# EFFECTIVE EXCELLENCE IN NURSING

Bridging the gap between measurement of quality of nursing care and clinical reality

**Dewi Stalpers**

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## Bridging the gap between measurement of quality of nursing care and clinical reality

**Effectieve excellentie in de verpleegkunde**
Het overbruggen van de kloof tussen het meten van de kwaliteit van verpleegkundige zorg en klinische realiteit
(met een samenvatting in het Nederlands)

**Proefschrift**

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door
Dewi Stalpers

geboren op 23 augustus 1978
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|---|---|
| Promotor: | Prof. dr. M.J. Schuurmans |
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**For the sick it is important to have the best.**

Florence Nightingale (1855)

# CONTENTS

## Part 2 Characteristics of nurses and their work environment that contribute to the quality of provided care

# GENERAL INTRODUCTION

## A typical day at the ward…

*Monday morning 7.30 AM, nurse Monique starts her day of work in the intensive care unit of a local hospital with a cup of coffee from the DE coffee machine. She is in good spirits, because she is working with some nice colleagues today. Her colleague of the nightshift tells her how her patient has been doing during the night. The patient is very sick, it is a 69-year old man with heart failure after a cardiac arrest. He is on a ventilator and was put on a dialysis machine, because his kidneys were no longer working properly. One can hear the continuous alarming of the bedside monitor, warning for low blood pressures and irregular heartbeats. The man looks swollen with edema all over his body. "This is going to be a busy day", nurse Monique thinks. Then, she opens her account on the computer and she gets totally discouraged of what she sees. A long checklist faces her; there are 10 tasks that had to be done the last hour, you're too* ***LATE*** *is written in red, and do* ***not forget*** *the 15 tasks that have to be validated within the next hour. "Determine the delirium score, check the stomach pump, fill in the wound form, check the VAS, check the RASS, check the CPOT, check…check…double check". She thinks to herself "Is this really quality of care?"*

Nurses are at the frontline of providing high-quality patient care. They constitute the largest group of employees in hospitals, and they have a central position in the complex web which contemporary health care is. Their actions have major consequences for patients, because nurses are the only health care professionals delivering direct patient care 24 hours a day, all days of the week.[1] Because of its relevance, it is necessary to gain insight into the quality of care as delivered by nurses.

## Assessment of quality of nursing care

Quality indicators are used as measures to evaluate the care that is provided. In the medical discipline, performance measurement by the use of quality indicators is very common. Most of these indicators are specialty-specific, such as blood pressure results for hypertensive patients, number of patients treated according to specific clinical guidelines etc.[2] With regard to the nursing discipline, Florence Nightingale, the figurehead and founder of modern nursing, was the first to acknowledge that measurement of quality indicators is important for the purpose of quantifying quality

data. She collected data on infection rates during the Crimean War (1854–1856). Based on these findings, hygiene regulations and handwashing were introduced, leading to important evidence-based quality improvements.[3] Since then, many efforts are made to define valid and reliable quality indicators for nursing care.

Donabedian's Structure-Process-Outcome framework [4] is often used to assess quality of care and related influential factors (Figure 1). The main component of the framework involves patient outcomes, which are the results of the care delivered. With regard to outcomes related to nursing care, nurse-sensitive outcomes are important indicators of quality of care. Nurse-sensitive outcomes are defined as "those patient outcomes that are relevant, based on nurses' scope and domain of practice, and for which there is empirical evidence linking nursing inputs and interventions to the outcome". [5] In other words, nurse-sensitive outcomes quantify care that is mostly affected and directly delivered by nurses. Frequently mentioned examples are pressure ulcers, patient falls, and healthcare-associated infections.[6] Structure indicators represent the context of care; those characteristics that affect the ability of the nursing system to meet health care needs. Examples are staffing levels and the skill mix of nursing professionals. Previous systematic reviews of literature have shown important relationships between structures and nurse-sensitive outcomes, such as significant associations between higher levels of nurse staffing and lower mortality rates, fewer patient falls, and shorter length of stay.[7,8] Process indicators reflect the care that is provided by nurses. In other words, the activities that are done by nurses. Examples are risk assessments and subsequent nursing interventions. The relationship between processes and nurse-sensitive outcomes received much less attention, as pointed out by various authors.[6,9] However, particularly for nursing it is essential to gain insight into processes, because there is scientific evidence that nurses' actions are essential in order to prevent negative and stimulate positive outcomes for patients.[10]

## Donabedian's Quality Framework

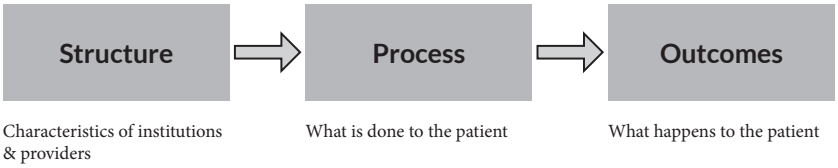


***Figure 1.*** *The framework of Donabedian on quality of care.*

## Benchmarking hospitals

The present thesis focuses on nurses in hospitals. This because most nursing care is delivered in hospitals and the measurements and benchmarking of quality of nursing care originally evolved in hospitals. In 1998, the American Nurses Association (ANA) was one of the first to develop a database of nurse-sensitive quality indicators, named the National Database of Nursing Quality Indicators (NDNQI). Currently, many of over 3600 hospitals in the USA voluntarily provide data to this nationwide database, including structure indicators (e.g., nursing care hours per patient day), process indicators (e.g., pain assessment), and outcome indicators (e.g., falls).[11] Since then, other databases of specific target populations were introduced in the USA, such as the Veterans Affairs Nursing Outcomes Database (VANOD) for veteran care, the Military Nursing Outcomes Database (MilNOD) for military care, and the California Nursing Outcomes Coalition (CalNOC) for statewide comparisons. Over the years, other countries started to benchmark according to nurse-sensitive quality indicators, for example the Canadian Health Outcomes for Better Information and Care (C-HOBIC) in Canada, and the Heart of England NHS Foundation Trust (HEFT) in England.[11,12]

Since 2007, there is a national mandatory system for the monitoring of quality indicators in the Netherlands. The Dutch Health Care Inspectorate (IGZ) mandates all hospitals to report their quality indicator data, including the nurse-sensitive indicators regarding delirium, malnutrition, pain, and pressure ulcers.[13] The Health Care Inspectorate, an autonomous department of the Ministry of Health, Welfare and Sports uses this information to gain insight into the quality of care in Dutch hospitals, and is empowered to start an investigation based on the performances on these indicators. Each year, the set of mandatory nurse-sensitive indicators is reviewed in consultation with relevant professional organizations, such as the Dutch Hospital Association (NVZ), Dutch Federation of University Medical Centers (NFU), Order of Medical Specialists (OMS), and Dutch Nurses' Association (V&VN). Additionally, data is publicly disclosed on a website (www.ziekenhuizentransparant.nl) and thereby visible for all kinds of stakeholders, among which health care consumers, providers, and insurance companies. The Dutch dataset includes data related to nursing process indicators (e.g., screening of delirium, screening of malnutrition) as well as nurse-sensitive outcome indicators (e.g., malnourished patients with an adequate protein-intake, pressure ulcers prevalence).

## Contributing factors to the quality of nursing care

In 2004, the Institute of Medicine (IOM) emphasized the importance of nurses' work environment in relation to the quality of nursing care.[1] Various studies have shown that organizations with healthy work environments have better outcomes for patients, such as lower risks of death and reduced failure-to-rescue.[14-17] Additionally, it is reported that nurses need a healthy work environment in order to perform well and to excel in their capabilities.[18,19] But, what defines a healthy work environment?
The USA is one of the leading countries in work environment research. In the nineties, the so-called Magnet hospitals were introduced. Based on a study of McClure and colleagues,[20] the ANA defined 14 organizational characteristics known as the Forces of

Magnetism (e.g., organizational structures, staffing policies, professional development) that should be present in any hospital organization, in order to guarantee a healthy work environment. Nowadays, these Magnet hospitals are known to act as a 'magnet' for excellence, because they attract and retain the best qualified staff that provides high quality of patient care.[21-23]

In addition to the Forces of Magnetism, representing relevant organizational work environment factors, Schmalenberg and Kramer [24] stated that it is also important to understand nurses' perception of their work environment. The Essentials of Magnetism-tool (EoM), later revised as the EoM II serves this purpose and involves eight work environment factors that affect nurses in the process of delivering care: (i) working with clinically competent peers, (ii) support for education, (iii) collaborative nurse-physician relationships, (iv) practice of clinical autonomy, (v) control of nursing practice, (vi) nurse manager support, (vii) patient-centered values, and (viii) adequacy of staffing. In 2010, following the example of the USA, the Dutch Nurses' Association (V&VN) in collaboration with the Dutch Federation of Patients and Consumers (NPCF) introduced the concept of 'Excellent Care' ('Excellente Zorg') in the Netherlands.[25] Several healthcare organizations, including six teaching hospitals participated in a pilot-study for the translation and validation of the Dutch version of the Essentials of Magnetism II (D-EoM II). The purpose of the D-EoM II is to determine nurses' perception of their work environment by using statements on the eight process factors as mentioned above.[26] Besides factors in nurses' work environment, individual characteristics of nurses (e.g., experience, level of education) potentially are influential on quality outcomes.[27]

Based on the Structure-Process-Outcome framework, we constructed a conceptual model to illustrate the relationship between quality of nursing care and influential factors, at the organizational level and the nurse level (Figure 2).

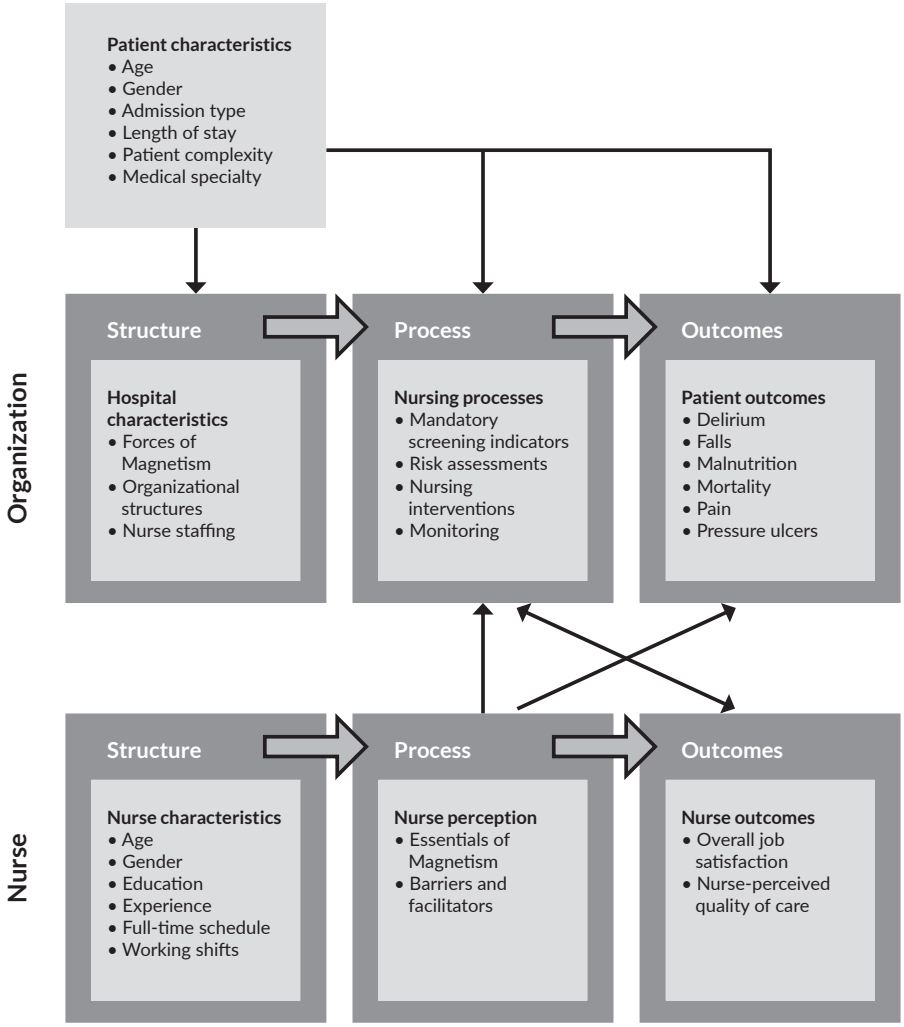


***Figure 2.*** *Conceptual model based on the Structure-Process-Outcome framework.*

## Aims and outline of this thesis

The general aim of this thesis is to examine quality of nursing care in hospitals expressed by nurse-sensitive quality indicators, and to identify influential factors in nurses' work environment and individual characteristics of nurses that contribute to the quality of care. Figure 2 guides the positioning of the chapters.

This thesis will cover two main topics. In **part 1**, the value of nurse-sensitive quality indicators, as mandated by the Dutch Health Care Inspectorate will be analyzed. Aim is to determine the validity and usefulness of these measures of quality of nursing care. **Chapter 1** presents an evaluation of Dutch hospitals' performances based on the mandatory nurse-sensitive screening indicators and its relationship with hospital characteristics and patient outcomes. In **Chapter 2**, to investigate the convergent validity of nurse-sensitive quality indicators, the degree of correspondence between objectively measured quality indicators (i.e., mandatory screening indicators) and subjectively measured quality indicators (i.e., nurse-perceived quality of care) is determined. **Chapter 3** empirically assesses a range of nurse-sensitive patient outcomes in three Dutch intensive care units (ICUs). More specifically, the occurrence of delirium, pain and pressure ulcers are examined and associations with patient characteristics and nursing processes are explored. **Chapter 4** identifies barriers and facilitators to the monitoring of nurse-sensitive quality indicators as perceived by ICU-nurses. **Chapter 5** elaborates on the methodological quality of the process and outcome indicators mandated by the Inspectorate (IGZ) by comparing them with mandatory indicators from a national patient safety database (VMS).

In **part 2**, influential work environment factors and nurse characteristics will be identified. Aim is to investigate nursing factors that contribute to quality of care deliverance by nurses. **Chapter 6** includes a systematic review of literature on the relationship between five nurse-sensitive patient outcomes (i.e., delirium, malnutrition, pain, patient falls, and pressure ulcers) and characteristics of nurses' work environment in hospitals. **Chapter 7** examines nurse-perceived quality of care and overall job satisfaction and the relationship with work environment characteristics as perceived by nurses in ICUs, and with characteristics of these nurses. The general discussion with overall results, practical implications and further recommendations is included in **Chapter 8**.

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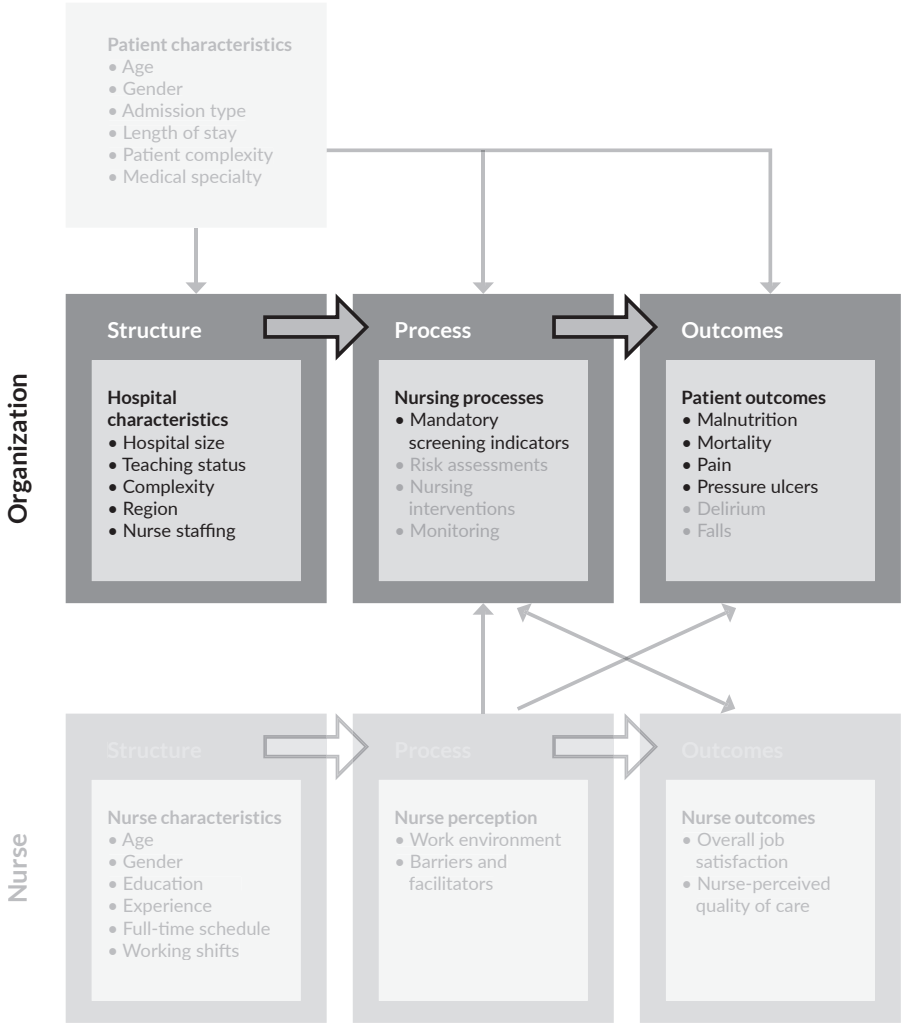
# CHAPTER 1

## USING PUBLICLY REPORTED NURSING-SENSITIVE SCREENING INDICATORS TO MEASURE HOSPITAL PERFORMANCE: THE NETHERLANDS EXPERIENCE IN 2011

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# Abstract

**Background:** Deliberate screening allows detection of health risks that are otherwise not noticeable and allows expedient intervention to minimize complications and optimize outcomes, especially during critical events like hospitalization. Little research has evaluated the usefulness of screening performance and outcome indicators as measures to differentiate nursing quality, although policymakers are using them to benchmark hospitals.
**Aims:** The aims of this study were to examine hospital performance based on nursing-sensitive screening indicators, and to assess associations with hospital characteristics and nursing-sensitive outcomes for patients.
**Methods:** A secondary use of nursing-sensitive data from the Dutch Health Care Inspectorate was performed, including the mandatory screening and outcome indicators related to delirium, malnutrition, pain, and pressure ulcers. The sample consisted of all 93 hospitals in the Netherlands in 2011. High- and low-performing hospitals were determined based on the overall proportion of screened patients. Descriptive statistics and analysis of variance were used to examine screening performances in relation to hospital characteristics and nursing-sensitive outcomes.
**Results:** Over all hospitals, the average screening rates ranged from 59% (delirium) to 94% (pain). Organizational characteristics were not different in high- and low-performing hospitals. The hospitals with the best overall screening performances had significantly better results regarding protein-intake within malnourished patients ($p < .01$). For mortality, marginal significant effects did not remain after controlling for organizational structures. No associations were found with prevalence of pressure ulcers and patient self-reported pain scores.
**Conclusions:** The screening for patient risks is an important nursing task.
Our findings suggest that nursing-sensitive screening indicators may be relevant measures for benchmarking nursing quality in hospitals. Time-trend studies are required to support our findings and to further investigate relations with nursing-sensitive outcomes.

## Introduction

The focus on quality and safety issues in healthcare has increased the demands for public reporting of indicator data. The purpose is to be transparent about clinical quality indicators in order to allow stakeholders to make comparisons between hospitals.[1] Moreover, such indicators are used by regulators for policy purposes and by insurance companies for compensation agreements. Quality indicator data also enable consumers to make informed choices, and offer opportunities for hospital organizations to gain insight into their performances.[2]

Nursing-sensitive indicators, defined as those that ". . . capture care or its outcomes most affected by nursing care" can be used to evaluate nursing quality.[3,4] In many countries (e.g., Australia, Canada, US, UK) efforts have been made to use nursing-sensitive indicators for national benchmarking purposes.[5] For example, many US hospitals voluntarily provide data to the National Database of Nursing Quality Indicators (NDNQI) and use of indicators such as pressure ulcers, falls, and medical errors, are federally mandated in the Minimum Data Set.[6] In the Netherlands, since 2007, the Health Care Inspectorate has required hospitals to publicly report nursing-sensitive indicators defined as delirium, malnutrition, pain, and pressure ulcers (www.ziekenhuizentransparant.nl). Since October 2014, it has also been mandatory for Dutch hospitals to publicly report the hospital standardized mortality ratio (HSMR).[7]

Nurses are the largest group of healthcare professionals in hospitals and, therefore, comparative research on nursing quality and performance is highly relevant. Donabedian's [8] structure-process-outcome framework is often used to assess the quality of nursing care. Outcome indicators refer to patient outcomes that are determined to be nursing-sensitive because they depend on the quantity or quality of nursing care. Process indicators reflect activities completed by nurses when giving care, such as performance of risk assessments and nursing interventions. Indicators of structures for nursing care involve all the factors that affect the context in which care is delivered.[9]

Assessment of healthcare-related risks is a main responsibility of nurses.[10] Based on this statement, screening performance indicators would be particularly useful for assessment of nursing quality. Screening refers to identification of patient risk as a process indicator of quality of hospital nursing care; screening refers to how often patients' risk identification has taken place after admission to the hospital. For example, the number of patients screened for malnutrition on admission and the number of postoperative patients with standardized pain assessments are potential screening indicators of hospital nursing care quality.

## Purpose

In the present study, we aimed to assess nursing care quality in Dutch hospitals using performance of publicly reported nursing-sensitive screening indicators. In order to gain insight into factors that possibly affect these performances, we also examined associations between structural characteristics of the hospitals and performance of screening. In addition, we tested the extent to which overall screening performances were related to nursing-sensitive outcomes of care for patients.

## Background

A vast body of literature exists on quality of nursing care across structure, process, and outcome levels. There is ample evidence of associations between structural workforce characteristics (e.g., skill mix, nurse staffing) and nursing-sensitive outcomes (e.g., occurrences of pressure ulcers, patient falls). Various reviews reported positive effects of higher levels of nurse staffing.[11-14] To date, there has been little evidence on structural hospital characteristics (e.g., teaching status, hospital size) in relation to nursing-sensitive outcomes. For example, only small associations were found between hospital size, university status, geographic location, and nurse-reported impression of quality of care on their nursing unit/ward.[15] Similar results were found with regard to the association between teaching status, bed size, and potentially preventable, adverse events.[16] As mentioned, it is difficult to directly relate structure to outcome because process is mediating the relationship.[17]

The relationship between variations in structure and processes has been examined in previous medical studies. For example, hospital process performance regarding acute myocardial infarction (AMI), heart failure, and pneumonia has been associated with system ownership and number of specialists, but no significant associations were found for region, teaching status, and hospital size.[18,19] Additionally, various attempts have been made to examine process performance in relation to outcomes. Significant associations were found with regard to AMI and mortality.[19-21]

In nursing, these kinds of comparisons have not yet been investigated much in previous studies—especially because process indicators have not often been used to compare nursing performances in hospitals.[22,23] Process indicators, however, may be well-suited for nursing performance assessment for several reasons: (a) evaluating hospital performance based on nursing-sensitive outcome indicators (e.g., pressure ulcers prevalence, patient falls rates) is difficult due to, for example, differential initial risks and complexity of patients, combined with a wide variation in measuring outcomes among hospitals; (b) process indicators are frequently included in large datasets and therefore quicker to obtain; and (c) process indicators are easy to interpret and sensitive to detect differences in quality of care.[24,25] In particular, screening indicators could be valuable as quality measures because of nurses' responsibilities in the screening of risks,[10,26] and the fact that nursing screening processes should occur regardless of the conditions of patients.[27] Additionally, screening allows for early recognition and interventions in high-risk patients which can prevent complications or other adverse events.[28] Therefore, our hypothesis was that although screening indicators may not directly express nursing quality, they can serve as a proxy for the quality outcomes for patients, and as such, these kinds of process indicators could be used to differentiate nursing quality in hospitals.

## Methods

### Design and Data Collection

The study used an observational design and was based on secondary use of data collected in 2011 for administrative and regulatory reporting purposes. The publicly reported hospital data on nursing-sensitive indicators were derived from the national database of the Dutch Health Care Inspectorate (Inspectie voor de Gezondheidszorg, IGZ). The Health Care Inspectorate is responsible for supervision on the quality of healthcare in the Netherlands. The database includes the mandatory reports of quality indicators for all 93 hospitals in the Netherlands. At the end of each year, hospital management is obliged to submit data from all its units (e.g., medical, critical care, step-down) on various, previously defined healthcare indicator sets, including the set of nursing-sensitive indicators.[29] The nursing-sensitive outcome and process indicators are related to delirium, malnutrition, pain, and pressure ulcers. Nurses collect the data on a daily basis. Data are documented in hospital unit-based data management systems. In this cross-sectional study, we used the 2011 data on nursing-sensitive indicators. Children (< 18 years) and day-care patients were excluded from our analyses. The data were provided by Dutch Hospital Data (DHD) which reviewed the study protocol in accordance with the protocol 'DHD-Databases Use' and with local regulations in the Netherlands (i.e., Data Protection Act). The DHD gave formal approval to conduct the study (reference number 12.11.21.01/PH.sdh).

### Measures

***Structure variables.*** We included hospital characteristics previously found to be related to quality of inpatient care [30]: (a) teaching status; (b) region, (c) patient complexity; (d) hospital size; and (e) nursing full-time equivalents. Teaching status was categorized as non-teaching hospitals (general hospitals without teaching status), teaching hospitals (general hospitals with teaching status), and academic hospitals (university hospitals with teaching status, including a medical faculty). For region, a division was made between hospitals in urban areas (> 100,000 inhabitants) and rural areas (≤100,000 inhabitants). Patient complexity was measured by comparing high technology and non-high technology hospitals; high technology hospitals were "… those that perform open-heart surgery and/or organ transplant surgery".[31] The annual reports of each hospital provided us these data, as well as the number of licensed beds (i.e., hospital size). Nursing full-time equivalents was included as a nursing workforce measure. The Netherlands Federation of University Medical Centers and the Dutch Hospital Association provided us the numbers on full-time equivalents (FTEs) of nurses per hospital in 2011.

***Process variables.*** We analyzed the five mandatory screening indicators: (a) proportion of patients screened for delirium, according to the Dutch delirium guideline for adults; (b) proportion of patients observed with delirium (i.e., with positive delirium screens who were subsequently reassessed at least once using the screening instruments Delirium Observation Screening or Confusion Assessment Method); (c) proportion of patients screened for malnutrition, using the Short Nutritional Assessment Questionnaire (SNAQ) or Malnutrition Universal Screening Tool (MUST); (d) proportion of postoperative patients in the recovery room with pain assessed, using a visual analogue scale (VAS) with scores ranging from 0= *no pain* to 10= *worst pain imaginable*; and (e) proportion of postoperative patients in hospital units with pain assessed using the VAS pain intensity tool. Table 1 contains definitions of all indicators and related data collection methods.

***Outcome variables.*** The mandatory nursing-sensitive outcome indicators were used: (a) proportion of malnourished patients with an adequate protein-intake; (b) prevalence of pressure ulcers; (c) severe pain after surgery (VAS>7); and (d) hospital standardized mortality ratio (HSMR) (see Table 1). The HSMR was only available for 47 hospitals because it has only been mandatory to publicly report these data since 2014.

***Table 1.*** *Definitions of nursing-sensitive indicators.*

| | Indicator computation [b] | | |
|---|---|---|---|
| **Type/indicator [a]** | **Numerator** | **Denominator** | **Comments** |
| Process | | | |
| Delirium screen | Units: with > 80% of patients ≥ 70 years screened | Units: with admitted patients ≥ 70 years | Risk indicated by ≥ 1 positive answer<br>• memory problems<br>• help with self-care prior 24 hours<br>• confusion during past hospitalization/illness [c] |
| Delirium observation | Patients: with CAM or DOS measured at least once | Patients: at risk of delirium | • CAM (short version) sensitivity = 53-90%, specificity = 84-100%<br>• DOS scale sensitivity = 89-100%, specificity = 88-97% [d] |
| Malnutrition screen | Patients: adults screened on admission | Patients: adults admitted | • MUST sensitivity = 73-96%, specificity = 80-82% [e]<br>• SNAQ sensitivity = 76-88%, specificity = 83-91% [f] |
| Pain assessment | • Patients/postoperative: pain assessment in RR<br>• Patients/postoperative: pain assessment on ward | • Patients/postoperative admitted to RR<br>• Patients/postoperative admitted to ward | • $r$ = .71-.99 between four pain intensity scales: VAS (verbal descriptive scale), numeric rating scale (NRS), verbal descriptor scale (VDS), and the Faces Pain Scale Revised (FPS-R) [g] |

| Outcome | | | |
|---|---|---|---|
| Malnutrition treatment | Patients/severe malnutrition with adequate protein intake on 4th hospital day | Patients/severe malnutrition on day five during one of four sampling days | • SNAQ ≥ 3 or MUST ≥2: severe malnutrition<br>• Adequate protein intake: 1.2-1.5 g/kg body weight [h] |
| Pressure ulcer | Patients: grade 2-4 pressure ulcer or skin lesions related to incontinence | Patients examined | • Data collection: wound counselor |
| Pain: severe post-operative | Patients: severe pain first 72 postoperative hours | Patients assessed, at least 6 occasions | • VAS: scores > 7<br>• Data collection: nurse in internal data systems |
| HSMR [i] | Patients: acute in-hospital death | Expected in-hospital deaths, adjusted for case mix, standardized at 100 | • Data collection: hospitals |

*Note.* CAM = Confusion Assessment Method; DOS = Delirium Observation Screening; HSMR = hospital standardized mortality ratio; MUST = Malnutrition Universal Screening Tool; RR = recovery room; SNAQ = Short Nutritional Assessment Questionnaire; VAS = Visual Analogue Scale. [a] Indicators mandated by the Dutch Health Care Inspectorate [29]; [b] Frequencies based on annual numbers in 2011, except: treatment malnutrition was assessed annually on four sampling days and pressure ulcer prevalence was evaluated at a fixed time during the year; [c] Dutch Association of Clinical Geriatrics [38]; [d] Richtlijnendatabase [39]; [e] Neelemaat et al.[40]; [f] Kruizenga et al.[41]; [g] Li et al.[42]; [h] Advisory Committee Undernutrition [43]; [i] Dutch Hospital Association.[7]

### Statistical Analysis

To evaluate the robustness of the dataset, we explored its stability by Pearson correlations between sets of data over two consecutive years: 2010 and 2011. For all other analyses, we used the most recent dataset from 2011.

First, to assess screening performances in the 93 hospitals, we determined the mean percentages of patients screened for delirium, malnutrition, and pain. In addition, we categorized hospitals into high- and low-performing hospitals on the basis of multiple indicators. This is in line with a review by Taylor et al.,[32] emphasizing the need to analyze hospital performance on a range of indicators in order to give a more comprehensive picture of performances. For each of the five screening indicators, we identified the mean, the median, (50th percentile), and the interquartile range (IQR). High-performing hospitals were the hospitals with the best screening performances; those hospitals without any of the screening indicators ranked in the lower quartiles. Low-performing hospitals were the hospitals with the least screening performances; those hospitals with three or more of the screening indicators ranked in the lower quartiles. All other hospitals were defined as intermediate-performing hospitals. Some hospitals did not provide data on one or more screening indicators (missing values). These hospitals were treated as non-responders and, therefore, were included in the lower quartile of that specific indicator. For example, hospital A could not report delirium-screening data, because these data were not yet available in 2011. As a result, hospital A was put in the lower quartile of the indicator screening delirium. We used $\chi^2$ tests for independence to assess associations between hospital characteristics and overall screening performance.

Second, we used analysis of variance (ANOVA) to identify the influence of hospital characteristics on hospital performance on each screening indicator. Normality assumptions were assessed using the Kolmogorov-Smirnov test. Then, ANOVAs with Bonferroni corrections for multiple post-hoc comparisons were used to examine hospital screening performance in relation to nursing-sensitive outcomes. Follow-up tests (including adjustments for the hospital characteristics (hospital size and nursing full-time equivalents) were performed when the omnibus test was significant. Nominal type 1 error rate of .05 was used for follow-up tests. IBM SPSS Statistics for Windows (version 21) was used for the analyses.

## Results

Characteristics of the 93 hospitals are presented in the first column of Table 2.
The hospitals in the Netherlands are mainly nonteaching (59%), non-high technology (83%) hospitals, located in rural areas (57%)/ Most of the hospitals are middle sized (300-600 beds; 400-800 nursing FTE).

In the preliminary analysis comparing indicators in the datasets from 2010 and 2011, correlations showed moderate stability for all nursing-sensitive indicators, ranging from a correlation of $r$ = .42 (prevalence pressure ulcers) to $r$ =. 67 (pain assessment units). These findings indicate that year-over-year performance was reasonably stable.

***Table 2.*** *Hospital characteristics: all hospitals and by performance level.*

| | **All** (***n*** = 93) | | **High** (***n*** = 23) | | **Intermediate** (***n*** = 53) | | **Low** (***n*** = 17) | | |
|---|---|---|---|---|---|---|---|---|---|
| **Characteristic** | ***n*** | (%) | ***n*** | (%) | ***n*** | (%) | ***n*** | (%) | ***p*** [a] |
| **Teaching status** | | | | | | | | | .63 |
| Academic | 8 | (8.6) | 1 | (4.3) | 6 | (11.3) | 1 | (5.9) | |
| Teaching | 30 | (32.3) | 10 | (43.5) | 15 | (28.3) | 5 | (29.4) | |
| Nonteaching | 55 | (59.1) | 12 | (52.2) | 32 | (60.4) | 11 | (64.7) | |
| **Region** | | | | | | | | | .31 |
| Urban | 40 | (43.0) | 13 | (56.5) | 21 | (39.6) | 6 | (35.3) | |
| Rural | 53 | (57.0) | 10 | (43.5) | 32 | (60.4) | 11 | (64.7) | |
| **Complexity** | | | | | | | | | .99 |
| High technology | 16 | (17.2) | 4 | (17.4) | 9 | (17.0) | 3 | (17.6) | |
| Non-high technology | 77 | (82.8) | 19 | (82.6) | 44 | (83.0) | 14 | (82.4) | |
| **Hospital beds** | | | | | | | | | .25 |
| < 300 | 28 | (30.1) | 4 | (17.4) | 18 | (34.0) | 6 | (35.3) | |
| 300-600 | 36 | (38.7) | 13 | (56.5) | 19 | (35.8) | 4 | (23.5) | |
| > 600 | 29 | (31.2) | 6 | (26.1) | 16 | (30.2) | 7 | (41.2) | |
| **Nursing FTE** [b] | | | | | | | | | .36 |
| < 400 | 29 | (31.2) | 8 | (38.1) | 17 | (35.4) | 4 | (33.3) | |
| 400-800 | 31 | (33.3) | 6 | (28.6) | 22 | (45.8) | 3 | (25.0) | |
| > 800 | 21 | (22.6) | 7 | (33.3) | 9 | (18.8) | 5 | (41.7) | |

*Note.* FTE = full time equivalent. [a] $\chi^2$ test for independence. [b] Missing for 12 hospitals

### Screening prevalence

Across the hospitals, the highest screening proportions were found for the indicators of pain; particularly pain assessment in the recovery room (*M* = 94%, Median = 98.9%, Q1 = 90.3%, Q3 = 100%, IQR = 9.7). In contrast, delirium showed relatively low screening rates with mean values of 58.5% for observation of delirium 64.9% for screening of delirium. Furthermore, large variation was found between the lower and upper quartiles of these screening indicators of delirium; for screening delirium Q1 was 39.6% and Q3 was 100% (IQR = 60.4), and for observation of delirium Q1 was 32.9% and Q3 was 83.8% (IQR = 50.9). The mean value of screening of malnutrition was a little over 77% (Median = 80.9%, Q1 = 67.6%, Q3 =88.1%, IQR = 20.5).

### Associations with hospital characteristics

Based on the criterion of having none of the individual screening indicators ranked in the lower quartiles, 23 hospitals, were labeled as high-performing hospitals. There were 53 intermediate-performing hospitals and 17 hospitals coded as low-performing hospitals. In Table 2, it is shown that the hospital characteristics (teaching status, region, complexity, beds, nursing FTEs) were not statistically associated with overall screening performance (high, intermediate, or low).

Table 3 reveals the associations between prevalence for each process indicator (delirium screening; delirium observations malnutrition screens; pain assessment in the recovery room and hospital unit) and hospital characteristics. Hospitals with the lowest number of FTEs (< 400) had the highest proportion of patients screened for delirium ($p < .05$). Teaching hospitals had the most favorable screening performances for pain assessment in hospital units ($p < .05$). A positive trend was found for teaching hospitals in relation to the screening of malnutrition ($p < .07$).

***Table 3.*** *Screening indicators by hospital characteristics.*

| | Delirium screening (*n* = 76) | | | Delirium observation (*n* = 70) | | | Malnutrition screening (*n* = 93) | | | Pain assessment recovery room (*n* = 93) | | | Pain assessment hospital unit (*n* = 91) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Characteristic** | *M* | *(SD)* | *p* | *M* | *(SD)* | *p* | *M* | *(SD)* | *p* | *M* | *(SD)* | *p* | *M* | *(SD)* | *p* |
| **Teaching status** | | | .22 | | | .49 | | | .07 | | | .44 | | | .05 |
| Academic | 58.6 | (23.3) | | 48.6 | (26.3) | | 69.4 | (21.9) | | 96.3 | (7.2) | | 70.7 | (10.6) | |
| Teaching | 57.3 | (33.1) | | 63.3 | (26.3) | | 81.6 | (13.2) | | 95.0 | (6.1) | | 85.2 | (13.9) | |
| Nonteaching | 70.5 | (32.5) | | 57.1 | (30.9) | | 76.0 | (14.2) | | 92.7 | (11.3) | | 77.2 | (16.5) | |
| **Region** | | | .82 | | | .42 | | | .37 | | | .29 | | | .22 |
| Urban | 63.9 | (28.6) | | 61.7 | (28.2) | | 78.8 | (14.7) | | 95.0 | (10.0) | | 81.7 | (15.4) | |
| Rural | 65.7 | (35.0) | | 56.1 | (29.6) | | 76.0 | (15.1) | | 92.8 | (9.3) | | 77.6 | (16.0) | |
| **Complexity** | | | .31 | | | .87 | | | .40 | | | .14 | | | .40 |
| High technology | 57.2 | (25.5) | | 57.2 | (31.3) | | 74.4 | (18.6) | | 97.0 | (5.7) | | 76.2 | (15.2) | |
| Non-high technology | 66.8 | (33.5) | | 58.8 | (28.8) | | 77.8 | (14.1) | | 93.1 | (10.1) | | 80.0 | (15.9) | |
| **Hospital beds** | | | .12 | | | .18 | | | .89 | | | .37 | | | .65 |
| < 300 | 73.6 | (27.6) | | 49.0 | (32.7) | | 76.1 | (16.6) | | 91.8 | (10.4) | | 78.1 | (14.8) | |
| 300-600 | 66.7 | (34.3) | | 64.4 | (27.2) | | 77.9 | (12.0) | | 93.9 | (11.0) | | 78.5 | (16.9) | |
| > 600 | 54.2 | (31.5) | | 59.0 | (26.3) | | 77.4 | (16.8) | | 95.4 | (6.4) | | 81.7 | (15.5) | |
| **Nursing FTE** | | | .05 | | | .35 | | | .91 | | | .79 | | | .98 |
| < 400 | 80.7 | (24.5) | | 54.0 | (31.0) | | 79.2 | (14.1) | | 92.2 | (10.2) | | 81.3 | (15.4) | |
| 400-800 | 50.0 | (34.8) | | 60.0 | (28.5) | | 77.6 | (12.2) | | 93.6 | (11.1) | | 80.7 | (14.1) | |
| > 800 | 65.1 | (28.1) | | 67.8 | (24.5) | | 78.7 | (16.8) | | 94.1 | (7.1) | | 81.6 | (16.7) | |

*Note.* Entries are mean percentages and SDs for percentages. *p*-values are for ANOVA results. FTE = full-time equivalent; *SD* = standard deviation.

### Relationships with nursing-sensitive outcomes

Table 4 reports that there was a significant positive association between overall screening performance and the outcome of protein-intake ($p < .05$); a higher proportion of malnourished patients had an adequate protein-intake in high-performing hospitals, as compared to low-performing and intermediate-performing hospitals. Post-hoc analysis confirmed the differences between the highest- and lowest-performing hospitals regarding protein-intake, by showing that the associations remained after adjusting for hospital characteristics ($F_{2,74} = 5.51$, $p < .01$, $\eta^2 = .13$). In addition, mortality trended lower in high-performing hospitals ($p < .09$); however, the trend was not apparent after adjusting for hospital characteristics.
Because HSMR was available for only a subset of hospitals, we examined associations between availability of HSMR and nursing sensitive indicators; there were no statistically significant associations with process indicators, treatment of malnutrition or severe pain but prevalence of pressure ulcers was higher in hospitals that did not report HSMR. Details are available as Supplemental Digital Content.

***Table 4.*** *Hospital performance by screening indicators and relation with nursing-sensitive outcomes.*

| | **Adequate protein (*n* = 90)** | | | **Severe pain [a] (*n* = 91)** | | | **Pressure ulcer (*n* = 93)** | | | **HSMR (*n* = 47)** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Performance** | ***M*** | **Min** | **Max** | ***M*** | **Min** | **Max** | ***M*** | **Min** | **Max** | ***M*** | **Min** | **Max** |
| Low | 35.5 | 23.4 | 47.6 | 6.5 | 4.2 | 8.9 | 3.6 | 2.5 | 4.7 | 106.2 | 98.0 | 114.5 |
| Intermediate | 44.9 | 39.1 | 50.7 | 7.1 | 6.1 | 8.1 | 3.0 | 2.4 | 3.5 | 97.6 | 92.4 | 102.8 |
| High | 53.5 | 43.3 | 63.8 | 6.0 | 4.3 | 7.7 | 3.0 | 2.2 | 3.8 | 91.9 | 79.9 | 103.9 |
| *p* | .05 | | | .50 | | | .46 | | | .09 | | |

*Note.* Entries are mean prevalence for adequate protein intake, severe pain, and pressure ulcers and mean mortality ratio for HSMR. HSMR = hospital standardized mortality rate; Max = maximum; Min = minimum; VAS = Visual Analogue Scale. [a] VAS > 7.

## Discussion

Measurement of quality of nursing care by the use of screening indicators is relevant and useful, because these indicators reflect nurses' responsibilities towards assessments of healthcare-related risks and subsequent interventions. Previous research on the relationship with outcomes is limited. Based on analyses of nursing-sensitive screening data, including all 93 hospitals in the Netherlands, our data showed that hospitals with the best overall screening performance also had the best achievement regarding protein-intake in malnourished patients. For mortality, initial differences between hospitals disappeared after controlling for organizational structures of the hospitals. These findings partially confirm our hypothesis that the easier-to-measure screening indicators can be predictors of the outcomes of nursing care for patients. This is because we did not find associations with the other included nursing-sensitive outcomes (i.e., pain score and pressure ulcer prevalence). To the best of our knowledge, this is one of the first scientific endeavors to assess quality of nursing care in hospitals based on process indicators instead of outcome indicators. Investigations of time-trends and performances over a longer period of time are required to show causality of the relations.

An important finding was that relevant differences exist in how the full population of Dutch hospitals, including approximately 1.7 million admissions in 2011,[33] scored on a range of nursing-sensitive screening indicators. With regard to the screening indicators of delirium and malnutrition, we reported low-screening proportions, as opposed to the high number of patients screened for pain. Internationally, delirium and malnutrition are not regularly used for benchmarking purposes, but in the Netherlands, the Healthcare Inspectorate determined that these indicators could be used as measures of nursing care quality. There is much debate about the degree to which some indicators, such as delirium and malnutrition, are sensitive to nursing care. Arend and Christensen,[34] in their review on the presence and effects of delirium in intensive care units, concluded that routine screening of all patients is essential for preventing and managing delirium. An international study on nutritional status in nursing homes in Austria, Switzerland and the Netherlands acknowledged the important role of nurses in screening and intervening to counter malnutrition.[35] Based on our findings, it is worth reconsidering the value of these specific indicators in evaluating nursing quality and, therefore, further empirical studies to determine the nurse-sensitivity of quality indicators are required.

