nursing vigilance and prevention of patients' deterioration; a significant positive association was observed between "surveillance-oriented nursing diagnoses" NANDA-I documented, and patients transferred to intensive care unit or kept in the ward (Juve-Udina et al., 2017).

Other authors found no association between (a) NIC interventions and emergency department admissions (Schein et al., 2005), (b) the presence of nursing diagnoses NANDA-I and institutionalization from home care services (Morales-Asencio et al., 2009), and (c) nursing diagnoses NANDA-I and transfer status (i.e., the "trajectory" of critical patients to other intensive care units, to general units or the recovery and discharge to home) of respiratory intensive care unit patients (Lee et al., 2002).

SNTs and costs

The presence and/or number of nursing diagnoses NANDA-I and the Nursing Severity Index (based on nursing diagnoses NANDA-I) showed to increase the explained variance of hospital costs when added to medical data, such as DRGs and All Patient Refined-DRGs, and in regression models including sociodemographic variables (Company-Sancho et al., 2017; Rosenthal et al., 1995; Welton & Halloran, 2005); consequently, nursing diagnoses were identified as an independent predictor of costs. The number of nursing diagnoses NANDA-I and the mean health-care expenditure appeared significantly related. A higher number of nursing diagnoses identified corresponded to greater costs (Company-Sancho et al., 2017). In addition, for those patients assigned to nurses who use nursing process adopting the NNN, there were lower pharmaceutical costs (Pérez Rivas et al., 2016).

Narrative results on patients' outcomes

SNTs and mortality

A linear positive relationship was found to exist between the number of nursing diagnoses NANDA-I documented on admission and mortality rates as reported in different populations such as intensive care, medical, and surgical patients (Castellan et al., 2016; D'Agostino et al., 2017). Hospital mortality rates increased by 45% for each additional nursing diagnosis NANDA-I reported (Sanson et al., 2019), while patients with "surveillance-oriented nursing diagnoses" (NANDA-I) were found to be in a significantly lower mortality rates when compared to other patients without "surveillance-oriented nursing diagnoses" (Juve-Udina et al., 2017). When nursing diagnoses NANDA-I (or diagnosis-derived indexes) were added to medical data as DRGs and All Patient Refined-DRGs, the explained variance in predicting mortality increased (Sanson et al., 2019; Welton & Halloran, 2005). The admission Nursing Severity Index (based of 34 specific nursing diagnoses, of which 28 NANDA-I) showed a high accuracy in predicting in-hospital mortality with an AUROC of 0.814 on 14,183 medical and surgical patients (Rosenthal et al., 1992), and 0.809 on 5347 medical and surgical patients with musculoskeletal diagnoses (Rosenthal et al., 1995). Finally, a twofold risk of patient's mortality was found when the caregiver had a nursing diagnosis NANDA-I of anxiety (Morales-Asencio et al., 2009).

SNTs and clinical outcomes

Studies investigating the use of SNTs (NANDA-I, NNN, NANDA-I/NIC, and OS transitional care programs) in different populations, reported a statistically significant enhancement in several physiological

or clinical outcomes such as glycemic control (Cardenas-Valladolid et al., 2012; Pérez Rivas et al., 2016; Wei et al., 2019; Zhang et al., 2017), blood pressure control (Cardenas-Valladolid et al., 2012;Pérez Rivas et al., 2016; Zhang et al., 2017), lipid levels (Pérez Rivas et al., 2016; Zhang et al., 2017), weight control (Zhang et al., 2017), sleep quality (Laguna-Parras et al., 2013; Liu et al., 2021), and post-postoperative complications (da Silva et al., 2019; Liu et al., 2021). However, some authors have not confirmed a significant improvement in patients for lipid levels (Cardenas-Valladolid et al., 2012; Zhao et al., 2020), sleep quality (Mello et al., 2016), and weight control (Cardenas-Valladolid et al., 2012). In studies reporting the use of NNN terminologies in postoperative and cancer patients with the nursing diagnosis of acute and/or chronic pain, results showed a significant improvement in NOC "Pain level" outcome (Luz Rodríguez Acelas et al., 2020) and for some pain NOC outcomes and corresponding indicators (Mello et al., 2016). Da Silva et al. (2015), however, did not report significant improvements in the NOC "Pain level."