A relevant consideration in the debates on assessing quality is whether nursing quality is indeed lower in some hospitals compared to other hospitals, or whether differences are a reflection of hospital organizational characteristics. In the medical literature, evidence has been found for associations between hospital performance on a combined set of medical process indicators and various hospital characteristics.[18,19] In our analyses, we used similar hospital characteristics (e.g., teaching status, hospital size, full-time equivalent); however, we were not able to show significant associations between the overall performance of screening indicators in hospitals and the hospital characteristics we studied. In line with results from a study on patient safety indicators,[16] we also only found relevant relationships with some individual nursing-sensitive screening indicators. This implies that, besides organizational characteristics, other factors such as characteristics of nursing may be important with regard to nurses' screening performances. For example, a recent study on screening for malnutrition in Dutch hospitals between 2007 and 2010 demonstrated that nursing factors such as high workload and lack of engagement were important in relation to screening rates.[36] Nursing leadership styles and autonomy, previously found to be relevant in relation to nursing practices and decision-making processes,[37] may be at play. Hence, it is necessary to understand where breakdowns in nursing care occur. , Further empirical research should be performed to assess nursing factors in relation to screening performances of nurses.

### Strengths and Limitations

The full population of hospitals in the Netherlands was included, thereby reducing potential bias from non-motivated hospitals. A disadvantage is that the data were self-reported by hospitals, which potentially may have led to underestimation of the real effects. Longitudinal follow-up studies are necessary to find causal links between screening activities and nursing-sensitive patient outcomes.

Although Dutch hospitals are obliged to publicly report all of the nursing-sensitive indicators, there was some missing data which prevented us from extracting a composite index for each hospital. Underreporting is a known phenomenon, which is difficult to counter, and can cause bias.[25] However, the mandatory character of the dataset achieves more participation compared to voluntary public reporting systems. In contrast to previous studies that focused on one specific indicator,[36] we determined high- and low-performing hospitals on a wide range of screening indicators, enabling us to make statements about the total screening performances of hospitals. Future research using patient-level data, in addition to the hospital-level data used in this study, is necessary in order to increase knowledge on associations with patient characteristics.

It is difficult to compare our results with international research, as some of the publicly reported indicators in the Netherlands (i.e., delirium and malnutrition) are not mandatory to report in other countries. In line with this, data on nurse characteristics, such as the educational background of nurses, were not available for all hospitals. This is because formal function differentiation has not yet been introduced in the Netherlands, and nurses of all educational levels (bachelor's degree and associate's degree) basically perform the same work activities. Future research should focus on examining screening performances in relation to nurse characteristics.

## Conclusions

Nursing-sensitive screening indicators are increasingly relevant as they offer opportunities to differentiate desirable versus less desirable quality of care provided by nurses—the only healthcare professionals at a patient's bedside 24 hours a day. In this study, we have shown that hospitals with high-performances regarding nursing screening processes did not differ from low-performing hospitals in terms of organizational characteristics. However, in relation to patient outcomes, hospitals with the highest proportions of screened patients had significantly more favorable results regarding protein-intake in malnourished patients and mortality rates, as compared to hospitals with lower screening proportions. The present study provides another step in research on nursing-sensitive screening indicators as measures to benchmark nursing quality in hospitals, by demonstrating that overall screening processes could be predictive for nursing-sensitive outcomes for patients. There is no time for "merely rating" the delivered quality of care; rather, nursing-sensitive screening indicators should be used for "truly indicating" the provided nursing care.

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## Supplemental Digital Content

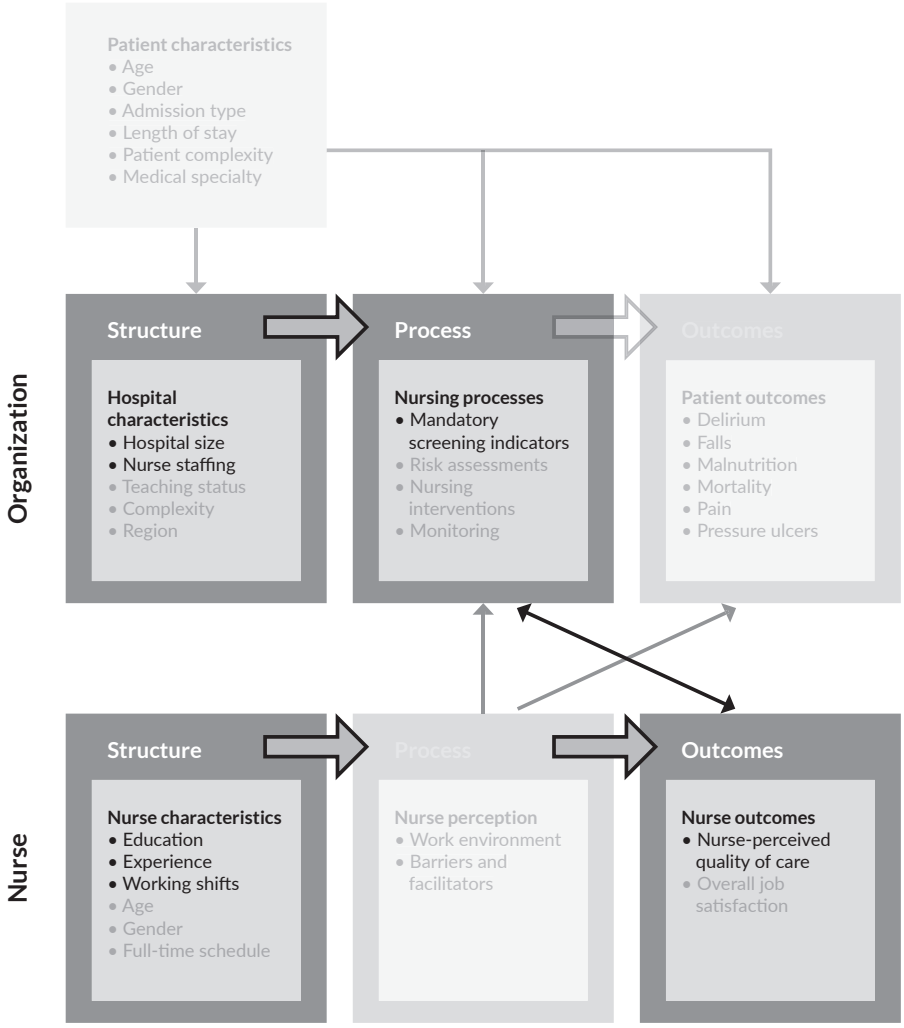
### Screening and outcome indicators in hospitals with and without HSMR

| | HSMR provided by hospitals | | Significance level |
|---|---|---|---|
| **Nursing-sensitive indicators** | yes | no | |
| | *n*=47 | *n*=46 | *p* |
| *Process indicators* | | | |
| Screening delirium | 60.8 | 69.1 | .26 |
| Observation delirium | 53.0 | 65.0 | .08 |
| Screening malnutrition | 76.4 | 78.1 | .59 |
| Pain assessment | | | |
| Recovery room | 95.5 | 92.0 | .08 |
| Hospital units | 80.2 | 78.5 | .62 |
| Overall screening performance | | | |
| High | 43.5 | 56.5 | .74 |
| Intermediate | 52.8 | 47.2 | |
| Low | 52.9 | 47.1 | |
| *Outcome indicators* | | | |
| Treatment malnutrition | 44.7 | 46.4 | .73 |
| Prevalence pressure ulcers | 2.6 | 3.5 | .02 |
| Severe pain score | 6.2 | 7.3 | .16 |

# CHAPTER 2

## CONCORDANCE BETWEEN NURSE-REPORTED QUALITY OF CARE AND QUALITY OF CARE AS PUBLICLY REPORTED BY NURSE-SENSITIVE INDICATORS



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# Abstract

**Background:** Nurse-sensitive indicators and nurses' satisfaction with the quality of care are two commonly used ways to measure quality of nursing care. However, little is known about the relationship between these kinds of measures.
**Aims:** This study aimed to examine concordance between nurse-sensitive screening indicators and nurse-perceived quality of care.
**Methods:** To calculate a composite performance score for each of six Dutch non-university teaching hospitals, the percentage scores of the publicly reported nurse-sensitive indicators: screening of delirium, screening of malnutrition, and pain assessments, were averaged (2011). Nurse-perceived quality ratings were obtained from staff nurses working in the same hospitals by the Dutch Essentials of Magnetism II survey (2010). Concordance between the quality measures was analyzed using Spearman's rank correlation.
**Results:** The mean screening performances ranged from 63 % to 93 % across the six hospitals. Nurse-perceived quality of care differed significantly between the hospitals, also after adjusting for nursing experience, educational level, and regularity of shifts. The hospitals with high-levels of nurse-perceived quality were also high-performing hospitals according to nurse-sensitive indicators. The relationship was true for high-performing as well as lower-performing hospitals, with strong correlations between the two quality measures ($r_s = 0.943$, $p = 0.005$).
**Conclusions:** Our findings showed that there is a significant positive association between objectively measured nurse-sensitive screening indicators and subjectively measured perception of quality. Moreover, the two indicators of quality of nursing care provide corresponding quality rankings. This implies that improving factors that are associated with nurses' perception of what they believe to be quality of care may also lead to better screening processes. Although convergent validity seems to be established, we emphasize that different kinds of quality measures could be used to complement each other, because various stakeholders may assign different values to the quality of nursing care.

## Background

Nursing care quality is important, because it is linked to patient safety, patient satisfaction, and other health care outcomes.[1,2] However, assessing a multi-faceted concept such as quality of care has many challenges. Quality indicators are commonly used measures to gain insight into health care organizations' performance regarding the quality of care provided. With regard to nursing quality, nurse-sensitive indicators are used, defined as "those outcomes that are relevant, based on nurses' scope and domain of practice, and for which there is empirical evidence linking nursing inputs and interventions to the outcome for patients".[3,4] Health care systems across the world use the public reporting of these indicators for benchmarking purposes. Transparency of quality is of great importance for informed decision-making by various stakeholders, such as health care providers, consumers, insurance companies and policy makers.[5] As in other countries, all hospitals in the Netherlands annually have to report on a mandatory set of nurse-sensitive indicators. Since 2007, the Dutch Health Care Inspectorate requires hospitals to publicly report indicators, such as delirium, malnutrition, pain and pressure ulcers.[6]

In the literature, there is much debate about the reliability and validity of nurse-sensitive indicators. For example, studies by Doran and colleagues [7] and Maas et al.[8] showed that nurses are able to collect reliable data regarding indicators (e.g., pain). On the other hand, the need for methodological checks of indicators as accurate measures of quality is also emphasized by various authors.[9-11] To contribute to the existing literature about nurse-sensitive indicators, the aim of the present study is to explore the convergent validity of these quality indicators by examining the correspondence with a nurse-reported measure of quality, namely nurses' perception of the quality of care. Where nurse-sensitive indicators provide a quantitative basis to monitor and evaluate nursing care and are referred to as objective quality measures, nurse-reported measures are used to determine nurses' perceptions and are referred to as subjective quality measures.[12]

Regarding the objective measures, our focus is on nurse-sensitive screening indicators, referring to how often patients' risk identification has taken place after admission to the hospital. Screening of health risks is one of the core duties of nurses and therefore well-suited as an indicator of care quality.[13] Furthermore, screening indicators are relatively easy to obtain and hospitals can be compared based on their performance without the complex task of adjusting for differences in patients' risks in the various hospitals.[14] We investigated data from six non-university teaching hospitals in the Netherlands. We examined: (i) the performance of each hospital on the following nurse-sensitive screening indicators: delirium, malnutrition, and pain assessments, (ii) nurses' perception of the quality of care; and whether any statistical differences between the hospitals can be ascribed to differences in nurse characteristics, and (iii) whether there is concordance between the two measures of quality of nursing care.

## Methods

### Study design and sample

This cross-sectional study included data from staff nurses working in one of six non-university teaching hospitals located in different parts of the Netherlands. In the Dutch health care setting, teaching hospitals are general hospitals with a transcending regional role and a teaching status. These hospitals are not equal to academic hospitals, as in many other countries (e.g., USA, Canada), because the university based faculty and a specific research role are not present.[15] The data concerning hospital characteristics, such as hospital size (number of licensed beds) and nursing full-time equivalents (FTE) were supplied by the hospital organizations themselves and the Dutch Hospital Association.

### Nurses' perception of quality of care

In the year 2010, the Dutch Nurses' Association issued the Dutch version of the Essentials of Magnetism II survey (D-EoM II) to all contracted staff nurses of the six hospitals. The D-EoM II survey, a validated instrument, asks nurses questions about their work environment, quality of care in their department, job satisfaction, and demographic characteristics.[16,17] In this study, we used the scores from the question regarding nurse-perceived quality of care: 'On a scale of 1 to 10, with 1 representing 'dangerously low quality' and 10 representing 'very high quality', how do you rate the quality of patient care in your own hospital unit?' The overall response rate to the survey was 53.3 % and 2338 nurses (=46.8 %) answered all the questions, including the nurse-perceived quality of care score.

We included the following demographic characteristics of nurses: (i) experience, (ii) education level, and (iii) working shift. Experience in nursing was expressed in years and was categorized per 5 years, ranging from less than 5 years to over 30 years. Nurses' education level was defined as: (i) Registered Nurses (RNs) with an Associate's degree in nursing, (ii) RNs with a Bachelor's degree in nursing, and (iii) RNs with a Bachelor's degree and additional training; with differences regarding complexity of roles and degree of responsibilities.[18] Working shift referred to the kinds of shifts that nurses work, including: (i) fixed shifts (i.e., exclusively day shifts, evening shifts or night shifts), and (ii) rotating shifts. We did not include the effect of gender, because the sample almost exclusively consisted of women. We also decided to exclude age from the analyses, because the years of experience were strongly co-related to age.

### Nurse-sensitive indicators

The national database of the Dutch Health Care Inspectorate was used to obtain nurse-sensitive indicator data. At the end of each year, all Dutch hospitals use their internal data management systems to extract the previously defined and legislated quality indicators. The data are publicly reported on a website (www.ziekenhuizentransparant.nl). In this study, the 2011 dataset was used, including five nurse-sensitive screening indicators concerning delirium, malnutrition, and pain.[19] The definitions and data collection methods are presented in Table 1.

***Table 1.*** *Definitions of nurse-sensitive screening indicators.*

| Indicators | Definition by numerator-denominator | Data collection |
|---|---|---|
| Screening of delirium | Number of hospital units in which a risk score was included in the medical record for more than 80% of all patients 70 years and older | Collected yearly from hospital unit-based data management systems. Submitted to the Inspectorate yearly by hospital organizations. |
| | Total number of hospital units with admitted patients 70 years and older | |
| Observation of delirium | Number of patients observed at least once using the measuring methods of DOSS or CAM for the presence of delirium, regardless of the outcome | Collected daily from hospital unit-based data management systems. Submitted to the Inspectorate yearly by hospital organizations. |
| | Total number of patients with an increased risk of delirium ('screening of delirium') | |
| Screening of malnutrition | Number of adult patients which on admission are screened for malnutrition | Collected daily from hospital unit-based data management systems. Submitted to the Inspectorate yearly by hospital organizations. |
| | Total number of clinically admitted adult patients in a year | |
| Standardized pain assessment in postoperative patients in the recovery room | Number of clinical postoperative patients with a standardized pain assessment in the recovery room | Collected daily from hospital unit-based data management systems. Submitted to the Inspectorate yearly by hospital organizations. |
| | Total number of clinical postoperative patients in the recovery room | |
| Standardized pain assessment in postoperative patients in hospital units | Number of clinical postoperative patients with a standardized pain assessment in hospital units | Collected daily from hospital unit-based data management systems. Submitted to the Inspectorate yearly by hospital organizations. |
| | Total number of clinical postoperative patients in hospital units | |

Inspectie voor de Gezondheidszorg. Kwaliteitsindicatoren. Basisset ziekenhuizen 2011.[19]

### Ethical statement

This research was executed in compliance with the Helsinki Declaration. The Dutch Hospital Data (DHD) reviewed the study protocol in accordance with the protocol 'DHD-databases use' and with local regulations in the Netherlands (Data Protection Act), and gave formal approval to conduct the study (reference number 12.11.21.01/PH.sdh.). Nurses' participation in the survey study was voluntary and anonymous. It was mentioned to them that completing and submitting the survey automatically meant that they gave informed consent.

**Statistical analysis**

First, descriptive statistics were used to characterize the staff nurses in our sample. To test differences in quality scores among stratified groups of nurses, we used analysis of variance (ANOVA) with Bonferroni post-hoc tests (adjusting for multiple comparisons). The assumptions of normally distributed data were met by normality plots of this large sample. We used univariate general linear models (GLM) to analyze differences in perceived quality between the six hospitals; adjusting for the nurse characteristics (experience, education level, working shifts) by including them into the model simultaneously.

To categorize nurse-perceived quality of care, we determined the percentage of satisfied nurses per hospital; the higher the percentage, the higher hospitals' performance. Nurses who gave a quality score of ≥ 8 (on a scale from 1 to 10) were labeled 'very satisfied', 'satisfied' refers to ≥ 6-8 and 'not satisfied' refers to < 6. Additionally, we ranked the hospitals ranging from 1$^{st}$ to 6$^{th}$, in which the ranking value of 1$^{st}$ represents the highest-performing hospital (i.e., hospital with the highest percentage of satisfied and very satisfied nurses). We considered nurse-perceived quality of care as a subjective measure regarding nursing quality (i.e., influenced by the nurse's personal judgment).

Regarding nurse-sensitive indicators, we calculated a composite score to address each of the six hospitals' performance level. A valid and simple method to compose a composite score is by averaging percentages.[20,21] The percentages on the five screening indicators, as described by numerator and denominator in Table 1, were used for this purpose. The composite scores for each hospital were used to categorize the quality of hospitals; the higher the percentage, the higher hospitals' performance. We ranked the hospitals ranging from 1$^{st}$ to 6$^{th}$, in which the ranking values of 1$^{st}$ resembles the highest-performing hospital (i.e., hospital with the highest mean composite score). We considered nurse-sensitive indicators as objective measures of nursing quality (i.e. involving an impartial measurement, that is, without bias or prejudice).

To test the association between the objective indicators of care and nurses' perception of care, we took the mean composite hospital score on the indicators and correlated that with the percentage of satisfied nurses per hospital. Due to the fact that these analyses were conducted at the hospital-level, we used Spearman's Rho correlation which is the appropriate method in this context as it is known to compare differences in rank-order. All statistical analyses were conducted using SPSS version 22.

## Results

The characteristics of nurses and the six hospitals are shown in Table 2. Nursing experience ranged between 1 and 40 years, with an average of 16.8 years across the sample. Predominantly nurses had at least a Bachelor's degree (64.9 %) and were working rotating shifts (80.6 %). The majority of hospitals were mid-sized; there were two larger hospitals, with more than 1000 licensed beds and more than 1000 nursing FTE.

The mean perceived quality scores for the hospitals ranged from 6.61 ($SD = 1.24$) to 7.11 ($SD = 1.09$). There was a strong positive correlation between years of experience and nurse-perceived quality; more experienced nurses were significantly more satisfied than less experienced nurses. Additionally, nurses with 20 to 25 years of experience were most satisfied, followed by nurses with 25 and 30 or more years of experience. RNs with an Associate's degree were significantly less satisfied as compared to RNs with a Bachelor's degree. Regarding working shifts, it was shown that nurses working fixed shifts were more satisfied than nurses working rotating shifts. Nurses working dayshifts were most satisfied with the quality of care in their hospital. The differences between the six hospitals were significant [$F(5, 2332) = 8.397$; $p < 0.01$] and post-hoc tests revealed that Hospital C had a significantly lower mean score, as opposed to the other hospitals. These differences could not be attributed to nurse characteristics (experience, education and working shifts), because after controlling for these characteristics the effects remained significant [$F(5, 2284) = 3.011$; $p = 0.01$].

***Table 2.*** *Demographic characteristics of the study sample.*

| | Licensed beds | Nursing FTE | Nurses | Experience | | Education level | | | | | | Working shifts [a] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Associate | | Bachelor | | Bachelor+ | | Fixed | | Rotating | |
| | *N* | *N* | *N* | Mean | SD | *N* | % | *N* | % | *N* | % | *N* | % | *N* | % |
| All hospitals | | | 2338 | 16.76 | 11.13 | 821 | 35.1 | 1131 | 48.4 | 386 | 16.5 | 447 | 19.4 | 1862 | 80.6 |
| Hospital A | 1102 | 1198 | 452 | 16.54 | 11.50 | 221 | 48.9 | 177 | 39.2 | 54 | 11.9 | 112 | 24.8 | 337 | 74.6 |
| Hospital B | 663 | 808 | 314 | 18.12 | 10.50 | 119 | 37.9 | 146 | 46.5 | 49 | 15.6 | 70 | 22.3 | 237 | 75.5 |
| Hospital C | 696 | 964 | 326 | 14.63 | 10.90 | 123 | 37.7 | 159 | 48.8 | 44 | 13.5 | 52 | 16.0 | 272 | 83.4 |
| Hospital D | 580 | 795 | 348 | 18.49 | 11.34 | 133 | 38.2 | 146 | 42.0 | 69 | 19.8 | 61 | 17.5 | 282 | 81.0 |
| Hospital E | 1070 | 1143 | 595 | 17.80 | 11.00 | 171 | 28.7 | 336 | 56.5 | 88 | 14.8 | 68 | 11.4 | 519 | 87.2 |
| Hospital F | 555 | 813 | 303 | 13.94 | 10.65 | 54 | 17.8 | 167 | 55.1 | 82 | 27.1 | 84 | 27.7 | 215 | 71.0 |

[a] Missing values regarding working shifts: All hospitals (N=29), Hospital A (3), Hospital B (7), Hospital C (2), Hospital D (5), Hospital E (8), Hospital F (4). Bachelors+ are RNs with a Bachelor's degree and additional training.

***Table 3.*** *Ranking by nurses' perception of quality of care.*

| | All | Hospital A | Hospital B | Hospital C | Hospital D | Hospital E | Hospital F |
|---|---|---|---|---|---|---|---|
| | *N*=2338 | *N*=452 | *N*=314 | *N*=326 | *N*=348 | *N*=595 | *N*=303 |
| **Nurse-perceived quality of care** | | | | | | | |
| % Not satisfied <6 (N) | 9.4 *(219)* | 10.2 *(46)* | 9.6 *(30)* | 16.3 *(53)* | 6.6 *(23)* | 7.4 *(44)* | 7.6 *(23)* |
| % Satisfied ≥6-8 (N) | 58.9 *(1377)* | 58.8 *(266)* | 57.3 *(180)* | 62.3 *(203)* | 55.7 *(194)* | 62.4 *(371)* | 53.8 *(163)* |
| % Very satisfied ≥8 (N) | 31.7 *(742)* | 31.0 *(140)* | 33.1 *(104)* | 21.5 *(70)* | 37.6 *(131)* | 30.3 *(180)* | 38.6 *(117)* |
| **Ranking** | | | | | | | |
| % Satisfied + very satisfied | 90.6 | 89.8 | 90.4 | 83.8 | 93.3 | 92.7 | 92.4 |

Table 3 summarizes nurses' perception of quality of care and the ranking of the six hospitals. The majority of nurses were satisfied with the quality of care in their hospital. Approximately 9 % ($N = 219$) were not satisfied and rated the quality of their hospital unit with a score less than 6. Table 3 indicates that, based on the percentage of satisfied (quality score ≥ 6-8) and very satisfied nurses (quality score ≥ 8), Hospital D had the best results and Hospital C had the least favorable results.

Table 4 shows the results regarding the nurse-sensitive indicators. High screening percentages were shown for the indicators of pain; in particular 'pain assessment in the recovery room', with values ranging from 90 to 100 %. Large differences between hospitals were found for the screening indicators of malnutrition and delirium; in particular 'observation of delirium', with values between 15 and 100 %. Based on the mean composite scores, Hospital D was identified as the highest-performing hospital with a composite score of 93.2 % and Hospital C had the least favorable composite score of 62.9 %.

***Table 4.*** *Ranking by nurse-sensitive indicators.*

| Quality indicator [a] | Hospital A | Hospital B | Hospital C | Hospital D | Hospital E | Hospital F |
|---|---|---|---|---|---|---|
| % Screening delirium | 26.3 | 61.5 | 23.1 | 81.3 | 86.4 | 78.6 |
| (*N* screened/ total *N*) | *(5/19)* | *(8/13)* | *(3/13)* | *(13/16)* | *(19/22)* | *(11/14)* |
| % Observation delirium | 79.8 | 51.7 | 32.2 | 91.9 | 100.0 | 15.0 |
| (*N* observed/ total *N*) | *(197/247)* | *(45/87)* | *(430/1337)* | *(91/99)* | *(425/425)* | *(9/60)* |
| % Screening malnutrition | 45.7 | 82.0 | 81.4 | 94.8 | 78.6 | 82.0 |
| (*N* screened/ total *N*) | *(6439/14095)* | *(16683/20345)* | *(15175/18637)* | *(16483/17379)* | *(18468/23507)* | *(854/1042)* |
| % Pain recovery room | 90.1 | 90.0 | 100.0 | 100.0 | 100.0 | 99.7 |
| (*N* assessed/ total *N*) | *(6418/7121)* | *(8087/8986)* | *(9473/9473)* | *(11775/11775)* | *(10595/10595)* | *(8432/8456)* |
| % Pain hospital units | 83.7 | 99.4 | 78.0 | 98.1 | 97.1 | 59.0 |
| (*N* assessed/ total *N*) | *(13045/15583)* | *(8932/8986)* | *(7388/9473)* | *(1411/1439)* | *(10943/11272)* | *(4428/7505)* |
| **Ranking** | | | | | | |
| Composite score | 65.1 | 76.9 | 62.9 | 93.2 | 92.4 | 66.9 |

[a] Nurse-sensitive screening indicators (see definitions Table 1).

We assessed Spearman's Rho correlations to test the overlap between nurse-perceived quality of care and nurse-sensitive indicators. A strong significant correlation was shown between the two quality measures of $r_S = 0.943$ ($p = 0.005$). Hospitals' ranking according to both measures of quality are shown in Table 5. There was a high degree of correspondence; nurses were generally most satisfied in hospitals with high scores on nurse-sensitive indicators, and least satisfied in lower-scoring hospitals.

***Table 5.*** *Ranking of quality of nursing care in six Dutch hospitals.*

| | Subjectively measured quality | Objectively measured quality | Ranking nurse-perceived quality | Ranking nurse-sensitive indicators |
|---|---|---|---|---|
| Hospital A | 89.8 | 65.1 | 5th | 5th |
| Hospital B | 90.4 | 76.9 | 4th | 3rd |
| Hospital C | 83.8 | 62.9 | 6th | 6th |
| Hospital D | 93.3 | 93.2 | 1st | 1st |
| Hospital E | 92.7 | 92.4 | 2nd | 2nd |
| Hospital F | 92.4 | 66.9 | 3rd | 4th |

Rank 1st denotes the best result, and 6th the least favorable result.

## Discussion

Nurse-sensitive indicators are widely used to evaluate the quality of nursing care. The present study examines their convergent validity by investigating concordance between publicly reported nurse-sensitive screening indicators (delirium, malnutrition, pain) and nurse-reported quality of care. To our knowledge, this is one of the first studies to explore the direct relationship between objectively measured quality of nursing care and subjectively measured quality, from a nurses' point of view. We found that there was a substantial correlation between the two quality measures. As such, our study adds knowledge to the international debate on the value of nurse-sensitive indicators as measures of quality of nursing care.

In literature, there is a scientific debate about the usefulness of publicly reported quality indicators as comparative performance measures. Critics claim that, because nurse-sensitive indicators are reported by hospital organizations themselves, there is a risk that they adjust the data in order to achieve goals of external accountability.[10,22] On the other hand, there is evidence that public reporting is associated with actual quality of care [23,24] and stimulates quality improvement activities at the hospital level.[25] In our study, we demonstrated that there is a strong relationship between publicly reported screening indicators and nurses' satisfaction with the quality of care, thereby implicating that these indicators both can be used to assess nursing care quality. However, we emphasize that the two quality measures are not likely to be completely interchangeable. Needleman and colleagues [2] stated that various kinds of quality measures potentially could have their own value for stakeholders. For example, regarding nurse-sensitive indicators, policy makers and insurance companies could use screening indicators to benchmark hospitals and hospital units. Nurse-sensitive screening indicators are particularly suitable for these kinds of purposes, because they are easy to measure and screening activities are a prime task of nurses. Additionally, health care organizations (e.g., hospitals) may benefit more from satisfaction with care ratings, because they provide input for quality improvement in a specific setting. Thus, the optimal approach for defining quality of nursing care depends on the underlying question and who poses the question.

Comparing objective versus subjective measures is increasingly relevant in current health care research. Previous studies demonstrated significant associations between hospital performance and patient-perceived quality. For example, Jaipaul et al.[26] reported lower mortality rates in hospitals with higher patient satisfaction with overall quality, and Nelson et al.[27] found that hospitals' financial performance was associated with patients' perception of quality of care. With regard to nurse-perceived quality, some studies elaborated on the relationship with medical performance indicators. McHugh and Witkoski Stimpfel [28] examined the convergent validity of nurse-reported quality by analyzing the correspondence with composite scores for processes related to acute myocardial infarction, pneumonia, and surgical patients. They reported that a 10 % increase in nurses' satisfaction with the quality of care was associated with a 0.6 to 2.0 point increase in composite performance scores. Tvedt et al.[29] found significant correlations between nurse-reported quality and survival probabilities after stroke or acute myocardial infarction. Despite their relevance, these studies solely focused on medical performances. They did not exclusively focus on quality related to nurse-specific indicators (i.e., nurse-sensitive screening indicators). Future research about the usefulness of nurse-sensitive indicators as quality measures can contribute to a better understanding of quality of nursing care.

Our results that Bachelor's educated nurses and more experienced nurses were mostly satisfied about quality of care is the opposite of what previous studies found.[17,30] We do not have a reasonable explanation for these differences, and therefore more studies assessing educational level and years of experience in relation to nurses' perception of quality should be performed. The kinds of shifts that nurses are working has not often been included as a nurse characteristic. We found that nurses working fixed shifts, especially day shifts were more satisfied that those working rotating shifts. An interpretation is that nurses working rotating shifts may have a fragmented perspective of the quality of care, because of the rotating shift schedule. According to our results, the differences between the individual hospitals could not be explained by the included nurse characteristics. There is ample evidence that other factors, such as leadership, autonomy and nurse-physician relationships are important in relation to nurse-perceived quality and other quality outcomes.[17,31] The influence of these kinds of work environment factors however, was not the main focus of the present study.

### Limitations

One of the limitations is that, due to missing values on indicators, we were not able to calculate a composite score for each of the six hospitals in 2010. As a result, the nurse-sensitive indicator data were derived in 2011, whereas the survey data of nurses were conducted in 2010. We tested intra-correlations for all nurse-sensitive screening indicators in the full population of 93 Dutch hospitals and found moderate correlations ($r = 0.59$ to $r = 0.67$) between the years 2010 and 2011. Therefore, we argue that the results of both years are comparable and adequately reflect the Dutch context. Further research in a larger sample is necessary to support out findings, because our study sample was limited to six hospitals. Second, critics claim that it may be more interesting to extract unit-level data instead of hospital-level data, because there may be unit characteristics (e.g., patient complexity, workload) that are influential.[22,32] Many attempts are made worldwide to benchmark on the unit-level, for example by ways of longitudinal studies on specific indicators, such as patient falls.[33,34] However, it takes years before these kinds of processes are adequately implemented; this is an ongoing process which deserves attention.[2,8] Third, we used one single-item score to determine satisfaction with quality of care. Although these kinds of quality scores are important indicators of nurses' perspectives, they also have their limits. In line with previous studies[35], it would be useful to further explore interrelations with other satisfaction scores (e.g., recommendation of own hospital, job satisfaction). Fourth, a possible limitation is that some might have reservations about composite scores based on percentages. As described before, is was shown previously that these kinds of composite scores are useful measures to evaluate process performance.[20,21]

## Conclusions

Nurse-sensitive quality indicators and nurse-reported quality of care can offer opportunities to differentiate hospitals in terms of quality of nursing care. Our results confirm that quality indicators correspond with nurses' perception of quality, by revealing strong correlations between the objective measurements from publicly reported indicators and nurses' perceived quality of care from a survey. This finding implies that both quality measures are valuable as indicators of hospital performance. Because there is no golden standard to determine nursing care quality, various quality measures could be used by stakeholders (policy makers, health care providers etc.) to complement each other. All in light of the overarching goal of provision of excellent quality of care to patients.

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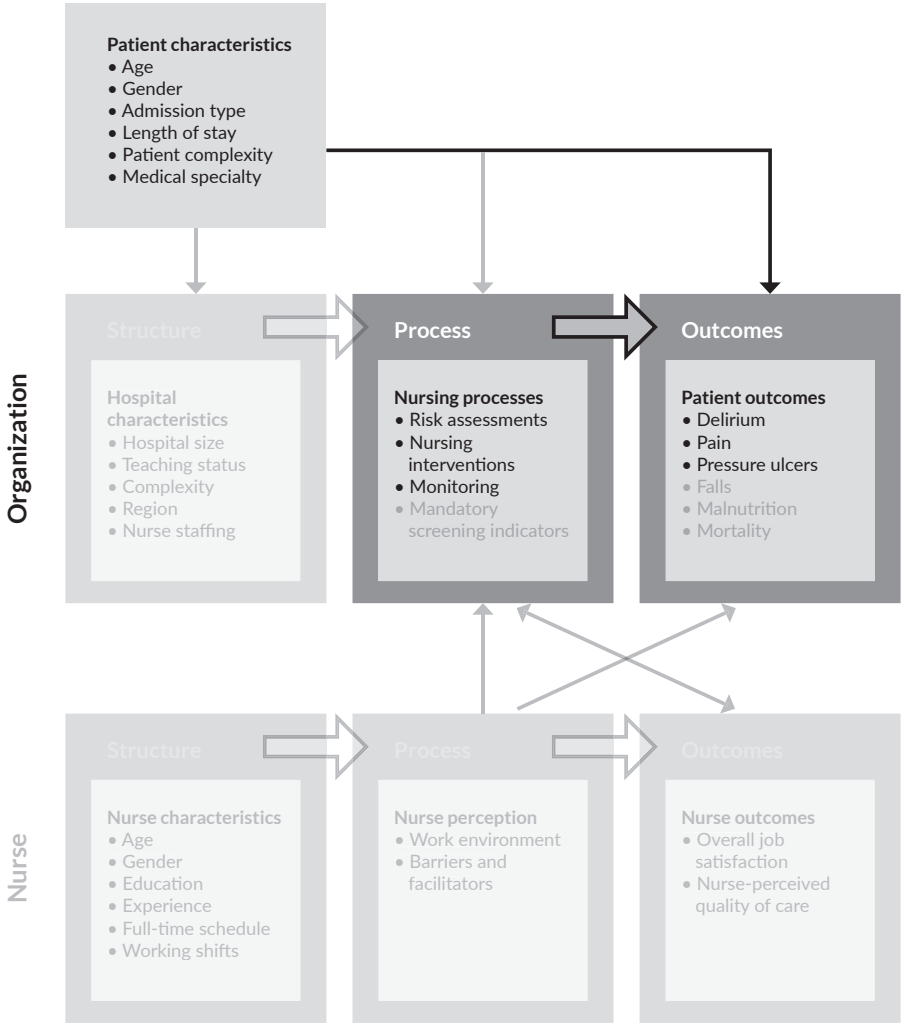
# CHAPTER 3

## PRACTICE WHAT YOU PREACH: DELIRIUM, PAIN, AND PRESSURE ULCERS IN INTENSIVE CARE UNITS AND CHALLENGES RELATED TO NURSING PROCESSES

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Submitted

# Abstract



**Background:** Nurse-sensitive outcomes (NSOs), such as delirium, pain, and pressure ulcers are frequently used as indicators for nursing quality. Besides influential patient characteristics, the relationship with nursing processes, involving nursing care which is planned and provided, is important to investigate in order to optimize the outcomes for patients.
**Aims:** To empirically assess delirium, pain, and pressure ulcers in intensive care units (ICUs), and to explore associations with patient characteristics and nursing processes.
**Methods:** A retrospective chart review was performed, including 310 patients admitted to three Dutch ICUs. Multiple logistic regression analyses were used to find associations between NSOs and patient characteristics. Nursing processes were categorized into documented problems, interventions and evaluations of nursing care.
**Results:** The occurrence of NSOs ranged from 23% (pain) to 46% (delirium). Being diagnosed with at least two out of three NSOs was negatively associated with a prolonged length of stay and surgical patients. Problem statements, including risks assessments, were documented for the vast majority of patients. Interventions to prevent pain were applied to nearly all patients, in contrast to only 6% of patients suspected for delirium who received specialized consultation. Between the units there was a lot of variation with regard to the continuity in monitoring and evaluation of NSOs.
**Conclusions:** In addition to the impact of patient characteristics, opportunities to improve quality of nursing care mainly involve specific nursing interventions and evaluation of their effectiveness. Further research is required to understand where nurses' barriers exist for application of nursing processes as it should be practiced.

## Introduction

Nurses constitute the largest group of employees in hospitals and deliver most of bedside patient care. Their actions or lack of these actions have an impact on the outcomes for patients, and therefore research on the provision and quality of nursing care is needed.[1] In this context, nurse-sensitive outcomes are important, because health care policies are relying on them as outcome measures for quality and patient safety purposes. Nurse-sensitive outcomes (NSOs) are "those outcomes that are relevant, based on nurses' scope and domain of practice, and for which there is empirical evidence linking nursing inputs and interventions to the outcome".[2] Internationally, a wide range of these NSOs are used as quality indicators for the purpose of benchmarking hospitals. Examples are healthcare-associated infections, patient falls and pressure ulcers.[3] Since 2007, all hospitals in the Netherlands are required to report on a mandatory set of NSOs, including delirium, pain, and pressure ulcers.[4]

The risks regarding delirium, pain, and pressure ulcers are expected to be evident in patients admitted to intensive care units (ICUs).[5] Previously, numerous studies demonstrated high incidences and prevalence in ICU patients. For example, Brown [6] described the incidence of delirium in ICU patients after cardiac surgery to be between 26% and 52%, and Ettema and colleagues [7] found numbers of 15% to 46% in patients after surgery. Van Gulik et al.[8] reported pain incidence ranging from 14% for patients in rest to 28% during pain periods. Several reviews on pressure ulcers in ICU patients found prevalence numbers ranging from 4% to 49% and incidence ranging from 1% to 56%.[9, 10] A wide variety of patient characteristics, such as age, gender, medical specialism, admission type, and length of stay are referred to be predictive for the occurrence of various NSOs.[9-11] Despite their impact, patient characteristics are not (easily) modifiable, and therefore research on NSOs in high intensity units and potentially modifiable contributing factors is necessary to prevent or enhance these adverse outcomes for patients.

A commonly used framework to assess quality of care and influential factors is the Structure-Process-Outcome framework. As conceptualized by Donabedian,[12] results on the outcomes are influenced by structure variables, which are characteristics affecting the ability of hospital units to meet health care needs, and process variables, which are activities and interventions of professionals in providing care.[13] Previous studies mainly reported on the relationship between structure variables, such as nurse staffing and skill mix and NSOs (e.g., mortality and patient falls).[14, 15] In addition, various authors stated that there is a lack of evidence on associations between process variables, such as risk assessments and nursing interventions and NSOs.[16-18] However, research on nursing processes is very important, as nurses play an important role in preventing negative and stimulating positive outcomes for patients.[19]

Therefore, in this study we empirically assessed the mandatory NSOs of delirium, pain, and pressure ulcers in Dutch ICUs, and in addition to patient characteristics we explored contributing factors related to nursing processes.

## Methods

### Study design and setting

An observational study by retrospective chart review was performed, including all consecutive patients admitted to the ICUs of three teaching hospitals, located in different geographical parts of the Netherlands. The study period ranged from October 2013 until June 2014. The units had 12 to 24 beds and were mixed medical and surgical ICUs, but two also had cardiac surgery patients. All three units were labeled as level 3, which in the Netherlands refers to the highest level of ICU by meeting the criterion of having a superregional role.[20] Two ICUs had a high care unit as a step-down unit. To prevent bias, we did not include patients admitted to these high care units. Furthermore, patients with a length of stay (LOS) less than 24 hours, patients that were readmitted at the ICU within 72 hours, and patients younger than 18 years were excluded.



The demographic characteristics of patients, the documentation on NSOs and nursing processes were extracted from patients' records. The chart review was performed by the principal investigator and the contact persons of the three units. The contact persons were staff nurses in the units who also had additional research degrees.

### Ethical considerations

Because of the observational design of the study, we received formal dispensation of the Medical Research Involving Human Subjects Act (WMO) by the hospitals' Medical Ethical Review Commission (W13.030). All patient data were coded and used blinded.

### Nurse-sensitive outcomes

We studied the following NSOs: delirium, pain, and pressure ulcers. Malnutrition is also a mandatory NSO in the Netherlands, however none of the ICUs used a validated screening instrument and therefore we excluded malnutrition from our analyses. Each patient record was assessed for positive scores according to the used measurement tool. A positive score indicated that the NSO had appeared in a patient during ICU admission. Included NSOs were: (i) occurrence of delirium according to the Confusion Assessment Method (CAM-ICU, sensitivity= 74%, specificity= 81.9%) or the Intensive Care Delirium Screening Checklist (ICDSC, sensitivity= 80%, specificity= 95.9%),[21] (ii) pain score in responsive patients by the Numerical Rating Scale (NRS, weighted kappa= .63),[22] (iii) pain score in sedated patients by the Behavioral Pain Scale (BPS, Cronbach α= .70) or the Critical-Care Pain Observation Tool (CPOT, Cronbach α= .71),[23] (iv) prevalence of pressure ulcers, and (v) incidence of pressure ulcers according to the National Pressure Ulcer Advisory Panel & European Pressure Ulcer Advisory Panel Guidelines.[24] We also extracted data on a sedation measurement tool which is regularly used in ICUs in combination with assessments of delirium and pain, namely the Richmond Agitation Sedation Scale (RASS, weighted kappa= .88).[25]

### Patient characteristics

The demographic features of patients during the study period included: age, gender, admission type (elective vs. acutely), length of stay on the ICU, patient complexity, and medical specialty. To determine patient complexity, we used the Acute Physiology and Chronic Health Evaluation (APACHE), which is a severity-of-disease classification system.[26] In the present study, we used the earlier version APACHE II-score instead of APACHE IV, because the APACHE IV was only available for two units (N=225). Regarding medical specialty, we categorized according to the Dutch National Intensive Care Evaluation (NICE) guidelines, including cardiac surgical patients, surgical patients and non-surgical (i.e., medical) patients (https://www.stichtingnice.nl/datainbeeld/public).

### Nursing processes

The Problem-Intervention-Evaluation (PIE) system to simplify nursing process documentation was used as a framework to reflect nursing processes.[27] 'Problem' stands for the problem statement and nursing diagnosis, 'intervention' refers to nursing interventions that are carried out and 'evaluation' denotes the continuity of care and effectiveness of interventions. The variables we used in our study are based on results from previous studies on nurse-sensitive indicators and potential flaws in nursing processes, for example by Zrelak et al.[28] Regarding problem documentation, two variables were studied: (i) initial assessment on admission, which was defined as the proportion of patients assessed on the presence of an NSO on the first day of admission, (ii) risk assessment, which was defined as the proportion of patients in which risk assessment has taken place at least once, including notifications whether the NSO was present or not present. To define nursing interventions, we used Mc Closkey and Bulecheck's [29] definition: "any (preventive) treatment, based upon clinical judgment and knowledge that a nurse performs to enhance patient outcomes". The Dutch guidelines on the various NSOs provided us the most frequently used interventions; repositioning patients in bed, pressure relief mattresses, wound material (pressure ulcers), pharmaceutical treatment with haloperidol, expertise of a specialized physician (delirium), and pain medication (pain).[30-32] The evaluation of nursing care was expressed by the variable of continuous monitoring, defined as the proportion of patients, in whom the potential preventable NSO had occurred, with ongoing assessments of risk, presence and status.