Gencbas et al. (2018) reported that nursing care plan using NNN linkages significantly resulted in improved incontinence-related outcomes in a randomized sample of 62 elderly women in nursing homes. Finally, randomized controlled trials using an OS-based continuing nursing care program found a statistically significant enhancement in nutritional status for 194 dialysis patients (Zhao et al., 2020) and a reduction of cancer-related fatigue in 95 hospitalized lung cancer patients on chemotherapy (Ning et al., 2021) (Table 1).

SNTs and quality of life

Several authors reported a significant association between the use of SNTs (OS, NANDA-I, and NNN linkages) and the patients' quality of life (Akkus & Akdemir, 2012; Gencbas et al., 2018; Liu et al., 2021; O'Brien-Pallas et al., 2002; Wei et al., 2019; Wong & Yeung, 2015; Zhang et al., 2017, 2018; Zhuang et al., 2021). However, these results were not confirmed by other authors using OS and NIC interventions (Erci, 2012; Schein et al., 2005).

SNTs and psychological outcomes

Studies focusing on NNN, ICNP/NNN, and OS transitional care programs, reported a statistically significant enhancement for anxiety (Amad Pastor et al., 2017; Liu et al., 2021; Sampaio et al., 2018; Zhuang et al., 2021) and depression (Liu et al., 2021; Wong & Yeung, 2015; Zhuang et al., 2021). A significant benefit in children with epilepsy was reported on depression, anxiety, and self-deficiency utilizing the "OS-based continual nursing care" (Zhuang et al., 2021). Students receiving nursing care from school nurses based on the use of the NNN language (when compared with not using NNN) significantly increased the number of coping strategies (Lunney et al., 2004).

SNTs and other health-related outcomes

In a 4-week transitional care program based on OS, study results indicated improved scores of the Modified Barthel Index of stroke survivors (Wong & Yeung, 2015); while Schein et al. (2005) reported that frail elderly individuals receiving NIC interventions (e.g., coping assistance) experienced changes in instrumental activities of daily living rather than activities of daily living. Studies on the use of SNTs (OS and OS transitional care program) reported a statistically significant enhancement of patients in health status (Erci, 2012; Liu et al., 2020) and satisfaction (Liu et al., 2021; Wong & Yeung, 2015; Zhang et al., 2018), although Morales-Asencio et al. (2009) did not confirm a significative association between nursing diagnoses NANDA-I and satisfaction. Finally, studies using SNTs (OS, NNN, and NANDA-I/ NOC) reported a positive impact on patients' knowledge (Azzolin et al., 2015; da Silva et al., 2015; Lemos et al., 2020; Liu et al., 2021; O'Brien-Pallas et al., 2002; Park et al., 2019; Wei et al., 2019).

Meta-analytic results: ICU length of stay, readmission, knowledge, and self-efficacy

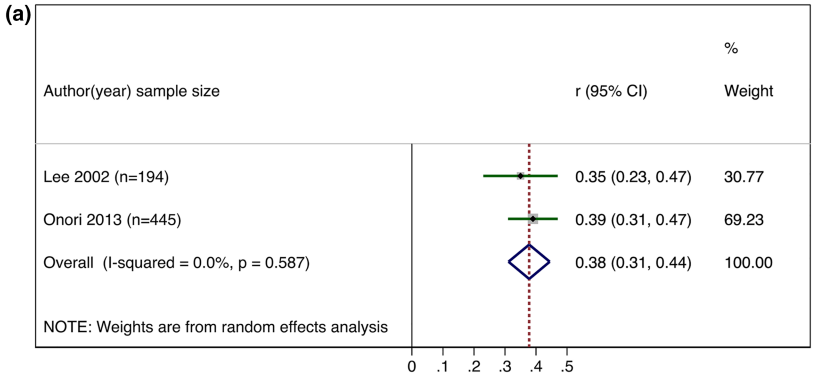
Table 1 reports a synthesis of both organizational and patients' outcomes and the use of standardized terminologies. A meta-analytic synthesis was undertaken for intensive care unit length of stay, readmission, knowledge, and self-efficacy (Figure 2a-d). The total number of nursing diagnoses NANDA-I identified showed a positive moderate and significant correlation with the length of stay in intensive care units ($r = 0.38$; 95% CI = 0.31–0.44; $p < 0.001$). Data documented from chronic patients, exposed to a nurse-led transitional care program based on the OS terminology, showed a significant and large reduction of the readmission likelihood when compared with patients exposed to routine care (OR = 0.46; 95% CI 0.09–0.83; $p = 0.014$). Cardiovascular patients exposed to the OS-transitional care showed a significant increase (large) in patient knowledge related to health goals when compared to patients treated with usual care ($d = 1.21$, 95% CI = 0.97–1.44; $p < 0.001$). Finally, patients with chronic illness participating to OS transitional care programs showed a significant and large self-efficacy level than those treated with usual care ($d = 1.23$, 95% CI = 0.97–1.48; $p < 0.001$). Details about the exploration of the publication bias are reported in the Appendix S6.

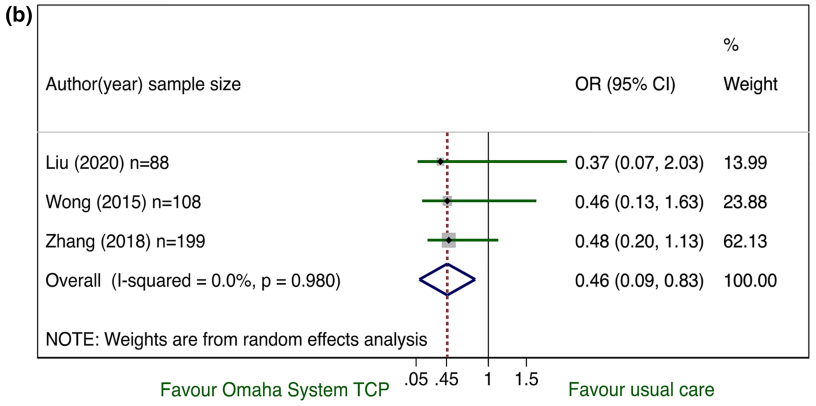
Certainty of the evidence

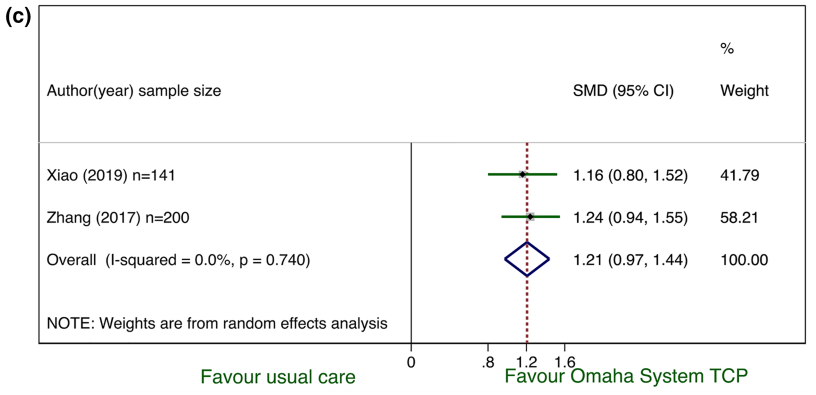
The GRADE was used to evaluate the certainty of evidence of studies included in the meta-analysis. The certainty of evidence ranged from "very low" (for intensive care unit length of stay and readmission) to "low" (for knowledge and self-efficacy). The downgrading of the certainty of evidence was due to factors including type of study design, imprecision (i.e., wide confidence intervals), and indirectness (e.g., difference in population, timing, and instruments used) (Table 2).

Conceptual framework

The "Nursing Terminologies and Outcomes Framework" provides a global picture about the main relationships between SNTs and