### Statistical analysis

First, descriptive statistics were used to characterize the study sample of patients in the three ICUs; Chi Square tests were used for categorical variables and analysis of variance (ANOVA) for continuous variables. Then, for reliability purposes, we assessed inter-rater agreement of NSO measurements between nursing professionals in a randomly selected sample of 24 patients admitted to one of the three ICUs. The two nursing professionals involved were the staff nurse taking care of the included patients and the contact person in that ICU. Cohen's Kappa was used for nominal variables and intra-class correlation coefficients (ICC) with two-way random effect model for ordinal and interval variables.[33]

Second, proportions of patients in whom delirium, pain and pressure ulcers occurred were determined. We used multiple logistic regression analyses to investigate the relationship of NSOs with patient characteristics on the patient level; with the NSOs as response variables and the patient characteristics as the explanatory variables. Included were the continuous variables of age, APACHE II-score, length of stay (LOS), and the dichotomous variables of gender (male vs. female), prolonged length of stay (≥5 days vs. <5 days) and admission type (elective vs. acutely). Dummy variables were created for medical specialty (cardiac surgical, surgical, medical) and individual ICUs (unit A, B and C). All variables were included simultaneously in order to adjust for each patient characteristic. A *p*-value of <.05 was considered statistically significant.
The proportion of explained variance was expressed by $R^2$. We determined differences in patient characteristics between those with and those without reports on delirium, pain, or pressure ulcers in order to deal with missing values on the various NSOs.
Third, variables related to nursing processes were measured at the unit level.
In addition, proportions and Chi Square tests were used to find associations between NSOs and nursing interventions. SPSS version 22 was used for quantitative analysis.



## Results

Table 1 illustrates the demographic characteristics of patients in the three ICUs.
A total of 310 out of 594 patients met the inclusion criteria and therefore were included in this study. The majority of patients were male (65.8%), acutely admitted (64.2%) and of a medical specialism; with mostly Pulmonary (17.4%) and Cardiology (15.8%) patients. The mean age was 66.8 years (site range, 64.9-68.5), the mean length of stay was 6.3 days (site range, 5.8-6.8), and patients had a mean APACHE II-score of 20.5 (site range, 20.0-21.5) within 24 hours of admission. Between the units, statistically significant differences occurred for the proportion of patients with a prolonged admission time (≥ 5 days), and for medical specialty (see Table 1).

For delirium there were no missing values (*N*=310) and for pain there was one missing value, which additionally was excluded from further analysis. Reports on pressure ulcers were available for 266 out of 310 patients; those patients without reports were more likely to be electively admitted (27% vs. 7%), of a cardiac surgical specialism (30% vs. 12%, 7%), with a shorter LOS (2.95 vs. 6.79), with a lower APACHE II-score (16.33 vs. 21.18), and being admitted to unit A (27% vs. 13%, 0%). We found moderate to good inter-rater reliability for the NSOs, with Kappa's coefficient ranging from .54 (pressure ulcers stage 1) to .89 (CAM-ICU), and ICC ranging from .71 (pain in sedated patients) to .99 (RASS-score). Only pain assessment in responsive patients by NRS showed a poor inter-rater reliability (ICC= .08).

***Table 1.*** *Baseline characteristics of the study population.*

| Patient characteristics | All units (*N*=310) | Unit A (*N*=95) | Unit B (*N*=81) | Unit C (*N*=134) | *p* |
|---|---|---|---|---|---|
| **Male (%)** | 204 (65.8) | 67 (70.5) | 50 (61.7) | 87 (64.9) | .453 |
| **Elective admission (%)** | 111 (35.8) | 39 (41.1) | 25 (30.9) | 47 (35.1) | .362 |
| **LOS mean (SD)** | 6.3 (5.7) | 5.8 (6.7) | 6.8 (5.9) | 6.2 (4.7) | .466 |
| **Admission time ≥5 days (%)** | 148 (47.7) | 34 (35.8) | 45 (55.6) | 69 (51.5) | .017* |
| **Age mean (SD)** | 66.8 (13.4) | 64.9 (13.9) | 68.5 (12.7) | 67.0 (13.2) | .193 |
| **Age (%)** | | | | | |
| <60 | 74 (23.9) | 27 (28.4) | 14 (17.3) | 33 (24.6) | .135 |
| 60-79 | 184 (59.4) | 57 (60.0) | 47 (58.0) | 80 (59.7) | |
| ≥ 80 | 52 (16.8) | 11 (11.6) | 20 (24.7) | 21 (15.7) | |
| **APACHE II mean (SD)** | 20.5 (7.5) | 21.5 (8.3) | 20.1 (7.6) | 20.0 (6.9) | .285 |
| **APACHE II [a] (%)** | | | | | |
| <20 | 154 (50.5) | 37 (40.2) | 40 (50.6) | 77 (57.5) | .051 |
| 20-29 | 108 (35.4) | 35 (38.0) | 30 (38.0) | 43 (32.1) | |
| ≥ 30 | 43 (14.1) | 20 (21.7) | 9 (11.4) | 14 (10.4) | |
| **Medical specialty (%)** | | | | | |
| Cardiac surgical | 90 (29.0) | 39 (41.1) | 1 (1.2) | 50 (37.3) | <.001* |
| Surgical | 41 (13.2) | 8 (8.4) | 26 (32.1) | 7 (5.2) | |
| Medical | 179 (57.7) | 48 (50.5) | 54 (66.7) | 77 (57.5) | |

Abbreviations: LOS= length of stay.
a APACHE II-score had 5 missing values.
* Significant at $p<.05$.

### Nurse-sensitive outcomes

Across the ICUs, the prevalence of pressure ulcers (stages 1 to 4) ranged from 25% to 41%, with an average of 31% (n= 82). The average incidence of newly developed pressure ulcers was 22% (n= 58), and the highest incidence occurred in the unit with the highest prevalence. Delirium appeared in 46% (n= 142) of the patients that were admitted to the ICU, with proportions varying between 32% and 57% in the individual units. For pain, 23% (n= 69) of responsive patients had moderate (NRS ≥ 4-7) to severe (NRS >7) pain at any point of time during the ICU admission. Pain assessments in sedated patients by CPOT or BPS indicated that 27% (n= 67) op patients experienced pain.

### Associations with patient characteristics

Logistic regression analyses (Table 2) revealed that patients with a prolonged length of stay (≥5 days) and surgical patients were more likely to experience at least two out of three adverse NSOs: delirium, pain, or pressure ulcers ($R^2$ = .26). For the individual NSOs it was shown that pressure ulcers prevalence was associated with a higher age (β= 0.03, *p*= .031), a longer length of stay (β= 0.10, *p*= .008), being acutely admitted (OR= 3.66, CI= 1.35- 9.95), and being admitted to unit A as opposed to unit C (OR= 2.45, CI= 1.17- 5.13). Delirium was also associated with length of stay (β= 0.11, *p*= .014), and being admitted to unit C as opposed to the other units (OR= 0.35, CI= 0.18- 0.65, and OR= 0.47, CI= 0.24- 0.94). Pain in responsive patients was associated with type of specialism; an approximately three and a half times higher probability of pain in surgical patients as opposed to medical patients. Responsive as well as sedated patients with a prolonged ICU stay were also more likely to experience pain.



***Table 2.*** *Relationship between patient characteristics and being diagnosed with at least two out of three NSOs.*

| Patient characteristics | Beta | OR | 95% CI | *p* |
|---|---|---|---|---|
| Constant | -2.91 | | | .001 |
| Age | 0.01 | | | .426 |
| APACHE II | 0.02 | | | .276 |
| Length of stay | 0.06 | | | .074 |
| LOS ≥5 days (vs. LOS <5) | | 3.55 | 1.81- 6.98 | <.001* |
| Male (vs. female) | | 0.78 | 0.45- 1.35 | .375 |
| Acutely admission (vs. elective) | | 1.77 | 0.78- 4.03 | .184 |
| Medical specialism | Reference | | | |
| Cardiac surgical | | 1.01 | 0.41- 2.51 | .981 |
| Surgical | | 2.63 | 1.00- 6.90 | .049* |
| Unit A | Reference | | | |
| Unit B | | 0.52 | 0.24- 1.14 | .102 |
| Unit C | | 1.16 | 0.61- 2.18 | .655 |

Abbreviations: LOS= length of stay; NSO=nurse-sensitive outcome.
* Significant at *p*<.05.

### Nursing processes

The results regarding documentation of problems are presented in Figure 1 and Figure 2. Figure 1 shows that the majority of patients are risk assessed on the first day of ICU admission, with mean values ranging from 71% (site range: 54%-90%) for pressure ulcers to 87% (site range: 77%-98%) for RASS. Regarding documentation of at least on risk assessment, delirium and RASS both scored 100%, pain was assessed in 99% (site range: 99%-100%) and pressure ulcers were assessed in 86% (site range: 73%-100%) of patients (Figure 2).

Almost all admitted ICU patients (98%) received pain medication (morphine, paracetamol etc.). Interventions to prevent pressure ulcers ranged from 68% of patients that were put on specialized air or other pressure relief mattresses, to 77% for repositioning or turning patients in bed, respectively every single shift (55%) and at least daily (22%). In addition, in 29% of the cases there was no documentation on used mattresses. The usage of wound material was reported to be done in 82% of patients with pressure ulcers stages 2 to 4. Approximately 6% of patients suspected for delirium received consultation of a medical specialist (neurologist, psychiatrist). The overall use of haloperidol in the units was 69% and in delirious patients it was used as a drug treatment in 75%. Significant associations between NSOs and interventions were found for pharmaceutical treatment by haloperidol and delirium ($\chi^2 = 8.41$, $P = .004$) and for wound care and pressure ulcers ($\chi^2 = 4.12$, $P = .042$).
In Figure 3 it is shown that RASS was continually monitored in 80% (site range: 30%-98%) of patients who experienced pain according to one of the pain measurement tools. With regard to delirium and pressure ulcers, the ongoing assessments during patients' admission showed lower proportions with mean values of 48% (site range: 29%-72%) for pressure ulcers and 74% (site range: 8%-99%) for delirium.

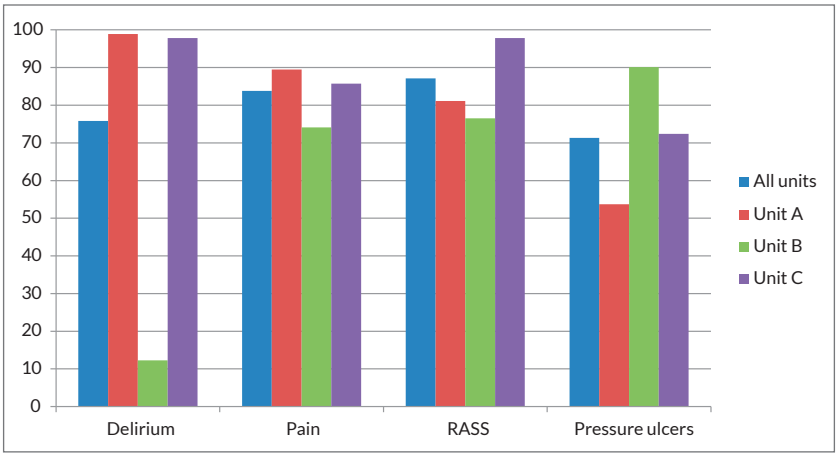


***Figure 1.*** *Proportion of patients in whom risks were assessed at first day of admission.*

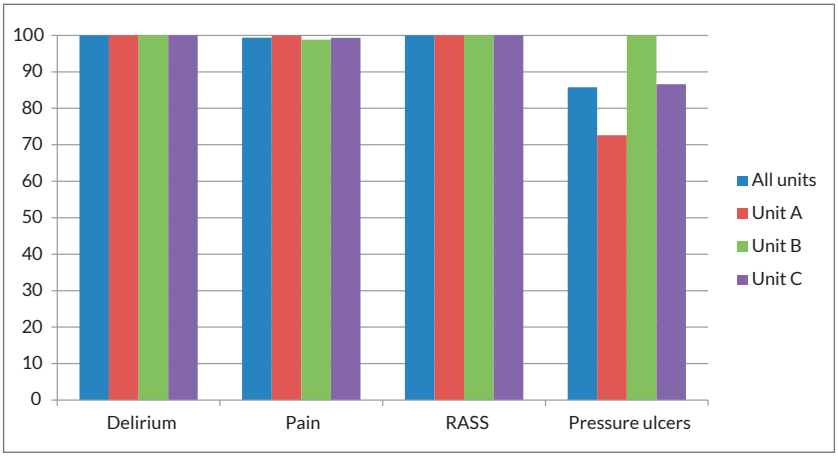


***Figure 2.*** *Proportion of patients in whom NSOs have been assessed at least once.*

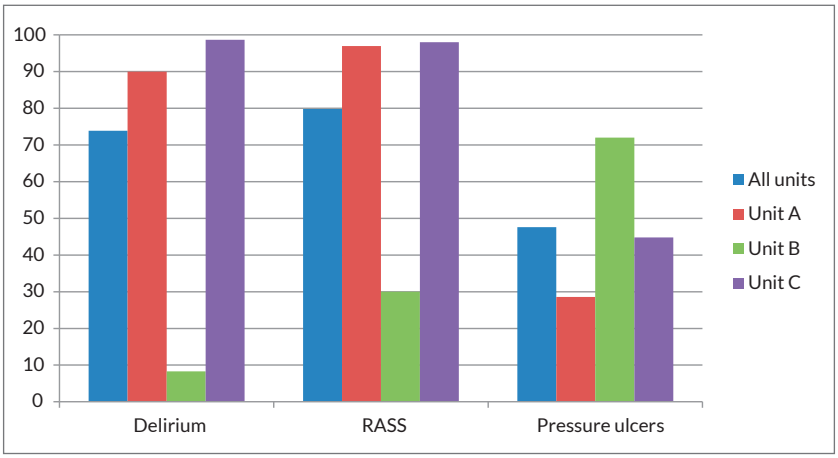


***Figure 3.*** *Proportion of patients with continuous monitoring during ICU admission.*

## Discussion

This observational study in three ICUs in the Netherlands is one of the first to describe associations between nursing processes and a range of adverse nurse-sensitive outcomes (NSOs), including delirium, pain, and pressure ulcers. Needleman, Kurtzman, and Kizer [34] in their review article involving nurse-sensitive performance measures, highlighted the need for refined research on nursing processes, as these process characteristics are interrelated with patient safety and healthcare outcomes. Besides the influence of various patient characteristics, we found that the documentation of nursing interventions and the continuity of nursing care during patients' admission provide challenges to further improve the quality of nursing care. Further research in a larger sample is required to confirm our findings on the relations between processes and outcomes.

The present study aimed to provide a broader picture of nursing care quality by examining a variety of NSOs, hereby adding knowledge to previous research which mainly focused on influential factors in relation to one single NSO. Empirical research on NSOs is relevant, because previously the NSOs studied in the present study were linked to increased morbidity and mortality.[35-37] Early recognition by timely risk assessments and additional undertaking of interventions by nurses to prevent adverse patient outcomes has been numerously emphasized, for example by the Agency for Healthcare Research and Quality (AHRQ). With our findings, we demonstrated that various aspects of the care as provided by nurses on a daily basis deserve attention. For example, we found that in almost half of the patients with a diagnosed pressure ulcer, there was no documentation on progress, status or undertaken interventions. These kinds of nursing processes are necessary elements in order to optimize the prevention and treatment of adverse NSOs. Future attempts to improve quality of nursing care by NSOs must focus on enhancing nurses' insight of the importance and engagement with their screening activities. Thus, emphasizing that the outcome of risk assessments is an input for nursing care and not just a common administrative duty.

Our findings on occurrence of the various NSOs correspond with evidence from previous studies in ICUs. [6, 7-10, 23] We reported high inter-reliability between nurses with regard to all NSOs; with the exception of pain according to the Numerical Rating Scale (NRS). Ahlers et al.[22] reported similar results with regard to inter-rater reliability of NRS, by showing that moderate to severe pain was underestimated by nurses in comparison to ICU patients. This implicates that, although our results are based on a validated screening instrument, interpretation variation may affect the outcomes of assessments of pain by NRS. A possible conclusion is that patients' opinion is essential in determining pain by measurement tools such as the NRS; and these kinds of tools may be less useful in high-intensity units in which patients often are not able to effectively communicate. Furthermore, we initially aimed to include all of the NSOs that are mandated to publicly report on by the Dutch Government, but we could not include 'malnutrition' because none of the ICUs used a validated screening instrument. The lack of specific instruments to identify malnourished ICU patients was previously mentioned by Heyland and collegaus.[38] Constructing validated instruments and increasing uniformity in used measurement methods may enable better comparisons of NSOs in critically ill patients.

Our results are in line with previous studies on the importance of reducing patients' length of stay (LOS) on the ICU.[39, 40] Although the effect of a prolonged LOS may seem an obvious effect, its relevance is beyond dispute as we demonstrated that LOS was associated with all of the included NSOs. Additionally, this study revealed that there also were associations between the individual units and performances regarding NSOs. For example, being admitted in unit A was related to a higher probability to develop pressure ulcers. The same unit also had the most unreported cases (missing values) of pressure ulcers, suggesting that nursing care involving pressure ulcers was less well organized in relation to the other units. More research on nurses' barriers and facilitators to monitoring of the various NSOs in individual units is recommended, in order to understand nurses' reasoning in usage of NSOs.

### Limitations

Although a major strength is that we intensively screened the administrative reports on patient outcomes as well as variables related to nursing processes, there are a few aspects of this study that should be considered. First, the relatively high number of missing values regarding pressure ulcers (>10%) can be explained by the fact that it were those patients who were less complex or who were only admitted to the ICU for a short period of time. Assessments of pressure ulcers and bed sores usually take place during ICU admission in multi-morbid and bedridden patients, in contrast to assessments of pain and delirium which are generally performed in an early stage of ICU admission. Second, the retrospective design may have resulted in some information bias. Although it concerned nationally mandatory NSOs, we acknowledge that reporting accuracy remains an issue. Third, because of the observational design of the study, our results are not showing causality of relationships. Future studies with a longitudinal design are required to support the findings from this and other cross-sectional studies. A final limitation was that we used the APACHE II for our analyses, because one unit could not provide us data on APACHE IV. Although APACHE IV is the most recent version, we claim that APACHE II is an adequate score to differentiate patient complexity, as we found a strong correlation of $r = .748$ between APACHE II and APACHE IV in the current sample.



## Conclusions

The present study provided meaningful information on the occurrence of delirium, pain and pressure ulcers in patients admitted to intensive care units, and related contributing factors. Besides various influential patient characteristics, evaluation of nursing processes revealed that continuity in risk assessments and documentation of nursing interventions are areas in which potential modifiable improvements can be reached. Optimal results on adverse NSOs, such as delirium, pain and pressure ulcers can only be achieved if the only health care professionals that are always present at the patient bedside really 'practice what they preach'. That is, provision of the highest possible quality of care during patients' entire admission. Our findings can serve as baseline data for tailored interventions aiming to enhance nursing processes and to improve appropriate monitoring of NSOs in critically ill patients in ICUs. Further research to understand nurses' rationale and perception of barriers to monitoring of NSOs should be pursued.

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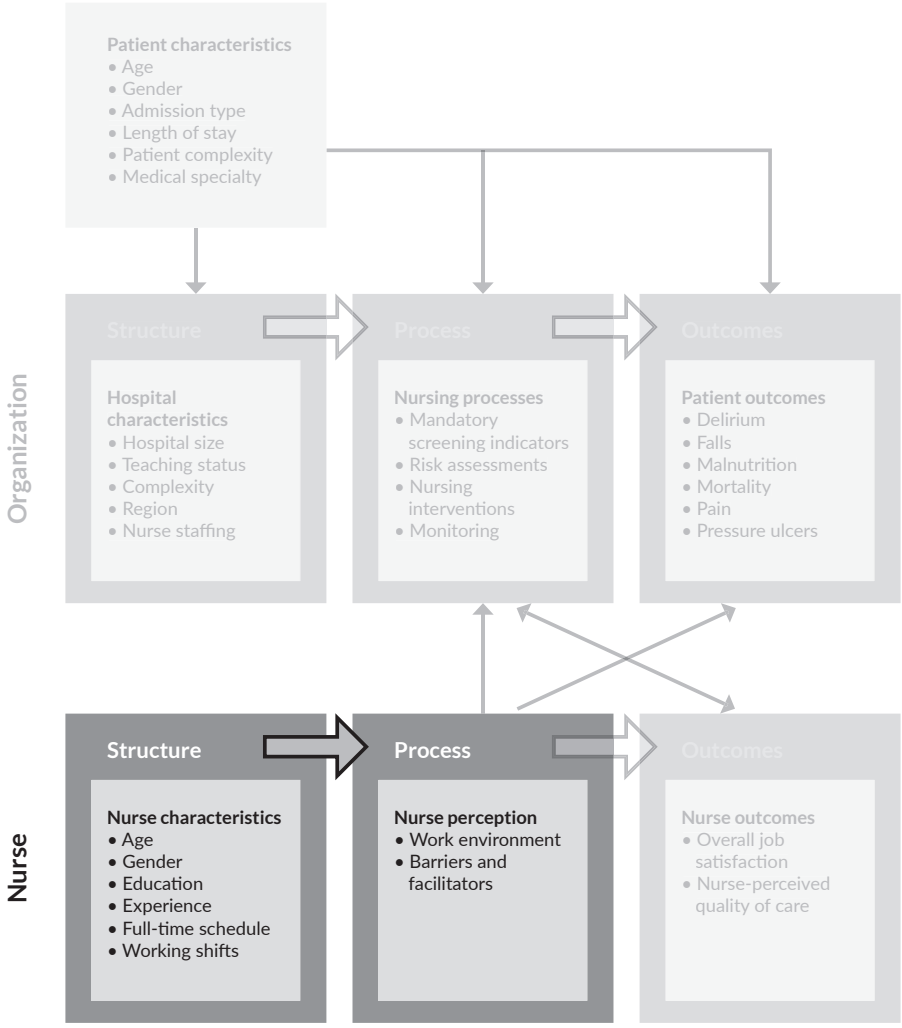
# CHAPTER 4

## BARRIERS AND CARRIERS: A MULTICENTER SURVEY OF NURSES' BARRIERS AND FACILITATORS TO MONITORING OF NURSE-SENSITIVE OUTCOMES IN INTENSIVE CARE UNITS

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In revision

# Abstract

**Background:** Nurse-sensitive outcomes are used as indicators of quality of nursing care. These kinds of adverse patient outcomes are most likely to occur in critically ill patients, and therefore it is important to determine the perspective of nurses in intensive care units.
**Aims:** To identify nurses' barriers and facilitators to monitoring of nurse-sensitive outcomes in intensive care units (ICUs), and to explore influential nurse characteristics and work environment characteristics.
**Methods:** A cross-sectional survey in three Dutch ICUs between October 2013 and June 2014, using a questionnaire with questions regarding facilitators and three types of barriers: knowledge, attitude, and behavior. The Dutch Essentials of Magnetism II was used to examine work environments.
**Results:** All 126 responding nurses identified pressure ulcers and patient satisfaction as outcomes that are nurse-sensitive and nurses' full responsibility. Lack of time (behavior) was perceived as the most prominent barrier, followed by unfamiliarity with mandatory indicators (knowledge), and unreliability of indicators as benchmark data (attitude). Education and clear policies were relevant facilitators. Of nurse characteristics, only regularity of shifts was related to perceived attitude related barriers. The work environment factor 'clinical autonomy' was potentially associated with behavior related barriers.
**Conclusions:** Various barriers and facilitators exist to monitoring of nurse-sensitive outcomes. Understanding nurses' perceived barriers and facilitators enables for future tailored interventions to improve monitoring of nurse-sensitive outcomes in daily clinical practice.

## Introduction

Nurses are first in the line of duty when it comes to the provision of care to patients in hospitals, as they are the only health care professionals present at patients' bedside 24 hours a day. Despite the high number of nurses in health care settings and their importance in delivering good patient care, the measurement of nursing performance remains a difficult issue.[1] Traditionally, nurses are known to care for and nurture patients based on intuition and nursing skills; little focus on measuring the effects of a nurse's care on patient outcomes. Florence Nightingale was the first to acknowledge the importance of collecting data and its relation to the improvements of health care outcomes.[2] Nowadays, nurse-sensitive outcomes are used as measures to quantify care that is provided and influenced by nurses.[3] Nurse-sensitive outcomes (NSOs) are defined as 'those outcomes that are relevant, based on nurses' scope and domain of practice, and for which there is empirical evidence linking nursing inputs and interventions to the outcome'.[4] Frequently mentioned examples of NSOs are pressure ulcers, patient falls and health care-associated infections.[5,6] In the Netherlands, hospitals are required to report several types of NSOs to the Dutch Health Care Inspectorate, including delirium, malnutrition, pain and pressure ulcers.[7]

## Background

NSOs are referred to as quality indicators and can be used for both external as well as internal purposes; in addition to their use as quality measurement tools for benchmarking hospitals, NSOs are used internally identifying areas in need of and practices for improving nursing professional care.[5] It is important that nurses themselves recognize the relevance of NSOs and show their commitment to the collection of NSO data, for example by optimizing their screening activities in order to routinely gather data on NSOs. While screening activities should be an integral part of nursing practice, several studies published in the last 20 years indicate that NSO related screening processes are often suboptimal. In their study including all hospitals in the Netherlands, Leistra et al.[8] reported an average screening percentage of 72% with regard to the screening of malnutrition, one of the mandatory nurse-sensitive indicators. Ely et al.[9] surveyed nearly one thousand ICU professionals and found that only 40% of nurses were routinely screening for delirium, with a mere 16% of them utilizing a formal assessment tool.

It has been previously suggested that nurses experience various barriers to the collection and completion of NSO data. Lack of time, inadequacy of measurement tools, and workload were demonstrated to be important barriers. These factors have been linked to specific NSOs, such as malnutrition,[8] pressure ulcers,[10] delirium,[11] and pain.[12] However, there is limited evidence of barriers to the overall use and monitoring of NSOs. The framework of Cabana et al.[13] proposes that a wide spectrum of barriers, including barriers related to knowledge, attitude, and behavior should be assessed in order to realize widespread behavioral change in health care. This study was designed to assess barriers in nurses' knowledge, attitude, and behavior to a range of NSOs, in order to give a general overview of the perceived barriers to the monitoring of NSOs.

This study focused on nurses in the intensive care unit (ICU) setting as complications and adverse outcomes of care, such as NSOs are prominently present in this type of high-risk unit.[14] Besides barriers, nurse characteristics (e.g., age, educational level) and factors in nurses' work environment (e.g., nurse-physician relationship, staffing) are also potentially relevant in relation to nurses' abilities to provide a high quality of care with regard to NSOs.[15,16] The research questions addressed are:

1. Which barriers and facilitators to the monitoring of NSOs are perceived by nurses working in ICUs?
2. How do nurse characteristics and factors in the work environment of ICU nurses relate to perceived barriers to NSO monitoring?

## Methods

### Design

A cross-sectional multicenter survey study in intensive care units (ICUs) was performed. Data were collected by means of a questionnaire, aimed at answering the research questions as described above.[17] The questionnaire included predefined statements on three types of barriers: knowledge, attitude, and behavior and facilitators to the monitoring of nurse-sensitive outcomes (NSOs), and close-ended questions regarding nurses' work environment.



### Data collection

The study was conducted in the ICU of three teaching hospitals located in different geographical areas in the Netherlands. These hospitals were previously pilot testing hospitals for the development of the Dutch Essentials of Magnetism II instrument.[18] The ICUs labeled as level 3 ICUs, representing the highest level of ICU care in the Netherlands,[19] had 12 to 24 licensed beds for adult patients.

The sample consisted of the staff nurses who were active in nursing practice during the study period from October 2013 to June 2014; including scholars working more than 6 months in the ICU. Nurses with temporary contracts and staff nurses not participating in direct patient care (e.g., team leaders) were excluded. All 283 staff nurses received a paper-based questionnaire which was anonymous and voluntarily. The questionnaires could be returned in a sealed box which was placed in each of the three ICUs. The study contact person in each of the three units (ICU nurses with an additional research education) motivated nurses to fill in the questionnaire. The primary researcher was present in the ICUs during the data collection period and sent several email reminders to the nurses.

### Questionnaire

The first part of the questionnaire referred to the demographic features of nurses; including age, gender, years of nursing experience, years of experience as an ICU nurse, highest level of education (Associate Degree in Nursing versus Bachelor Degree in Nursing or higher), full-time versus part-time employment status (32 or more hours/week versus less than 32 hours/week), and regularity of shift schedules (exclusively working day shifts, evening shifts, or night shifts versus rotating shifts).

The second part addressed nurses' opinion on barriers and facilitators to monitoring of NSOs. For this purpose, the statements from a previous study on quality indicators in Dutch ICUs were used.[20] These statements on barriers were based on the validated framework of Cabana et al.[13] regarding behavior change in health care, and included the following domains: (i) knowledge (awareness or familiarity), (ii) attitude (motivation), and (iii) behavior (external factors, time and organizational issues). The facilitators were based on a literature review by Davies et al.[21] regarding health care professionals' views on enablers for quality improvements. For the current study, an independent expert group (*n*=3), consisting of a team leader with a background in ICU nursing, a person with a PhD with a background in ICU nursing, and a staff nurse with a scientific background, evaluated the face validity and content validity of these statements, as well as their relevance for nurses. Based on this expert feedback and on relevant literature,[22-24] the barrier statement 'monitoring of quality indicators can be done without huge investments' was replaced with 'nurse-sensitive indicators offer opportunities to increase nursing autonomy' and the facilitator 'pay-for-performance' was replaced with 'support manager', resulting in a questionnaire including 11 statements on barriers and 13 facilitators to the monitoring of NSOs. These items were scored on a 5 point Likert-scale, ranging from 'strongly disagree' (*1) to 'strongly agree' (*5). In addition, we added a self-developed item to the questionnaire to assess which NSOs are considered by ICU nurses to be nurse-sensitive. Results on the 4 point Likert-scale, ranging from 'strongly disagree' (*1) to 'strongly agree' (*4) were used to extract proportions on the importance of the 18 predefined indicators. Various Dutch databases, including the dataset of the Dutch Health Care Inspectorate (IGZ), the Dutch National Society of Intensive Care Medicine (NVIC), and the Netherlands Centre of Excellence in Nursing (LEVV) were used to develop the list with NSOs.

In the third part of the questionnaire, the validated Dutch version of the questionnaire Essentials of Magnetism II (D-EoM II) was used to explore nurses' perception of their work environment. The internal consistency of the D-EoM II showed an acceptable Cronbach's alpha of 0.92 for the entire scale, and 0.58 to 0.92 for the eight subscales. While one subscale showed a low Cronbach's alpha, the authors claimed that the correlations between the items of this subscale were high, and therefore they did not alter the subscale.[18] The D-EoM II contains 58 statements and the EoM II was designed to assess the eight domains which are essential for a magnetic and healthy work environment: (i) working with clinically competent peers, (ii) support for education, (iii) collaborative nurse-physician relationships, (iv) practice of clinical autonomy, (v) control of nursing practice, (vi) leadership and nurse manager support, (vii) patient-centered cultural values and (viii) adequacy of staffing.[25] These statements were scored on a 4 point Likert-scale, ranging from 'strongly disagree' (*1) to 'strongly agree' (*4).

### Data analysis

First, descriptive statistics were used to characterize the study sample of responding ICU nurses. Second, nurses' perception of barriers and facilitators were analyzed using proportions on the 24 items. To calculate an overall mean score (MS) of the barrier domains of knowledge, attitude and behavior, we used negative, neutral, and positive formulated statements, including reverse-order questions. A score less than 3 was considered as a negative overall result, indicating a need for improvement. Responses that were missing a value for one or more statements in a barrier domain resulted in the data for that domain being excluded from the data analysis. In addition, to explain differences in scores among subgroups, we used analysis of variance (ANOVA) with the overall mean scores on the domains as response variables and nurse characteristics as explanatory variables. Then, nurse characteristics were accounted for by involving all variables simultaneously in a multiple linear regression analysis. Dummy variables were created for the three units (Unit A, B and C). Multi-collinearity was tested by means of the variance inflation factor (VIF) and tolerance value. Variables with a VIF >10 or a tolerance of < 0.10 were suspected for multi-collinearity and were excluded from further analysis.[26] Lastly, for each individual ICU the overall mean scores of the eight domains which considered as essential for a magnetic and healthy work environment were calculated, using negative and positive formulated statements. A score less than 2.5 indicated a negative result and a need for improvement. A $p$-value of <0.05 was considered statistically significant. SPSS version 22 was used for quantitative analysis (IBM SPSS Statistics for Windows, Armonk, NY, USA: IBM Corp.).



### Ethical consideration

Ethics approval for this study was granted by the hospitals' Medical Ethical Review Commission (W13.030). The board of directors of each hospital involved in this study gave formal permission to conduct the study.

## Results

The overall response rate across the three ICUs was 45% (site range, 43%- 46%), representing 126 ICU nurses. The majority of these respondents were female (78%), educated at least at the Bachelor's level (70%), working rotating shifts (87%) and working full-time (62%). The median age was 41 years (IQR= 30-50), the median for nurses' working experience was 20 years (IQR= 10-30), and for experience in the ICU the median was 11 years (IQR= 4-21) (Table 1).

***Table 1.*** *Baseline demographics of the study population.*

| Nurse characteristics [a] | *N* | (%) |
|---|---|---|
| **Responding nurses** | 126 | (100) |
| **Gender** | | |
| Male | 28 | (22.4) |
| Female | 97 | (77.6) |
| **Education level** | | |
| Associate's degree | 37 | (29.6) |
| At least Bachelor's degree | 88 | (70.4) |
| **Shift schedule** | | |
| Regular shifts | 16 | (12.8) |
| Rotating shifts | 109 | (87.2) |
| **Employment status** | | |
| Full-time working | 77 | (61.6) |
| Part-time working | 48 | (38.4) |
| **Age** | | |
| <40 | 58 | (46.4) |
| 40-49 | 36 | (28.8) |
| ≥50 | 31 | (24.8) |
| **Nursing experience** | | |
| <10 | 30 | (24.2) |
| 10-19 | 31 | (25.0) |
| ≥20 | 63 | (50.8) |
| **ICU experience** | | |
| 5 | 37 | (29.6) |
| 5-14 | 37 | (29.6) |
| ≥15 | 51 | (40.8) |

[a] Missing values for gender, education level, shift schedule, employment status, age, ICU experience (*N*=1) and nursing experience (*N*=2).

### Barriers and facilitators to NSO monitoring

Figure 1 shows that the indicators pressure ulcers and patient satisfaction were fully perceived as nurse-sensitive (100%), while mortality was not considered nurse-sensitive by 35% (*n*=43) of respondents. Additionally, urinary tract infections (UTI), delirium, sepsis and multidrug-resistant (MDR) infections were not perceived to be nurse-sensitive by approximately 20% of respondents.

As shown in Figure 2, 42% (*n*= 51) agreed that the monitoring of NSOs takes too much time (behavior domain), nearly 20% (*n*= 24) was not familiar with the mandatory set of NSOs as determined by the Dutch Health Care Inspectorate (knowledge domain), and 15% (*n*= 19) did not agree that monitoring leads to reliable benchmark data (attitude domain).

Figure 3 illustrates the perceived facilitators; nearly 92% (*n*= 105) of nurses were in need of education about NSOs and 80% (*n*= 98) agreed that clear rules and policies on NSOs in the unit are important facilitators. One-third of the respondents mentioned that social pressure from the hospital management is ineffective as a facilitating factor.

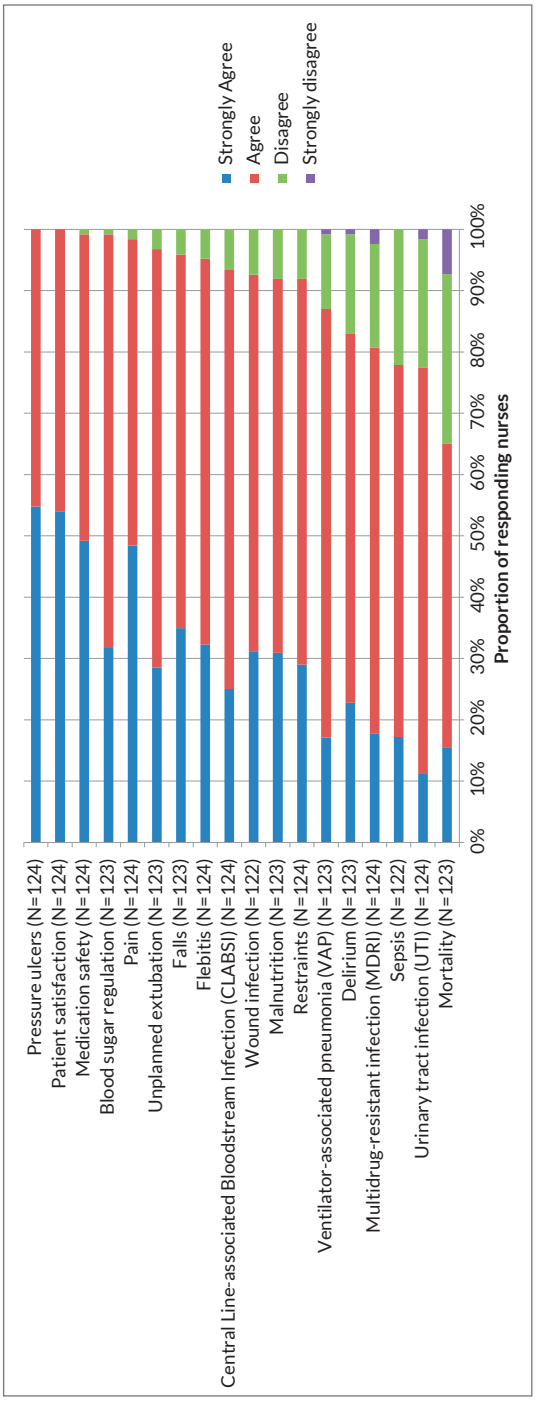


***Figure 1.*** *Nurse-sensitivity of indicators, as perceived by ICU nurses.*

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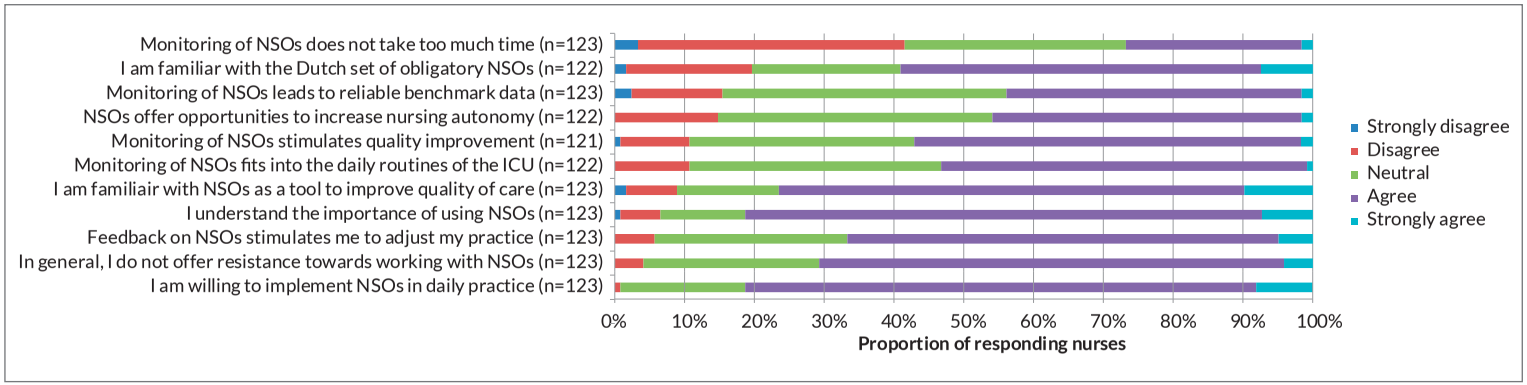


***Figure 2.*** *Barriers with regard to monitoring of NSOs, as perceived by ICU nurses.*

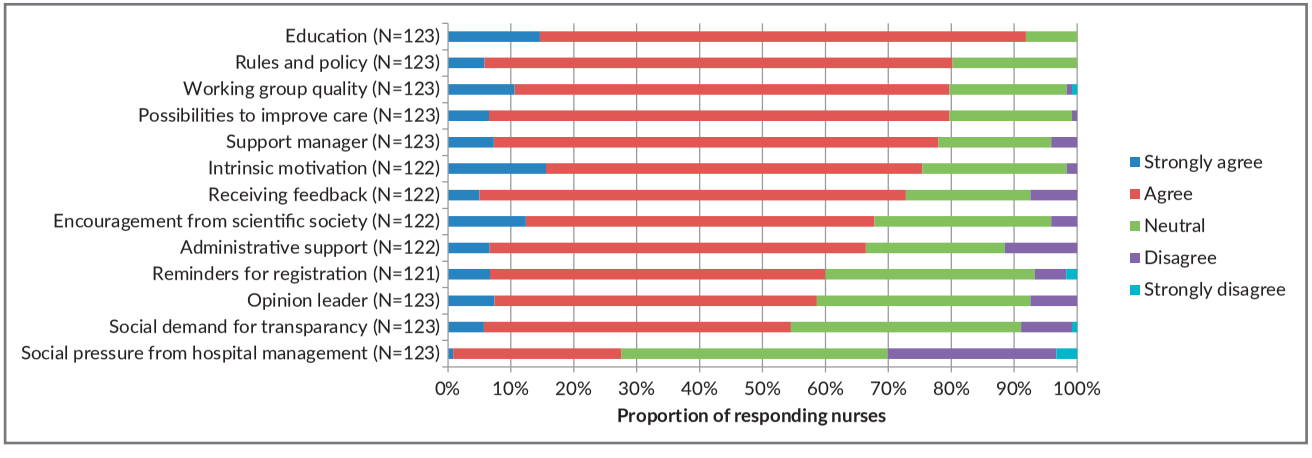


***Figure 3.*** *Facilitators with regard to monitoring of NSOs, as perceived by ICU nurses.*

### Relationship with nurse characteristics and work environment

Collinearity statistics showed that age was interfering too much with other nurse characteristics (VIF= 13, tolerance= 0.08), and therefore age was excluded from further analyses. For the units combined, all domain scores regarding barriers were positive (MS≥3); behavior (*M*= 3.21, *SD*= 0.60), knowledge (*M*= 3.60, *SD*= 0.78), and attitude (*M*= 3.63, *SD*= 0.45). Subgroup analysis revealed that there were significant differences between units regarding the behavior domain; one unit (unit B) had a negative and significantly lower behavior related score (*M*= 2.90, *SD*= 0.59; $p < 0.003$), as compared to the other units (*M*= 3.28, *SD*= 0.49; *M*=3.37, *SD*= 0.69). Further tests of differences in overall domain scores among subgroups showed a significantly higher score for the attitude domain in regular working nurses as compared to nurses working rotating shifts. Those working regular shifts scored 3.86 (*SD*= 0.40) versus those working rotating shifts who scored 3.60 (*SD*= 0.46). None of the other nurse characteristics were statistically significant related to the overall domain scores.
The multiple linear regression analysis, as shown in Table 2, confirms that after adjusting for nurse characteristics, nurses in unit B gave a significant lower behavior-related score as compared to nurses in the other units ($R^2$= 0.15, F(8, 120)= 2.42, *p*= 0.02).

For the three units combined, the overall mean scores on the eight work environment domains were positive (MS≥2.5). Nurses were most satisfied with adequacy of staffing (*M*= 3.01, *SD*= 0.39) and least satisfied with control of practice (*M*= 2.71, *SD*= 0.35). The only negative score related to work environment was unit B's 'practice of clinical autonomy'; which was significantly lower (*M*= 2.46, *SD*= 0.42; $p<0.001$) than the scores from other units for this same area (*M*= 2.93, *SD*= 0.22; *M*= 2.93, *SD*= 0.35).

***Table 2.*** *Multiple linear regression results for the barrier domains of knowledge, attitude and behavior.*

| | **Knowledge** | | **Attitude** | | **Behavior** | |
|---|---|---|---|---|---|---|
| **Nurse characteristics** | | | | | | |
| | Beta | *p*-value | Beta | *p*-value | Beta | *p*-value |
| Unit A (versus unit B) | 0.09 | 0.47 | 0.03 | 0.81 | 0.32 | < 0.01* |
| Unit C (versus unit B) | 0.07 | 0.54 | 0.21 | 0.07 | 0.36 | < 0.01* |
| Female (versus male) | -0.17 | 0.10 | 0.04 | 0.68 | 0.03 | 0.74 |
| Bachelor (versus Associate) | 0.30 | 0.78 | -0.04 | 0.69 | 0.12 | 0.23 |
| Rotating (versus regular) | -0.05 | 0.67 | -0.19 | 0.08 | -0.20 | 0.05 |
| Full-time (versus part-time) | 0.02 | 0.83 | 0.04 | 0.73 | -0.08 | 0.41 |
| Nursing experience | -0.17 | 0.46 | -0.01 | 0.96 | -0.27 | 0.18 |
| ICU experience | 0.25 | 0.28 | 0.01 | 0.95 | 0.18 | 0.38 |

* Significant at $p < 0.05$ level.