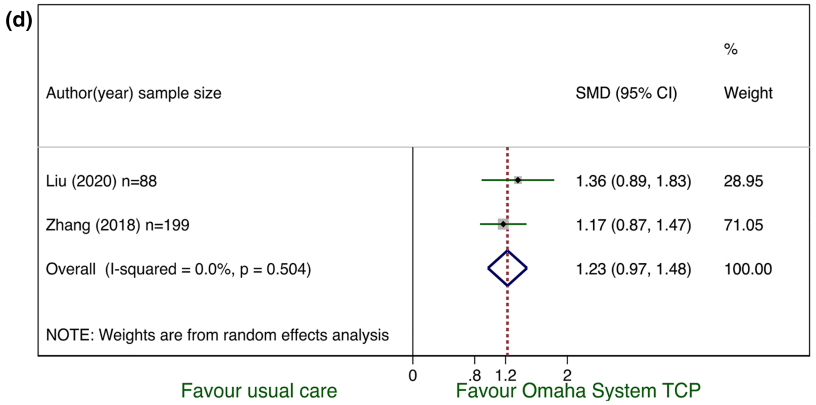


FIGURE 2 Forest plot of the meta-analyses. (a) Correlations between the number of nursing diagnoses NANDA-I and intensive care unit length of stay. Random effects meta-analysis of Pearson's *r* correlation showing that higher number of nursing diagnoses NANDA-I are associated with longer intensive care length of stay ($z = 11.12$ $p < 0.001$). < *r* = Pearson's *r* Correlation. ♦ = *r* of individual study. −−− =95% CI of individual study>. Heterogeneity: $Q = 0.30$, df = 1, $p = 0.587$, and $I^2 = 0.0\%$. (b) Effect of a Transitional Care Program based on Omaha System on readmission. Odds ratio of the effect of Transitional Care Program based on Omaha System—Random effects meta-analysis of the odds ratio showing that in chronic patients using Omaha System Transitional Care Program, the odds of readmission were 54% lower versus usual care ($z = 2.46$ $p = 0.014$). < OR = Odds Ratio. ♦ = OR of individual study. −−− =95% CI of individual study>. Heterogeneity: $Q = 0.04$, df = 2, $p = 0.980$, and $I^2 = 0.0\%$. (c) Effect of a Transitional Care Program based on Omaha System on knowledge of cardiovascular disease patients. Standardized mean difference (*d* Cohen) of the effect of Transitional Care Program based on Omaha System.—Random effects meta-analysis of the standardized mean difference showing that cardiovascular disease patients using Omaha System based Transitional Care Program have higher knowledge versus usual care ($z = 10.16$, $p < 0.001$). < SMD = Standardized mean difference. ♦ = SMD of individual study. −−− =95% CI of individual study>. Heterogeneity: $Q = 0.11$, df = 1, $p = 0.740$, and $I^2 = 0.0\%$. (d) Effect of a Transitional Care Program based on Omaha System on self-efficacy. Standardized mean difference (*d* Cohen) of the effect of Transitional Care Program based on Omaha System.—Random effects meta-analysis of the standardized mean difference showing that cardiovascular disease patients using Omaha System based Transitional Care Program have higher self-efficacy versus usual care ($z = 9.49$, $p < 0.001$). < SMD = Standardized mean difference. ♦ = SMD of individual study. −−− =95% CI of individual study>. Heterogeneity: $Q = 0.45$, df = 1, $p = 0.504$, and $I^2 = 0.0\%$.

outcomes following the Donabedian's Structure–Process–Outcome Model (Donabedian, 1992) (Figure 3).

DISCUSSION

Narrative synthesis

In accordance with available evidence, the most investigated SNTs were NANDA-I, NIC, NOC, and the OS (Tastan et al., 2014). These SNTs provide a comprehensive person-centered framework (Figure 3) for describing components of the nursing process and achieve the quality of care. Using SNTs can be useful in describing the patients experience, as linked to the effectiveness of critical thinking and clinical decision-making process. The results of engaging in this process can improve the implementation of evidence-based nursing care in clinical practice promoting better patient's outcomes. This study shows that SNTs or diagnosis-derived indexes, can be independent predictors of both length of stay and mortality in different settings. Furthermore, SNTs can also predict the nursing workload, the length and number of nursing visits, and the return to community, confirming their role as possible measures of clinical patient's complexity and costs. In this regard, nursing diagnoses reflected the intensity of the demand for nursing care resource utilization suggesting the need for nursing data to be included in decisions about health-care reimbursement (D'Agostino et al., 2019; Sasso et al., 2017). Clinically complex patients can experience a high number of nursing problems which require advanced nursing interventions, over a longer time, and additional human and financial resources when resolving these responses to illness. For these reasons, nursing data should be considered along with medical data when allocating resources (Company-Sancho et al., 2017; Welton & Halloran, 2005). Currently, reimbursement for hospital care services in several countries continues to be based on the medical DRGs system and nursing-specific data are still not available in hospital discharge abstracts. As a result, nursing's contribution to clinical and organizational outcomes continue to be "invisible" and mainly "task oriented" to health-care administrators, funders, and policymaker eyes, who fail to view the nurse's work as complex and cognitively and managerially demanding (Sasso et al., 2017). The use of SNTs in clinical practice can be costed out allowing hospitals to quantify nursing's contribution to health care and related reimbursement (Jones et al., 2010). This opportunity has not been yet considered in many countries around the world.

Meta-analytic synthesis: ICU length of stay, readmission, knowledge, and self-efficacy

This systematic review is the first providing a meta-analytic synthesis about the impact of SNTs on patients' and organizational outcomes. In this regard, a moderate significant correlation emerged between the number of NANDA-I nursing diagnoses and the intensive care unit length of stay (Lee et al., 2002; Onori, 2013). In addition, a nurse-led transitional care program based on OS provided at discharge to home care led to a reduction in the readmission rate, and an increase of both knowledge and self-efficacy levels in chronic patients (Liu et al., 2020; Wong & Yeung, 2015; Xiao et al., 2019; Zhang et al., 2017; Zhang et al., 2018). These outcomes are explained by the ability of transitional care interventions provided by nurses to raise the knowledge and self-care ability of patients helping them to actively seek medical assistance and improving their belief to effectively face the disease.

Risk of bias

The methodological quality of the included studies highlighted some critical points that must be considered when interpreting the results.

The evidence of concerns related to the risk of bias in the "measurement of the outcomes" domain, especially in nonrandomized studies for interventions, was mainly due to the use of patient-reported outcomes. The lack of blindness of outcome assessors and the patients' awareness about the interventions received are elements reinforcing the presence of possible bias in this domain.

TABLE 2 Summary of findings with GRADE evaluation.

Summary of findings:						
SNTs compared to No SNT for organizational and patients' outcomes						
Patient or population: for organizational and patients' outcomes Setting: Any setting Intervention: SNTs Comparison: No SNTs						
Outcome No of participants (studies)	Relative effect (95% CI)	Anticipated absolute effects (95% CI)			Certainty	What happens
				Difference		
ICU LOS No of participants: 639 (Two observational studies)	-		-	*r* (correlation) 0.38 higher (0.31 higher to 0.44 higher)	⨁◯◯◯ Very low[a]	SNTs (number of NDs NANDA-I) may be moderated correlated with ICU LOS but the evidence is very uncertain.
Readmission Nº of participants: 395 (Three RCTs)	OR 0.46 (0.09 to 0.83)	15.2%	7.6% (1.6 to 13)	7.6% fewer (13.6 fewer to 2.3 fewer)	⨁◯◯◯ Very low[b,c]	SNTs (transitional care program based on Omaha System) may reduce readmission but the evidence is very uncertain.
Knowledge Nº of participants: 341 (Two RCTs)	—	—	—	SMD 1.21 SD higher (0.97 higher to 1.44 higher)	⨁⨁◯◯ Low[d]	The evidence suggests that SNTs (transitional care program based on Omaha System) results in a large increase in knowledge.
Self-efficacy Nº of participants: 287 (Two RCTs)	—	—	—	SMD 1.23 SD higher (0.97 higher to 1.48 higher)	⨁⨁◯◯ Low[e]	The evidence suggests that SNTs (transitional care program based on Omaha System) results in a large increase in self-efficacy.

Note: GRADE Working Group grades of evidence: *High certainty*: We are very confident that the true effect lies close to that of the estimate of the effect. *Moderate certainty*: We are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. *Low certainty*: Our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect. *Very low certainty*: We have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Abbreviations: CI: confidence interval; ICU, Intensive care unit; LOS, length of stay; NDs, nursing diagnoses; OR, odds ratio; RCTs, randomized controlled trials; SMD, standardized mean difference; SNTs, standardized nursing terminologies.

[a]Downgraded of one level for imprecision due to the wide confidence intervals.

[b]Downgraded of one level for indirectness due to different timing of follow-up and different disease.