## Discussion

This study aimed to investigate potential barriers and facilitators to monitoring of nurse-sensitive outcomes (NSOs) from the perspective of nurses in Dutch intensive care units (ICUs), and to explore influential nurse characteristics and work environment factors. A major strength of this study is that we determined barriers and facilitators with regard to a wide range of NSOs, in contrast to previous studies focusing on one single NSO.[8,10-12] As a result, we were able to draw more comprehensive conclusions about NSO monitoring by ICU nurses.

We found that all nurses agreed that pressure ulcers and patient satisfaction were clearly nurse-sensitive indicators. Fewer nurses agreed regarding presumed NSOs, such as mortality, urinary tract infections, and sepsis. These findings contradicted those of Needleman et al.[6] who referred to urinary tract infection and sepsis to be highly nurse-sensitive. It is important to know how ICU nurses view NSOs, as those nurses who not perceive them as reliable and valid outcome measures of their work will be less likely to be motivated to adequately monitor these NSOs.

Another important finding was that lack of time was perceived as a major behavior related issue in the monitoring of NSOs in ICUs. Besides the usual care practices, the administrative burden on nurses is increasingly present in the contemporary health care setting.[27] NSOs can be important indicators for the quality of care; however, in order to persuade nurses to behave accordingly, health care organizations need to place an emphasis on how monitoring NSOs relates to nurses' regular duties and responsibilities, and that monitoring is not an unnecessary time-consuming activity. One way in which this can be achieved is by determining the usefulness of NSOs in various types of units.[28] For example, specific NSOs, such as pressure ulcers and delirium frequently occur in patients admitted to critical care units, but are not as common in step-down units involving patients with lower levels of complexity. As a result, nurses in critical care units should dedicate more time to monitoring these specific NSOs than non-critical care units.

One reason for not screening NSOs is an ignorance on the part of nurses that screening for NSOs is part of their job requirement. For example, nearly 20% of nurses in the current sample were not familiar with the set of NSOs mandated by the Dutch Health Care Inspectorate. De Vos et al.[20] reported that nurses in Dutch ICUs perceived higher levels of unfamiliarity with mandatory indicators than other health care professionals. Another study demonstrated that nurses in Magnet hospitals in the USA perceived lack of communication regarding mandatory NSOs as an important barrier to monitoring those NSOs as required.[29] These knowledge related barriers are relatively easy to counter, and the most commonly described facilitators in this study, more education and clear policies, could stimulate NSO knowledge in ICUs and ideally improve the screening levels. The relevance of continuing education has been mentioned in previous studies investigating screening processes by health care professionals.[8]

In addition to barriers related to behavior and knowledge, other factors identified as potentially contributing to suboptimal monitoring of NSOs were related to nurses' attitudes. For example, 15% of nurses in our sample did not understand that NSO data could be utilized for benchmark purposes. This implies that simply informing nurses of the requirement to monitor NSOs may not be enough; in order to make a change, nurses need to understand how data related to NSOs is used by the local and national health care organizations. The abstract nature of attitude related barriers make them more difficult to overcome than knowledge related barriers, and changing a nurse's attitude often takes much longer than changing a nurse's level of education on NSOs. While attitude related barriers may prove more challenging than other barriers, they have a large impact on clinical outcomes, such as ventilation associated pneumonia, pressure ulcers, and central line infections.[30,31] In line with Baker et al. 's review of health professionals' performance interventions,[32] this study emphasizes that future interventions to improve nurses' compliance with NSOs should be tailored to and focused on prospectively identified barriers; such as enhancing positive attitudes towards NSOs. This could be achieved by interactive learning and feedback, as previously reported by Pittet and colleagues.[33]

In line with previous NSO studies [12,20] various nurse characteristics, such as gender and educational level were included in the study analysis. Besides differences between regular versus rotating working nurses, we could not find any relevant associations with perceived barriers. Although the present study does not allow us to directly assess the specific contribution of work environment factors to nurses' perception of barriers to monitoring NSOs, it did identify a potential link between nurses' satisfaction with clinical autonomy and nurses' perceived barriers. This is important, because satisfaction with work environments is relevant in relation to nursing processes. For example, studies on nursing care left undone showed that less favorable work environments are associated with higher levels of care left undone.[34] Additionally, autonomy has been directly linked to both nurse outcomes (turnover, job satisfaction) as well as patient outcomes (patient safety, mortality).[24] Future studies should further investigate the role of work environment factors in a larger sample of ICUs, in order to test the study findings regarding potentially modifiable factors that may affect nursing processes and quality of care.

### Limitations

Several study limitations occurred during the course of this study. These limitations concerned cross-sectional data and as a result no causality could be demonstrated for the study findings. Another limitation is the generalizability of the results, since internationally a variety of NSOs are used to benchmark nursing care in hospitals. Delirium and malnutrition are mandatory NSOs in the Netherlands, whereas many other countries exclude these NSOs. Future empirical research should be performed consistently to determine the nurse-sensitivity of indicators and their usefulness in different health care settings and countries. Although this study had an acceptable response rate of 45%,[35] bias from non-responders was another limitation in this study. This response rate is comparable to that of other survey studies focusing on critical care nurses [36] and the demographic characteristics of our sample resemble that of the full population of Dutch ICUs.[37]

## Conclusions

NSOs are frequently used as indicators for the quality of nursing care in ICUs; however, various barriers exist to the appropriate monitoring of NSOs. This study contributes to the current literature by focusing on nurses, the health care professionals who have a key role in NSO utilization. Greater understanding of barriers and facilitators enables health care organizations to provide future tailored interventions aimed at optimally integrating NSOs into daily nursing practice. Enhancing nursing knowledge, behavior, and attitude towards the necessity of NSO monitoring is one way to increase nurses' understanding of NSOs and NSO monitoring. Further research on work environment factors that potentially affect nursing processes in ICUs is needed in order to permanently improve and optimize nursing quality in these high-intensity units.

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# Appendix

## Survey questions

**INDICATOREN**

*Wilt u een kruisje zetten bij het best passende antwoord?*

| | | Zeer mee oneens | Mee oneens | Neutraal | Mee eens | Zeer mee eens |
|---|---|---|---|---|---|---|
| 1 | Ik ben bekend met het gebruik van verpleegsensitieve indicatoren als middel om de kwaliteit van zorg te verbeteren. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | Ik ben bekend met de set van verpleegsensitieve indicatoren die door de Inspectie voor de Gezondheidszorg verplicht zijn gesteld om te registreren. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3 | Ik snap het belang van het gebruik van verpleegsensitieve indicatoren. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4 | In het algemeen bied ik geen weerstand tegen het gebruik van en werken met verpleegsensitieve indicatoren. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5 | Ik ben bereid om verpleegsensitieve indicatoren te integreren in de dagelijkse verpleegkundige zorg. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6 | Feedback wat betreft verpleegsensitieve indicatoren stimuleert mij in het gebruik ervan en om mijn handelen ernaar aan te passen. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 7 | De registratie van verpleegsensitieve indicatoren stimuleert de kwaliteit van zorg. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 8 | De registratie van verpleegsensitieve indicatoren leidt tot betrouwbare benchmark data, ofwel IC's zijn op deze manier goed te vergelijken. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 9 | De registratie van verpleegsensitieve indicatoren is goed in te passen in de dagelijkse praktijk op de IC. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 10 | De registratie van verpleegsensitieve indicatoren kost niet veel extra tijd. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 11 | Verpleegsensitieve indicatoren geven de mogelijkheid om de verpleegkundige autonomie vergroten. | ☐ | ☐ | ☐ | ☐ | ☐ |

**Wat vind u belangrijk** met betrekking tot gebruik en registratie van **verpleegsensitieve kwaliteitsindicatoren?**

| | | Zeer mee oneens | Mee oneens | Neutraal | Mee eens | Zeer mee eens |
|---|---|---|---|---|---|---|
| 12 | Duidelijke regels en afdelingsbeleid gericht op verpleegsensitieve indicatoren | ☐ | ☐ | ☐ | ☐ | ☐ |
| 13 | Ondersteuning van leidinggevende | ☐ | ☐ | ☐ | ☐ | ☐ |
| 14 | Intrinsieke motivatie van de verpleegkundige | ☐ | ☐ | ☐ | ☐ | ☐ |
| 15 | Aanmoediging vanuit de wetenschap | ☐ | ☐ | ☐ | ☐ | ☐ |
| 16 | Maatschappelijke vraag om transparantie | ☐ | ☐ | ☐ | ☐ | ☐ |
| 17 | Sociale druk vanuit ziekenhuismanagement | ☐ | ☐ | ☐ | ☐ | ☐ |
| 18 | Mogelijkheid van verpleegsensitieve indicatoren om de zorg te verbeteren | ☐ | ☐ | ☐ | ☐ | ☐ |
| 19 | Administratieve ondersteuning | ☐ | ☐ | ☐ | ☐ | ☐ |
| 20 | Feedback ontvangen | ☐ | ☐ | ☐ | ☐ | ☐ |
| 21 | Herinneringen aan registratie van verpleegsensitieve indicatoren | ☐ | ☐ | ☐ | ☐ | ☐ |
| 22 | Onderwijs/ klinische lessen | ☐ | ☐ | ☐ | ☐ | ☐ |
| 23 | Werkgroep kwaliteitsverbetering | ☐ | ☐ | ☐ | ☐ | ☐ |
| 24 | Opinieleider/ voortrekker | ☐ | ☐ | ☐ | ☐ | ☐ |

Ik registreer de verplichte IGZ- kwaliteitsindicatoren (decubitus, delier, ondervoeding en pijn)

Altijd ☐ Regelmatig ☐ Soms ☐ Nooit ☐

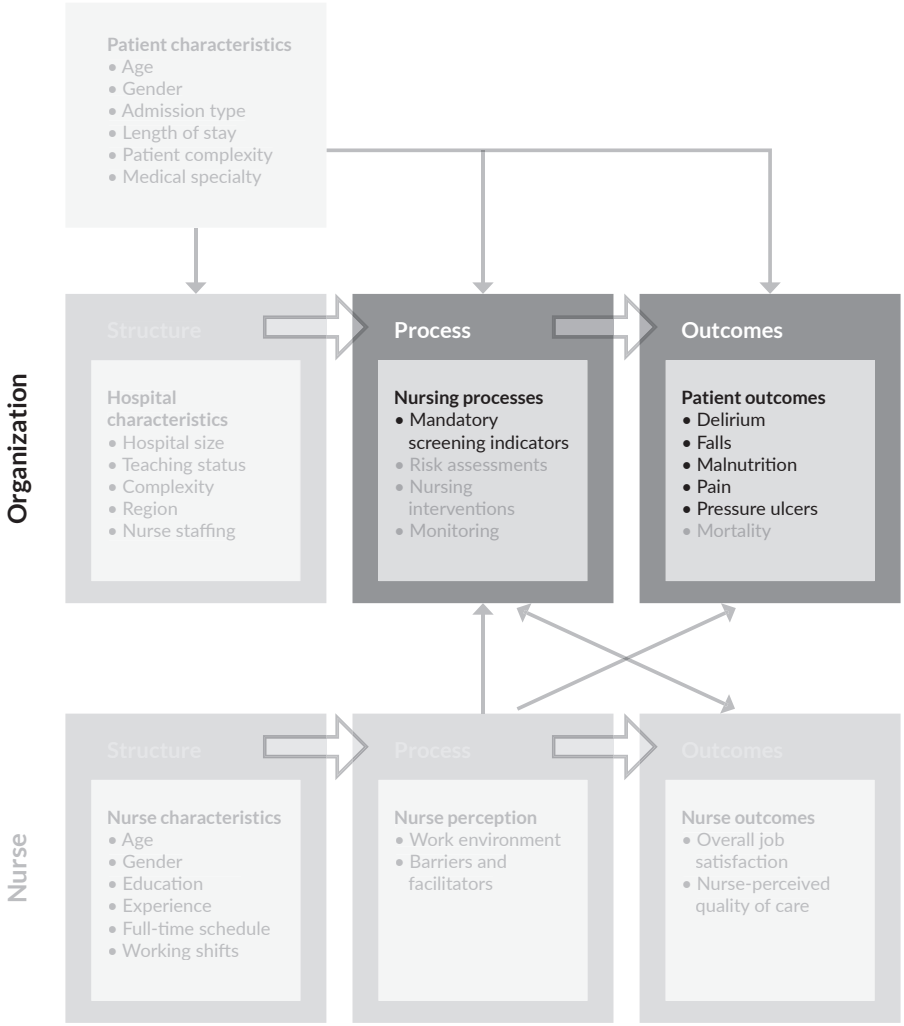
Voor welke van de onderstaande kwaliteitsindicatoren **voelt u zich het meest verantwoordelijk als IC-verpleegkundige?**

| | Heel verantwoordelijk | Verantwoordelijk | Niet verantwoordelijk | Helemaal niet verantwoordelijk |
|---|---|---|---|---|
| Ventilatie-gerelateerde pneumonie (VAP) | ☐ | ☐ | ☐ | ☐ |
| Centrale lijn infecties | ☐ | ☐ | ☐ | ☐ |
| Mortaliteit | ☐ | ☐ | ☐ | ☐ |
| Urineweginfecties | ☐ | ☐ | ☐ | ☐ |
| Decubitus/ doorligplekken | ☐ | ☐ | ☐ | ☐ |
| Ondervoeding | ☐ | ☐ | ☐ | ☐ |
| Delier | ☐ | ☐ | ☐ | ☐ |
| Vrijheidsbeperkingen | ☐ | ☐ | ☐ | ☐ |
| Pijn | ☐ | ☐ | ☐ | ☐ |
| Wondinfecties | ☐ | ☐ | ☐ | ☐ |
| Medicatieveiligheid | ☐ | ☐ | ☐ | ☐ |
| Valincidenten | ☐ | ☐ | ☐ | ☐ |
| Sepsis | ☐ | ☐ | ☐ | ☐ |
| Flebitis | ☐ | ☐ | ☐ | ☐ |
| Tevredenheid patiënt en familie | ☐ | ☐ | ☐ | ☐ |
| Onvoorziene extubatie | ☐ | ☐ | ☐ | ☐ |
| Glucosespiegel | ☐ | ☐ | ☐ | ☐ |
| Multiresistente infecties (ESBL, BRMO) | ☐ | ☐ | ☐ | ☐ |

Anders, namelijk……

# CHAPTER 5

## THE METHODOLOGICAL QUALITY OF NURSE-SENSITIVE INDICATORS IN HOSPITALS: A DESCRIPTIVE-EXPLORATIVE RESEARCH STUDY

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Submitted

# Abstract

**Background:** Two Dutch national programmes use nurse-sensitive indicators to monitor quality of care.
**Aims:** The objective was to gain insight into the methodological quality of mandatory nurse-sensitive indicators in Dutch hospitals.
**Methods:** We applied a descriptive-explorative design, starting with desk research to determine which quality indicators are mandatory for hospital care. We prepared an overview of quality indicators and an expert group identified those that are nurse-sensitive. We used the validated AIRE instrument to evaluate the methodological quality of these indicators.
**Results:** The quality of nursing care in Dutch hospitals is structurally monitored. Two national programmes, both committed to increasing healthcare safety, use nurse-sensitive indicators. They are related to 'pain', 'wound care', 'malnutrition', 'delirium' and are developed in close dialogue with stakeholders and professionals. The methods used to establish a scientific basis for the nurse-sensitive indicators are not detailed by the developers. Moreover, we found incongruence between formulation, definition, target groups and assessments frequency regarding 'pain' and 'malnutrition'.
**Conclusions:** The development process is not sufficiently transparent. The methodological quality therefore remains unclear. Inconsistency in the quality of data could lead to inconsistency in evidence. Nursing professionals should critically contemplate if the current nurse-sensitive indicators are of sufficient value for nursing practice. It is important to maintain efforts to strengthen a sustainable development of suitable nurse-sensitive indicators.

## Introduction

Quality indicators have been developed and implemented within nursing practice to indicate the quality of nursing care.[1,2] Nurse-sensitive indicators (NSIs) reflect aspects or outcomes of care that can be affected by nursing care.[3] Quality indicators are often subdivided into structure, process and outcome indicators.[4,5] Structure indicators are related to organisational aspects, such as the percentage of nurses at unit level. Process indicators provide an indication of, for instance, compliance with guidelines and standards of care. Outcome indicators relate to the effects of care, for example the percentage of patients with pain scores above a certain threshold.

The scores of quality indicators are used for a variety of objectives related to both internal quality improvement and external accountability.[6] Internal quality improvement means that nurses measure and evaluate the nursing care and make their contribution to patient outcomes visible,[7] in order to "improve, maintain or recover health and functioning of patients, to cope with health problems, and to achieve the best possible quality of life, whatever their disease or disability, until death".[8] Quality indicator scores can be used to share and compare nursing quality within or with other healthcare organisations, which helps to identify and understand problems and formulate improvement goals.[9]

External accountability has to do with the need of healthcare quality regulators (e.g. national quality commissions or healthcare inspectorates) to control the functioning of the healthcare system and evaluate the impact of policies.[10] External accountability also refers to governmental quality regulation, pay-for-performance contracts or consumer information.[11] In this case, quality indicator scores are needed to measure 'return on investment', for selective contracting or to facilitate choice for consumers.

Because of the increased significance of NSIs, the development process should be a thorough and careful one. Developers must pay attention to the methodological quality, including factors associated with the acceptance and implementation process, such as an explicit objective and purpose, as well as a comprehensible formulation, substantiation and usability, meaning the extent to which nurses can use and understand the scores.[12,13] Methodological quality is about the process in which scientific evidence is collected and compiled. It involves the scientific development and construction of quality indicators.[14]

An unclear development process can lead to inconsistent evidence. As confirmed by a literature review, Burston et al.[15] found no consistent evidence regarding NSIs and their effects on patient outcomes. This can be attributed to different definitions of quality indicators, as well as to such aspects as an unclear level of analysis or lack of diligence when documenting and reporting. It is therefore important to maintain efforts to strengthen a sustainable development of suitable NSIs.

The Dutch government, like for instance governments in Australia, Denmark or Scotland, encourages and supports the development and implementation of quality indicators in order to enhance quality.[16-19] It is not clear, however, which quality indicators are labelled 'nurse-sensitive' and what their methodological quality is in terms of scientific evidence and factors influencing acceptance and implementation. The aim of this study was to evaluate the methodological quality of the NSIs that have been developed and adopted in Dutch hospital settings.

By sharing knowledge and lessons learned, other nursing policymakers and researchers involved in the development or implementation of quality indicators may profit.

### Research questions

1. Which NSIs are mandatory for Dutch hospitals to monitor the quality of care?
2. What is the methodological quality of these indicators?

## Method

### Research design

A descriptive-explorative design to identify NSIs and their methodological quality.

### Data collection

We used various data sources, including desk research, in order to find out which quality indicators were labelled 'nurse-sensitive' and how they were defined.
Two researchers and also nursing experts (AJ, RK) studied and reviewed literature related to the assignment and development of Dutch NSIs that is published in freely available public documents, reports and websites.[16,20-33]
Next, expert opinion was obtained from a group of four researchers with expert knowledge of NSIs and six policymakers who work within hospital care and are familiar with the administration process of NSIs. The experts are participating in a Dutch programme 'Excellent Care' (http://www.venvn.nl/Dossiers/ExcellenteZorg.aspx), which focuses on creating an inspiring and innovative nurse work environment to improve quality of care.
Finally, to investigate the methodological quality of the developed NSIs, we used the validated Appraisal of Indicators through Research and Evaluation (AIRE).
This instrument is primarily intended to assess the methodological quality of existing quality indicators and provides information about their development trajectory.[34]
It was therefore suitable for the purpose of our study.

**Data analysis**

Two Dutch programmes are leading in the development and choice of quality indicators that are relevant for nursing care. The Healthcare Inspectorate (further mentioned the Inspectorate programme) – an autonomous department of the Ministry of Health, Welfare and Sport – has developed a national 'risk-based' supervision programme to identify areas in which potential risks to the quality of care exist. The Inspectorate programme sets healthcare sector-specific quality indicators, which are mandatory for healthcare organisations.[16] The basic set can change over time depending policy priorities or public attention to emerging topics. We analysed the included mandatory healthcare indicators of 2014. In 2008, the Ministry launched a national safety management programme (further mentioned the safety programme). The purpose is to prevent or reduce healthcare-related accidents and adverse events. It entails the implementation of a safety management system for 10 substantive themes [23-33], including the development of quality indicators. The selection of these themes was based on research into the preventability of adverse events in Dutch hospitals.[22] Since 2013, all Dutch hospitals are obliged to participate in the programme; they can, however, decide which themes to prioritize (http://www.vmszorg.nl/). The Healthcare Inspectorate monitors the progress of the implementation of the safety programme within hospitals.

Both programmes include a large number of quality indicators, of which two researchers (RK, AJ) made an overview (see appendix). For those quality indicators that were mandatory for hospitals, they explored which were assigned or could be regarded as NSIs. Because there were no fixed criteria for labelling quality indicators 'nurse-sensitive' indicators, we consulted a group of experts (n=10) with both practical and scientific expertise in NSIs. The expert group reached consensus about which quality indicators can be labelled 'nurse-sensitive'.

We then assessed the methodological quality of the selected 10 NSIs using the AIRE instrument,[34] which consists of four domains:

- Purpose, relevance and organisational entity
- Stakeholder involvement in the development and assignment process
- Scientific evidence (i.e. which systematic methods were used to search for scientific evidence)
- Additional evidence, formulation and usage (i.e. the specification of the quality indicator)

Each domain contains several items, amounting to a total of 20. Each item has a score ranging from 1 ('strongly disagree') to 4 ('strongly agree'). The item scores were converted to domain level by a standardized calculation procedure.[34]

Four researchers (RK, AJ, IvP and MH) independently completed the AIRE instrument separately for each NSI. The scores were based on knowledge extracted from the documents studied. The scores supported the researchers (RK, AJ, DD, DS) in their analysis and discussion.

## Results

### Nurse-sensitive indicators

The Inspectorate programme provides 'nursing care' quality indicators, divided into two categories: 'basic care' and 'monitoring function'. Wound care and malnutrition come under 'basic care', and delirium and pain under 'monitoring function'.[16]

Two themes within the safety programme contain NSIs: 'early recognition and treatment of pain' and 'vulnerable elderly', including screening for and treatment of malnutrition and delirium risk assessment, and screening for and observation of delirium, falls and physical limitations.[24,33] Table 1 shows the overlap between the programmes. The dashes mean that the quality indicator has not been developed within the programme.

***Table 1.*** *Nurse-sensitive indicators for Dutch hospital care (2014).*

| Hospital care | Inspectorate programme | Safety programme |
|---|---|---|
| Pain – Percentage of standardized pain assessments | x | x |
| Pain – Percentage of patients with, at any time, a pain score above 7 | x | x |
| Wound care – Wound expertise centre | x | - |
| Wound care – Diabetic feet pressure ulcer | x | - |
| Malnutrition – Screening for malnutrition (adults and children) | x | x |
| Malnutrition – Treatment of malnutrition (adults and children) | x | x |
| Delirium – Risk of developing delirium | x | x |
| Delirium – Screening for and observation of delirium | x | x |
| Screening for fall risk | - | x |
| Screening for physical limitations | - | x |



### Methodological quality of nurse-sensitive indicators

Here, we present the results of our analyses of the methodological quality of the selected NSIs, which we assessed with the AIRE instrument.

### Purpose, relevance and organisational entity

Both programmes are committed to increasing patient safety. Within the Inspectorate programme substantive priorities for the period up to 2015 have been defined, such as improving care for the elderly. These priorities are established in dialogue with representatives of healthcare organisations, insurers, scientists and politicians.[21] By using NSIs, care processes that need extra attention (external purpose) can be examined.[20]

The safety programme quality indicators were determined after a study of avoidable adverse events and mortality in Dutch hospitals.[22] Ten 'highly avoidable' themes emerged, including pain and vulnerable elderly. By using these quality indicators, healthcare organisations can examine how to improve their care processes (internal purpose) (www.vmszorg.nl). Within each theme, the management's responsibility for monitoring patient safety performance and reporting the results to the board of directors is laid down.[24,33] The level of analysis is not always clearly specified.

Both programmes specify the criteria on which quality indicators were selected. The relevance of the subjects was determined by the impact on patient's health and functional status or where the probability of death is increasing.[16,24,33]

### Stakeholder involvement

Regarding the Inspectorate programme, a coordinator maintains contact with the Dutch Hospitals Association, Dutch Federation of University Medical Centres, Order of Medical Specialists and (since 2012) the Dutch Nurses' Association.[16] The development process from proposal to approval takes approximately two years. Which professionals or experts participate in the development process is not mentioned. The NSIs were formally approved by a medical scientific committee.[16]

The safety programme had set up an expert team per theme; each team developed a guide describing quality indicators. The 'pain' team had 15 members: two nurse practitioners, one nursing professor and 12 professionals with a medical background.[33] The 'malnutrition, delirium, falls and physical limitations' team consisted of 13 professionals, including one nurse practitioner, one nursing researcher and one nursing professor.[24] Whether patient organisations or insurers were included was not stated.

Since 2013, the safety programme has been supporting Dutch hospitals by offering a cooperation structure and knowledge on the subject of the 10 themes in order to increase patient safety. The Inspectorate programme, is monitoring the extent to which hospitals are progressing in their implementation of the 10 themes.[16]

### Scientific evidence

Both programmes provide no further information about the search strategy or the search terms used, or they offer inconsistent information about underlying evidence related to the selection of quality indicators, validation or evaluation studies, or the accuracy and reliability of quality indicators. However, within the specification of each quality indicator, they do refer, although not always consistently, to scientific evidence presented in the literature. In contrast to the Inspectorate programme, the safety programme provides a literature overview per theme.[24,33]

### Additional evidence, formulation and usage

We analysed each NSI by examining its definition, indicator description, numerator, denominator, target group, assessment frequency, assessment scale and type of indicator. Because both programmes use quality indicators for pain, malnutrition and delirium, we could compare them with each other. We only elaborate these results; 'wound care, falls and physical limitations' are not dealt with.

***Pain***

Within the Inspectorate programme 'pain' has not been defined, whereas the safety programme uses two references (see table 2). 'Pain' has been divided into two indicators. The first is the percentage of standardized pain assessments. The target group differs: the Inspectorate programme includes post-operative patients and excludes children aged below seven, whereas the safety programme includes all in-patients, including all children. The description of the numerator and denominator also differs, as shown in table 2.

The second indicator is the number of patients with a pain score. The Inspectorate programme includes patients with a pain score above 7 after the first 72 hours following an operation. The safety programme incorporates diverse levels of pain (see indicator 2).

There are differences in assessment frequency. The Inspectorate programme specifies at least six measurements per patient equally divided over the 72 hours following surgery, whereas the safety programme recommends three measurements per day and states a preference for the numerical rating scale. The Inspectorate programme recommends various scales. It is not mentioned whether the scores can be compared.

***Table 2.*** *Pain: comparison between the Inspectorate programme and safety programme.*

| Pain | |
|---|---|
| **Inspectorate programme** | **Safety programme** |
| No definition of pain | Two definitions of pain:<br>• 'Pain is whatever the experiencing person says it is, existing whenever the experiencing person say it does' (McCaffery M. Nursing Management of the Patient with Pain. Philadelphia: IC Lippincott; 1979)<br>• 'An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage' (IASP, 1979) |
| Pain level:<br>Acceptable pain: pain score < 4<br>Moderate pain: pain score > 4 and ≤ 7<br>Severe pain: pain score >7 | Pain level: only acceptable pain has been explained: pain score < 4 |
| Indicator 1<br>Percentage of standardized pain assessments including post-operative patients | Indicator 1<br>• Percentage of standardized pain assessments including patients at unit level<br>• Percentage of standardized pain assessments including first-aid patients during triage and discharge |
| Numerator of indicator 1<br>The number of post-operative in-patients who underwent a standardized pain assessment on the nursing ward | Numerator of indicator 1<br>• The number of clinical patients who underwent a standardized pain assessment on the nursing ward<br>• The number adult patients in the emergency department who underwent a standardized pain assessment during triage and discharge and such was registered |
| Denominator of indicator 1<br>The total number of post-operative in-patients on the nursing ward | Denominator of indicator 1<br>• The number of occupant days on nursing wards multiplied by three measurements per day<br>• All reported adult patients in the emergency department |

| Type of indicator 1: not mentioned | Type of indicator 1: process indicator |
|---|---|
| Target group<br>Inclusion criteria: post-operative patients<br>Exclusion criteria:<br>• Children under the age of seven<br>• Outpatient setting | Target group<br>All in-patients and patients in the emergency department |
| Indicator 2<br>Percentage of patients with a pain score >7 at any time within the first 72 hours following surgery | Indicator 2<br>a) Percentage of patients with a pain score >7 at any time within the first 72 hours following surgery<br>b) Percentage of cancer patients with moderate or severe pain<br>c) Percentage of pain scores <4 of all registered pain scores |
| Numerator of indicator 2<br>The number of patients with a pain score >7 at any time within the first 72 hours following surgery | Numerator of indicator 2<br>a) Not mentioned<br>b) Not mentioned<br>c) Not mentioned |
| Denominator of indicator 2<br>The total number of patients whose pain score is systematically measured | Denominator of indicator 2<br>a) Not mentioned<br>b) Not mentioned<br>c) Not mentioned |
| Type of indicator 2: not mentioned | Type of indicator 2: outcome indicator |
| Target group<br>Inclusion criteria: all systematically measured pain scores including post-operative patients<br>Exclusion criteria:<br>• Children under the age of seven<br>• Patients in an outpatient setting | Target group<br>All in-patients and patients in the emergency department |
| Assessment frequency<br>At least 6 measurements per patient divided equally over the first 72 hours after surgery | Assessment frequency<br>Three measurements per day |
| Assessment scale<br>• Numerical rating scale (NRS)<br>• Visual analogue scale (VAS)<br>• Verbal rating scale (VRS) | Assessment scale<br>• Preference for numerical rating scale (NRS)<br>• Visual analogue scale (VAS) offered as an alternative<br>• Children > 7: visual analogue scale (VAS) and numerical scales<br>• Children < 7: Comfort or FlACC observation tool (Face, Legs, Activity, Cry and Consolability)<br>• Neonates and infants: Comfort-neo or Neonatal Infant Pain Scale (NIPS) or Premature Infant Pain Profile (PIPP) |

***Malnutrition***

The definition of malnutrition differs between programmes. A clear distinction between 'moderate', 'severe' and 'acute' malnutrition is lacking. Both programmes divide 'malnutrition' into a screening and a treatment indicator.

Regarding screening, the Inspectorate programme only specifies an indicator for children. In the accompanying description, it is assumed that in practice adults are routinely screened. However, the safety programme has developed a screening indicator for those aged older than 70 years. In the explanation of the numerator and denominator, the safety programme refers to the Inspectorate programme's indicator 'early recognition and treatment of malnutrition'.

The Inspectorate programme differentiated 'treatment of malnutrition' into a separate indicator for adults and children. Adults should have an adequate intake of protein. Although the target group varies between both programmes (severely malnourished adult patients versus moderately and severely malnourished adult patients), the safety programme refers to the Inspectorate programme. The numerator and denominator are not given.

The assessment frequency within the Inspectorate programme has been quantified in one measurement per quarter. An adequate protein intake norm has been specified. It is unclear, however, who is responsible for an accurate registration and which registration form is applicable. The safety programme does not specify an assessment frequency.

***Table 3.*** *Malnutrition: comparison between the Inspectorate programme and safety programme.*

| Malnutrition | |
|---|---|
| **Inspectorate programme** | **Safety programme** |
| Definition of malnourished patient:<br>• Children (28 days – 1 year) with a weight less than the number relating to -2 SD on the growth curve weight to age<br>• Children (1 - <18 years) with a weight less than the number relating to -2 SD on the growth curve weight to length<br>• Adults (≥18 years) with a SNAQ score on admission of ≥ 3 or a MUST score of ≥ 2 (no reference) | Definition of malnourished patient:<br>• Body mass index < 20 (patients affected by COPD < 21)<br>• and/or > 10% unintentional weight loss in the past six months<br>• and/or > 5% unintentional weight loss in the past month<br><br>Moderate malnourished patient:<br>• Body mass index 20-22<br>• and/or 5-10% weight loss in the past six months |
| Indicator 1<br>Screening for malnutrition including children admitted to the clinic<br>• Percentage of children screened for malnutrition<br>• Percentage of children classified as having acute malnutrition | Indicator 1<br>Screening for malnutrition including elderly (70 years or older) during admission (the programme refers to the Inspectorate programme's indicator 'early recognition and treatment of malnutrition') |
| Numerator of indicator 1<br>• Number of children screened for acute malnutrition during admission<br>• Percentage of children classified as having acute malnutrition | Numerator of indicator 1<br>The numerator is not given; the programme refers to the Inspectorate programme's indicator 'early recognition and treatment of malnutrition' |

| | |
|---|---|
| Denominator of indicator 1<br>• Number of children admitted during the reporting year<br>• Number of children screened for acute malnutrition during admission | Denominator of indicator 1<br>The denominator is not given; the programme refers to the Inspectorate programme's indicator 'early recognition and treatment of malnutrition' |
| Type of indicator 1: not mentioned | Type of indicator 1: not mentioned |
| Target group<br>Exclusion criteria:<br>• Children in an outpatient setting<br>• Children aged younger than 28 days | Target group<br>Elderly patients (70 years or older) |
| Assessment frequency indicator 1<br>Children: screening for malnutrition on admission | Assessment frequency indicator 1<br>All patients aged 70 years or older on admission |
| Assessment scale<br>• Children: StrongKids | Assessment scale<br>• Preference for Malnutrition Universal Screening Tool (MUST) or<br>• Short Nutritional Assessment Questionnaire (SNAQ) |
| Indicator 2<br>Treatment of malnutrition including children and adults<br>• Adults: percentage of severely malnourished adults with an adequate amount of protein intake<br>• Children: percentage of acutely malnourished children with an adequate amount of protein and energy intake | Indicator 2<br>Rapid and adequate nutrition intervention including malnourished elderly patients (70 years or older). The programme refers to the Inspectorate programme's indicator 'early recognition and treatment of malnutrition'. |
| Numerator of indicator 2<br>• Adults: number of severely malnourished adults with an adequate protein intake on the fourth day of admission<br>• Children: number of malnourished children with an adequate protein and energy intake on the fourth day of admission<br>• Children: number of malnourished children with an adequate energy intake on the fourth day of admission | Numerator of indicator 2<br>The numerator is not given; the programme refers to the Inspectorate programme's indicator 'early recognition and treatment of malnutrition' |
| Denominator of indicator 2<br>• Adults: number of severely malnourished adults on the fifth day of admission<br>• Children: number of severely malnourished children on the fifth day of admission | Denominator of indicator 2<br>The denominator is not given; the programme refers to the Inspectorate programme's indicator 'early recognition and treatment of malnutrition' |
| Type of indicator 2: not mentioned | Type of indicator 2: not mentioned |
| Target group indicator 2<br>Severely malnourished adult patients<br>Acutely malnourished children > 1 year | Target group indicator 2<br>All moderately and severely malnourished patients |
| Assessment frequency indicator 2<br>• Adults: continuously or quarterly (one measurement per quarter)<br>• Children: continuously or quarterly (one measurement per quarter) | Assessment frequency indicator 2<br>• Moderate or severe malnutrition: the nurse calls the nutrition assistant for assistance<br>• Severe malnutrition: The doctor calls the dietician for assistance. The nurse monitors the food intake and weight |
| Assessment scale for indicator 2<br>During treatment of malnutrition no specific monitoring scales or instruments are stipulated | Assessment scale for indicator 2<br>During treatment of malnutrition, no specific monitoring scales or instruments are stipulated |

***Delirium***

This NSI is divided into screening and observation/early recognition (table 4). Although the indicator title related to screening differs, both programmes aim at identifying high-risk patients. The elaboration is aligned with definition, target group and assessment scales. As regards the screening indicator, the safety programme refers to the numerator and denominator of the Inspectorate programme.

Looking at the assessment frequency related to 'observation/early recognition', the safety programme recommends assessing patients three times a day for three days using the DOSS/CAM. Although the assessment frequency is not stipulated within the Inspectorate programme, the assessment method is well defined: all patients assessed with the DOSS/CAM instrument should be counted once per quarter. The outcome of this indicator is the average of the four quarterly counts.

***Table 4.*** *Delirium: comparison between the Inspectorate programme and safety programme.*

| **Delirium** | |
|---|---|
| **Inspectorate programme** | **Safety programme** |
| Definition of delirium<br>Based on DSM IV | Definition of delirium<br>Based on DSM IV |
| Indicator 1<br>Risk assessment for delirium<br>Percentage of nursing wards that register screening | Indicator 1<br>Screening for and early detection of delirium: percentage of nursing wards that systematically screen patients |
| Numerator of indicator 1<br>The number of nursing wards (or in pre-operative screening, outpatient clinics) where over 80% of all patients (70 years or older) are registered for delirium risk score on admission in the medical records. | Numerator of indicator 1<br>Not mentioned. The nominator is not given; refers to the Inspectorate programme |
| Denominator of indicator 1<br>The number of nursing wards where at any time during the record year, patients aged 70 years or older are admitted | Denominator of indicator 1<br>Not mentioned. The nominator is not given; refers to the Inspectorate programme |
| Type of indicator: not mentioned | Type of indicator: process indicator |
| Target group indicator 1<br>Elderly patients (70 years or older) | Target group indicator 1<br>Elderly patients (70 years or older) |
| Assessment frequency indicator 1<br>On admission | Assessment frequency indicator 1<br>On admission |
| Assessment scale for indicator 1<br>Three questions:<br>• Do you have memory problems?<br>• Did you need help with anything in the last 24 hours?<br>• Did you have periods of confusion during a previous admission or sickness? | Assessment scale for indicator 1<br>Three questions:<br>• Do you have memory problems?<br>• Did you need help with anything in the last 24 hours?<br>• Did you have periods of confusion during a previous admission or sickness? |
| Indicator 2<br>Screening for and observation of delirium | Indicator 2<br>Early recognition of delirium on the nursing ward |
| Numerator of indicator 2<br>Number of patient assessed at least once for delirium by the DOSS or CAM (regardless of outcome) | Numerator of indicator 2<br>Not mentioned |

| | |
|---|---|
| Denominator of indicator 2<br>Number of patients assessed by the method of indicator 1 and who have a high risk of developing delirium (numerator of indicator 1), along with patients who were otherwise assessed and have a high risk of developing delirium | Denominator of indicator 2<br>Not mentioned |
| Type of indicator: not mentioned | Type of indicator: process indicator |
| Target group indicator 2<br>Elderly patients (70 years or older) with a confirmed high risk of developing delirium | Target group indicator 2<br>Elderly patients aged 70 years or older with a confirmed high risk of developing delirium |
| Assessment frequency indicator 2<br>Not clearly stated.<br>The measurement method is to assess all patients quarterly (one measurement once per quarter) | Assessment frequency indicator 2<br>Three times a day for three days, starting on the first admission day. Scores should be reported to the physician. |
| Assessment scale for indicator 2<br>DOSS or CAM | Assessment scale for indicator 2<br>DOSS or CAM |

## Discussion

In the Netherlands, there are two national programmes that are leading in the development and selection of quality indicators. Both programmes have set up a carefully designed development process that includes nurse-sensitive indicators (NSIs). This means that nursing quality in Dutch hospitals is structurally monitored as part of a national quality and safety programme.

Regarding the methodological quality of the NSIs in terms of scientific evidence and factors influencing the acceptance and implementation of the individual NSI, we found a lack of coherence between the programmes. For instance, there is dissimilarity in the definition of malnutrition, the assessment frequency and the target group. Also the numerator and denominator of malnutrition are striking: the energy or protein intake should be calculated on the fourth and fifth admission day of each malnourished patient. This seems to be highly impracticable, for example because a patient can be transferred to another nursing ward. It could be questioned whether the accuracy of quality indicators has been tested, since the process of collecting and compiling scientific evidence is unclear. This also applies to the 'pain' quality indicator. Imprecisely specified and elaborated quality indicators or technical specifications lead to inconsistency in the quality of data. This is also confirmed by Burston et al.[15] and Doran,[2] who state that disparity in definitions, data collection and analysis methods lead to inconsistency in evidence. A well-functioning monitoring system can only operate if nurses unambiguously specify which data need to be exchanged. Clearly defined and uniformly implemented nursing information will lead to the correct interpretation of the data recorded or exchanged.[35] One finding in this study was that nurses have not had considerable influence on the development process, since nurses and nursing experts are in the minority. In our view nurses, nursing experts and nursing researchers should be much more decisive during the development process. Nursing professionals understand nursing practice and can determine which NSIs are relevant and of sufficient value for nursing practice. They also can specify, formulate and uniformly define NSIs in order to allow consistent data collection. We believe that this will help to increase acceptance and ownership.

Although one programme has an internal purpose and the other an external purpose, they use most of the same NSIs. The data mainly give a general impression of the quality of nursing care, since data are aggregated to organisation level rather than unit level. Quality improvement can best occur when data are directly available to nurses, so they can take any action in response and compare the quality of care at unit level within their organisation or compare it to that of similar units in peer hospitals.[36] One example is the national nursing database of NSIs (NDNQI), which provides accessible nursing data at unit level to, for instance, monitor outcomes over time or compare data with peer units or peer hospitals.[37]
Although it is very positive that nursing quality is structurally monitored as part of a national quality and safety programme, neither programme specifies fixed criteria for labelling quality indicators as NSIs. It is therefore arguable whether for example, 'treatment of malnutrition' is truly a NSI. The identification of NSIs is not straightforward. The concept of NSI is difficult, because of inconsistencies and irregularities in definitions and explanations, as confirmed by Heslop et al.[38] Therefore, the implications of our findings must be considered within the context of the limits of this study.

## Conclusions

To monitor the quality of care, two national programmes incorporate NSIs that are developed in close dialogue with stakeholders and professionals.
Our study, however, revealed a lack of coherence between two programmes, which has led to dissimilarities between definitions, target groups and usage of NSIs.
The development process is not sufficiently transparent, which makes the quality of the methodology unclear. If we embrace the challenge to use data to improve quality of care, it is important to maintain efforts to strengthen a sustainable development of suitable NSIs.

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# Appendix

## An overview of quality indicators per programme

| Inspectorate programme | |
|---|---|
| Indicator 1 | Percentage of standardized pain assessments including post-operative patients |
| Indicator 2 | Percentage of patients with a pain score above 7 at any time within the first 72 hours following surgery |
| Indicator 3 | Re-operation after a hip fracture |
| Indicator 4 | Geriatric team as part of the treatment in hip fracture |
| Indicator 5 | Time-out |
| Indicator 6 | Prompt perioperative antibiotic prophylaxis |
| Indicator 7 | Volume bariatric surgery |
| Indicator 8 | Percentage of post-operative controls |
| Indicator 9 | Registration of cataracts |
| Indicator 10 | Participation in Quality Registry Neurosurgery (QRNS) |
| Indicator 11 | Multidisciplinary MIC user meeting |
| Indicator 12 | Centre of expertise for wounds |
| Indicator 13 | Diabetic foot wound classified by the Texas classification |
| Indicator 14 | Screening for malnutrition including children admitted to the clinic |
| Indicator 15 | Treatment of malnourished adults and children |
| Indicator 16 | Screening for malnutrition in the clinic |
| Indicator 17 | Risks for delirium |
| Indicator 18 | Screening for and observation of delirium |
| Indicator 19 | Respiratory hours for children on an ICU |
| Indicator 20 | Multidisciplinary staff meeting |
| Indicator 21 | Percentage of patient whose cancer tissue is left after the first breast-conserving surgery |

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| Indicator 22 | Participation in the Dutch Breast Cancer Audit (DBCA) |
| Indicator 23 | Waiting period between diagnosis and start of neo-adjuvant chemotherapy in breast cancer patients |
| Indicator 24 | Number of anatomy's resections |
| Indicator 25 | Participation in the Dutch Upper GI Cancer Audit (DUCA) |
| Indicator 26 | Resection of the Whipple of PPPD |
| Indicator 27 | Unplanned re-interventions after resection of a primary colorectal carcinoma |
| Indicator 28 | Multidisciplinary staff meeting for muscle-invasive bladder cancer |
| Indicator 29 | Participation in the registration of prostatectomy |
| Indicator 30 | Distribution and organisation of ovarian cancer treatment |
| Indicator 31 | Palliative radiotherapy bone metastases |
| Indicator 32 | Volume of abdominal aortic aneurysm surgery |
| Indicator 33 | Mortality in the first year of administrative consultation (EAC) in the outpatient cardiology clinic |
| Indicator 34 | Treatment of patients with a STEMI |
| Indicator 35 | Evaluation of the insertion of pacemakers: participation in systematic registration of data |
| Indicator 36 | Implantation and/or exchange of pacemakers and ICDs |
| Indicator 37 | Interventions of patients with a TIA-CVA |
| Indicator 38 | Percentage of complications |
| Indicator 39 | Participation in the national risk-adjusted mortality registration |
| Indicator 40 | Percentage of internal mammary artery used as graft |
| Indicator 41 | Percentage of deep sternal wound problems, mediastinitis |
| Indicator 42 | Surveillance of hospital infections |
| Indicator 43 | Usage scoring system CAP |
| Indicator 44 | Prompt administration of antibiotics in patients with severe CAP |

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|---|---|
| Indicator 45 | Digital reports of endoscopy |
| Indicator 46 | Performance of the time-out procedure in endoscopic operations |
| Indicator 47 | Percentage of spontaneous parturition in the 'NTSV group' |
| Indicator 48 | Extent of implementation of perinatal audits |
| Indicator 49 | Vulnerable groups: Screening for malnutrition in geriatric patients |
| Indicator 50 | Vulnerable groups: Screening for vulnerability in colorectal surgery |
| Indicator 51 | Vulnerable groups: Vulnerability Assessment |
| Indicator 52 | General quality policy: Annual interview |
| Indicator 53 | General quality policy: Individual performance of medical specialists |
| Indicator 54 | General quality policy: Regulation during malfunctioning of medical specialists |
| Indicator 55 | Hospitality mortality: Hospital Standardized Mortality Ratio (HSMR) |
| Indicator 56 | Hospitality mortality: Activities for improvement based on HSMR |
| Indicator 57 | File examination on preventable healthcare-related harm |
| Indicator 58 | Unexpectedly long occupational time |

| Safety programme | |
|---|---|
| **Theme 1 Optimal care in acute coronary syndromes** | |
| Indicator 1 | Structure indicator: Has your hospital developed policy on referring patients with myocardial infarction to a cardiac rehabilitation programme? |
| Indicator 2 | Structure indicator: Does the hospital have a cardiac rehabilitation programme? |
| Indicator 3 | Structure indicator: Are there written agreements between providers of cardiac rehabilitation in your area? |
| Indicator 4 | Process indicator: % of patients whose PCI treatment is started within 90 minutes after making the first medical contact |
| Indicator 5 | Process indicator: % of patients with an IAP/non-STEMI whereby the policy decision based on risk stratification is documented |
| Indicator 6 | Process indicator: % of patients with ACS who received a prescription for the discharge medication bundle after discharge |
| Indicator 7 | Outcome indicator: % mortality within 30 days after ACS |
| **Theme 2 Early recognition and treatment of critically ill patients** | |
| Indicator 8 | Structure indicator: Does your hospital structurally register resuscitations? |
| Indicator 9 | Structure indicator: Has your hospital developed a warning system for the recognition of critically ill patients? |
| Indicator 10 | Structure indicator: Has your hospital developed an emergency response team? |
| Indicator 11 | Structure indicator: Has your hospital developed a training and evaluation system? |
| Indicator 12 | Process indicator: Number of calls related to the emergency response team per 1000 discharged patients |
| Indicator 13 | Process indicator: Number of resuscitations on the nursing wards per 1000 patients |
| Indicator 14 | Process indicator: Does the main practitioner prepare a treatment plan within 30 minutes and does he/she evaluate the treatment effect within one hour after set? |
| Indicator 15 | Process indicator: How much time elapsed between the initial determination of an early warning score by the nurse and the time the emergency response team was approached? |

**Theme 3 Prevention of sepsis caused by line contamination and treatment of severe sepsis**

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|---|---|
| Indicator 16 | Process indicator: % of central venous catheters (CVCs) in which the sepsis intervention bundle is fully applied |
| Indicator 17 | Outcome indicator: Number of cases of sepsis caused by a contaminated line per 1000 catheter days |
| Indicator 18 | Process indicator: % of patients aged 18 years or older who are screened for sepsis by the screening document on admission to the ICU |
| Indicator 19 | Process indicator: % of patients aged 18 years or older admitted to the ICU with severe sepsis and whereby element X of the bundle had been applied |
| Indicator 20 | Outcome indicator: % of patients aged 18 years or older admitted to the ICU with severe sepsis and during hospitalization deceased |
| Indicator 21 | Outcome indicator: % of patients aged 18 years or older admitted to the ICU with severe sepsis and deceased within 30 days after diagnosis |

**Theme 4 Early recognition and treatment of pain**

| | |
|---|---|
| Indicator 22 | Structure indicator: Has your hospital developed a protocol for treatment of a) acute pain or post-operative pain, b) pain at the emergency department, c) pain due to cancer? |
| Indicator 23 | Structure indicator: Does your hospital organize a joint hospital-wide training in pain measurement and pain treatment for physicians and nurses, at least once a year? |
| Indicator 24 | Process indicator: % of performed standardized pain assessment including inpatients on the nursing ward |
| Indicator 25 | Process indicator: % of patients at the emergency department who underwent a standardized pain assessment during triage and discharge and has such registered |
| Indicator 26 | Outcome indicator: % of patients with a pain score above 7 at any time within the first 72 hours following surgery |
| Indicator 27 | Outcome indicator 1: % of moderate or severe pain including inpatients affected by cancer |
| Indicator 28 | Outcome indicator: % of all registered pain scores that are <4] |

**Theme 5 Vulnerable elderly**

| | |
|---|---|
| Indicator 29 | Structure indicator: Has the hospital developed a protocol for patients aged 70 years or older with developed delirium? |
| Indicator 30 | Process indicator: Screening for risk factors |
| Indicator 31 | Process indicator: Early recognition of delirium on the nursing ward |
| Indicator 32 | Indicator: Screening for risk factors for falls |
| Indicator 33 | Indicator: Screening for malnutrition, including in those 70 years or older, during admission |
| Indicator 34 | Indicator: Rapid and adequate nutrition intervention in malnourished elderly patients (70 years or older) |
| Indicator 35 | Process indicator: % of inpatients aged 70 years or older who are fully screened by the VMS bundle |
| Indicator 36 | Process indicator: % of inpatients aged 70 years or older with loss of function |

**Theme 6 Medication verification on admission and at discharge**

| | |
|---|---|
| Indicator 37 | Process indicator: % of patients whose medication record is verified on admission |
| Indicator 38 | Process indicator 2: % of patients whose medication record is verified at discharge |

**Theme 7 Safety healthcare for children in the case of illness**

| | |
|---|---|
| Indicator 39 | Process indicator: % of central venous catheters (CVCs) in which the sepsis intervention bundle is fully applied |
| Indicator 40 | Outcome indicator: Number of line sepsis cases per 100 catheter days |
| Indicator 41 | Process indicator: % of children with sepsis or a high probability of sepsis who received antibiotics within 1 hour after diagnosis |
| Indicator 42 | Structure indicator: Has your hospital developed a warning system (or a paediatric early warning system) for the recognition of a critically ill child? |
| Indicator 43 | Process indicator: % of children whose medication record is verified on admission |
| Indicator 44 | Process indicator: % of children whose medication record is verified at discharge |
| Indicator 45 | Structure indicator: Has your hospital developed a protocol for the treatment of a) acute pain or post-operative pain in children and b) pain in children at the emergency department? |
| Indicator 46 | Process indicator: % of performed standardized pain assessments in post-operative patients on wards |
| Indicator 47 | Early recognition and treatment of pain. Process indicator 5: % of children in the emergency department who underwent a standardized pain assessment during triage and discharge and such was registered |
| Indicator 48 | Process indicator: % of correctly prepared parenteral preparations administered to children |
| Indicator 49 | Process indicator: % of correctly administered parenteral preparations |
| Indicator 50 | Structural indicator: Has your hospital developed assignable identification and verification procedures for critical transfer moments as to a) the right patient, b) correct position and side, c) appropriate intervention, d) proper supplies, e) right patient materials? |
| Indicator 51 | Structural indicator: Are these identification and verification procedures registered at a central place (EPD and/or digital notification and registration system for interventions)? |
| Indicator 52 | Structural indicator: Are wrong-patient incidents structurally reported to the internal hospital incident reporting system? |
| Indicator 53 | Process indicator: % of elective surgeries at the clinic where the identification and verification procedures are applied |
| Indicator 54 | Process indicator: % of elective surgeries in which a time-out procedure was carried out before anaesthesia |
| Indicator 55 | Outcome indicator: number of wrong-patient incidents, wrong location and side, and wrong intervention per 1000 elective surgeries |

**Theme 8 Prevention of renal failure in intravascular use of iodinated contrast**

| | |
|---|---|
| Indicator 56 | Process indicator: % of patients whose eGFR before contrast administration is known |
| Indicator 57 | Process indicator: % of high-risk patients who are hydrogenated before contrast administration |
| Indicator 58 | Process indicator: % of patients identified as a high or low risk patients by both the applicant and the performer |
| Indicator 59 | Process indicator: % of patients whose eGFR is determined within the first 2–5 days following contrast administration |
| Indicator 60 | Process indicator: Number of patients whose contract ex is cancelled or is postponed due to an incorrect risk assessment by the applicant |
| Indicator 61 | Outcome indicator: % of patients in whom contrast-induced nephropathy (eGFR decreases 25%) has occurred |
| Indicator 62 | Outcome indicator: Number of patients who required dialysis due to contra-nephropathy |

**Theme 9 Wrong-patient incidents / mix-up patients**

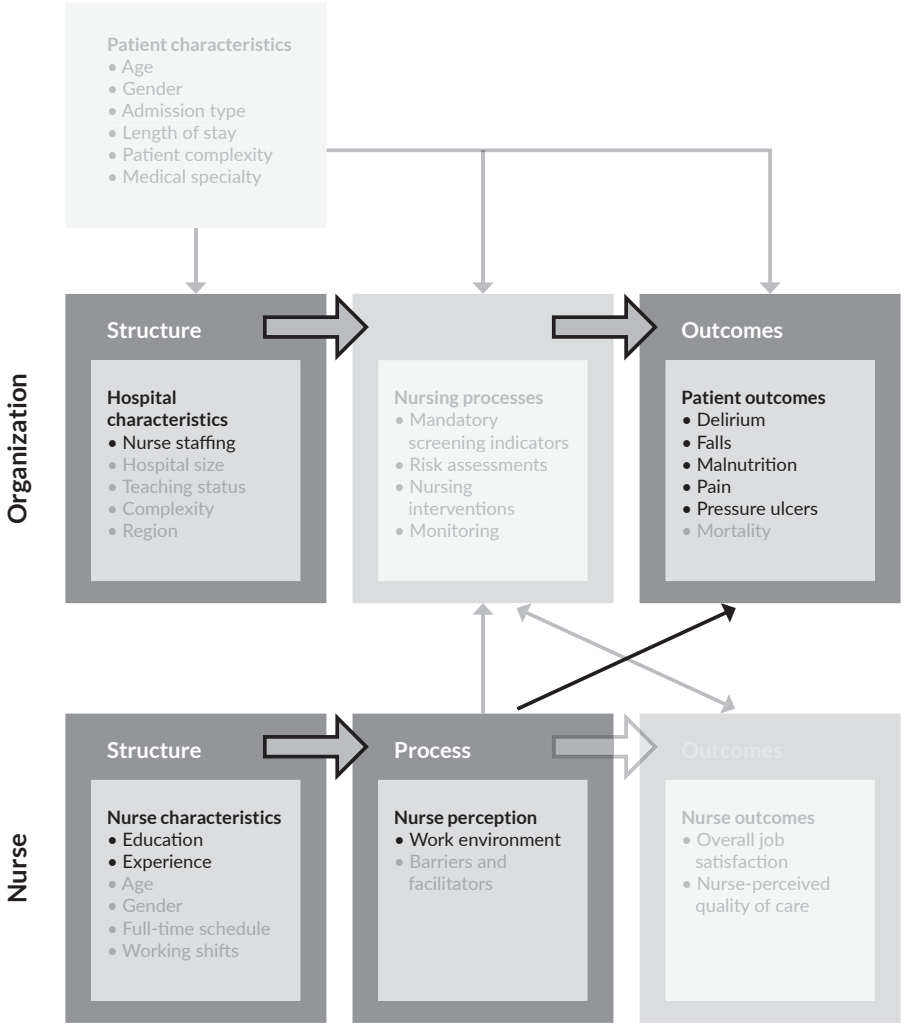
| | |
|---|---|
| Indicator 63 | Structural indicator: Has your hospital developed assignable identification and verification procedures for such critical transfer moments as a) the right patient, b) correct position and side, c) appropriate intervention, d) proper supplies, e) right patient materials? |
| Indicator 64 | Structural indicator: Are these identification and verification procedures registered at a central place (EPD and/or digital notification and registration system for interventions)? |
| Indicator 65 | Structural indicator: Are patient mix-up incidents structurally reported to the internal hospital incident reporting system? |
| Indicator 66 | Process indicator: % of elective surgeries at the outpatient clinic during which the identification and verification procedures are applied |
| Indicator 67 | Process indicator: % of elective surgeries during which a shared time-out procedure was carried out before anaesthesia |
| Indicator 68 | Outcome indicator: number of mix-up incidents, wrong location and side, and wrong intervention per 1000 elective surgeries |
| Indicator 69 | Process indicator: % of patients who went for surgery and were discovered during the time-out procedure (in the operating room) to not have the right side and position marked |
| Indicator 70 | Outcome indicator: % of surgeries during which the time-out procedure led to the detection of [inaccuracies that could lead to errors. These errors are related to a) right patient, b) correct position and side, c) appropriate intervention and d) proper supplies |

**Theme 10 High Risk Medication**

| | |
|---|---|
| Indicator 71 | Structure indicator: During this reporting year, did you report to the Central Medication Errors Registration databank, all medical errors that were recorded in your internal reporting system? |
| Indicator 72 | Process indicator: % of correctly prepared parenteral preparations |
| Indicator 73 | Process indicator: % of correctly administered parenteral preparations |
| Indicator 74 | Process indicator: % centrally prepared parenteral preparations at the pharmacy department |

# CHAPTER 6

## ASSOCIATIONS BETWEEN CHARACTERISTICS OF THE NURSE WORK ENVIRONMENT AND FIVE NURSE-SENSITIVE PATIENT OUTCOMES IN HOSPITALS: A SYSTEMATIC REVIEW OF LITERATURE

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# Abstract

**Background:** Nurse work environment is an important contributor for nurse outcomes, such as job satisfaction and burnout. Previous research showed associations between nurse staffing and patient outcomes, such as mortality and length of stay. High quality systematic reviews in this research area indicate methodological issues of primary studies.
**Aims:** To systematically review the literature on relationships between characteristics of the nurse work environment and five nurse-sensitive patient outcomes in hospitals.
**Methods:** The search was performed in Medline (PubMed), Cochrane, Embase, and CINAHL. Included were quantitative studies published from 2004 to 2012 that examined associations between work environment and the following patient outcomes: delirium, malnutrition, pain, patient falls and pressure ulcers. The Dutch version of Cochrane's critical appraisal instrument was used to assess the methodological quality of the included studies.
**Results:** Of the initial 1120 studies, 29 were included in the review. Nurse staffing was inversely related to patient falls; more favorable staffing hours were associated with fewer fall incidents. Mixed results were shown for nurse staffing in relation to pressure ulcers. Characteristics of work environment other than nurse staffing that showed significant effects were: (i) collaborative relationships; positively perceived communication between nurses and physicians was associated with fewer patient falls and lower rates of pressure ulcers, (ii) nurse education; higher levels of education were related to fewer patient falls, and (iii) nursing experience; lower levels of experience were related to more patient falls and higher rates of pressure ulcers. No eligible studies were found regarding delirium and malnutrition, and only one study found that favorable staffing was related to better pain management.
**Conclusions:** Our findings show that there is evidence on associations between work environment and nurse-sensitive patient outcomes. However, the results are equivocal and studies often do not provide clear conclusions. A quantitative meta-analysis was not feasible due to methodological issues in the primary studies (for example, poorly described samples). The diversity in outcome measures and the majority of cross-sectional designs make quantitative analysis even more difficult. In the future, well-described research designs of a longitudinal character will be needed in this field of work environment and nursing quality.

## Introduction

In 2004, the Institute of Medicine (IOM) published the report *Keeping Patients Safe: Transforming the Work Environment of Nurses,* emphasizing the importance of work environment in relation to the quality of nursing care.[1] Nurses constitute the largest group of employees in hospitals and deliver most of bedside patient care. Therefore, research on work environment factors influencing nursing quality is highly relevant to the healthcare field. McClure et al.[2] were the first to explicitly identify some of the major characteristics of the nursing work environment, such as nurse staffing, nurse autonomy and collaboration with physicians.[3] Since then, several studies have focused on the measurement of nursing work environments, for example the Nursing Work Index,[4] the Practice Environment Scale,[5] and the Essentials of Magnetism.[6] A healthy work environment is defined as "one in which leaders provide the structures, practices, systems and policies that enable clinical nurses to engage in the work processes and relationships essential to safe and quality patient care outcomes".[7]

Donabedian's Structure-Process-Outcome paradigm is often used as a framework for assessing work environments in relation to quality of care.[8] Structural variables refer to those characteristics affecting the ability of hospital units to meet health care needs and include organizational characteristics (e.g., staffing, skill mix), nurses' characteristics (e.g., education, experience) and patients' characteristics (e.g., age, complexity). Process variables refer to activities of nurses in providing care and include nurses' perception and nursing interventions. Outcome variables are the results of provided care. To date, the relationship between characteristics of nurse work environment and quality of nursing care has been the subject of many studies that have been summarized in several reviews.[9-14] Yet, previous reviews have almost exclusively focused on structural characteristics regarding staffing levels, such as nurse staffing and skill mix. For example, the review of Lang et al.[12] showed that higher levels of nurse staffing are associated with lower failure-to-rescue rates, lower inpatient mortality rates, and shorter hospital stays. Kane et al.[10] performed a meta-analysis on staffing ratios between 1990 and 2006 and found that increased ratios of registered nurses were associated with decreased mortality rates, decreased length of stay and fewer adverse events. Although these reviews greatly contributed to insight in the effects of nurse staffing on patient outcomes, there is a need for information about characteristics other than nurse staffing. Therefore, in the present review, in addition to nurse staffing, we will focus on a broader set of characteristics of work environment and their effect on patient outcomes.

We aim to accumulate knowledge in addition to previous research referring to outcome measures such as mortality, length of stay and healthcare-associated infections.[15-17] The main objective of the present study is to systematically review the literature and to provide an overview of associations between characteristics of the nurse work environment (e.g., nurse staffing, nurse-physician collaboration) and five nurse-sensitive patient outcomes (i.e., delirium, malnutrition, pain, patient falls, and pressure ulcers). Nurse-sensitive patient outcomes are defined as 'those outcomes that are relevant, based on nurses' scope and domain of practice, and for which there is empirical evidence linking nursing inputs and interventions to the outcome for patients'.[18,19] Focusing on a limited set of outcomes enables the opportunity for closer scrutiny on these five nurse-sensitive patient outcomes. Pain, patient falls and pressure ulcers are among the most commonly used nurse-sensitive outcome measures for benchmarking purposes in many countries (e.g., Canada, UK, and USA).[20] Additionally, delirium and malnutrition are less used in this context; however, their relevance is acknowledged, as in for example, the Netherlands it is mandatory for hospitals to publicly report these formal indicators of nursing quality.[21] We focus on articles published since 2004, which coincides with the release of the IOM- report mentioning the importance of quality of nursing care and the role of nurse work environments.[1]

## Methods

### Search strategy and inclusion criteria

The following electronic databases were used to extract relevant studies: Medline (PubMed), Cochrane Library, Embase and CINAHL. First, search terms were determined by screening abstracts and reference lists of reviews on nurse work environment. Figure 1 shows the final search strings. Second, two reviewers who are experts in the nursing field independently screened titles and abstracts of studies on their relevance. The final sample was established after full text reading by the same reviewers using inclusion and exclusion criteria, which are described in detail below. In case of discrepancies, there was discussion until consensus was reached. The MOOSE guidelines were used to structure this systematic review.[22]

We included studies that examined associations between work environment and nurse-sensitive patient outcomes in hospitals, had a quantitative study design, were written in English and were published from 2004 to 2012. In the literature search, we focused on delirium, malnutrition, pain, patient falls and pressure ulcers. These outcome measures are internationally used and acknowledged as benchmark indicators, for example in Scotland (NHS), UK (NHS), Sweden (CALNOC), Australia (CALNOC), Canada (C-HOBIC), USA (NDNQI), USA military (Milnod), USA veterans (VANOD), Belgium (B-NMDS), and the Netherlands (IGZ).[20] Two well-recognized indicator datasets of the Agency for Healthcare Research and Quality (AHRQ) and the National Database of Nursing Quality Indicators (NDNQI) allow these nurse-sensitive patient outcomes to be available and clearly defined.[23]

PubMed
((((patient[tiab] OR patients[tiab] OR patient's[tiab]) AND outcome*[tiab]) AND ("Hospitals"[Mesh] OR hospital*[tiab] OR inpatient*[tiab] OR hospitali*[tiab]) AND ("Nursing"[Mesh] OR "Nurses"[Mesh] OR "Nursing Staff, hospital"[Mesh] OR "nursing"[Subheading] OR ((nurse[tiab] OR nurses[tiab] OR nursing[tiab]) AND (characteristic*[tiab] OR practice*[tiab] OR staffing[tiab] OR quality[tiab] OR ((work[tiab] OR working[tiab]) AND (environment[tiab])) OR (skills mix[tiab] OR skill mix[tiab])))))) AND ((("Pressure Ulcer"[Mesh] OR pressure ulcer*[tiab] OR bedsore*[tiab] OR pressure sore*[tiab] OR decubitus[tiab]) OR ("Delirium"[Mesh] OR delirium*[tiab]) OR ("Pain Measurement"[Mesh] OR pain measur*[tiab] OR pain assess*[tiab]) OR ("Accidental Falls"[Mesh] OR fall*[tiab]) OR ("Malnutrition"[Mesh] OR malnutrition[tiab] OR undernutrition[tiab] OR nutritional deficienc*[tiab])) OR ((adverse event*[tiab] OR adverse occurrenc*[tiab]))))) OR (nurse sensitive[tiab] OR nursing sensitive[tiab]) OR ("Restraint, Physical"[Mesh] OR restraint*[tiab])

Embase
((patient* and outcome*).ti,ab. and (exp Hospital/ or hospital*.ti,ab. or inpatient*.ti,ab. or hospitali*.ti,ab.) and (exp Nursing/ or exp Nurse/ or exp Nursing Staff/ or ((nurse or nurses or nursing) and (characteristic* or practice* or staffing or quality or ((work or working) and environment) or (skills mix or skill mix))).ti,ab.) and (exp decubitus/ or pressure ulcer*.ti,ab. or bedsore*.ti,ab. or pressure sore*.ti,ab. or decubitus.ti,ab. or (exp Delirium/ or delirium*.ti,ab.) or (exp Pain assessment/ or pain measur*.ti,ab. or pain assess*.ti,ab.) or (exp Falling/ or fall*.ti,ab.) or (exp Malnutrition/ or malnutrition.ti,ab. or undernutrition.ti,ab. or nutritional deficienc*.ti,ab.) or ((adverse event* or adverse occurrenc*).ti,ab.))) or (nurse sensitive or nursing sensitive). ti,ab or (restraint*):ti,ab

Cinahl
((patient* and outcome*) AND (MH "Hospitals+" or hospital* or inpatient* or hospitali*) AND ((MH "Nurses+") OR (MH "Nursing Staff, Hospital") OR (MH "Nursing Practice+") OR ((nurse or nurses or nursing) and (characteristic* or practice* or staffing or quality or ((work or working) and environment) or (skills mix or skill mix)))) AND (MH "Pressure Ulcer+" OR pressure ulcer* or bedsore* or pressure sore* or decubitus OR MH "Delirium+" OR delirium* OR MH "Pain Measurement" OR pain measur* or pain assess* OR MH "Accidental Falls+" OR fall* OR MH "Malnutrition+" OR malnutrition or undernutrition or nutritional deficienc* OR MH "Adverse Health Care Event+" OR adverse event* or adverse occurrenc*)) OR "nurse sensitive" or "nursing sensitive" OR (MH "Restraint, Chemical" OR MH "Restraint, Physical" OR restraint*)

***Figure 1.*** *Search query.*

To find as many applicable studies for work environment characteristics, we used broad definitions regarding the nurse work environment (see Figure 1). Then, to categorize the results we divided structural and process characteristics. For the structural characteristic of nurse staffing, we included the frequently used measures: (i) total nursing hours defined as "total number of productive hours worked by all nursing staff with direct care responsibilities per number of days a patient stays in the hospital", (ii) registered nurses' hours (RN hours) defined as "number of productive hours worked by a registered nurse (a nurse who holds a specific license with at least a three-year training certificate and holding post graduate qualifications) with direct care responsibilities per patient day", (iii) proportion of registered nurses (% RN) defined as "proportion of productive hours worked by a registered nurse", (iv) temporary nurses defined as 'any licensed nurse who is providing service at the facility as an employee of another entity" and (v) turnover defined as "the process whereby nursing staff leave or patients transfer within the hospital environment".[1,10,24] In addition to nurse staffing, the structural characteristics of nurse experience and nurse education were added to the review, because these characteristics are potential influential factors.[7,25]

To categorize process characteristics of the work environment, we used the items of the *Essentials of Magnetism*,[7] including the eight factors which, according to nurses and experts in the field are essential for a healthy work environment and necessary for the provision of quality of care: (i) clinically competent peers, (ii) collaborative nurse-physician relationships, (iii) clinical autonomy, (iv) support for education, (v) adequacy of staffing, (vi) nurse manager support, (vii) control of nursing practice and (viii) patient-centered cultural values. These items have shown to be reliable and valid indicators regarding the quality of the nurse work environment.[26]

### Exclusion criteria

This review concerns hospital care; studies examining healthcare settings other than hospitals (e.g., nursing homes, homecare, and rehabilitation clinics) were excluded. Initially, we wanted to perform a quantitative evaluation of previous research by presenting a meta-analysis of studies using objective outcome measures (e.g., clinical reported medical records from hospital databases). Therefore, study designs in which analysis was limited to only subjective perception measures (e.g., surveys) and articles on staff-related or organization-related outcomes (e.g., nurse satisfaction studies, economic evaluations) were excluded. An exception was made for the outcome measure of pain; ratings of pain express a subjective measure as pain is experienced by patients. Dissertations, reviews and studies initiated in developing or non-Western countries were excluded to enable valid comparison.

### Quality appraisal

To determine methodological quality of selected studies we used the Dutch version of Cochrane's critical appraisal instrument, addressing randomized controlled trials (RCTs), cohort studies, and cross-sectional studies.[27] The criteria of validity (e.g., well-described design, appropriate methods, definition of research participants, and selection bias), reliability (e.g., follow up, confounders, outcome data, and statistical methods) and applicability (e.g., generalizability, relevance within health care) were assessed for each study. The criteria were scored as the following: fully met (1 point), partly met (½ point) or not met (0 point). The total scores give an indication of study quality. Specifically, studies of low quality scored ½ -1 point, studies of moderate quality 1½ - 2 points and studies of high quality 2½ - 3 points. Subsequently, the levels of evidence, ranging from A2 to D status, were determined. The A2-level constitutes RCTs and prospective cohort studies with sufficient sample sizes and follow-up. Observational studies (i.e., cohort and patient control) that did not meet the criteria of A2- level were labeled level B. Level C includes studies with a descriptive design (i.e., cross-sectional studies) and level D includes experts' opinion.

## Results

### Description of studies

The initial search yielded 1120 references of which 989 remained after removing duplicates (Figure 2). After screening the titles, 298 studies were selected for further examination. Based on the abstracts, the two reviewers independently decided that 57 studies met the inclusion criteria. After full text reading, the final sample included 29 studies (Kappa's coefficient: 0.74). Table 1 represents the characteristics of these studies. Most studies originated from North-America (20 from the USA and three from Canada). Two studies were conducted in Australia and New-Zealand, one in the UK and one in Belgium. Two studies compared data from the USA with data from other countries (Sweden and Canada). The studies differed in their level of analysis; five studies described results at the hospital-level and 24 studies at the unit-level. The unit-level analysis mainly focused on intensive care, surgical and medical/surgical units.

In terms of the nurse-sensitive outcomes, 12 studies examined pressure ulcers and 11 examined patient falls. Six studies analyzed both pressure ulcers and patient falls, among which one also elaborated on pain management. The search did not yield any applicable studies referring to delirium or malnutrition.

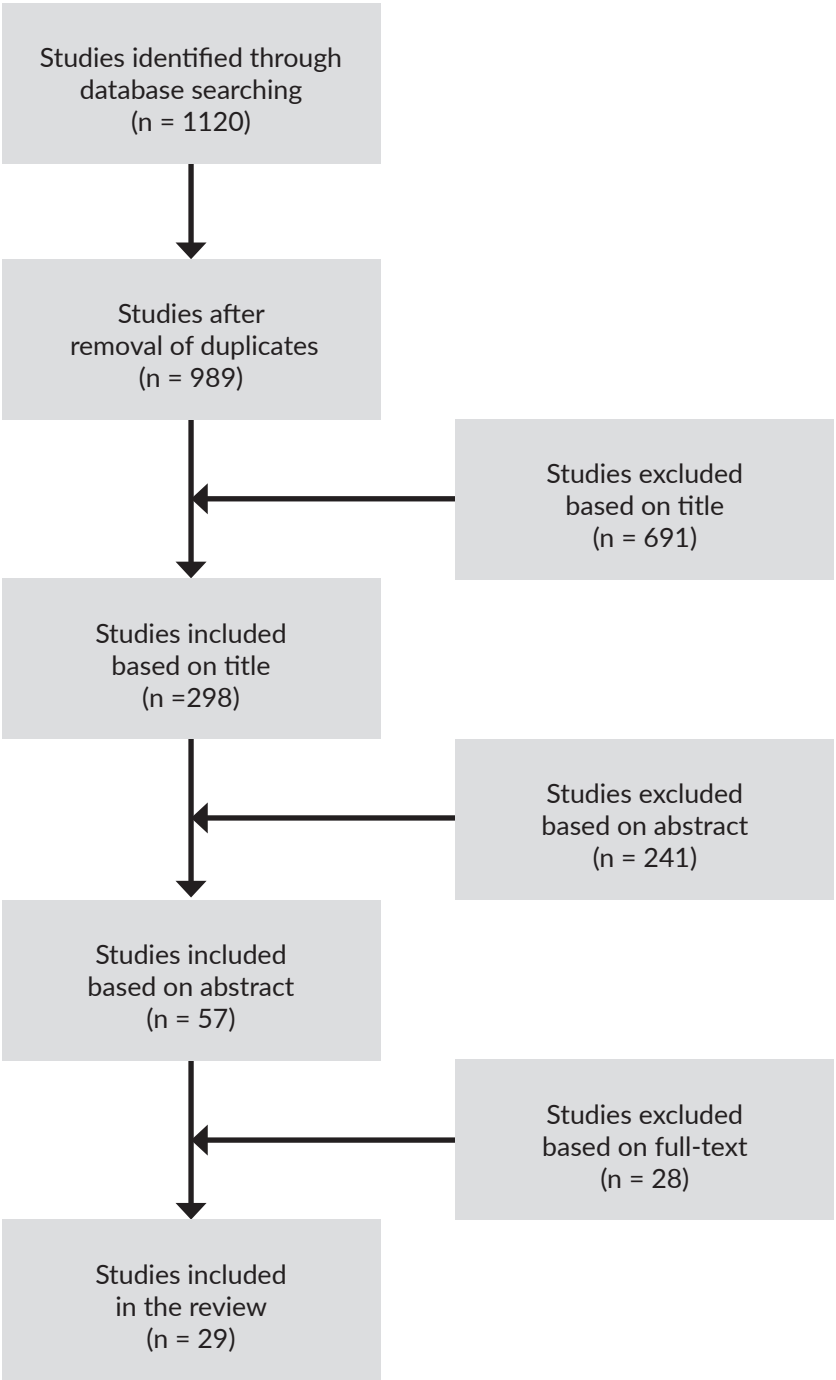


***Figure 2**. Flowchart of the inclusion process.*

*Table 1. Characteristics of included studies.*

| Author, year, and country | Design | Sample | Independent variables | Outcome variables | Factors controlled for | Key findings |
|---|---|---|---|---|---|---|
| Bae et al. 2010a, USA | Cross-sectional<br>Retrospective<br>2003-2004<br><br>Staff nurse survey | N= 277 medical/surgical units of 142 hospitals<br><br>N nurses= 4954<br>N patients= not described | **Skill mix**<br>% External temporary nurse hours/RN<br>% Internal temporary nurse hours/RN<br>% Total temporary nurse hours/RN | **Patient falls**<br>Incidence/1000 patient days | Work complexity<br>Support services<br>Nurse age<br>Educational level<br>Unit tenure<br>RN hours<br>Unit size<br>Magnet certification | Significant more falls in units with high levels of total temporary nurse hours RR= 1.188 $p$=.05<br><br>No significance for external or internal temporary nurse hours |
| Bae et al. 2010b, USA | Cross-sectional<br>Retrospective<br>2003-2004<br><br>RN survey | N= 268 medical/surgical and general units of 141 hospitals<br><br>N nurses= not described<br>N patients= not described | **Nurse staffing**<br>Turnover rates/six months<br><br>**Mediating variables**<br>Workgroup process (cohesion, learning, relational coordination) | **Falls**<br>Patient falls/1000 patient days | Work complexity<br>Unit size and tenure<br>Hospital size<br>Technological status<br>Teaching status<br>Nurse education level<br>Care hours<br>Patient age<br>Patient health status<br>Prior hospitalizations | Significant fewer falls in units with low levels of turnover compared to units without turnover β= -0.297 $p$=.02<br><br>No significant mediating effect of workgroup process on falls |

| Author, year, and country | Design | Sample | Independent variables | Outcome variables | Factors controlled for | Key findings |
|---|---|---|---|---|---|---|
| Breckenridge-Sproat et al. 2012, USA | Longitudinal cohort<br>Retrospective<br>2003-2006<br><br>Staff nurse survey | N= 23 medical/surgical, step-down and critical care unitsof 4 Military hospitals<br><br>N nurses= 506<br>N patients= not described | **Nurse staffing**<br>NHPPD<br>Reserve nurses<br>(temporary nurses)<br><br>**Skill mix**<br>% RN/total nursing hours<br>% LPN/total nursing hours<br>% Nurse aid/total nursing hours<br><br>**Mediating variables**<br>Daily patient acuity | **Falls**<br>Incident reporting | Unit type<br>Acuity<br>Staff category<br>Study duration | No significant associations nurse staffing and falls<br><br>Significant increase of falls in step down units associated with increase of reserve nurses β= 4.921 $p<.05$<br><br>Significant positive effect acuity in medical/surgical units on falls β= 0.328 $p<.05$ |
| Burnes Bolton et al. 2007, USA | Longitudinal cohort<br>Prospective<br>Pre-data 2002<br>Post-data<br>2004/2006 | N= 187 medical/surgical units<br>N= 65 step down units<br>of 108 hospitals<br><br>N patients= 11740 | **Nurse staffing**<br>RN hours/patient day<br>LPN hours/patient day<br>Unlicensed hours/patient day<br>Total hours/patient day<br><br>**Skill mix**<br>% RN hours/skill mix<br>% LPN hours/skill mix<br>% Unlicensed hours/skill mix<br>% Contracted hours/skill mix | **Falls**<br>Incidence falls/1000<br>patient days<br>Falls with injury/1000 days<br><br>**Pressure ulcers**<br>Prevalence pressure ulcers<br>Prevalence HAPU | Hospital size | Significant increases in staffing hours and ratios pre/post<br><br>Significant inverse relation falls and %RN step down units β= -0.029 $p=.008$<br><br>Significant positive relation total hours of care on >stage 2 pressure ulcers in stepdown units β= 0.928 $p=.004$<br><br>Significant inverse effect contracted staff on falls with injury in medical/surgical units β= -0.003 $p=.006$ |

| Author, year, and country | Design | Sample | Independent variables | Outcome variables | Factors controlled for | Key findings |
|---|---|---|---|---|---|---|
| Chang et al. 2006, USA | Cross-sectional<br>Retrospective<br><br>RN survey<br>Patient survey | N= 222 medical/surgical units of 126 hospitals<br><br>N nurses= not described<br>N patients= not described | **Other variables**<br>Workgroup diversity (e.g. education, RN experience)<br>Workgroup performance (e.g. team-work)<br><br>Intervening process variables (workgroup cohesion, workgroup initiative) | **Falls**<br>Patient falls/total patient days | Patient age<br>Unit size | Significant inverse effect of workgroup initiative on falls β= -0.18 $p<.01$<br><br>No significant effect of intervening process variables, workgroup diversity and performance on falls |
| Donaldson et al. 2005, USA | Longitudinal cohort<br>Retrospective<br>Pre-data 2002<br>Post-data 2004 | **For patient falls**<br>N= 200 medical/surgical units<br>N= 68 stepdown units of 68 hospitals<br><br>**For pressure ulcers**<br>N= 119 medical/surgical units<br>N= 43 stepdown units of 38 hospitals<br><br>N patient days= ±196000 | **Nurse staffing**<br>NHPPD<br>RN Hours/patient day<br>LVN Hours/patient day<br>Non RN+ LVN caregiver hours/patient day<br><br>**Skill mix**<br>% RN/total nursing hours<br>% LVN/total nursing hours<br>% Non RN/total nursing hours<br>Contracted hours/patient day | **Falls**<br>Incidence/1000 patient days<br><br>**Pressure ulcers**<br>Prevalence pressure ulcers<br>Prevalence HAPU | Hospital size<br>Hospital system | Increases nurse-patient ratios of staffing and skill mix in medical/surgical units NHPPD increased with 7.4% $p=.0024$<br><br>No significant changes of nurse-patient ratios of staffing and skill mix in step down units<br><br>No significant changes of falls and pressure ulcers after mandated staff ratios |
| Frith et al. 2010, USA | Cross-sectional<br>Retrospective<br>2005-2007<br><br>Patient survey | N= 11 medical/surgical units of 4 hospitals<br><br>N patients= 34838 | **Nurse staffing**<br>RN hours/patient day<br>LPN hours/patient day<br><br>**Skill mix**<br>% RN/skill mix<br><br>% LPN/skill mix | **Adverse events**<br>One of them: pressure ulcers<br>Prevalence/1000 patient days | Patient age<br>Complication index | No significant relationships between nurse staffing and adverse events<br><br>Significant relation between %RN in skill mix and adverse events<br>An increase of RN by 1% reduced adverse events with 3.4% |

| Author, year, and country | Design | Sample | Independent variables | Outcome variables | Factors controlled for | Key findings |
|---|---|---|---|---|---|---|
| Goode et al. 2011, USA | Cross-sectional Retrospective 2005 | N= 35 Non-Magnet hospitals<br>N= 19 Magnet hospitals<br><br>General and intensive care units<br><br>N patients= not described | **Nurse staffing**<br>NHPPD<br><br>RN/patient day<br>LPN/patient day<br>CNA/patient day<br><br>**Skill mix**<br>% RN/staffing mix | **Pressure ulcers**<br>Rate observed and expected risk | Patient characteristics<br>Patient condition<br>Hospital case mix | Significantly less NHPPD in general units of Magnet hospitals<br><br>Significantly lower %RN in general and intensive care units of Magnet hospitals<br><br>Less pressure ulcers Magnet hospitals<br><br>Significant inverse association pressure ulcers and NHPPD in intensive care units β= -0.022 $p$<.10 |
| Gunningberg et. al. 2012, USA, Sweden | Cross-sectional Retrospective 2009 | N= 33 medical/surgical units of a university hospital in Sweden<br>N patients= 630<br><br>N= 14 medical/surgical units of a general hospital in Sweden<br>N patients= 253<br><br>N= 1100 medical/surgical units of 207 hospitals in the USA<br>N patients= 16427 | **Nurse staffing**<br><br>NHPPD<br>% Patient (bed) turnover<br>% Voluntary turnover<br><br>**Skill mix**<br>% RN/staff mix<br><br>**Mediating variables**<br>Patients per RN | **Pressure ulcers**<br><br>Prevalence pressure ulcer<br>Prevalence HAPU | Hospital size | In USA higher total staff and %RN<br><br>In USA higher patient (bed) turnover<br>In USA less patients/RN<br><br>In USA lower prevalence pressure ulcers and HAPU |

| Author, year, and country | Design | Sample | Independent variables | Outcome variables | Factors controlled for | Key findings |
|---|---|---|---|---|---|---|
| Jiang et al. 2006, USA | Cross-sectional Retrospective 2001 | N= 372 acute hospitals<br><br>N patients= not described | **Nurse staffing and skill mix**<br>*AHA:*<br>FTE/adjusted patient day<br>Ratio of FTE to average daily census<br><br>*OSHPD:*<br>Paid hours RN/adjusted patient day<br>Paid hours LPN/adjusted patient day<br>% RN/licensed nurses<br>Total paid hours/adjusted patient day<br>% RN % LPN, % nurse aid/total nurses | **Decubitus ulcers**<br>Risk adjusted rates | Case mix<br>Severity illness<br>Hospital ownership<br>Size<br>Teaching status<br>Urban vs. Rural | Significant inverse relation RN hours/ patient days and decubitus ulcers<br>ANA: β= -0.001 $p$< .001<br>OSHPD: β= -0.002 $p$<.001<br><br>Significant inverse relation %RN/ licensed nurses and decubitus ulcers<br>ANA: β= -0.044 $p$<.01<br>OSHPD: β= -0.053 $p$<.001 |
| Kendall-Gallagher & Blegen 2009, USA | Cross-sectional Retrospective 2000 | N= 48 intensive care units of 29 hospitals<br><br>N patients= not described | **Nurse staffing**<br>NHPPD<br><br>**Skill mix**<br>% RN/skill mix<br><br>**Other variables**<br>% Staff nurses with specialty certification<br>% Staff nurses with at least a Bachelor degree<br>Mean years of experience<br>Organizational characteristics | **Falls**<br>Rate of falls/1000 patient days | Patient risk | No significant effects of staffing and skill mix<br><br>Inverse association between unit proportion of certified staff nurses and rate of falls β= -0.06 $p$=.04<br><br>No significant effects of experience, Bachelor degree or organizational characteristics |

| Author, year, and country | Design | Sample | Independent variables | Outcome variables | Factors controlled for | Key findings |
|---|---|---|---|---|---|---|
| Krapohl et al. 2010, USA | Cross-sectional Retrospective<br><br>Staff nurse survey | N= 25 intensive care units of 8 hospitals<br><br>N nurses= 450<br>N patients= not described | **Other variables**<br>% Certified nurses<br>Workplace empowerment (opportunity, information, support, resources) | **Pressure ulcers**<br>Prevalence | Not described | No significant effect of proportion certified nurses or workplace empowerment on pressure ulcers<br><br>Significant positive association nurses' perception of workplace empowerment and certification (r= .397 *p*=.05) |
| Mallidou et al. 2011, Canada | Cross-sectional Retrospective 1998-1999<br><br>RN survey | N= 12 hospitals (medical, surgical, emergency, intensive care units)<br><br>N nurses= 1937<br>N patients= not described | **Other variables**<br>Informal practices (autonomy, control over practice nurse-physician relationships)<br><br>Formal practice (satisfactory salary, education, quality assurance program, preceptorship, experience) | **Falls**<br>Adverse event | Not described | Inversed effect of experience on adverse events in medical units β= -0.104 and emergency departments β= -0.136<br><br>Significant inverse effect RN/physician relationship on adverse events in medical units β= -0.115<br><br>Significant inverse effect of fulltime/ part-time on adverse events in surgical units (β= -0.104) and emergency units (β= -0.178)<br><br>Significant inverse effect preceptorship on adverse events in intensive care units β= -0.164<br><br>No significance regarding education, autonomy and control over practice |