[c]Downgraded of two levels for imprecision due to the considerable wide confidence intervals.

[d]Downgraded of two levels for indirectness due to the different tools used for assessment (self-rated by Zhang et al., 2017 while evaluated by nurse in Xiao et al., 2019).

[e]Downgraded of two levels for indirectness due to the difference in the type of population, timing of the intervention, and instruments used.

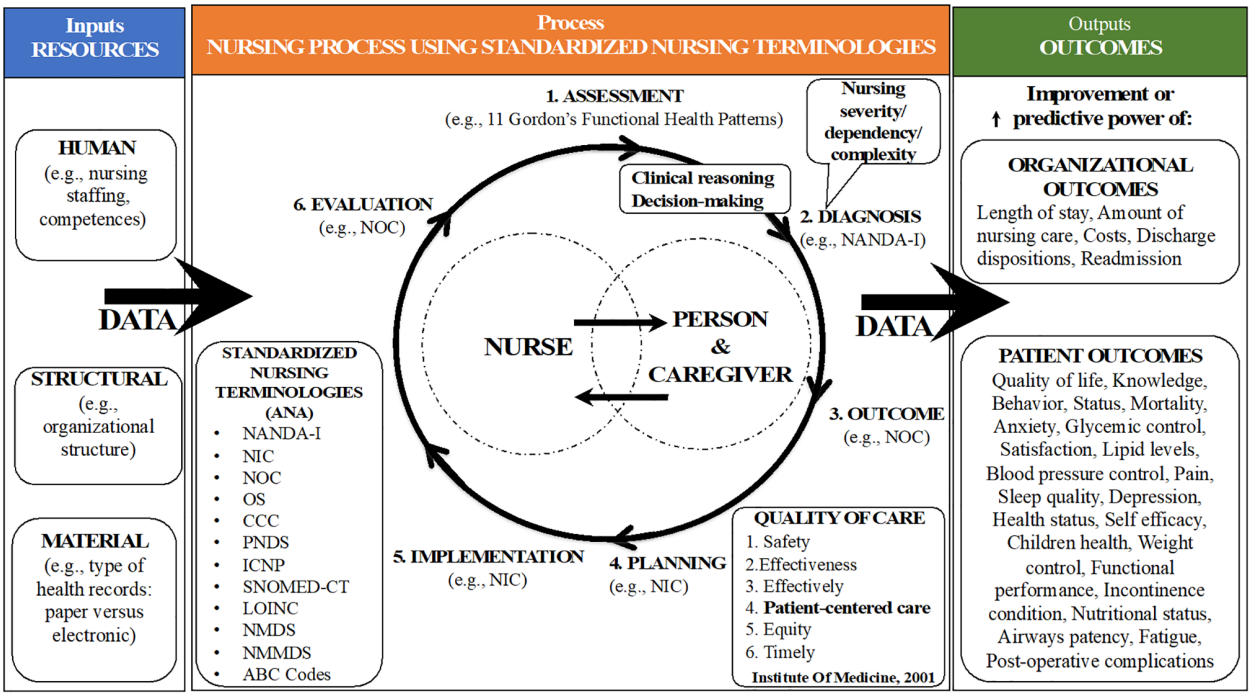


FIGURE 3 Nursing Terminologies and Outcomes Framework (NTOF): conceptual framework on relationships between using standardized nursing terminologies and patient and organizational outcomes. Standardized Nursing Terminologies: NANDA-International (NANDA-I), Nursing Intervention Classification (NIC), Nursing Outcome Classification (NOC), Clinical Care Classification (CCC), Omaha System (OS), Perioperative Nursing Data Set (PNDS), International Classification for Nursing Practice (ICNP), Systemized Nomenclature Of Medicine Clinical Terms (SNOMED-CT), Logical Observation Identifiers Names and Codes (LOINC), Nursing Minimum Data Sets (NMDS), and Nursing Management Minimum Data Sets (NMMDS).

For this reason, future studies should consider involving blinded assessors and to train patients to be neutral and direct their attention inward instead of toward intervention received, when they fill the self-reported questionnaire (Evans et al., 2021). In nonrandomized studies for interventions, the risk of confounding and selection biases were mainly due to the lack of multivariate analyses and randomization processes in the allocation of participants. While the confounding bias could be controlled by using multivariate analysis (Sterne et al., 2019), the selection bias is more difficult to control in this type of study design without modifying their nature. For this reason, future research could be orientated toward experimental studies.

Finally, in cross-sectional studies, the domain "exposure measured in not a valid and reliable way" was the most prevalent concern. The inter-rater reliability values related to the exposure were not always reported. An agreement between two raters could minimize this type of bias in future research.

Strengths and limitations

To the authors' knowledge, this broad systematic review is the first conducted on SNTs using meta-analysis. It is useful to highlight that in this investigation, none of the studies analyzed showed any negative outcome or side effect related to the use of these nursing terminologies in documenting nursing care or patient responses to illness.

Some limitations of this systematic review were considered. First, SNTs were part of a more complex intervention not allowing the researcher to extract the unique and separate contributions of the terminologies used (i.e., diagnosis, interventions, and outcomes) on reaching the desirable outcome. Second, nurses who were assessing, generating, and documenting nursing diagnosis, interventions and outcomes could have varying levels of knowledge and use of the decision-making process and standardized languages when documenting. Third, the literature search included four different databases in English or Italian language articles, creating the possibility of eliminating those studies published in other languages or other databases. Fourth, meta-analyses were feasible for four outcomes due to the heterogeneity of investigation methodologies used by researchers over time. To make possible a more robust evidence-based decisions, policies related to nursing process in every health-care setting, is expected a convergence in terms of objectives and methods in the future research. Study findings suggest that it is possible to track a common trend across study results, however, in this study, the heterogeneity of the investigation methods reviewed does not allow for a definitive conclusion to be reached. Certainty of the evidence and methodological quality of included studies suggest that study results should be taken with caution; further high-quality research is needed to increase the certainty of evidence utilizing multicenter study designs, larger sample sizes, and similar study conditions.

CONCLUSION

This extensive systematic review with meta-analyses highlights that SNTs can have beneficial effects on several outcomes including, for example, mortality, quality of life, knowledge, self-efficacy, and hospital readmission rate. However, these results should be considered at the light of the risk of bias detected in some of the included studies that was mainly related to the paucity of high-quality research. For this reason, researchers should give priority to the use of randomized controlled study designs when investigating the relationship between the SNTs and patient and organizational outcomes.

CLINICAL RELEVANCE

This review suggests the significant impact of SNTs on both patient and organizational outcomes. Therefore, policymakers should consider promoting the use of SNTs into clinical practice to improve the quality of care.

CLINICAL RESOURCES

- NANDA International. http://www.nanda.org
- Nursing Intervention Classification (NIC). https://nursing.uiowa.edu/cncce/nursing-interventions-classification-overview
- Nursing Outcome Classification (NOC). https://nursing.uiowa.edu/cncce/nursing-outcomes-classification-overview
- The Omaha System. https://www.omahasystem.org
- International Classification for Nursing Practice (ICNP). https://www.icn.ch/what-we-do/projects/ehealth-icnptm/about-icnp

ACKNOWLEDGMENTS

The authors thank the NANDA-I Foundation for the grant to the study, *The Marjory Gordon Program for Clinical Reasoning and Knowledge Development* and Gordon International Scholars at Boston College for their constant insights in contributing to this work. Finally, the authors thank Dr. Gianfranco Sanson (University of Trieste – Italy), Dr. Fabio D'Agostino (Unicamillus – International Medical University in Rome – Italy) for their valuable contribution in the protocol stage, and Dr. Christopher Lee (Connell School of Nursing, Boston College - USA) for his support in statistical analyses.

FUNDING INFORMATION

This project was made possible with a grant from the NANDA Foundation [Grant n°: 5.20], the nursing science research not-for-profit charity (2018–2020).

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Appendix S1

Appendix S2

Appendix S3

Appendix S4

Appendix S5

Appendix S6

How to cite this article: Bertocchi, L., Dante, A., La Cerra, C., Masotta, V., Marcotullio, A., Jones, D., Petrucci, C. & Lancia, L. (2023). Impact of standardized nursing terminologies on patient and organizational outcomes: A systematic review and meta-analysis. *Journal of Nursing Scholarship*, *00*, 1–28. https://doi.org/10.1111/jnu.12894