| Author, year, and country | Design | Sample | Independent variables | Outcome variables | Factors controlled for | Key findings |
|---|---|---|---|---|---|---|
| Manojlovich et al. 2009, USA | Cross-sectional Retrospective 2005<br><br>Staff nurse survey | N= 25 intensive care units of 8 hospitals<br><br>N nurses= 462<br>N patients= 1090 | **Other variables**<br>Perception of communication<br>Characteristics of the Practice Environment | **Pressure ulcers**<br>Prevalence >stage 2 | Patient severity | No significant relation communication on any adverse events<br><br>No significant effect of Practice Environment as mediator |
| Manojlovich et al. 2011, Canada, USA | Cross-sectional Retrospective<br><br>2007 | N= 14 medical/surgical units of 1 hospital in Canada<br><br>N= 12 medical/surgical units of 1 hospital in USA<br><br>N patients= not described | **Other variables**<br>Level of RN needed to provide care<br><br>(Active ingredient: skill mix, education, experience)<br>(Intensity: FTE's, RN-Patient Ratio, RN worked hours/patient day) | **Falls**<br>Rate of falls/1000 patient days | Not described | Significant inverse effect of active ingredient on falls r= -.44 *p*=.03<br><br>Significant inverse effect of intensity on falls r= -.44 *p*=.03 |
| Mark et al. 2004, USA | Longitudinal cohort Retrospective 1990-1995 | N= 422 hospitals<br><br>N patients= not described | **Nurse staffing**<br>RN FTE/ 1000 inpatient days<br>LPN FTE/1000 inpatient days<br>Non-nurse FTE/1000 inpatient days | **Decubitus ulcers**<br>Risk-adjusted observed and expected decubitus ulcers | Hospital heterogeneity<br>Historical circumstances | Significant inverse effect of RN FTE on decubitus ulcers β= -0.017 *p*=.01<br><br>Significant inverse marginal effect of RN FTE on decubitus in all quartiles<br>$25^{th}$: β= -0.050 *p*=.001<br>$50^{th}$: β= -0.045 *p*=.001<br>$75^{th}$: β= -0.040 *p*=.01<br><br>After controlling for hospital-specific effects, results are insignificant |

| Author, year, and country | Design | Sample | Independent variables | Outcome variables | Factors controlled for | Key findings |
|---|---|---|---|---|---|---|
| McCloskey & Diers 2005, New Zealand | Longitudinal cohort<br>Retrospective<br>1993-2000<br><br>Staff nurse survey | N= medical and surgical units of 85 hospitals<br><br>N nurses RN and EN= 65221<br>N patients= ±3.3 million | **Nurse staffing**<br>FTE/1000 patient days<br>FTE/1000 discharges<br>Total nursing hours/1000 patient days<br>Total nursing hours/1000 discharges<br><br>**Skill mix**<br>% RN/total FTE | **Decubitus ulcers**<br>Rate of decubitus ulcers | No risk adjustment, other than cohort | After mandated staffing ratios 36% decrease of total nursing hours and FTE/1000 discharges and 18% increase of %RN skill mix<br><br>After mandated ratios increase of decubitus ulcers 88%(medical units) and 258%(surgical units)<br><br>Significant correlations between decubitus ulcers and total nursing Hours, %RN and FTE ($p<.05$) |
| McGillis Hall et al. 2004, Canada | Cross-sectional<br>Retrospective<br>Year= not described | N= 77 medical, surgical and obstetric units of 19 hospitals<br><br>N patients= not described | **Nurse staffing**<br>% Professional staffing<br><br>**Other variables**<br>Average nurse experience | **Falls**<br>Rate of falls | Patient complexity<br>Age | No significant effects of nurse staffing on falls<br><br>No significant relations between level of experience and patient outcomes |

| Author, year, and country | Design | Sample | Independent variables | Outcome variables | Factors controlled for | Key findings |
|---|---|---|---|---|---|---|
| Patrician et al. 2011, USA | Longitudinal cohort<br>Prospective<br>2003-2006 | N= 31 medical/surgical units<br>N= 8 step-down units<br>N= 18 critical care units of 13 Military Hospitals<br><br>N patients= 111522 | **Nurse staffing**<br>NCHPPS<br><br>**Skill mix**<br>% RN/skill mix per shift<br><br>**Other variables**<br>Worked hours by staff category (civilian vs. military) | **Falls**<br>Incidence reporting<br><br>**Falls with injury**<br>Incidence reporting | Patient census<br>Patient acuity<br>Hospital size<br>Shift time | With every 1 hour decrease of NCHPPS significant increase of falls (with injury) in all units (15%-51%)<br><br>With every 10% decrease in %RN increase of falls with injury critical care (36%) and medical/surgical units (30%)<br><br>Every 10% decrease of civilian nurses associated with 36% (critical care) and 48% (medical/surgical units) increase of falls<br><br>Significant positive association between patient acuity/census and falls in medical/surgical and stepdown units |
| Purdy et al. 2010, Canada | Cross-sectional<br>Retrospective<br><br>Staff nurse survey<br>Patient survey | N= 61 medical/surgical units of 21 hospitals<br><br>N nurses= 679<br>N patients= 1005 | **Other variables**<br>*Group level:*<br>Group processes (teamwork)<br>Structural empowerment (workplace factors)<br><br>*Individual level:*<br>Psychological empowerment<br>Empowerment behavior | **Falls**<br>Falls/1000 patient days | Length of stay<br>Nursing experience<br>Nursing care hours | Significant inverse effects on falls on the group level: group processes β= -0.19 *p*=.05 and structural empowerment β= -0.12 *p*=.05<br><br>No significant effects of nurse empowerment on the individual level |

| Author, year, and country | Design | Sample | Independent variables | Outcome variables | Factors controlled for | Key findings |
|---|---|---|---|---|---|---|
| Seago et al.<br>2006, USA | Longitudinal cohort<br>Retrospective<br>1999-2002<br><br>Patient survey | N= 3 medical/surgical units of 1 university hospital<br><br>N patients= not described | **Nurse staffing**<br>Total RN Hours/patient day<br>Non-RN Hours/patient day<br>NHPPD<br><br>**Skill mix**<br>% RN/total nursing hours | **Falls**<br>Incidence/1000 patient days<br><br>**Decubitus ulcers**<br>Incidence/1000 patient days<br><br>**Pain management**<br>Patient satisfaction | Case mix<br>Work intensity | Significant positive effect NHPPD on perception pain management<br>β= 2.44 $p$<.01<br><br>Significant positive effect %RN on perception pain management<br>β= 13.63 $p$<.01<br><br>No significant effect of RN or non-RN hours on pain, falls or decubitus |
| Shuldham et al.<br>2009, UK | Cross-sectional<br>Retrospective<br>2006-2007 | N= 2 hospitals<br>***Low dependency units:***<br>wards (cardiology, cardio-thoracic surgery, respiratory)<br>***High dependency units:***<br>critical and intensive care unit<br><br>N adult patients= 23192<br>N child patients= 2315 | **Nurse staffing**<br>NHPPD<br><br>**Skill mix**<br>% Permanent hours/total hours<br>% Permanent hours/permanent and temporary internal hours | **Pressure sores**<br>Prevalence<br><br>**Patient falls**<br>Incidence reporting | Not described | No significant effects of NHPPD on falls and pressure ulcers<br><br>Significant positive effect %permanent hours/permanent and temporary hours on pressure sores in low dependency units OR= 1.092 $p$=.026<br><br>Significant positive effect %permanent hours/total hours on pressure sores in low dependency units<br>OR= 1.070 $p$=.019<br><br>No significant effects %permanent hours in high dependency units |

| Author, year, and country | Design | Sample | Independent variables | Outcome variables | Factors controlled for | Key findings |
|---|---|---|---|---|---|---|
| Stone et al. 2007, USA | Cross-sectional<br>Retrospective<br>2002<br><br>Staff nurse survey | N= 51 intensive care units of 31 hospitals<br><br>N nurses= 1095<br>N patients= 15902 | **Nurse staffing**<br>RN hours/patient day<br>Ratio overtime/regular RN hours<br><br>**Other variables**<br>Average RN wage<br>Organizational climate | **Decibiti**<br>Incidence | Patient severity<br>Patient co-morbidity<br>Patient demographics<br>Patient socio-economics<br>Hospital size<br><br>Teaching status<br>Nurse case mix<br>ICU-type | Significant inverse effect of RN hours on decubiti OR= 0.69 $p<.001$ (third quartile vs. first quartile)<br><br>Significant positive effect of overtime on decubiti OR= 1.91 $p<.001$ (fourth quartile vs. first quartile)<br><br>No significant relations decubiti and wages or organizational climate |
| Taylor et al. 2012, USA | Cross-sectional<br>Retrospective<br>2004-2005<br><br>Staff nurse survey | N= 29 medical/surgical and rehabilitation units of 1 trauma hospital<br><br>N nurses= 723<br>N patient discharges= 28876 | **Nurse staffing**<br>RNHPPD<br>Unit turnover rate<br><br>**Other variables**<br>Teamwork | **Falls**<br>Incidence<br><br>**Decubitus ulcers**<br>Incidence | Patient complexity | Every additional hour RNHPPD associated with 9% decrease odds patient falls<br><br>Significant association teamwork and decubitus ulcers OR= 0.56 $p<.001$<br><br>No significant association of unit turnover on decubitus ulcers or falls |
| Titler et al. 2011, USA | Longitudinal cohort<br>Retrospective<br>1998-2002 | N= 1 hospital<br><br>N patients= 7851<br>N hospitalizations= 10187 | **Nurse Staffing**<br>Average RN/hour<br><br>**Skill mix**<br>% RN/skill mix | **Falls**<br>Incident reporting | Patient characteristics<br>Clinical conditions<br>Co-morbidities<br>Interventions | Fall group N= 481<br>Non-fall group N= 9706<br><br>With every 10% increase of %RN odds of falling decreased with 18,8%<br><br>No significant effect average RN/hour |

| Author, year, and country | Design | Sample | Independent variables | Outcome variables | Factors controlled for | Key findings |
|---|---|---|---|---|---|---|
| Twigg et al. 2011, Australia | Longitudinal cohort<br>Retrospective<br>2000-2004<br><br>2 time series pre/post mandated staffing in 2002 | N= 52 units of 3 hospitals<br><br>N patients= 236454 | **Nurse staffing**<br>NHPPD | **Pressure ulcers**<br>Incidence rate | Time period<br>Season<br>Patient group | No significant increase of RN hours and NHPPD pre/post (58420-69327)<br><br>No significant relation between staffing and pressure ulcers<br><br>Significant decrease of pressure ulcers in individual hospitals pre/post |
| Unruh & Zhang 2012, USA | Longitudinal cohort<br>1996-2004<br><br>Staff nurse survey | N= 124 hospitals<br><br>N nurses= not described<br>N patients= not described | **Nurse staffing**<br>RN FTE<br>RN FTE/adjusted patient day | **Decubitus ulcers**<br>Incidence/1000 patients<br><br>Patient safety indicators (decubitus ulcers, infections, sepsis) | Patient turnover<br>Hospital size<br>Hospital case mix<br>Urban vs. Rural<br>Payer mix<br>Ownership | Significant positive effect of initial levels of RN FTE/adjusted on initial level of decubitus $\beta$= 0.996 $p$=.05<br><br>Significant inverse effect of initial levels of RN FTE/adjusted on decubitus over time $\beta$= -0.001 $p$=.05<br><br>No significance regarding RN FTE and decubitus |
| Van den Heede. et al. 2009, Belgium | Cross-sectional<br>Retrospective<br>2003 | N= 1403 general acute care and intensive care units of 115 hospitals<br><br>N patients= 260923 | **Nurse staffing**<br>NHPPD<br>Standardized NHPPD<br><br>**Other variables**<br>% Nurses with Bachelor's degree | **Pressure ulcers**<br>Incidence | Co-morbidity<br>Patient age<br>Patient gender<br>Admission type<br>Hospital size<br>Technology status | No significant associations between nurse staffing and patient outcomes<br><br>No significant effect Bachelor's degree |

| Author, year, and country | Design | Sample | Independent variables | Outcome variables | Factors controlled for | Key findings |
|---|---|---|---|---|---|---|
| Wolf et al. 2008, USA | Randomized controlled trial 2006-2007<br><br>Patient survey | N= 1 unit of a Bariatric Center<br><br>N control group= 58<br>N intervention group= 58 | **Other variables**<br><br>Nurses trained in patient-centered are vs. usual care | **Falls**<br><br>Absence of falls | Demographics nurse<br>Demographics patient<br>Co-morbidity | No significant differences between control and intervention groups regarding falls |

AHA: American Hospital Association
CNA: certified nurse assistant
EN: enrolled nurses
FTE: fulltime equivalent
HAPU: hospital-acquired pressure ulcers
LPN: licensed practical nurse
LVN: licensed vocational nurse
NCHPPS: Total Nursing Care Hours per Patient per Shift
NHPPD: Nursing Hours of Care per Patient Day
OSHPD: Office for Statewide Health Planning and Development
RCT: randomized controlled trial
RN: registered nurse
RNHPPD: Registered Nursing Hours of Care per Patient Day

Regarding work environment characteristics, 17 studies exclusively focused on nurse staffing; five of these studies were appraised as high quality studies, eight studies as moderate quality studies and four studies were rated low quality (Table 2a).
A total of 12 studies also reported on characteristics other than nurse staffing; three of these studies were appraised as high quality studies, seven studies as moderate quality studies and two studies were rated low quality (Table 2b).

***Table 2a.*** *Quality appraisal of included studies (exclusively nurse staffing).*

| Author/Date | Validity | Reliability | Applicability | Total | Level of Evidence |
|---|---|---|---|---|---|
| Seago 2006 | 1 | 1 | ½ | 2½ | A2 |
| Burnes Bolton 2007 | 1 | 1 | 0 | 2 | A2 |
| Mark 2004 | ½ | 1 | 1 | 2½ | B |
| Titler 2011 | 1 | 1 | 0 | 2 | B |
| Mc Closkey 2005 | ½ | ½ | 1 | 2 | B |
| Unruh 2012 | 0 | ½ | 1 | 1 ½ | B |
| Breckenridge-Sproat 2012 | 1 | ½ | 0 | 1 ½ | B |
| Twigg 2011 | ½ | ½ | 0 | 1 | B |
| Donaldson 2005 | ½ | ½ | 0 | 1 | B |
| Bae 2010a | 1 | 1 | 1 | 3 | C |
| Bae 2010b | 1 | ½ | 1 | 2 ½ | C |
| Stone 2007 | ½ | 1 | 1 | 2 ½ | C |
| Jiang 2006 | 1 | 1 | 0 | 2 | C |
| Frith 2010 | ½ | ½ | 1 | 2 | C |
| Goode 2011 | ½ | ½ | ½ | 1½ | C |
| Gunningberg 2012 | ½ | ½ | 0 | 1 | C |
| Shuldham 2009 | 1 | 0 | 0 | 1 | C |

***Table 2b.*** *Quality appraisal of included studies (nurse staffing and other characteristics).*

| Author/Date | Validity | Reliability | Applicability | Total | Level of Evidence |
|---|---|---|---|---|---|
| Wolf 2008 | ½ | 0 | 1 | 1½ | A2 |
| Patrician 2011 [a] | ½ | ½ | ½ | 1½ | B |
| Kendall-Gallagher 2009 [a] | 1 | 1 | ½ | 2½ | C |
| Chang 2006 | ½ | 1 | 1 | 2½ | C |
| Van den Heede 2009 [a] | 1 | 1 | ½ | 2 ½ | C |
| Purdy 2010 | ½ | ½ | 1 | 2 | C |
| Krapohl 2010 | ½ | ½ | 1 | 2 | C |
| Manojlovich 2009 | ½ | ½ | 1 | 2 | C |
| Mallidou 2011 | ½ | 0 | 1 | 1½ | C |
| Taylor 2012 [a] | 1 | ½ | 0 | 1 ½ | C |
| Manojlovich 2011 | ½ | ½ | 0 | 1 | C |
| McGillis Hall 2004 [a] | 1 | 0 | 0 | 1 | C |

[a] Studies which also analyzed nurse staffing and/or skill mix

### Patient falls

***Nurse staffing***

Only one of the six studies on patient falls and total nursing hours reported significant relationships. In this study, Patrician et al.[28] found that significantly more falls occurred in various units of military hospitals if total nursing hours were lower. However, the study provided no description of the width of confidence intervals. Another cohort study on military hospitals [29] did not find any significant associations between nursing hours and patient falls. Additionally, Burnes Bolton et al.,[30] Kendall-Gallagher and Blegen,[31] McGillis Hall et al.[32] and Shuldham et al.[33] did not find evidence regarding total nursing hours. A similar trend occurred for RN hours; one of six studies found small and inversed associations with patient falls. The cross-sectional study of Taylor et al.[34] showed significant inversed effects, as an additional hour of care by RNs was associated with a 9% decrease in the odds to fall. Yet, five other studies did not find any significant associations.[30,35-38] Three of four studies on the proportion of RNs reported significant effects. The three cohort studies showed that higher proportions of RNs were significantly related to lower numbers of patient falls. More specifically, small effect sizes were reported for medical/surgical and critical care units [28] and for step down units.[30] Titler et al.[38] evaluated the reported fall incidences in one hospital and found that with every 10% increase in the proportion of RNs, the odds of falling decreased by approximately 19%. There was one cross-sectional study showing no significant associations with patient falls.[31] Regarding temporary nurses, Breckenridge-Sproat et al.,[29] Burnes Bolton et al.[30] and Bae et al.[39] all showed significant positive associations between patient falls and temporary nurses (i.e., more patients fall in units with higher levels of temporary nurses). Two studies reported nurse turnover; Bae et al.[40] found that, compared to units without nurse turnover, fall rates in medical/surgical units with low turnover rates (< 3.3%) were significantly lower. Taylor et al.[34] did not find any significant associations between falls and unit turnover.

In sum, most studies on nurse staffing and patient falls did not show significant associations. However, the studies that did report significant effects were labeled as moderate to high quality and found inversed effects, indicating that a more favorable staffing is associated with a lower number of patient falls.

***Education***

Two of four studies found significant associations between patient falls and education. Manojlovich et al.[41] showed that higher levels of education were related to lower rates of patient falls. Another study found that a higher proportion of certified nurses were associated with fewer patient falls.[31] However, this study did not find evidence in regard to nurses with at least a Bachelor's degree. Two studies [42,43] did not find effects of nursing education.

***Experience***
Three of six studies on experience found significant associations with patient outcomes. Patrician et al.[28] found that decreasing the numbers of civilian nurses, who on average have more experience, was associated with more fall incidences. Similar inversed associations were reported by Manojlovich et al.[41] and Mallidou et al.[43] Additionally, Kendall-Gallagher and Blegen,[31] McGillis Hall et al.[32] and Chang et al.[42] did not find significant effects of experience.

***Collaborative nurse-physician relationships***
Two out of three studies on collaboration with physicians in relation to patient falls reported significant associations. Specifically, positively appreciated communication was associated with fewer adverse events (i.e., patient falls, medical errors, and nosocomial infections) [43] and lower number of patient falls.[44] Chang et al.[42] did not find significant associations.

***Patient-centered values***
The only randomized controlled trial that was available addressed the relationship between patient-centered care (PCC) and the absence of falls. No significant differences were found between 58 patients who received care from PCC trained nurses and 58 patients who received usual care.[45]

**Pressure ulcers**
***Nurse staffing***
Regarding total nursing hours of care, three of nine studies found significant effects on pressure ulcers. In their New-Zealand study, McCloskey and Diers [46] reported a 36% decrease in total nursing hours after health care reengineering policies between 1993 and 2000. During these years, the rates of pressure ulcers increased and associations with staffing hours were significant. Goode et al.,[47] using a significance level of $p<.10$, found the following significant inversed associations: higher total nursing hours and fewer pressure ulcers in intensive care units in the USA. Burnes Bolton et al.[30] unexpectedly found that in 65 step-down units, higher levels of nursing hours were significantly related to higher prevalence of pressure ulcers between 2002 and 2006 ($\beta= 0.928$ $p= .004$). These types of associations were, however, not found for the same study sample in the period from 2002 to 2004.[35] Five studies in different countries (i.e., England, Australia, Belgium, and USA) did not find significant associations with pressure ulcers.[31,33,48-50] Regarding the hours of care performed by registered nurses (RN hours), four of six studies reported significant relationships. Jiang et al.[51] compared two databases, the American Hospital Association (AHA) and the Office of State-wide Health Planning and Development (OSHPD). Both databases agreed on the small inversed effects of higher numbers of RN hours on pressure ulcers. Stone et al.[52] and Mark et al.[53] found similar significant inverse relationships between RN hours and pressure ulcers. In the study by Mark et al.,[53] associations were no longer significant after controlling for hospital-specific effects (e.g., patient case mix and hospital size). Stone et al.[52] also found that higher rates of pressure ulcers were significantly related to more overtime hours by RNs. Unruh and Zhang [54] found contrasting results regarding

pressure ulcers; higher levels of RN hours were associated with higher incidences of pressure ulcers ($\beta$= 0.996 $p$= .05). Two studies did not find any associations between RN hours and pressure ulcers.[34,36] Regarding the proportion of registered nurses (%RN) in relation to pressure ulcers, three of six studies found significant associations. One cohort study reported counterintuitive, yet significant positive associations; higher proportion of RNs in the skill mix related to higher rates of pressure ulcers.[46] However, two cross-sectional studies that used retrospective analysis found significant inversed associations.[36,51] It is important to note that the results of Frith et al.[36] are difficult to interpret as they used a large category of adverse events as the outcome variable, which included pressure ulcers, but they did not differentiate the effects of each adverse event. Three cross-sectional designs did not find any significant associations.[31,47,48] One study examined pressure ulcers in relation to temporary and non-temporary nurses and found that higher levels of permanent nurses (i.e., non-temporary nurses) led to higher pressure ulcers rates.[33] The two studies on turnover did not find significant associations; Taylor et al.[34] investigated unit turnover and Gunningberg et al.[48] investigated several variables, such as patient turnover, staff voluntary turnover and patients per registered nurse.

In sum, contradicting results were shown for measures of nurse staffing in relation to pressure ulcers. Most studies found inversed effects; more favorable staffing was associated with fewer pressure ulcers. However, these effect sizes were small in contrast to the large effect sizes of the three cohort studies that revealed high staff numbers were related to high levels of pressure ulcers.

***Education***

Both studies on education in relation to pressure ulcers did not find significant associations; Van den Heede et al.[50] with regard to nurses with at least a Bachelor's degree and Krapohl et al.[55] did not show significant effects in relation to certified nurses.

***Collaborative nurse-physician relationships***

Positively appreciated communication was associated with a lower number of pressure ulcers in the study by Taylor et al.[34] However, Manojlovich et al.[56] did not find significant associations.

**Pain**

The only study to report on the outcome measure of pain showed that patients were more satisfied with pain management if favorable staffing existed. Moreover, a higher number of total nursing hours and higher proportion of RNs in the skill mix improved pain management.[37]

## Discussion

The aim of the present study was to systematically review the literature on the relationship between characteristics of nurse work environment and five nurse-sensitive patient outcomes (i.e., delirium, malnutrition, pain, patient falls, and pressure ulcers) in hospitals. We considered a broad set of work environment characteristics, thereby potentially adding to existing knowledge in this area. Regarding the articles in this study, we originally intended to report on five nurse-sensitive patient outcomes; however, the literature search revealed that there were only eligible studies on pressure ulcers and patient falls and one study on pain assessment. This finding is informative, because it suggests that future work should be conducted to identify relationships between work environment and outcome measures such as malnutrition and delirium. Otherwise, one may want to reconsider whether or not these patient outcomes should be used as indicators of nursing quality. For example, in the Netherlands malnutrition and delirium are part of a mandatory set of quality indicators, determined by the Health Care Inspectorate. Health care policy makers should ask whether these types of data are useful as benchmark indicators for nursing quality.

Initially, we wanted to perform a quantitative meta-analysis; however, comparing study results proved to be problematic due to the lack of relevant statistical information in many of the primary studies. For example, some articles missed clear information about sample sizes. In other articles the information on statistical analysis was incomplete (e.g., p-value or confidence interval not reported). Additionally, large differences in outcome measures compromised the possibility of conducting a meta-analysis. We consider it imperative to note these issues, because it may hinder the accumulation of knowledge about optimal nurse work environments. Based on the findings of this review, there are two overall conclusions. First, there were mixed results regarding the association between nurse staffing and the outcome measures of patient falls and pressure ulcers. Second, we found indications that specific work environment characteristics other than staffing are related to nurse-sensitive outcomes. We will discuss these findings in more detail in the following paragraphs.

### Nurse staffing

Overall, regarding the structural characteristic of nurse staffing in relation to nurse-sensitive patient outcomes, we found that the studies that were labeled low quality were also the studies that were unable to show significant effects. Significance was found in studies of moderate or high quality, including the only study to report on pain, showing that patients were more satisfied with pain management if favorable staffing levels existed. Most studies were based on North American data and to prevent an underestimation of effects in other areas, it would be useful to examine nurse work environments and nursing quality in various continents (e.g., Europe, Australia).

Regarding nurse staffing in relation to patient falls, most studies did not report significant effects. However, the evidence is rather consistent and shows that higher staffing numbers are associated with fewer patient falls. This finding is consistent with previous reviews (e.g., Kane et al.[10]). Most studies that found significant effects used a longitudinal cohort design (i.e., level of evidence A2 or B). The major preponderance of cross-sectional designs (level C) in this research field, with a high risk of contamination of confounders and bias makes it difficult to generate explanatory results. Randomized controlled trials would be the preferred research design, yet as mentioned by Clarke and Donaldson,[57] it is almost impossible to use these designs in the present research area, because it requires randomization of interventions that cannot be controlled. In our review, one randomized controlled trial [45] was included; the small sample size of 58 patients could be a possible explanation for the lack of significant effects. In future research on work environment and nursing quality, longitudinal observational designs would be preferred. These types of designs allow for descriptions of trends over time and therefore provide more robust evidence on associations.[58]

For pressure ulcers, the findings indicate that there are mixed outcomes in this area. Most studies found that more favorable staffing, such as more nursing hours or higher proportions of registered nurses (RNs), is related to lower levels of pressure ulcers. However, there were a few cohort studies in the dataset that found contradictory results, in which higher staffing numbers were associated with higher levels of pressure ulcers. As a possible explanation for these counterintuitive effects, McCloskey and Diers [46] referred to work prioritization; more emphasis on the importance of adverse events, such as pressure ulcers may have led to increased reporting on these adverse events. Furthermore, the influence of patient acuity might have played a role. It may be useful to systematically examine the possible role of this factor in future studies. According to Kramer et al.,[26] conflicting results may reflect methodological errors related to finding relationships between structure variables (e.g., staffing, skill mix) and outcomes (e.g., pressure ulcers) without including an analysis of process variables (i.e., nursing interventions) that mediate the relationship. The safest conclusion that can be drawn is that evidence on nurse staffing and pressure ulcers is inconclusive and more research is necessary.

### Characteristics other than nurse staffing

Analysis of the 12 studies on characteristics of the work environment other than staffing showed significant effects for collaborative relationships, education and experience. To appreciate these findings several aspects need to be considered. We found evidence that positively appreciated nurse-physician collaboration and a more experienced and higher-educated staff were significantly associated with lower rates of pressure ulcers and fewer patient falls. Effective collaboration is already acknowledged to be an important work environment factor by the Institute of Medicine.1 The findings of the present study support this view. Nevertheless, it was the only process characteristic that was linked to pressure ulcers and falls. This finding implicates a gap in literature concerning a lack of evidence regarding the relationship between process variables of the work environment and patient outcomes.

Regarding structural nurse characteristics, our findings regarding the favorable effects of higher nursing education are consistent with ongoing insights in the relevance of this work environment factor. For example, two recently published articles showed that higher levels of nurses with (at least) a Bachelor's degree are significantly associated with lower in-hospital mortality [59] and with lower failure to rescue, shorter length of stay, and lower decubitus ulcer rates.[60] Additionally, experience is considered to be a highly relevant factor in work performance in general performance literature as well as in studies on nurse performance. For example, it is well known that experience is associated with the accumulation of job knowledge and automation of procedures, which allow an employee to conduct the job more effectively and efficiently.[61] This factor is also true for nurses.[62,63] The findings of the present review confirm that nursing experience and education (structure) are influential factors and play a role in determining nursing quality (outcome), potentially through knowledge and competencies on the job (process).

### Quantitative analysis

We have discussed some fundamental problems with assessing and comparing data from primary studies that prevented us from conducting an adequate quantitative meta-analysis of the literature. There is an ongoing debate regarding the robustness of quantitative meta-analyses of observational studies. Previous reviews, including Lake and Cheung [11] and Lankshear et al.[13] suggested that improvements in measurements and methods in this research field have not been achieved. However, in the absence of evidence from randomized controlled trials, there is growing evidence from observational studies in this research area. Meta-analyses could provide a pooled summary of effects from individual studies and highlight topics in which findings are limited.[22] Therefore, in addition to increasing the number of studies in this area, future research should also consider that individual studies may eventually be data-points for quantitative reviews and therefore should provide sufficient levels of statistical information (e.g., clear description of sample and effect sizes).

### Limitations

The present review reveals the relationship between nurse work environment and nurse-sensitive patient outcomes. Nevertheless, there are several limitations that should be considered in interpreting the results. First, due to methodological issues as described in the previous paragraph, we were unable to perform a quantitative meta-analysis on the study results. Second, our aim was to analyze patient outcomes that are specifically related to nursing quality. We focused on a limited set of nurse-sensitive patient outcomes, whereas other outcomes were excluded (e.g., medication errors, and nosocomial infections). Nevertheless, we emphasize that the present review gives us the opportunity to draw clear conclusions on the quality of nursing care regarding the five nurse-sensitive patient outcomes. Third, although a full description of study results is provided, there were primary studies that did not report on confounding factors (e.g., patient and organizational characteristics) which may have affected patient outcomes.

## Conclusions

In the present systematic review scientific evidence was found on the effects of nurse staffing and other characteristics of the work environment (i.e., collaborative relationships, experience, and education) on falls, pain management and pressure ulcers. These findings complement the knowledge from previous reviews on staffing in relation to patient outcomes such as mortality and length of stay, in providing evidence that more favorable work environments contribute to improved patient outcomes. Contemporary health care requires that the quality of nursing care is excellent, and therefore, understanding the relationship with nurse work environment is imperative. Our findings emphasize the need for longitudinal research with well-defined outcome measures and comparable samples of hospitals or hospital units.

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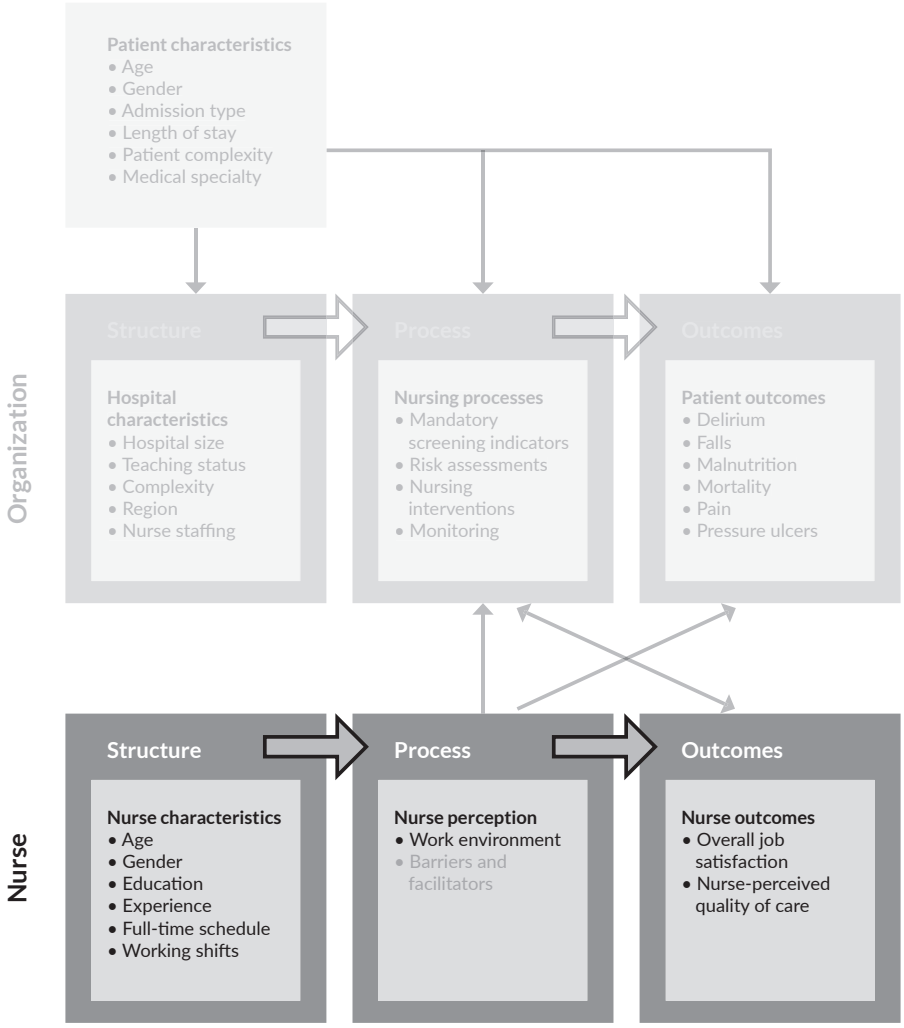
# CHAPTER 7

## NURSE-PERCEIVED QUALITY OF CARE IN INTENSIVE CARE UNITS AND ASSOCIATIONS WITH WORK ENVIRONMENT CHARACTERISTICS: A MULTICENTER SURVEY STUDY

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In revision

# Abstract

**Background:** Nurse-perceived quality of care and job satisfaction have been positively linked to quality outcomes for nurses and patients. Much evidence exists on factors contributing to job satisfaction. Understanding specific factors that affect nurse-perceived quality potentially enables for improvements of nursing care quality.
**Aims:** To examine nurse-perceived quality of care, controlling for overall job satisfaction among critical care nurses and to explore associations with work environment characteristics.
**Methods:** A multicenter survey study was conducted in three Dutch intensive care units. The Dutch version of the Essentials of Magnetism II questionnaire was used; including the single-item measures: (i) nurse-perceived quality of care, (ii) overall job satisfaction, and (iii) 58 statements on work environments. Data were collected between October 2013 and June 2014.
**Results:** The majority of 123 responding nurses (response rate 45%) were more than satisfied with quality of care (55%) and with their job (66%). No associations were found with nurse characteristics, besides differences in job satisfaction between the units ($F$ (2,120)= 5.073, $p$< 0.05). After controlling for job satisfaction, nurse-perceived quality was positively associated with the work environment characteristics: adequacy of staffing, patient-centeredness, competent peers, and support for education. Patient-centeredness and autonomy were the most important predictors for overall job satisfaction.
**Conclusions:** Factors that contribute to nurse-perceived quality of care in intensive care units, independent from the effects of overall job satisfaction, were identified. Hereby, offering opportunities to maximize high-quality of care to critically ill patients. Research in a larger sample is needed to confirm our findings.

## Introduction

Working in intensive care units (ICUs) and dealing with complex situations requires many mental and physical resources of nurses, who are the only health care professionals providing direct patient care at the bedside all hours of the day. The recruitment and retention of qualified and motivated nursing personnel is a major challenge in all types of hospital units. Additionally, it has been shown that critical care nurses have more work stress and are less satisfied with their current job as opposed to nurses working in other departments.[1,2]

A vast body of literature exists on the effects of job dissatisfaction, not only in relation to nurse outcomes, such as intention to leave and nurse turnover, but also with regard to various patient outcomes, such as patient satisfaction, mortality, and adverse nurse-sensitive outcomes.[3-5] Single-item outcome indicators, such as job satisfaction are used to obtain a person's perception of particular dimensions of an overall concept, and therefore give insight into a wide range of factors related to nursing care quality.[6,7] Nurse-perceived quality of care is another frequently used single-item indicator which has been associated with various nurse and patient outcomes.[8,9] The latter is a somewhat different conceptualization of satisfaction; it does not relate to how satisfied nurses are about their own job, but instead it involves satisfaction with the quality of care nurses believe to be present at the designated department. Understanding factors that contribute to job satisfaction and nurse-perceived quality in ICUs is necessary, in order to effectively improve quality of nursing care in these high-intensity units.

In the literature, the evidence on nurse-perceived quality of care received much less attention, in contrast to several reviews that summarized factors contributing to overall job satisfaction among registered nurses in various hospital units.[10,11] However, knowledge of factors that contribute to nurses' perception of quality of care is highly relevant. Aiken et al.[12] showed that many nurses working in hospitals across 12 European countries perceived the quality of care in their institution to be poor or fair, with the most dissatisfied nurses being in Greece (47%), Germany (35%), and the Netherlands (35%). Furthermore, previous research indicated that job satisfaction and nurse-perceived quality of care are inter-correlated [9,13,14] suggesting that the perception of quality of care might be influenced by nurses' general opinion about their job. These findings provided the rationale for this study, which aims to establish an accurate and realistic picture of contributing factors to nurse-perceived quality of care in ICUs by accounting for nurses' overall job satisfaction.

## Background

The structure-process-outcome framework of Donabedian [15] guiding this study, emphasizes the relationship between quality outcomes and influential factors of structure and process. 'Structure' refers to those workplace characteristics affecting the ability of organizations to meet health care needs. In 1983, McClure and colleagues [16] were the first to identify structure factors that are important elements in any hospital organization in the USA, known as the Forces of Magnetism. Examples are organizational structure, staffing policies, and image of nurses. With regard to nurse-perceived quality of care, several studies reported positive associations with nurse staffing levels. Aiken et al.[17] in a cross-sectional study of 300 hospitals in various countries (i.e., USA, Canada, England, and Scotland), found that nurses in hospitals with low staffing levels were more dissatisfied with the quality of care, as compared to nurses in hospitals with higher staffing levels. Cho et al.[18] demonstrated that more favorable staffing levels significantly increased nurse-perceived quality of care in a sample of 65 ICUs in Korea. 'Process' refers to those workplace characteristics that affect nurses in their daily activities to provide care to patients, such as clinical autonomy, manager support, and professional relationships. The emphasis on process factors and its relation with quality outcomes was enhanced by the development of process measurement instruments, such as the Essentials of Magnetism-tool, later revised as the Essentials of Magnetism II by Schmalenberg and Kramer.[9]
The importance of these kinds of measurements has spread across many other countries, such as China, Turkey, and the Netherlands. In the latter country, prioritizing nursing quality has led to the introduction of the Dutch Essentials of Magnetism II in 2010.[19] Various Dutch healthcare organizations (hospitals, home care, nursing homes, and psychiatric care) use this instrument to measure and improve the work environment of nurses, and in line with this aim to increase the quality of care for patients. Previously, studies demonstrated positive associations between nurses' perception of quality of care and positively perceived nurse-physician relationships and good nurse manager support.[20-23]

Despite their relevance, previous studies analyzed nurse-perceived quality of care without controlling for the effects of overall job satisfaction. Hence, to better understand the specific contributors for nurse-perceived quality, the aim of this study was to determine factors in nurses' work environment that are associated with nurse-perceived quality of care in ICUs independently from nurses' overall job satisfaction.

## Methods

### Aims

The aims of this study were (i) to assess job satisfaction and nurse-perceived quality of care in a sample of Dutch ICUs and (ii) to determine work environment characteristics that, according to ICU nurses are associated with overall job satisfaction and with perceived quality of care, after controlling for the effects of overall job satisfaction.

### Design
A cross-sectional multicenter survey study was conducted.

### Participants
The present study involved nurses working in the ICUs of three hospitals in the Netherlands. These 12 to 24 beds ICUs with an adult patient population are comparable, because they are all determined to be of the highest complexity level, level III, and the ICUs are based in teaching hospitals.[24] The questionnaires were administered in these specific hospitals, because they were among the pilot-testing hospitals for the translation and validation of the Dutch Essentials of Magnetism II (D-EoM II). The D-EoM II aims at the goals as described in the original Essentials of Magnetism (EoM): 'identifying areas in which change is needed in order for a hospital to pursue an excellent work environment that attracts and retains well-qualified nurses'.[9] All 283 staff nurses working in the ICUs received a questionnaire. Nursing students with less than six months of working experience and those nurses not participating in direct patient care (e.g., team leaders) were excluded.

### Survey instrument
The questionnaire had two parts. The first part addressed demographic characteristics of nurses, involving age, gender, years of nursing experience, years of experience on the ICU, educational level (Associate's degree in nursing versus at least Bachelor's degree in nursing), full-time schedule (≥ 32 hours per week) versus part-time schedule (<32 hours per week), and working shifts (rotating shifts versus fixed shifts; exclusively day shifts, evening shifts or night shifts).

The second part included the D-EoM II with 58 statements on eight *process indicators* concerning nurses' work environment: (i) working with clinically competent peers, (ii) support for education, (iii) collaborative nurse-physician relationships, (iv) practice of clinical autonomy, (v) control of nursing practice, (vi) nurse manager support, (vii) patient-centered values, and (viii) adequacy of staffing. Items consisted of a 4 point Likert-scale, including 'strongly disagree', 'disagree', 'agree', and 'strongly agree'. In the initial study to validate the D-EoM II, acceptable Cronbach's alphas were reported for the eight subscales, ranging from 0.58 to 0.92.[19] 'Working with clinically competent peers' showed a relatively low Cronbach's alpha, possibly because of multiple interpretations of the definition of this subscale. However, the correlations between the items of this subscale were high and therefore the subscale was included in the D-EoM II. The D-EoM II also provided two single-item *outcome indicators*: (i) overall job satisfaction, "On a scale from 1 to 10, how satisfied are you with your current job in the hospital?" in which the value of 1 indicates 'not satisfied at all' and the value of 10 indicates 'very satisfied'. and (ii) nurse-perceived quality of care, "On a scale of 1 to 10, how do you rate the quality of patient care in your hospital unit?" in which the value of 1 indicates 'very bad' and the value of 10 indicates 'very good'.

### Data collection

The primary researcher distributed paper-based questionnaires to nurses in the ICUs between October 2013 and June 2014. A closed mailbox was placed in each unit, in order for responding nurses to return the questionnaire. A short instruction letter was provided with background information on the purpose and on how to address the questionnaire. The contact persons in the hospitals, who were nurses with a research background, stimulated the nurses to respond, for example by emphasizing that participation was voluntary and anonymous. In addition, several reminders were sent by mail. All questionnaires were collected by the primary researcher.

### Ethical considerations

The Medical Research Ethics Commissions United (MEC-U) gave ethics approval for this study (W13.030). The board of directors of each participating hospital gave formal permission to conduct the study. All data were coded.

### Data analysis

Descriptive statistics, including means, standard deviations, frequencies, and percentages were used to characterize demographics of the responding nurses. Nurses' scores on overall job satisfaction and nurse-perceived quality of care were categorized into three categories; a score of less than 6 referred to 'dissatisfied', between 6 and 8 referred to 'satisfied' and ≥ 8 referred to 'very satisfied'. Then, we calculated mean scores for overall job satisfaction and nurse-perceived quality of care. Analysis of variance (ANOVA) with Bonferroni post-hoc comparisons (to adjust for multiple comparisons) was used to evaluate overall job satisfaction and nurse-perceived quality of care in relation to nurse characteristics. Dummy variables were created for age (<40 years, 40 to 49 years, ≥50 years), nursing experience (<10 years, 10 to 19 years, ≥20 years) and ICU experience (<5 years, 5 to 14 years, ≥15 years). Subsequently, we tested Pearson's correlation between overall job satisfaction and nurse-perceived quality of care.

To assess associations with the work environment characteristics, we constructed hierarchical multiple regression models. The first model represents the relationship between work environment characteristics and overall job satisfaction and the second model reveals the effects with regard to nurse-perceived quality of care. In the latter model, overall job satisfaction was inserted in step 1, in order to control for its effect on nurse-perceived quality of care (outcome variable). The work environment characteristics (explanatory variables) were inserted in step 2. Model 3 resembles model 2, with the extension that potentially confounding nurse characteristics were also put in this model. Multi-collinearity of the variables was determined, with a variance inflation factor (VIF) >10 and tolerance value of <0.10 as thresholds.[25] The normality plots showed that the data were distributed normally. A statistical power calculation for a hierarchical regression analysis with eight explanatory variables, with an alpha of 0.05, estimated effect size of $f^2$ 0.15, and 80% power, showed that at least 110 participants were required.[26]

SPSS version 22 was used for quantitative analyses (IBM SPSS Statistics for Windows, Armonk, NY, USA: IBM Corp.). A *p*-value of <0.05 was considered statistically significant.

## Results

The response rate was 45% (*N*= 126, site range: 43%- 46%). Three nurses did not complete the questions regarding the single-item outcome indicators. Analysis of their characteristics revealed that they were working in units A or C, represented various ages, educational levels and experience categories. These non-responders were excluded from further analyses, because there were only three (2%). The majority of nurses had at least a Bachelor's degree (71%) and were working in rotating shifts (88%). Most nurses were female (78%) and working full-time (62%). The mean age was 41 years (*SD*= 10.8), and nurses on average had 20 years (*SD*= 11.5) of experience as qualified staff nurses, and 13 years (*SD*= 10.0) of experience on the ICU (Table 1).

***Table 1.*** *Baseline demographics of the study population.*

| **Nurse characteristics** [a] | **All ICUs** *N*=123 | **Unit A** *N*=57 | **Unit B** *N*=33 | **Unit C** *N*=33 |
|---|---|---|---|---|
| Gender (%) | | | | |
| Male | 27 (22.1) | 5 (8.8) | 10 (30.3) | 12 (37.5) |
| Female | 95 (77.9) | 52 (91.2) | 23 (69.7) | 20 (62.5) |
| Education level (%) | | | | |
| Associate | 35 (28.7) | 27 (47.4) | 6 (18.2) | 2 (6.3) |
| Bachelor | 87 (71.3) | 30 (52.6) | 27 (81.8) | 30 (93.8) |
| Working shifts (%) | | | | |
| Fixed | 15 (12.3) | 9 (15.8) | 4 (12.1) | 2 (6.3) |
| Rotating | 107 (87.7) | 48 (84.2) | 29 (87.9) | 30 (93.8) |
| Schedule (%) | | | | |
| Part-time | 47 (38.5) | 25 (43.9) | 16 (48.5) | 6 (18.8) |
| Full-time | 75 (61.5) | 32 (56.1) | 17 (51.5) | 26 (81.3) |
| Age, mean years (SD) | 41.0 (10.8) | 39.3 (11.2) | 42.9 (9.0) | 41.9 (11.4) |
| Nursing experience, mean years (SD) | 20.1 (11.5) | 18.6 (11.9) | 22.1 (10.3) | 20.7 (12.0) |
| ICU experience, mean years (SD) | 12.9 (10.0) | 11.6 (10.6) | 15.6 (9.3) | 12.7 (9.4) |

[a] Missing values on all nurse characteristics, N=1 (Unit C).

The proportion of nurses that were 'very satisfied' (mean score ≥ 8) ranged from 55% for nurse-perceived quality of care to 66% for overall job satisfaction. The proportion of dissatisfied nurses (mean score <6) was low for nurse-perceived quality as well as overall job satisfaction, respectively 0% and 1%. The mean scores for the single-outcome indicators were 7.58 ($SD$= 0.70) for nurse-perceived quality and 7.75 ($SD$= 0.82) for overall job satisfaction. Analysis of variance revealed that nurses in one ICU (unit B) were significantly less satisfied with their job, as opposed to another ICU (unit A) ($F$ (2,120)= 5.073, $p$< 0.05). There were no other significant associations between the single-item indicators and nurse characteristics (Table 2). A moderate correlation was found between job satisfaction and nurse-perceived quality ($r$= .448, $p$< 0.001).

With regard to influential work environment characteristics, it is shown in Table 3 that overall job satisfaction (model 1) was positively associated with all included factors. The factors 'patient-centered values' and 'practice of clinical autonomy' explained approximately 30% of the total variance. The second hierarchical regression model revealed that, independently from the effects of overall job satisfaction, the following factors were related to nurse-perceived quality: 'patient-centered values', 'adequacy of staffing', 'competent peers', and 'support for education'. Based on multi-collinearity, nursing experience was excluded for further analysis with regard to model 3. As presented in Table 3, the effects of model 2 remained after including all other nurse characteristics (unit, gender, education level, working shifts, schedule, age, and ICU experience) in the model. The variability in nurse-perceived quality of care, accounted for overall job satisfaction was respectively 7% (support for education), 9% (adequacy of staffing, competent peers), and 10% (patient-centered values).

***Table 2.*** *Overall job satisfaction and nurse-perceived quality of care in relation to demographic variables (N=123).*

| | **Job Satisfaction** | | **Quality of Care** | |
|---|---|---|---|---|
| **Nurse characteristics** | Mean (SD) | *p* | Mean (SD) | *p* |
| **Unit** | | 0.008 | | 0.996 |
| A | 7.97 (0.79) | | 7.58 (0.65) | |
| B | 7.42 (0.83) | | 7.58 (0.79) | |
| C | 7.70 (0.77) | | 7.59 (0.71) | |
| **Gender** | | 0.844 | | 0.159 |
| Male | 7.78 (0.70) | | 7.74 (0.81) | |
| Female | 7.74 (0.86) | | 7.53 (0.66) | |
| **Education level** | | 0.673 | | 0.461 |
| Associate | 7.70 (0.79) | | 7.50 (0.61) | |
| Bachelor | 7.77 (0.85) | | 7.60 (0.73) | |
| **Working shifts** | | 0.212 | | 0.584 |
| Fixed | 8.00 (1.07) | | 7.67 (0.82) | |
| Rotating | 7.72 (0.79) | | 7.56 (0.68) | |
| **Schedule** | | 0.467 | | 0.993 |
| Part-time | 7.68 (0.84) | | 7.57 (0.71) | |
| Full-time | 7.79 (0.82) | | 7.57 (0.69) | |
| **Age** | | 0.555 | | 0.983 |
| < 40 | 7.67 (0.76) | | 7.58 (0.72) | |
| 40-49 | 7.86 (0.59) | | 7.56 (0.69) | |
| ≥ 50 | 7.77 (1.14) | | 7.58 (0.67) | |
| **Nursing experience** | | 0.117 | | 0.743 |
| < 10 | 7.88 (0.61) | | 7.67 (0.59) | |
| 10-19 | 7.48 (0.83) | | 7.53 (0.82) | |
| ≥ 20 | 7.82 (0.90) | | 7.57 (0.66) | |
| **ICU experience** | | 0.311 | | 0.845 |
| < 5 | 7.88 (0.63) | | 7.60 (0.63) | |
| 5-14 | 7.58 (0.81) | | 7.61 (0.77) | |
| ≥ 15 years | 7.78 (0.95) | | 7.53 (0.70) | |

***Table 3.*** *Hierarchical regression models for overall job satisfaction, nurse-perceived quality of care, and work environment characteristics (N=123).*

| | **Model 1** | | **Model 2** | | | **Model 3** | | |
|---|---|---|---|---|---|---|---|---|
| **Explanatory variables** | Standardized coefficient | Adjusted $R^2$ | Standardized coefficient | Adjusted $R^2$ | $\Delta R^2$ | Standardized coefficient | Adjusted $R^2$ | $\Delta R^2$ |
| Nurse-physician relationships | 0.37* | 0.13 | 0.12 | 0.22 | 0.01 | 0.12 | 0.19 | 0.01 |
| Support for education | 0.39* | 0.14 | 0.29** | 0.31 | 0.07 | 0.29** | 0.30 | 0.07 |
| Clinical autonomy | 0.53* | 0.28 | 0.35 | 0.20 | 0.00 | 0.03 | 0.17 | 0.00 |
| Control of nursing practice | 0.36* | 0.12 | 0.13 | 0.21 | 0.01 | 0.10 | 0.18 | 0.01 |
| Adequacy of staffing | 0.42* | 0.17 | 0.34* | 0.29 | 0.09 | 0.35* | 0.28 | 0.09 |
| Competent peers | 0.47* | 0.22 | 0.33* | 0.27 | 0.08 | 0.34* | 0.26 | 0.09 |
| Nurse manager support | 0.48* | 0.22 | 0.15 | 0.20 | 0.02 | 0.15 | 0.18 | 0.02 |
| Patient-centered values | 0.56* | 0.30 | 0.40* | 0.30 | 0.11 | 0.40* | 0.28 | 0.10 |

Model 1 represents predictors for overall job satisfaction.
Model 2 represents predictors for nurse-perceived quality of care, controlling for overall job satisfaction.
Model 3 represents predictors for nurse-perceived quality of care, controlling for overall job satisfaction and including nurse characteristics as confounders.
* $P < 0.001$
** $P < 0.05$

## Discussion

Nurses' abilities to deliver high-quality of care to patients has been linked to workplace satisfaction. In addition to the numerous studies on job satisfaction, to our knowledge we are the first to assess satisfaction with the quality of care according to nurses in ICUs while controlling for overall job satisfaction; enabling insight into factors specifically associated with nurse-perceived quality, without the interference of positive or negative perceptions of the job in general. We demonstrated that the majority of nurses in three Dutch ICUs were highly satisfied with the quality of care in their department. Several nurse demographic characteristics, such as working experience and educational level previously have been mentioned to affect nurse-perceived quality of care,[9,13] however we did not find significant associations. Adequacy of staffing, competent peers, patient-centered values, and support for education were identified as the key factors in ICU nurses' work environment that are particularly essential in quality of care deliverance.

In addition to previous studies that reported significant associations between quality outcomes and the structural factor of nurse staffing [9,13] we found that perceived adequacy of staffing (process factor) was a relevant predictor for nurse-reported quality of care. Cho et al.[18] in their study among 1365 ICU-nurses in Korea, also mentioned that from nurses' perspective the adequacy of staffing was a relevant contributor for the quality of care. These findings imply that it is necessary to keep striving for optimal staffing levels, as they have a strong effect on the final quality outcomes in ICUs, for patients as well as for nurses. In the literature, the evidence that the work environment factors 'competent peers' and 'support for education' are directly related to nurse-perceived quality of care, is yet scarce.[13] However, various authors mentioned that nurses attach great importance to these factors.
For example, interview studies of nurses in various health care settings and countries showed that continuous education and clinical competent peers are among nurses' main values.[29-31] Furthermore, in the article of Aiken et al.[12] it is stated that across 12 European countries, between 23% (Switzerland) and 77% (Greece) of nurses were dissatisfied with education opportunities. One of the recommendations was that health care organizations should focus on continuously educating nurses, particularly because of the complexity of care. This is especially relevant in ICUs, because nurses in these specialty units have to deal with complex patient categories. Future longitudinal studies in ICUs are necessary to evaluate causal relations between nurses' competencies, educational support and quality of care provided to critically ill patients.

Our findings concerning the most explanative positive predictors for job satisfaction are consistent with results from previous studies with regard to autonomy [32,33] as well as patient-centered care.[34] Acknowledgement of these factors is a relevant precondition to further improve job satisfaction and quality outcomes in ICUs. Interestingly, patient-centered care was also a positive predictor for nurse-perceived quality of care. One possible interpretation is that the hierarchical culture in health care settings motivates the value assigned to patient-centeredness from nurses' viewpoint. Traditionally, physicians are focused on the process of curing diseases, whereas nurses' domain of practice mainly involves the process of caring for ill patients. Particularly in ICUs, with the specific characteristics of its patient population, with critically ill and mostly unresponsive and uncommunicative patients, patient-centered care is highly relevant.[35]

Another important finding of the study is that, in the sample of Dutch ICUs higher means for overall job satisfaction were found as opposed to nurse-perceived quality of care. Conversely, higher means for nurse-perceived quality instead of overall job satisfaction were shown in two EoM II-studies; in 34 US hospitals by Schmalenberg and Kramer [9] and in 28 Chinese ICUs.[13] Cultural differences may have been influential; an explanation which may also be applicable for the low percentages of dissatisfied nurses in our study. Moreover, we found that almost none of the nurses were dissatisfied, as opposed to previous studies mentioning numbers of respectively 24% to 51% for overall job satisfaction and 16% to 27% for nurse-perceived quality of care.[9,36] Although we used a different cut-off value (a score of <6), results were similar in case the original cut-off value (a score of <6.5) was used, with 5.7% of dissatisfied nurses for both satisfaction ratings. Since the introduction of the Dutch Essentials of Magnetism II in 2010, a greater awareness in the Netherlands has arisen about the importance of work environments in relation to nursing care quality. Although the majority of nurses in the current sample (2013-2014) were satisfied with the quality of care, trend measurement over time would complete the findings from this cross-sectional study.

**Limitations**

Schmalenberg and Kramer [9] mentioned that single-item outcome indicators, such as overall job satisfaction and nurse-perceived quality of care have advantages (e.g., quick, easy interpretable) but also disadvantages (e.g., concerns about accuracy of results, completeness). Although Youngblut and Casper [7] demonstrated acceptable validity and reliability of single-item indicators in the nursing research field, further psychometric analyses on overall job satisfaction and nurse-perceived quality of care as specific single-item outcome indicators should be performed.

Because we included a non-randomly selected sample of ICUs in three teaching hospitals, our results may not be representative for ICUs in non-teaching hospitals and university hospitals. However, we found that nursing demographics corresponded with other Dutch ICUs, as described in a national assessment of ICUs.[37] Although a response rate of 45% is acceptable in survey studies, we had to exclude three respondents. These responders did not complete the questions regarding the single item indicators, however including them would potentially have had positive effects. This because these nurses were working in units A and C, which on average were the

units with most satisfied nurses. Additionally, we assume that dissatisfied nurses would always complete the single-item questions to express their dissatisfaction. Further research in a larger sample is required to support our findings.

Another limitation involves the use of a different cut-off value than as used in previous studies on overall job satisfaction and nurse-perceived quality of care.[9,36] As a result, it is more difficult to make appropriate comparisons between our and previous international results. However, in the Netherlands this cut-off value is regularly used for ranking purposes (school results, satisfaction ratings) and therefore we assume that they adequately reflect Dutch nurses' perspectives (http://www.allesopeenrij.nl/article.php?aid=1098).

## Conclusions

This multicenter study on workplace satisfaction among nurses in intensive care units is of great relevance, because we gained insight into factors in nurses' work environment that are essential for quality of care delivery in ICUs. In addition to the numerous studies on contributing factors to overall job satisfaction, we explicitly showed that nurses' satisfaction with the quality of care in their own ICU was significantly associated with nurse-perceived adequacy of staffing, patient-centeredness, competent peers, and support for education; independently from the effect of satisfaction with the job in general. In addition to organizational structures that are relevant preconditions for nurses to provide high quality of care, understanding nurses' perception of work environment characteristics that affect their direct care processes is necessary in order to further increase workplace satisfaction, and in line with this, optimize the quality of nursing care. Future research in a larger sample of high-intensity units is needed to verify our findings on specific contributing work environment factors.

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# Appendix

## Dutch Essentials of Magnetism II (De Brouwer et al., 2014)

### B. Werktevredenheid

*Wilt u een kruisje zetten bij het best passende antwoord?*

| | | Zeer mee oneens | Mee oneens | Mee eens | Zeer mee eens |
|---|---|---|---|---|---|
| 1 | Artsen zijn bereid verpleegkundigen uit te leggen en te onderwijzen. | ☐ | ☐ | ☐ | ☐ |
| 2 | De samenwerkingsrelaties tussen verpleegkundigen en artsen zijn gebaseerd op gelijkwaardige inbreng, vertrouwen en respect. | ☐ | ☐ | ☐ | ☐ |
| 3 | De relaties tussen artsen en verpleegkundigen zijn vijandig, frustrerend en gekenmerkt door machtsvertoon. | ☐ | ☐ | ☐ | ☐ |
| 4 | De verpleegkundigen beïnvloeden vanuit hun eigen vakgebied keuzes die de arts maakt in de patiëntenzorg. | ☐ | ☐ | ☐ | ☐ |
| 5 | Onze arts – verpleegkundigen relaties zijn terughoudend, afstandelijk en voornamelijk gekenmerkt door formele uitwisseling van informatie. | ☐ | ☐ | ☐ | ☐ |
| 6 | Artsen en verpleegkundigen hebben een gelijkwaardige relatie; we gebruiken elkaars expertise. | ☐ | ☐ | ☐ | ☐ |
| 7 | Binnen onze organisatie wordt het gewaardeerd wanneer verpleegkundigen zelf hun kennis en vakbekwaamheid willen vergroten. | ☐ | ☐ | ☐ | ☐ |
| 8 | Onze direct leidinggevende stelt ons in staat om bij- en nascholingen, cursussen en / of vervolgopleidingen te volgen. | ☐ | ☐ | ☐ | ☐ |
| 9 | In deze organisatie wordt het behalen van diploma's nauwelijks beloond; bijvoorbeeld in de vorm van promotie, salarisverhoging of waardering. | ☐ | ☐ | ☐ | ☐ |
| 10 | Deze organisatie geeft verpleegkundigen financiële steun en/of betaald verlof om scholingsprogramma's te volgen. | ☐ | ☐ | ☐ | ☐ |
| 11 | Verpleegkundigen hier zijn bang om 'in de problemen te raken' wanneer zij zelfstandig handelen binnen het eigen vakgebied. | ☐ | ☐ | ☐ | ☐ |
| 12 | Verpleegkundigen durven hier zelfstandig te handelen, omdat zij 'voelen' of weten dat de direct leidinggevende hen hierin steunt. | ☐ | ☐ | ☐ | ☐ |
| 13 | Verpleegkundigen moeten eerst opdracht/toestemming krijgen van hogerhand voordat zij zelfstandig beslissingen nemen binnen het eigen vakgebied. | ☐ | ☐ | ☐ | ☐ |
| 14 | Op deze afdeling beslissen verpleegkundigen zelf over zaken binnen het eigen vakgebied en wanneer het probleem de grenzen van andere disciplines overschrijdt, worden beslissingen in overleg met deze disciplines genomen. | ☐ | ☐ | ☐ | ☐ |
| 15 | Wij baseren ons handelen op de meest actuele kennis. | ☐ | ☐ | ☐ | ☐ |

| | | Zeer mee oneens | Mee oneens | Mee eens | Zeer mee eens |
|---|---|---|---|---|---|
| 16 | Binnen deze organisatie zijn zoveel regels en reglementen dat verpleegkundigen niet zelfstandig of in overleg met anderen besluiten kunnen nemen. | ☐ | ☐ | ☐ | ☐ |
| 17 | In deze organisatie moeten verpleegkundigen dingen doen die, naar ons oordeel, in strijd zijn met de belangen van de patiënt. | ☐ | ☐ | ☐ | ☐ |
| 18 | Verpleegkundigen worden op een positieve, opbouwende en ondersteunende wijze aangesproken op de resultaten van hun zelfstandig verpleegkundig/verzorgend handelen. | ☐ | ☐ | ☐ | ☐ |
| 19 | Op deze afdeling hebben de meeste verpleegkundigen het gevoel dat de directie wil dat ze zelfstandig handelen in hun vakgebied. | ☐ | ☐ | ☐ | ☐ |
| 20 | Binnen onze organisatie hebben we raden en commissies, waarin verpleegkundigen zeggenschap hebben over de beroepsuitoefening. | ☐ | ☐ | ☐ | ☐ |
| 21 | De verpleegkundigen hebben inspraak en zeggenschap over praktische kwesties en beleid zoals de selectie van apparatuur en de inhoud van protocollen. | ☐ | ☐ | ☐ | ☐ |
| 22 | Het management, andere verpleegkundigen en andere disciplines accepteren dat verpleegkundigen in deze organisatie zeggenschap hebben over hun eigen beroepsuitoefening. | ☐ | ☐ | ☐ | ☐ |
| 23 | Men zegt wel dat er sprake is van gezamenlijke besluitvorming, maar in de praktijk is daar weinig sprake van. | ☐ | ☐ | ☐ | ☐ |
| 24 | Vertegenwoordigers van andere afdelingen en disciplines nemen regelmatig deel aan onze gezamenlijke besluitvorming. | ☐ | ☐ | ☐ | ☐ |
| 25 | Verpleegkundigen binnen deze organisatie beslissen mee over het personeelsbeleid dat direct effect heeft op hen, zoals het inzetten van invalkrachten, dienstroosters, de manier van werken, etc. | ☐ | ☐ | ☐ | ☐ |
| 26 | De verpleegkundigen op mijn afdeling weten welke resultaten behaald zijn en welke beslissingen genomen zijn als resultaat van de gezamenlijke besluitvorming. | ☐ | ☐ | ☐ | ☐ |
| 27 | Het beleid op het gebied van verpleging/verzorging wordt bepaald door managers of mensen van buiten de verpleging: verpleegkundigen hebben geen inspraak of zeggenschap. | ☐ | ☐ | ☐ | ☐ |
| 28 | De verpleegkundigen op mijn afdeling hebben het gevoel dat wij meestal voldoende personeel hebben om patiënten zorg van goede kwaliteit te geven. | ☐ | ☐ | ☐ | ☐ |
| 29 | We hebben niet genoeg bekwame en ervaren verpleegkundigen die de afdeling, de patiënten en de artsen 'kennen'. | ☐ | ☐ | ☐ | ☐ |
| 30 | We laten onze manier van zorg verlenen afhangen van hoeveelheid en de ervaring van beschikbare verpleegkundigen. | ☐ | ☐ | ☐ | ☐ |
| 31 | Onze normale personeelsbezetting brengt de veiligheid van de patiëntenzorg niet in gevaar. | ☐ | ☐ | ☐ | ☐ |

| | | Zeer mee oneens | Mee oneens | Mee eens | Zeer mee eens |
|---|---|---|---|---|---|
| 32 | Dankzij de samenwerking en onze teamgeest kunnen wij met onze huidige personeelsbezetting zorg van goede kwaliteit bieden. | ☐ | ☐ | ☐ | ☐ |
| 33 | We hebben niet genoeg verpleegkundigen om zorg van goede kwaliteit te leveren, zelfs niet wanneer alle toegewezen formatieplaatsen van onze afdeling ingevuld / bezet zijn. | ☐ | ☐ | ☐ | ☐ |
| 34 | Verpleegkundigen op mijn afdeling zijn erg vakbekwaam. | ☐ | ☐ | ☐ | ☐ |
| 35 | In deze organisatie wordt vakbekwaamheid van verpleegkundigen erkend en beloond. | ☐ | ☐ | ☐ | ☐ |
| 36 | Een (vervolg)opleiding wordt gezien als een manier waarop verpleegkundigen hun vakbekwaamheid kunnen vergroten. | ☐ | ☐ | ☐ | ☐ |
| 37 | Een afgeronde vervolgopleiding wordt gezien als bewijs van extra vakbekwaamheid. | ☐ | ☐ | ☐ | ☐ |
| 38 | Onze direct leidinggevende vertegenwoordigt de positie en de belangen van onze afdeling en het personeel bij andere afdelingen en het management; hij / zij "komt voor ons op". | ☐ | ☐ | ☐ | ☐ |
| 39 | Als we verpleeg- en hulpmiddelen nodig hebben, dan kan onze direct leidinggevende ervoor zorgen dat we deze krijgen. | ☐ | ☐ | ☐ | ☐ |
| 40 | Onze direct leidinggevende is diplomatiek, redelijk en eerlijk in het oplossen van conflicten. | ☐ | ☐ | ☐ | ☐ |
| 41 | Onze direct leidinggevende ondersteunt en moedigt interdisciplinaire samenwerking, planning en actie aan tussen artsen, verpleegkundigen en andere disciplines. | ☐ | ☐ | ☐ | ☐ |
| 42 | Onze direct leidinggevende let erop dat we voldoende en bekwaam personeel hebben om ons werk te doen. | ☐ | ☐ | ☐ | ☐ |
| 43 | Wanneer onze direct leidinggevende ons feedback geeft, gebruikt hij / zij concrete voorbeelden, zowel positieve als negatieve. | ☐ | ☐ | ☐ | ☐ |
| 44 | Onze direct leidinggevende stimuleert de teamgeest en heeft een positieve invloed op onze samenwerking. | ☐ | ☐ | ☐ | ☐ |
| 45 | Onze direct leidinggevende is zichtbaar, beschikbaar, toegankelijk en je kunt er 'veilig' mee praten. | ☐ | ☐ | ☐ | ☐ |
| 46 | Onze direct leidinggevende draagt de zorgvisie van onze instelling uit, zowel in woorden als in daden. | ☐ | ☐ | ☐ | ☐ |
| 47 | Onze direct leidinggevende helpt ons om goede beslissingen te nemen door te vragen naar de argumenten waarop wij ons handelen baseren. | ☐ | ☐ | ☐ | ☐ |
| 48 | Deze instelling is bereid nieuwe dingen te proberen. | ☐ | ☐ | ☐ | ☐ |
| 49 | In onze instelling staat de patiënt centraal. | ☐ | ☐ | ☐ | ☐ |
| 50 | Problemen worden snel opgelost; mensen zijn niet bang om risico's te nemen. | ☐ | ☐ | ☐ | ☐ |
| 51 | Mensen zijn enthousiast over hun werk hier. | ☐ | ☐ | ☐ | ☐ |
| 52 | Hoge prestaties en een goede inzet worden van iedereen verwacht. | ☐ | ☐ | ☐ | ☐ |

| | | Zeer mee oneens | Mee oneens | Mee eens | Zeer mee eens |
|---|---|---|---|---|---|
| 53 | We werken samen als een team; zowel binnen de verpleging als met artsen en andere disciplines. | ☐ | ☐ | ☐ | ☐ |
| 54 | Kosten (geld) zijn belangrijk, maar de kwaliteit van patiëntenzorg staat in deze organisatie voorop. | ☐ | ☐ | ☐ | ☐ |
| 55 | De inbreng van iedereen op de afdeling is belangrijk en wordt gewaardeerd. | ☐ | ☐ | ☐ | ☐ |
| 56 | Ons management is alert op organisatorische veranderingen die nodig zijn als gevolg van veranderingen in de gezondheidszorg en zorgt ervoor dat wij voorop lopen. | ☐ | ☐ | ☐ | ☐ |
| 57 | Deze organisatie wordt gedreven door waarden. Deze waarden zijn bekend, worden begrepen en gedeeld en zijn regelmatig onderwerp van gesprek. | ☐ | ☐ | ☐ | ☐ |
| 58 | We spannen ons bewust in om onze normen en waarden over te brengen op verpleegkundigen en artsen die bij ons komen werken. | ☐ | ☐ | ☐ | ☐ |

**59. Hoe tevreden bent u met uw huidige baan in dit ziekenhuis? (cijfer van 1 t/m 10)**

☐☐

**60. Hoe beoordeelt u de kwaliteit van de zorg op uw afdeling? (cijfer van 1 t/m 10)**

☐☐

# CHAPTER 8

## GENERAL DISCUSSION

**EFFECTIVE EXCELLENCE IN NURSING**
BRIDGING THE GAP BETWEEN MEASUREMENT OF QUALITY OF NURSING CARE AND CLINICAL REALITY; CURRENT EVIDENCE AND FUTURE PERSPECTIVES


Dewi Stalpers - Marian J. Kaljouw - Marieke J. Schuurmans

Submitted

## A typical day at the ward…

*Monday morning 7.30 AM, nurse Monique starts her day of work in the intensive care unit of a local hospital with a cup of coffee from the DE coffee machine. She is in good spirits, because she is working with some nice colleagues today. Her colleague of the nightshift tells her how her patient has been doing during the night. The patient is very sick, it is a 69-year old man with heart failure after a cardiac arrest. He is on a ventilator and was put on a dialysis machine, because his kidneys were no longer working properly. One can hear the continuous alarming of the bedside monitor, warning for low blood pressures and irregular heartbeats. The man looks swollen with edema all over his body. "This is going to be a busy day", nurse Monique thinks. Then, she opens her account on the computer and she gets totally discouraged of what she sees. A long checklist faces her; there are 10 tasks that had to be done the last hour, you're too* ***LATE*** *is written in red, and do* ***not forget*** *the 15 tasks that have to be validated within the next hour. "Determine the delirium score, check the stomach pump, fill in the wound form, check the VAS, check the RASS, check the CPOT, check…check…double check". She thinks to herself "Is this really quality of care?"*

## Introduction

In the last decades, the importance of measuring the quality of care has become more notable. Indicators to express quality are used to make appropriate healthcare-related choices by various stakeholders in the healthcare system, such as consumers, insurance companies, providers, and policymakers. Nurses constitute the largest group of professionals in hospitals and deliver most of bedside patient care. Research on nurses' contribution to the quality of care expressed by nurse-sensitive quality indicators is therefore highly relevant to the healthcare field.[1,2]

Donabedian's Structure-Process-Outcome framework is commonly used to assess quality of nursing care.[3] Structure indicators are measures to define the contextual and organizational setting, with examples of nurse staffing levels and financial resources. Process indicators include the activities that are done by nurses in delivery of care, such as risk assessments and subsequent interventions. Outcome indicators reflect the outcomes of nursing care. A vast body of literature exists on the most accessible outcome indicators, such as mortality, morbidity, and length of stay.[4-7] A limitation of these kinds of outcome indicators is the difficulty to disentangle the specific contribution of nurses to the quality of care.[8] More recent studies try to overcome this problem by examining nurse-sensitive outcomes (NSOs), defined as "…those patient outcomes that are relevant, based on nurses' scope and domain of practice, and for which there is empirical evidence linking nursing inputs and interventions to the outcome".[9] Pressure ulcers prevalence, fall incidences, and nosocomial infections are examples of such NSOs.[10] There is much debate however, about the value of these kinds of outcome indicators as measures of nursing care quality. First, critics claim that NSOs represent adverse events, thereby giving a negative focus to the concept of quality of nursing care.[11] Second, with regard to outcome measurement in general, a major drawback is that patient characteristics, such as disease severity, age, and multi-morbidity play a crucial role in the final outcomes for patients, leading to difficulties in

interpreting and comparing performances, for instance between hospitals.[1]
Third, incorporating outcome data into nursing clinical practice has numerous challenges, for example the ambiguous relationship between the time-consuming data collection and the value of these efforts in daily practice.[12]

With regard to the relationship with structure and process indicators, previous studies found significant positive associations between nurse staffing and skill-mix levels (structure) and NSOs, such as urinary tract infections, pressure ulcers, and patient falls.[5,13,14] The evidence on associations between process indicators and NSOs is limited, because process indicators are often not included in large administrative database, resulting in a lack of usable data.[11,15] However, evaluating the quality of nursing care by indicators related to nursing processes should not be underestimated, because nursing activities or lack of these activities potentially imposes serious consequences for patients.[16] For example, monitoring patients' risk for the development of pressure ulcers and taking preventive measures, are key nursing tasks that, if not implemented, can cause problems for patients (occurrence of an adverse event) as well as for society (costs).[17] In this paper, we will further elaborate on process indicators as measures of nursing care quality and explore whether better performances on these indicators (e.g., more favorable screening performances) also lead to better outcomes for patients (e.g., lower pressure ulcers prevalence). We focus on intensive care units (ICUs), because adverse patient outcomes, such as NSOs are evident in these high intensity units.[18]

In the Netherlands, the Health Care Inspectorate, as an independent supervisory body of the Ministry of Health, Welfare and Sports uses a mandatory set of performance indicators to supervise quality of care.[19] Since 2007, hospitals must report their results on nurse-sensitive process and outcome indicators, including delirium, malnutrition, pain, and pressure ulcers to the Inspectorate and these results are also publicly reported on a website (http://www.ziekenhuizentransparant.nl/). A previous study on the use of these indicators in Dutch ICUs showed that the majority of responding nurses were not familiar with the mandatory set of indicators as opposed to physicians.[20]
Nurses also had less knowledge about the use of indicators as tool to improve nursing care quality. Collecting the indicator data, in other words, the appropriate monitoring of these nurse-sensitive indicators in daily practice is an essential element of nurses' responsibility in quality of care deliverance. Previously, nurse characteristics, such as gender, experience and educational level have been mentioned to affect nurses in their clinical performances.[21,22] Besides nurse characteristics, the important role of nurses' work environment also has been emphasized. After the release of a meaningful report of the Institute of Medicine "Keeping Patients Safe: Transforming the Work Environment of Nurses",[23] various studies reported significant positive associations between healthy work environments and the quality of nursing care, as measured with outcomes such as mortality, failure-to-rescue, and healthcare-associated infections.[24,25] In order to effectively improve nursing care quality, it is important to gain insight into factors that contribute to nurses' performance, for example with regard to nurse-sensitive indicators.

Over the last years, we conducted a series of studies with regard to the mandatory nurse-sensitive indicators in the Dutch health care system. In these studies we focused on the following two topics: (i) validity and usefulness of nurse-sensitive process indicators as measures of quality of nursing care, and (ii) nurse characteristics and factors in nurses' work environment that contribute to quality of care provision by nurses. The present study will first briefly address the studies and findings to provide a background context. Subsequently, a critical reflection on these studies may provide valuable insights for other researchers, clinicians and policymakers in this field; resulting in recommendations to bridge the gap between measurement of quality of nursing care and clinical reality.

## Current evidence

We conducted two cross-sectional studies involving Dutch hospitals, an observational study in three intensive care units (ICUs), a survey study among the critical care nurses of these ICUs, a descriptive-exploratory study involving two Dutch quality indicator datasets, and a systematic review of the literature. We constructed a conceptual model based on Donabedian's Structure-Process-Outcome framework, and organized our data using the organizational level and nurse level (Figure 1).

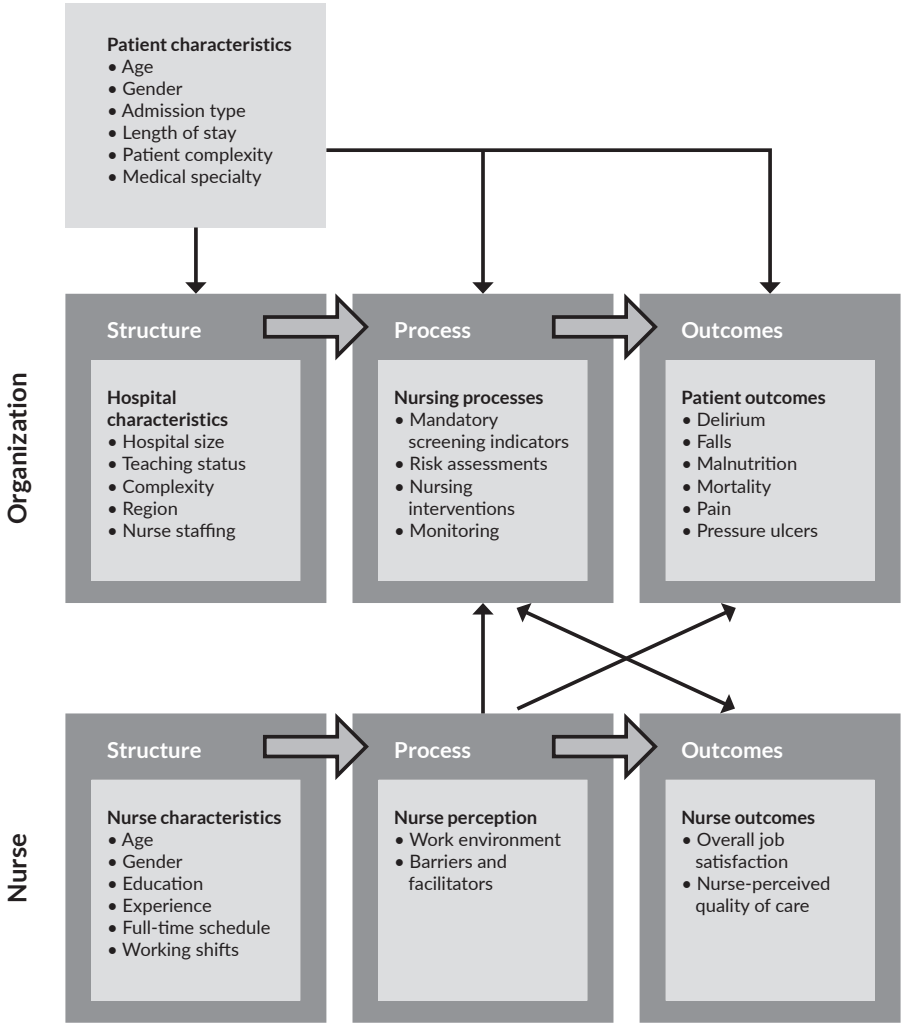


***Figure 1.*** *Conceptual model based on Donabedian's Structure-Process-Outcome framework.*

**Validity and usefulness of nurse-sensitive process indicators**

We analyzed the 2011 indicator dataset of the Dutch Health Care Inspectorate involving all 93 hospitals in the Netherlands. Structure, process, and outcome indicators were examined on the organizational level. We concluded that, although screening and risk assessments are important nursing tasks, hospital performance with regard to the mandatory screening indicators of delirium, malnutrition, and pain were not yet optimal. Across the Dutch hospitals, the average screening rates ranged from 59% (IQR= 50.9) for the observation of delirium to 94% (IQR= 9.7) for pain assessments in postoperative patients in the recovery room. We found that, after controlling for hospital characteristics (see Figure 1) hospitals with the best overall screening performances had significantly better results regarding the nurse-sensitive outcome (NSO) 'adequacy of protein-intake in malnourished patients'. Moreover, a higher proportion of malnourished patients had an adequate protein-intake in high-performing hospitals as compared to lower-performing hospitals. We also assessed the relationship with mortality by the Hospital Standardized Mortality Ratio (HSMR) and found that significant effects disappeared after controlling for hospital characteristics. Although we could not establish causal relationships, the findings suggest that screening indicators are potentially valid measures of nursing care quality, as overall performance on these process indicators showed to be indicative for the outcomes for patients.[26]

To underpin our findings, we determined the convergent validity of the screening indicators in a subsample of six teaching hospitals. These hospitals were pilot-testing hospitals for the validation of the Dutch Essentials of Magnetism II (D-EoM II, an instrument that aims to 'identify areas in which change is needed for a hospital to pursue an excellent work environment that attracts and retains well-qualified nurses'.[27,28] A composite score was used to define hospitals' performance based on the screening indicators (organizational level). This score was compared with hospitals' ranking based on the number of nurses who were satisfied with the quality of care in their hospital (nurse level). We used a single-item outcome measure from the D-EoM II to determine nurses' perception of the quality of care. Spearman's correlation analysis showed that there was a very strong degree of correspondence between the two quality measures ($r_S$= 0.94, $p$= 0.005). Hereby, we demonstrated concordance between objectively measured quality indicators (i.e., nurse-sensitive screening indicators) and subjectively measured quality indicators (i.e., nurse-perceived quality of care).[29]

In addition to these validity findings, we also explored the reliability of nurse-sensitive indicators. In the cross-sectional study of 93 hospitals,[26] we compared the 2011 indicator data with the 2010 data and found a moderate stability ($r$= 0.42 to $r$= 0.67) for all nurse-sensitive quality indicators. Furthermore, as part of an observational study in three ICUs, the reliability of the measurements of delirium, pain, and pressure ulcers was determined in a subsample of 24 randomly selected patients.[30] A moderate to good inter-rater reliability was shown between two nurses (i.e., the nurse taking care of the included patients and the contact nurses in the ICUs), with Kappa's coefficients between 0.54 and 0.89 and intra-class correlation coefficients (ICC) between 0.71 and 0.99.

Given these results, the next step was to determine the usefulness of nurse-sensitive indicators. A multicenter observational study in three ICUs was performed, in order to gain insight into the monitoring of NSOs in daily nursing practice.[30] Besides the influence of individual patient characteristics, the associations with nursing processes were explored. The Problem-Intervention-Evaluation (PIE) framework of Siegrist, Dettor, & Stocks [31] was used to assess the monitoring and documentation of delirium, pain and pressure ulcers. The following variables were included: (i) initial assessment of delirium, pain, and pressure ulcers (problem), (ii) at least one risk assessment (problem), (iii) documented nursing interventions (intervention), and (iv) continuous monitoring in case delirium, pain or pressure ulcers had occurred (evaluation). The chart review of 310 patients showed that the challenges with regard to monitoring of NSOs mainly involve the evaluation of provided care and specific nursing interventions. If we take the example of delirium, we found that although delirium occurred in 46% of the patients, a specialized physician (intervention) was only consulted in 6% of the cases and major differences occurred between the three units regarding the continuity of delirium monitoring (evaluation), with a site range of 8% to 99%.

To further understand the usefulness of nurse-sensitive indicators, a survey study among the nurses in the three ICUs was performed. The main goal was to assess perceived barriers and facilitators to the monitoring of NSOs. The framework of Cabana [32] was used, including three barrier-domains regarding attitude, knowledge, and behavior. The most important barriers according to the 126 responding nurses: (i) time pressure, a behavior-related barrier (42%), (ii) unfamiliarity with mandatory indicators, a knowledge-related barrier (20%), and (iii) unreliability as benchmark data, an attitude-related barrier (15%). Education and clear policies were perceived as important facilitators by more than 80% of nurses. With regard to the degree of nurse-sensitivity of NSOs, all nurses agreed that pressure ulcers and patient satisfaction capture the care that is mostly affected by nurses. Mortality, urinary tract infections, and sepsis were considered as the least sensitive to nursing care.[33] These findings are in line with results from a descriptive-exploratory study at the organizational level in which the quality indicators of the Inspectorate dataset were compared with the ones included in another national dataset that structurally monitors the quality of nursing care.[34] The latter, the national safety program (http://www.vmszorg.nl/) was launched by the Ministry of Health, Welfare and Sports in 2008 as a result of a previous study on avoidable adverse events and mortality in Dutch hospitals.[35] The aim of this program was to use mandatory quality indicators to prevent or reduce healthcare-related accidents and adverse events. We demonstrated that, between the two datasets, there were dissimilarities in the definitions of nurse-sensitive indicators. Furthermore, we found a lack of scientific evidence supporting the nurse-sensitivity of the included indicators. This potentially interferes with the proper use and suitability of nurse-sensitive indicators.

In sum, nurse-sensitive process indicators are potentially valid and useful measures to differentiate the quality of nursing care in hospitals. An essential precondition for optimizing the effects of quality indicators is that nurses are aware of the importance of these indicators and act accordingly, for example by continuity in monitoring. However, various barriers to indicator measurement in daily practice are perceived by nurses.

**Associations with characteristics of nurses and work environments**

The systematic literature review of quantitative studies between 2004 and 2012 revealed that, although there was a lack of high methodological quality studies, various factors in nurses' work environment were important in relation to the five included NSOs.[36] At the organizational level, more favorable staffing levels were associated with less patient falls and mixed results were shown with regard to pressure ulcers. At the nurse level, a positively perceived collaborative nurse-physician relationship was associated with lower rates of patient falls and lower pressure ulcers prevalence. The literature review also identified education and experience as influential nurse characteristics. The importance of the latter characteristics is supported by the results from our studies that focused on the nurse level. The cross-sectional study in six teaching hospitals involving 2338 nurses [29] showed that nurses with at least a Bachelor's degree and the more experienced nurses were significantly more satisfied with the quality of care in their department, as compared to less experienced nurses and nurses with an Associate's degree. Additionally, nurses working fixed shifts, particularly dayshifts, were more positive about the quality of care in their hospital as compared to nurses working rotating shifts. The survey study among nurses in the three ICUs confirmed the positive influence of working fixed shifts, as these nurses perceived less attitude-related barriers (i.e., outcome expectancy, self-efficacy, motivation) as opposed to nurses working rotating shifts.[33] Furthermore, it was shown that after adjusting for the included individual nurse characteristics, one of the three units had a negative and significantly lower behavior-related barrier score (i.e., time, organizational issues, external factors) as opposed to the other units, and this unit was also the unit with the least favorable score with regard to the work environment factor 'practice of clinical autonomy'. The survey study also elaborated on work environment characteristics related to overall job satisfaction and nurse-perceived quality of care. After controlling for the effects of nurses' overall job satisfaction, hierarchical regression analysis showed that the factors 'adequacy of staffing', 'patient-centered values', 'competent peers', and 'support for education' were positively associated with nurse-perceived quality of care. We demonstrated that job satisfaction was positively associated with all eight included work environment (process) characteristics of the D-EoM II; 'patient-centered values' and 'practice of clinical autonomy' had the highest explanative values (adjusted $R^2$= 0.30 and 0.28).[37]

Thus, from our studies we conclude that education, experience, and type of working shifts are important individual nurse characteristics. The most appointed work environment factors are nurse staffing, autonomy, patient-centered values, and collaborative relationships.

## Discussion

Based on our findings, we can draw some overall conclusions regarding the quality of nursing care expressed by nurse-sensitive indicators and influential factors. Figure 1 shows the conceptual model we developed to illustrate the relationship between structure, process, and outcome indicators of nursing care quality at the organizational level, and the nurse level.

### Validity and usefulness of nurse-sensitive process indicators

Benchmarking on the basis of screening indicators is useful in order to gain insight into the quality of care in hospitals. Besides confirming the convergent validity of nurse-sensitive screening indicators by showing strong correlations with a subjective measure of nursing quality (i.e., nurse-reported quality of care), we also found indications that overall screening performances in all 93 Dutch hospitals were linked to nurse-sensitive outcomes, such as adequate protein-intake in malnourished patients. Our findings are consistent with previous medical studies, which revealed significant associations between process performance measures and outcomes, for example guideline adherence and its effect on mortality and acute coronary syndromes.[38,39] However, various authors emphasize the need, but also the specific conditions that have to be complied with before these kinds of process indicators can be used as measures of nursing care quality. For example, indicators should be feasible to collect and should provide useful information.[40] Mant [41] suggested that process indicators are the preferred indicators in case processes have scientifically proven to lead to certain outcomes.

Screening checklists have many advantages and they could improve quality and safety in health care, as argued in an article in Nature regarding quality issues in operating rooms.[42] The case example in the introduction however, illustrates a potential pitfall of measurement of quality by these checklists, which is that screening activities become a purpose on their own. Moreover, instead of increasing quality, a double negative effect occurs; on the one hand, a high workload on nurses because of the time-consuming administrative burden, and on the other hand, a negative effect on the quality of nursing care because less time remains for direct patient care.[43] Some examples as to why indicator measurement by checklist usage is failing: (i) imposed top-down policies, (ii) feelings of little involvement of the people directly involved, and (iii) discrepancies in ownership.[42]

From an organizational perspective, an overall issue with the measurement of indicators is the large quantity in which they occur. In a press release in January 2016, the Dutch Hospital Association (NVZ) claimed that the registration of quality indicators by hospital organizations and health care professionals in the Netherlands has reached a breaking point.[44] On average, a Dutch hospital is involved in 45 quality measurements, 19 quality marks and seven patient experience measurements. In a blog about quality reports in the USA, it is also mentioned that the list is very long and that much duplicate reporting are required.[45] The plurality of quality data may create a false sense of security, because it is questionable whether the shared information is a representation of clinical reality.[46] For example, under pressure to be transparent,

hospital organizations might tend to show their performances on the most accessible and measurable indicators instead of focusing on indicators that truly reflect quality.

At the nurse level, it is important that nurses are aware that indicators are meant to direct the care they are providing. Nurses must understand that screening is a first requirement for the adequate monitoring of patients, and that the initiation of follow-up assessments and nursing interventions is essential in order to enhance quality.[16,20] In our studies, we found that the continuity in monitoring (i.e., follow-up and interventions) of nurse-sensitive indicators is an important challenge in daily nursing practice, and that various attitude-, knowledge-, and behavior-related barriers to appropriate monitoring exist.

### Associations with characteristics of nurses and their work environment

With regard to study aim two, we reported some relevant predictors for quality of care delivery. From our studies, we conclude that education, staffing, nurse-physician relationships, and autonomy are important factors. With regard to educational level, previous studies by the RN4CAST-consortium already demonstrated relevant associations between nurses' educational background and the outcomes for patients. In an article of Aiken and colleagues,[47] which was published in the Lancet and involved nine European countries, it was reported that for every ten percent increase in Bachelor-educated nurses in a health care setting, the likelihood of patient mortality dropped by seven percent. Furthermore, studies showed significant associations between the level of education and adverse patient outcomes, such as failure-to-rescue and pressure ulcers.[4,47,48] Besides nurse staffing, a structural characteristic which extensively has been discussed in previous studies, the the work environment characteristics of characteristics of autonomy and nurse-physician relationships are key factors. In a review by Brady Germain and Cummings [49] it is mentioned that, in addition to leadership behaviors, autonomy and work relationships are the most important factors that nurses believe to positively influence their motivation and performance. The interrelationship between all factors is evident; autonomous nurses use their theoretical background and nursing knowledge to make adequate decisions for which they feel accountable, and autonomous nurses are more likely to have professional relationships with physicians as compared to less autonomous nurses.[50,51]

### From influential factors at the nurse level to performances at the organizational level

Simultaneously with the work environment in which nurses are working, the variation in professional decision-making between individuals also plays an important role in care provided.[52] Our case example is illustrative, because nurse Monique is on a crossroad; she can either first complete all the checklists and then start her further daily activities, or she can decide to go to the patient first and check the patient on potential risks and then uses this information to take further actions and document these risks and interventions during her working day. The saying "a nurse is a nurse is a nurse" is rather questionable. In general, all nurses are able to handle many clinical situations; they fulfill to the seven roles (i.e., health advocate, communicator, collaborator, leader, scholar, professional, nursing expert) as described in the

CanMEDS framework, a widely used framework to improve patient care by enhancing professional training.[53] There are however, differences in nurses' level of competence which involve critical thinking skills, ability to apply knowledge in actual clinical situations, and effective clinical judgment skills.[52,54] Moreover, highly competent nurses (i.e., experts) have an intuitive ability to connect situational independent qualities (e.g., knowledge, autonomy) to specific situations, and they are able to anticipate. Griffin et al.[55] referred to the importance of proactive behavior in addition to nurses' core performance. Core performance is defined as "…performing tasks which are a requirement of the job, meeting expectations" (e.g., filling in the screening checklists, because you are required to do so) and proactive behavior which involves "…self-starting and forward thinking to prevent, rather than react to workplace problems" (e.g., use checklists to identify what needs to happen). Differences in nurses' proactivity generally may cause differential outcomes. We complemented our conceptual model based on the assumption that proactivity mediates the relationship between individual nurses at the nurse level and nurses' job performance at the organizational level. Potentially, this also affects patient outcomes (Figure 2).

If we take autonomy, an important work environment factor in relation to nursing care quality, it is shown in Figure 2 that role breadth, defined as "…the capability of carrying out a broader and more *proactive* set of work tasks that extend beyond prescribed technical requirements" mediates the relationship between autonomy and job performance.[49,56] In other words, we assume that autonomy by itself does not have that much value without a certain amount of proactive behavior of the one that has to deliver high-quality patient care. Furthermore, we concluded that the level of education is an important predictor for nursing care quality. Educational level can be represented by knowledge. Based on the literature, we complemented Figure 2 with an intermediate factor between educational level and job performance, through general mental abilities (GMA). GMA is a higher-order concept and involves reasoning abilities (e.g., *proactivity*), verbal and numerical skills, analytical skills, and overall intelligence level.[57] A higher GMA acquires higher and quicker job knowledge. Other traits, such as aptitudes (i.e., specific narrow cognitive abilities), job experience and personality traits are also important, but show weaker correlations. In other words, as with autonomy, knowledge by itself does not have that much value; someone has to apply it in the right way.

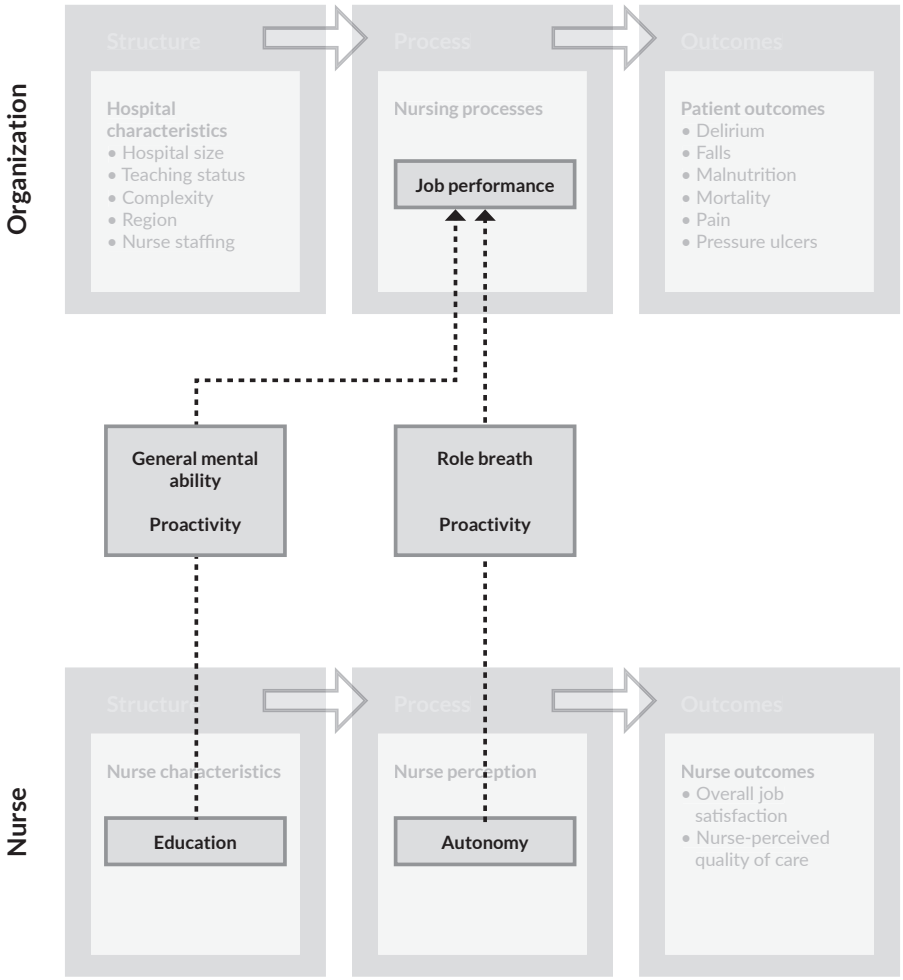


***Figure 2.*** *Emerging mediating factors between individual nurses and organizational job performance.*

**Methodological reflection**

Conducting research with regard to nursing care quality and influential factors has several challenges. First, a difficulty in interpreting results from previous studies is that authors attempted to directly connect structures (e.g., staffing) to outcomes (e.g., mortality).[58] A strength of our studies is that we assessed both structure as well as process indicators, and their potential relationship with patient outcomes. However, because of the cross-sectional and observational designs, we could not establish causal relationships. In this research field in order to demonstrate causality, more longitudinal studies are needed.[59] At the same time, high methodological quality must be pursued. For example, we were not able to perform a quantitative meta-analysis on the relationship between work environment characteristics and nurse-sensitive outcomes, because of unclear and small effect sizes in the primary studies. A review on differences in patient and nurse outcomes between Magnet and non-Magnet hospitals, involving studies between 1994 and 2014, also revealed difficulties with pooling quantitative results, because of the poor research designs of included studies.[60] Future research should focus on finding causal linkages between structural and process characteristics, and the outcomes for patients by means of longitudinal time-trend studies with high appraised quality designs.

Second, a commonly mentioned limitation is that performance comparison of patient outcomes at the hospital-level is compromised by differential case-mix and organizational structures of the various units in each hospital.[2,61] To deal with this issue, various countries are making efforts to determine unit-specific or specialty-specific indicators. For example, Canada uses the following unit-specific indicators to benchmark nursing quality in critical care units: central line infections, ventilator associated pneumonia, unplanned extubating, medication errors, pressure ulcers and urinary tract infections. In the nursing field, specialty-specific indicators have emerged in the USA and UK for ambulatory cancer care, pediatric care and psychiatric care.[62] The advantage of these kinds of indicators is that they arise from a specific setting and therefore they align well with the care provided.[63] Future research is needed to assess whether the determination of unit/specialty-specific indicators improves the monitoring of nurse-sensitive indicators and quality outcomes for patients.

Third, a methodological issue of our survey studies in the ICUs is bias from non-responders. Although previous studies among nurses in critical care units encountered similar response rates between 41% and 51%,[64-66] this may have led to underestimation or overestimation and should be taken into account in interpreting findings. With regard to the cross-sectional studies, the mandated character of data collection of indicators by the Dutch Health Care Inspectorate has the advantage of potentially less non-responders as opposed to voluntary participation. However, the risk of underreporting or inappropriate data-information remains, because the indicator-data are self-reported by hospitals. One way to deal with these issues is to combine various quality measurement methods. In order to get a more comprehensive view on nursing care quality, the results from quantitative studies regarding indicator data could be compared with patient's experiences coming from qualitative studies.

Fourth, our studies mainly focused on ICUs and the results in terms of influential nurse characteristics and work environment factors therefore relate in particular to these high intensity units. It has to be mentioned that other studies found similar results for surgical and medical units.[24,36] We choose to examine multiple NSOs at the one hand and focus on ICUs on the other hand, which gave us the opportunity to gain a broad and at the same time targeted insight into quality. Previous studies focused exclusively on one outcome; a view on quality in a broader sense is missing. In line with literature on improving nurses' professional practice [67] we propose that, future (intervention) studies to enhance quality care provided, should be tailored for nurses, taking into account influential nurse and work environment characteristics in a particular setting.

## Future perspectives

### Bridging the gap between measurement and clinical reality: organizational level

In our opinion, to achieve true quality of nursing care, the indicators to measure quality should be used for the intended purpose. From a hospital organization's point of view this means that the multitude of quality registrations should be reduced while maintaining the most important indicators to assess quality of nursing care.
In other words, hospital organizations have to, and also should be allowed to prioritize which quality measures are important for them to monitor. Based on our findings that process indicators are valid measures to benchmark nursing care quality, supervisory bodies could benefit from only controlling screening indicators.
The goal of supervising health care is to gain insight into hospital performances regarding nursing care and to identify potential risks to the quality of care.[68]
Trend measurement of a set of screening indicators, instead of measuring various outcome and process indicators in isolation will give an overall picture of nursing screening processes in hospitals. For instance, hospitals that have low screening performances and hospitals that have 100% screening performances could be visited and potential causes for differential results could be investigated. As in other countries, in the Netherlands, the quality indicators are reassessed each year. Consequently, this involves a lot of work, high costs, and uncertainty for health care organizations and professionals as to which indicators are mandatory. Therefore, it would be better to have a four or five year cycle in which the same indicators are monitored.
The obligation to publicly report nurse-sensitive indicator data should be maintained, because there is evidence confirming public reporting has a positive impact on quality of care [69,70] and that it stimulates quality improvement activities at the hospital level.[71] Thereby, a high degree of nurse-sensitivity and uniformity in definitions of indicators should be pursued.

**Bridging the gap between measurement and clinical reality: nurse level**

For nurses, it is important they understand that risk screening is a necessary first step in the prevention of adverse outcomes and the stimulation of positive outcomes for patients.[16,20] In their initial training, nursing students should already be educated about the sense and usefulness of screening checklists as quality tools. Thereby, creating support for the appropriate use of these checklists in daily practice. In hospitals, nurse managers are primarily responsible for facilitating a work environment that stimulates working nurses to excel in their performances, however it has to be mentioned that it is difficult to get these nurses actively involved and engaged in quality improvement initiatives.[72] Taking the example of dashboards with performance scores, which are often used to create awareness about the occurrence of adverse outcomes in a specific department. These kinds of quality improvements do not directly relate to nurses' perspective, because the real impact of nurses' screening and intervention activities on patient outcomes is not revealed.[12] In line with strategies to enhance intrinsic motivation to use quality tools (e.g., screening checklists), it is necessary to clarify nurses' accountability towards monitoring of nurse-sensitive indicators.

Timely feedback to nurses in the workplace previously showed to be effective in reducing central line-associated bloodstream infections.[73] Furthermore, in a study among 500 various health care professionals, multidisciplinary patient-care review sessions, such as discussions about healthcare-related complications and adverse outcomes, were frequently mentioned as effective ways to improve accountability.[74] Additionally, these sessions could be personalized by inviting(ex)-patients who could explain what, in retrospect was the impact of these complications on their lives.

The concept of GMA could aid in bridging the gap at nurses' level.

Besides acceptable staffing levels, a good mix of nurse professionals with various educational backgrounds is necessary. In line with a policy statement by the Tri-Council for Nursing, consisting of the American Association of Colleges of Nursing (AACN), American Nurses Association (ANA), American Organization of Nurse Executives (AONE), National League for Nursing (NLN) [75] we believe that, if Bachelor-educated nurses could take a clear position by using their specific expertise of a transcending coordinating role and an evidence-based approach while at the same time Associate-educated nurses could focus on coordinating care of one or more patients, every nurse will be more satisfied and the quality of patient care will improve. For example, instead of the nurse manager who is further removed from the working floor, a Bachelor-educated nurse, as a practicing nurse on the working floor, could be the designated *proactive* professional who encourages and provides direct feedback on screening activities and nursing interventions in a department. In the Netherlands, formal differentiation of functions in hospital nursing care should be stimulated, because except for clinical nurse specialists, nurses of all educational levels (i.e., Associate and Bachelor) basically have the same jobs. This has negative consequences for all involved; those who do not meet the job requirements have to work very hard and those who do meet the requirements, but who are not appreciated for it are constantly disappointed which can lead to demotivation. The roles and qualifications mentioned in the newly developed professional nursing standards could be used as a guidance.[76]

Bridging the gap on the level of individual nurses refers to each nurse's professional competences. Individual nurses' responsibility towards quality of care includes that they are reflective professionals who regularly evaluate their own job performances, for example regarding indicator measurement, in addition to the need to uphold their expertise by continuously educating themselves. As the patient of nurse Monique from our case example you would want her to fight for you (autonomy), to be well-informed (knowledge), to be able to map out the best action plan for you in collaboration with other disciplines (professional relationships), and to have your best interests (patient-oriented). In the interest of the care provided to patients, it is important that nurses acknowledge their own level of competence. In the words of Florence Nightingale: "For the sick it is important to have the best".

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# SUMMARY

NEDERLANDSE SAMENVATTING
DANKWOORD
CURRICULUM VITAE

Nurses are the largest group of health care professionals in hospitals. Nurse-sensitive indicators are used to gain insight into the quality of nursing care. These indicators represent care that is mostly affected by nurses. In the Netherlands, it is mandatory to report the results regarding process and outcome indicators of delirium, malnutrition, pain and pressure ulcers to the Health Care Inspectorate and to publicly report them on a website. In daily nursing practice however, the continuous registration and documentation of these indicators is perceived as an administrative burden. A relevant question therefore is whether nurse-sensitive indicators are useful and representative measures of nursing care quality. Besides the influence of nurse characteristics, a healthy work environment is important in nurses' care delivery. Understanding contributing factors potentially enables for improving the quality of nursing care.

In this thesis, the aim is to assess whether nurse-sensitive indicators are valid and useful for measuring the quality of nursing care (part 1), and in addition we examine the influence of nurse characteristics and contributing factors in nurses' work environment (part 2).

**Part 1: Validity and usefulness of nurse-sensitive quality indicators**

The first two chapters address the validity of nurse-sensitive quality indicators at the hospital-level. One of the main tasks of nurses is to risk assess (screening) and intervene on health related-risks.

In **Chapter 1**, a cross-sectional study is presented which describes the performances of all 93 Dutch hospitals regarding the mandatory nurse-sensitive screening indicators in 2011. The following screening indicators were analyzed: (i) proportion of patients screened for delirium, (ii) proportion of high-risk patients observed at least once on the presence of delirium, (iii) proportion of patients screened for malnutrition, (iv) proportion of postoperative patients in the recovery room with pain assessed, and (v) proportion of postoperative patients in hospital units with pain assessed. Over all hospitals, the best screening performances were found for assessments of pain in the recovery room (94%) and the least performances were shown for the observation of delirium (59%). Next, associations with nurse-sensitive outcome indicators were assessed, including: (i) proportion of malnourished patients with an adequate protein-intake, (ii) prevalence of pressure ulcers, (iii) pain score according to a Visual Analogue Scale (VAS), and (iv) Hospital Standardized Mortality Ratio (HSMR). We found that high-performing hospitals regarding overall screening performance had significantly more favorable results regarding protein-intake within malnourished patients, compared to less performing hospitals. Mortality showed a trend towards significant better results in high-performing hospitals. These findings suggest that the, relatively easy to measure screening indicators, are predictive for patient outcomes, and therefore can be considered as relevant measures of nursing care quality.

In **Chapter 2**, the convergent validity of nurse-sensitive quality indicators was determined by comparing these objective measures with subjective measures of quality of nursing care. A study of six Dutch teaching hospitals is presented in which screening performances, as described in Chapter 1, were used as objective measures. For each hospital, a composite score was calculated to determine the overall performance regarding screening of delirium, malnutrition, and pain. Across the hospitals, the composite scores ranged from 63% to 93%. Nurses' perception of the quality of care was used as a subjective quality measure: "On a scale from 1 to 10, how would you perceive the quality of patient care in your hospital unit?" The value of 1 represents 'dangerously low quality' and the value of 10 indicates 'very high quality'. The majority of the 2338 nurses in the six hospitals (91%) were satisfied with the quality of care and gave a score of ≥ 6. Analyzing the concordance between the two quality measures (objective versus subjective) showed a high degree of correspondence ($r_S$ =0.94), confirming the convergent validity of nurse-sensitive indicators as measures of quality of nursing care.

Chapters 3 and 4 summarize the results of a multi-center study in three intensive care units (ICUs) regarding the usefulness of nurse-sensitive quality indicators in daily practice. In Chapter 5 the usability is tested by means of a comparison between nurse-sensitive indicators as mandated by the Inspectorate and another nationwide database of obligatory indicators.

**Chapter 3** is an observational study which assesses delirium, pain, and pressure ulcers in 310 patients admitted to the ICU and the relationship with nursing processes. Nursing processes were categorized as: (i) initial assessment on admission, (ii) at least one risk assessment, (iii) continuous assessments, and (iv) nursing interventions. Retrospective chart reviews showed that the potential preventable nurse-sensitive outcomes (NSOs) occurred in 22% (pressure ulcers) to 46% (delirium) of patients. Seemingly, the documentation of initial problems is done by almost all patients. However, a wide variation occurred for documented interventions, ranging from 6% for specialized consultation in diagnosed delirium to 98% of patients receiving pain medication. The continuous assessments for risk, presence and status in case a NSO had occurred was described to be done in 48% (delirium), 74% (pressure ulcers), and 80% (pain) of patients. The findings imply that areas in which potential modifiable improvements can be reached mainly relate to continuity of risk assessments and documentation of nursing interventions.

Nurses working in the three ICUs were invited to participate in a survey study by means of a questionnaire. In **Chapter 4** the aim was to identify important barriers and facilitators to effective monitoring of NSOs. The most frequently cited barriers by the 126 responding nurses: (i) lack of time (42%), (ii) unfamiliarity with mandatory indicators (20%), and (iii) unreliability of indicators as benchmark data (15%). Facilitators for NSO monitoring were mentioned to be clear rules and policies (80%) and education about NSOs (92%). All nurses in the sample felt full responsibility with regard to the patient outcomes of pressure ulcers and patient satisfaction.

Mortality, sepsis and urinary tract infections were not perceived as nurse-sensitive by approximately 20% of responding nurses. 'Practice of clinical autonomy' emerged as a potential important factor in nurses' work environment in relation to barriers, as perceived by the ICU-nurses.

**Chapter 5** is a descriptive-explorative study (2014) in which the mandatory nurse-sensitive quality indicators as supervised by the Dutch Health Care Inspectorate (IGZ) were compared with the mandatory indicators of the national safety management program (VMS) as supervised by the Ministry of Health, Welfare and Sports(VWS). Both database involve the indicators of delirium, malnutrition, pain, and pressure ulcers; however, it was found that there was a lack of coherence between the datasets regarding uniformity of definitions and development of the indicators. The methodological quality of included indicators, as measured by the Appraisal of Indicators through Research and Evaluation (AIRE) instrument, was questionable. One of the recommendations is to revise indicators, and only to monitor suitable indicators that are determined to be nurse-sensitive and useful in daily practice.

**Part 2: Influential nurse characteristics and work environment characteristics**

In **Chapter 6** we describe a systematic review of quantitative studies on the topic of the relationship between characteristics of nurses' work environment and five nurse-sensitive patient outcomes in hospitals. Initially, 1120 studies were evaluated of which 29 studies met the inclusion criteria. Positively appreciated nurse-physician collaboration and a more experienced and higher-educated nursing staff were significantly associated with lower rates of pressure ulcers and fewer patient falls. Higher staffing levels were associated with more favorable results regarding patient falls and pain, and mixed results were shown for pressure ulcers. There was no relevant evidence with regard to delirium or malnutrition. The results were related to hospitals as well as a diversity of hospital units (e.g., intensive care, medical-surgical unit). Because of methodological issues of many of the included studies, one of our recommendations is that more high-quality studies with longitudinal research designs should be undertaken to assess nurses' work environment in relation to nursing care quality.

**Chapter 7** evaluates nurses' job satisfaction and nurse-perceived quality of care among 123 ICU nurses. Furthermore, the relationship with characteristics of nurses' work environment is examined. Nurses were asked to score their overall job satisfaction: "On a scale from 1 to 10, how satisfied are you with your current job in the hospital?", in which 1 indicates 'not satisfied at all' and 10 indicates 'very satisfied', and nurse-perceived quality of care: "On a scale from 1 to 10, how do you rate the quality of patient care in your hospital unit?", in which 1 indicates 'very bad' and 10 indicates 'very good'. The majority of nurses was highly satisfied (≥ 8) with the job (66%) as well as with the quality of care (55%). All eight included work environment factors (working with clinically competent peers, support for education, collaborative nurse-physician relationships, practice of clinical autonomy, control of nursing practice, nurse manager support, patient-centered cultural values, and adequacy of

staffing) were positively associated with job satisfaction. The highest predictive values occurred for 'patient-centered cultural values' and 'practice of clinical autonomy'. After controlling for nurses' overall satisfaction with their job, nurse-perceived quality of care was positively associated with: (i) adequacy of staffing, (ii) patient-centered values, (iii) competent peers, and (iv) support for education.

**Chapter 8** covers the general discussion with overall findings of all studies. Practical implications and further recommendations are presented. Based on the results of our studies, we conclude that nurse-sensitive screening indicators are potentially valid and useful measures to benchmark nursing care quality in hospitals. From an organizational perspective, challenges are to strive for (i) uniformity in indicator measurement in order to ensure optimal comparisons, (ii) optimization of nursing processes, such as the continuity in monitoring of nurse-sensitive indicators, and (iii) prioritization of the most relevant quality indicators. From nurses' point of view, several factors in their work environment are important in relation to the provision of high quality of care: (i) autonomy, (ii) competent peers, (iii) patient-centered values, (iv) adequacy of staffing, and (v) collaborative nurse-physician relationships. The ability to act proactive (behavior) emerged as an important mediating factor, connecting characteristics of the work environment at nurses' level to job performance of nurses and the outcomes for patients at the organizational level. Besides proactivity, the recognition of nurses' professional competences (knowledge), and the enhancement of nurses' engagement to act from an intrinsic motivational attitude (attitude) are necessary to bridge the gap between measurement of quality of nursing care and clinical reality.

# NEDERLANDSE SAMENVATTING

SUMMARY
DANKWOORD
CURRICULUM VITAE

Verpleegkundigen zijn de grootste groep van gezondheidszorgprofessionals in ziekenhuizen. Om inzicht te krijgen in de kwaliteit van de verpleegkundige zorg worden verpleeg-sensitieve indicatoren gebruikt. Dit zijn indicatoren die uiting geven aan de zorg die het meest wordt beïnvloed door verpleegkundigen. In Nederland is het verplicht om de resultaten van proces- en uitkomstindicatoren met betrekking tot delier, ondervoeding, pijn en decubitus te rapporteren aan de Inspectie voor de Gezondheidszorg (IGZ) als ook publiekelijk te openbaren op een landelijke website. In de dagelijkse verpleegkundige praktijk wordt de continue registratie en documentatie van deze indicatoren echter ervaren als een administratieve last. Een relevante vraag is daarom of verpleeg-sensitieve indicatoren nuttige en representatieve maten van kwaliteit van de verpleegkundige zorg zijn. Naast de invloed van kenmerken van verpleegkundigen zelf is een gezonde werkomgeving van belang bij het leveren van goede zorg. Het goed begrijpen van invloedrijke factoren maakt het mogelijk om de kwaliteit van de verpleegkundige zorg te verbeteren.

Het doel van dit proefschrift is om te onderzoeken of verpleeg-sensitieve indicatoren valide en bruikbare maten zijn om inzicht te krijgen in de kwaliteit van verpleegkundige zorg (deel 1) en daarnaast onderzoeken we wat de invloed is van verpleegkundige kenmerken en factoren in de werkomgeving van verpleegkundigen (deel 2).

**Deel 1: Validiteit en bruikbaarheid van verpleeg-sensitieve kwaliteitsindicatoren**
De eerste twee hoofdstukken hebben betrekking op de validiteit van verpleeg-sensitieve kwaliteitsindicatoren op ziekenhuisniveau. Eén van de belangrijkste taken van verpleegkundigen is om gezondheids-gerelateerde risico's te inventariseren (screening) en om vervolgens interventies daarop in te zetten.

In **Hoofdstuk 1** wordt een dwarsdoorsnede-onderzoek gepresenteerd waarin de prestaties van alle 93 Nederlandse ziekenhuizen met betrekking tot de verplichte verpleeg-sensitieve screeningsindicatoren in 2011 worden beschreven. De volgende screeningsindicatoren werden geanalyseerd: (i) percentage patiënten dat gescreend werd op delier, (ii) percentage hoog-risicopatiënten waarbij de aanwezigheid van delier tenminste 1x geobserveerd werd, (iii) percentage patiënten dat gescreend werd op ondervoeding, (iv) percentage postoperatieve patiënten in de uitslaapkamer waarbij de mate van pijn beoordeeld werd, (v) percentage postoperatieve patiënten op ziekenhuisafdelingen waarbij de mate van pijn beoordeeld werd. Over de ziekenhuizen heen, werden de beste screeningsprestaties gevonden voor het aantal patiënten waarbij de mate van pijn beoordeeld werd in de uitslaapkamer (94%) en de minste prestatie werd gevonden voor het aantal hoog-risico patiënten waarbij delier geobserveerd werd (59%). Vervolgens hebben we onderzocht wat de relatie is met verpleeg-sensitieve uitkomstindicatoren, waaronder: (i) percentage ondervoede patiënten met een adequate eiwit-inname, (ii) prevalentie van decubitus, (iii) pijnscore volgens een visuele analoge schaal (VAS) en (iv) mortaliteit. We vonden dat de ziekenhuizen met de beste algemene screening prestaties significant betere resultaten hadden met betrekking tot eiwit-inname bij ondervoede patiënten ten opzichte van minder

presenterende ziekenhuizen. Mortaliteit liet een trend tot significant betere resultaten in goed presterende ziekenhuizen zien. Deze bevindingen suggereren dat de, relatief makkelijk te meten screeningsindicatoren, voorspellend kunnen zijn voor patiënten-uitkomsten en derhalve kunnen worden beschouwd als een relevante maat voor de kwaliteit van verpleegkundige zorg.

In **Hoofdstuk 2** hebben we de convergente validiteit van verpleeg-sensitieve indicatoren bepaald door deze objectieve kwaliteitsmetingen te vergelijken met een subjectieve maat voor kwaliteit van de verpleegkundige zorg. Het onderzoek vond plaats in zes Nederlandse opleidingsziekenhuizen waarbij de screeningsindicatoren, zoals beschreven in hoofdstuk 1, werden gebruikt als objectieve maat. Voor elk ziekenhuis werd een samengestelde score berekend om de algemene prestaties met betrekking tot het screenen van delier, ondervoeding, en pijn te bepalen. Voor de verschillende ziekenhuizen varieerde deze score van 63% tot 93%. De verpleegkundige perceptie van de kwaliteit van zorg werd gebruikt als een subjectieve kwaliteitsmaat: "op een schaal van 1 tot 10, hoe zou u de kwaliteit van de patiëntenzorg op uw ziekenhuisafdeling beoordelen?" De waarde 1 staat voor 'gevaarlijk lage kwaliteit' en de waarde 10 betekent 'hoge kwaliteit'. De meerderheid van de 2338 verpleegkundigen in de zes ziekenhuizen (91%) waren tevreden met de kwaliteit van de zorg en gaf een score van ≥ 6. Er werd een hoge mate van overeenkomst ($r_s = 0.94$) gevonden tussen de twee kwaliteitsmaten (objectief versus subjectief), wat een bevestiging is voor de convergente validiteit van verpleeg-sensitieve indicatoren als maat voor de kwaliteit van verpleegkundige zorg.

In hoofdstuk 3 en 4 wordt een samenvatting gegeven van de resultaten van een multicenter studie op drie intensive care afdelingen (IC) wat betreft de bruikbaarheid van verpleeg-sensitieve kwaliteitsindicatoren in de dagelijkse praktijk. In hoofdstuk 5 wordt de bruikbaarheid getest aan de hand van een vergelijking tussen verplichte verpleeg-sensitieve indicatoren die gerapporteerd moeten worden aan de IGZ en een andere landelijke dataset met verplichte indicatoren.

**Hoofdstuk 3** is een observationele studie naar het vóórkomen van delier, pijn en decubitus bij 310 patiënten die zijn opgenomen op de IC en de relatie met verpleegkundige processen. Verpleegkundige processen werden als volgt gecategoriseerd: (i) initiële risicoscreening bij opname, (ii) ten minste 1x een risicobeoordeling, (iii) tussentijdse evaluaties en vervolgscreening en (iv) verpleegkundige interventies. Uit retrospectief documentenonderzoek bleek dat de potentieel vermijdbare verpleeg-sensitieve uitkomsten aanwezig waren bij 22% (decubitus) tot 46% (delirium) van de patiënten. Initiële risicoscreening werd bij bijna alle patiënten gedaan. Er was echter een grote variatie in het aantal gedocumenteerde interventies, variërend van 6% voor het raadplegen van een gespecialiseerd arts na vaststelling van de diagnose delier, tot 98% van de patiënten die pijnstillers kreeg tegen de pijn. In het geval dat een verpleeg-sensitieve uitkomst had plaatsgevonden, vond tussentijdse evaluatie en vervolgscreening plaats bij 48% (delier), 74% (decubitus) en 80% (pijn) van de patiënten. De bevindingen impliceren dat met betrekking

tot verpleegkundige processen, er met name op het gebied van continuïteit van risicobeoordelingen en documentatie van verpleegkundige interventies nog potentiële verbeteringen kunnen plaatsvinden.

De verpleegkundigen van de drie IC-afdelingen werden uitgenodigd om deel te nemen aan een vragenlijstonderzoek. Het doel van **Hoofdstuk 4** is om belangrijke belemmerende en bevorderende factoren te identificeren voor het effectief monitoren van verpleeg-sensitieve uitkomsten. De belemmerende factoren die het meest werden genoemd door de 126 verpleegkundigen: (i) het gebrek aan tijd (42%), (ii) onbekendheid met de verplichte indicatoren (20%) en (iii) de onbetrouwbaarheid van de indicatoren als benchmarkgegevens (15%). Duidelijke regels en beleid (80%) en voorlichting over verpleeg-sensitieve uitkomsten (92%) werden genoemd als bevorderende factoren voor goede monitoring. Alle verpleegkundigen in deze steekproef voelden zich volledig verantwoordelijk voor de patiënten-uitkomsten met betrekking tot decubitus en patiënttevredenheid. Mortaliteit, sepsis en urineweginfecties werden door ongeveer 20% van de verpleegkundigen niet als verpleeg-sensitief beschouwd. 'Het toepassen van klinische autonomie' kwam naar voren als een potentieel belangrijke werkomgevingsfactor in relatie tot de belemmerende factoren, zoals ervaren door de IC-verpleegkundigen.

**Hoofdstuk 5** is een descriptief-explorerende studie (2014) waarbij de verplichte verpleeg-sensitieve kwaliteitsindicatoren van de Inspectie voor de Gezondheidszorg (IGZ) worden vergeleken met de verplichte indicatoren van het Veiligheidsmanagementprogramma (VMS) dat onder toezicht staat van het ministerie van Volksgezondheid, Welzijn en Sport (VWS). Beiden includeren de indicatoren met betrekking delier, ondervoeding, pijn en decubitus. De ontwikkeling en totstandkoming van indicatoren en uniformiteit in definities bleken echter erg te verschillen tussen de datasets. De methodologische kwaliteit van de indicatoren, zoals gemeten aan de hand van het Appraisal of Indicators through Research and Evaluation (AIRE) instrument, bleek twijfelachtig te zijn. Eén van de aanbevelingen van deze studie is om de indicatoren te herzien, en om alleen die indicatoren te meten die bruikbaar zijn in de dagelijkse praktijk en waarbij verpleeg-sensitiviteit is vastgesteld.

### Deel 2: Invloedrijke verpleegkundige kenmerken en karakteristieken van de werkomgeving

In **Hoofdstuk 6** beschrijven we een systematisch literatuuronderzoek van kwantitatieve studies naar de relatie tussen karakteristieken van de verpleegkundige werkomgeving en vijf verpleeg-sensitieve uitkomsten in ziekenhuizen. Aanvankelijk werden er 1120 studies gevonden, waarvan er uiteindelijk 29 studies voldeden aan de inclusiecriteria. Een goede samenwerkingsrelatie tussen verpleegkundigen en artsen, en meer ervaren en hoger opgeleide verpleegkundigen waren geassocieerd met significant minder decubitus en minder valincidenten. Een hogere personeelsbezetting was geassocieerd met betere resultaten wat betreft pijn en valincidenten; en gemengde resultaten in relatie tot decubitus. Er werd geen relevant bewijs gevonden met betrekking tot delier of ondervoeding. De resultaten hadden zowel betrekking op ziekenhuizen als diverse ziekenhuisafdelingen (bijv. intensive care, medisch-chirurgische afdeling).

Vanwege methodologische onduidelijkheden in veel van de geïncludeerde studies, is één van onze aanbevelingen dat er meer longitudinale studies van hoge kwaliteit moeten worden uitgevoerd om de invloed van werkomgeving op de kwaliteit van de verpleegkundige zorg te onderzoeken.

**Hoofdstuk 7** evalueert de werktevredenheid en de perceptie op kwaliteit van zorg onder 123 IC-verpleegkundigen. Daarnaast wordt onderzocht wat de relatie is met kenmerken van de werkomgeving van verpleegkundigen. Verpleegkundigen werd gevraagd om wat hun algemene waardering is wat betreft werktevredenheid: "Op een schaal van 1 tot 10, hoe tevreden bent u met uw huidige baan in het ziekenhuis?", waarbij 1 staat voor 'helemaal niet tevreden' en 10 staat voor 'zeer tevreden' en hun perceptie van de kwaliteit van zorg: "Op een schaal van 1 tot 10, hoe zou u de kwaliteit van de patiëntenzorg op uw ziekenhuisafdeling beoordelen?", waarbij 1 staat voor 'zeer slecht' en 10 staat voor 'zeer goed'. De meerderheid van de verpleegkundigen was zeer tevreden (≥ 8) met hun werk (66%), evenals met de kwaliteit van zorg (55%). Alle acht geïncludeerde werkomgevingsfactoren (werken met vakbekwame collega's, goede relaties met artsen, autonomie, support van de direct leidinggevende, zeggenschap over de beroepsuitoefening, opleidingsmogelijkheden, voldoende personeel en patiëntgerichte zorgcultuur) waren positief geassocieerd met werktevredenheid. 'Patiëntgerichte zorgcultuur' en 'autonomie' hadden de hoogste voorspellende waarde. Na het controleren voor de algemene werktevredenheid van verpleegkundigen, was de perceptie op kwaliteit van zorg positief geassocieerd met: (i) voldoende personeel, (ii) patiëntgerichte zorgcultuur, (iii) werken met vakbekwame collega's en (iv) onderwijsmogelijkheden.

**Hoofdstuk 8** behandelt de algemene discussie met de belangrijkste bevindingen van alle studies. Praktische implicaties en verdere aanbevelingen worden gepresenteerd. Op basis van de resultaten van onze studies concluderen we dat verpleeg-sensitieve screeningsindicatoren potentieel valide en bruikbare maten zijn om de kwaliteit van verpleegkundige zorg in ziekenhuizen te benchmarken. Vanuit organisatorisch oogpunt is het belangrijk om te streven naar (i) uniformiteit in indicatoren-metingen, om te zorgen voor optimale vergelijkingen, (ii) optimalisering van verpleegkundige processen, zoals de continue monitoring van verpleeg-sensitieve indicatoren en (iii) prioritering van de meest relevante kwaliteitsindicatoren. Vanuit het perspectief van verpleegkundigen is een aantal factoren in hun werkomgeving van belang om hoge kwaliteit van zorg te kunnen bieden: (i) autonomie, (ii) vakbekwame collega's, (iii) patiëntgerichte zorgcultuur, (iv) personeelsbezetting en (v) goede samenwerking met artsen. De mogelijkheid om proactief te handelen (gedrag) is naar voren gekomen als een belangrijke mediërende factor tussen kenmerken van de werkomgeving op het verpleegkundig niveau en de prestaties van verpleegkundigen en de resultaten voor patiënten op het organisatorisch niveau. Naast pro-activiteit, zijn ook de erkenning van professionele competenties van verpleegkundigen (kennis) en het verbeteren van betrokkenheid van verpleegkundigen om te handelen vanuit een intrinsieke motivatie (attitude) nodig om de kloof tussen kwaliteitsmetingen van verpleegkundige zorg en de klinische realiteit te overbruggen.

# DANKWOORD

SUMMARY
NEDERLANDSE SAMENVATTING
CURRICULUM VITAE

Allereerst wil ik mijn promotor, prof. dr. Schuurmans en mijn copromotor, dr. Kaljouw bedanken. Marieke, het ultieme voorbeeld van verpleegkundig vakmanschap.
De definitie van vakmanschap: "de vaardigheid om hoog kwalitatief werk af te leveren". Jij weet als geen ander de link te leggen tussen theoretische vraagstukken en de dagelijkse verpleegkundige praktijk. Dit maakt dat je het beste kan halen uit beide kanten. Jouw visie en enthousiasme om verpleegkundigen te laten excelleren daar waar ze goed in zijn (lees: goede zorg verlenen aan de patiënt) deel ik volledig. Het feit dat jij tijdens mijn promotietraject constant de grote lijn in de gaten hield, heeft mij heel erg geholpen, want als promovenda raak je de rode draad wel eens kwijt. Dank dat je deze buitenpromovenda tot een afgerond proefschrift hebt gebracht!

Marian, het ultieme voorbeeld van verpleegkundig vakmanschap. De definitie van vakmanschap: "de vaardigheid om hoog kwalitatief werk af te leveren". Jij kan als geen ander allerlei soorten professionals in de zorg met elkaar in contact brengen en met elkaar laten samenwerken. Van bestuurders, tot zorgverzekeraars, verpleegkundigen, artsen enz. In onze discussies daagde jij mij constant uit om op het scherpst van de snede te redeneren. Ondanks je drukke schema (met op het hoogtepunt 3 banen tegelijkertijd!) heb je tijd voor mij vrij proberen te maken, omdat je het promotietraject tot een goed einde wilde brengen. En dat is volgens mij wel gelukt. Voor mij ben je een voorbeeld en ik hoop in de toekomst nog vaak met je samen te werken.

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… en vrienden
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Zoals ons lijflied het eigenlijk heel mooi verwoord "…you're the best, you're the best, you're the best …." ☺

# CURRICULUM VITAE

SUMMARY
NEDERLANDSE SAMENVATTING
DANKWOORD

Dewi Stalpers was born August 23, 1978 in Goirle (Noord-Brabant). She attended Pierson College in 's-Hertogenbosch and Elde College in Schijndel. After graduating (VWO), she started her Bachelor of Nursing in Amsterdam and graduated *cum laude* at the University of Applied Sciences Saxion in Deventer in 2002.
Dewi started working as a registered nurse at the University Medical Center Utrecht in which she worked in the traumatology, orthopedic and surgical department. In 2005, she obtained her Certificate of Intensive Care Nursing at the St. Antonius Hospital, Nieuwegein. From 2007 to 2010, while working at the Intensive Care Unit( ICU), she studied the Master Health Economics, Policy and Law (HEPL) on a part-time basis at the Institute of Health Policy & Management (iBMG), Erasmus University Rotterdam. She did her internship at the Health Care Inspectorate (IGZ) on a project about influential factors on calamities in hospitals during evening, night and weekend hours. In 2011, she won a PhD grant (Excellente Zorg) which was made available by the St. Antonius Academy. This enabled her to start a research on the topic of quality of nursing care, expressed by nurse-sensitive indicators, and the relationship with characteristics of nurses' work environment. In 2014, she received an additional subsidy from the St. Antonius Research Fund for one of her research proposals "Practice what you preach". From 2011 to 2016 she combined the research activities with her work at the ICU in Nieuwegein. Since July 2016, Dewi started working on the project "function differentiation MBO-HBO in hospitals" at the Dutch Hospital Association (NVZ) and also continues to work at the ICU.