Accuracy of Nursing Diagnoses: Knowledge, Knowledge Sources and Reasoning Skills

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Accuracy of nursing diagnoses: knowledge, knowledge sources and reasoning skills

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| AIC: Akaike’s Information Criterion |
| ANOVA: Analysis Of Variance |
| CCTDI: California Critical Thinking Disposition Inventory |
| CI: Confidence Intervals |
| CONSORT: Consolidated Standards of Reporting Trials |
| COPD: Chronic Obstructive Pulmonary Disease |
| HSRT: Health Science Reasoning Test |
| ICC: Intra-class Correlation Coefficient |
| ICF: International Classification of Functioning, Disability, and Health |
| NANDA-I: North American Nursing Diagnosis Association International |
| ND: Nursing Diagnosis |
| NIC: Nursing Intervention Classification |
| NOC: Nursing Outcome Classification |
| PES-Structure: Problem label, Aetiology (related factors) and Signs and Symptoms \ (defining characteristics) |
| RCT: Randomized Controlled Trial |
| SD: Standard Deviation |
| SE: Standard Error |
| SNOMED CT: Systemized Nomenclature of Medicine Clinical Terms |
| Kw: Cohen’s weighted kappa |
| TREND: Transparent Reporting of Evaluations with Non-randomised Designs |
| Q-DIO: Quality of Diagnoses, Interventions, and Outcomes instrument |
| QOD: Quality Of nursing Diagnosis instrument |
| STROBE: Strengthening the Reporting of observational Studies in Epidemiology |
| UK: United Kingdom |
| USA: United States of America |
| VIPS: Välbefinnande, Integritet, Prevention, Säkerhet (Well-being, Integrity, Prevention, Security) |
| ZCEQNP: Ziegler Criteria for Evaluating the Quality of the Nursing Process Instrument |
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CHAPTER 1

GENERAL INTRODUCTION
Nursing diagnoses: a conceptual history in brief

Since Florence Nightingale’s “Notes on Nursing, What It Is, and What It Is Not” (1859) was published, leaders in nursing have increasingly recognised the need for nurses to describe and evaluate their contribution to care for reasons as improving efficiency, patient safety, and quality of care (Lunney 2001). Traditionally this was done verbally, primarily retrospectively, and related to nursing actions based on doctors’ orders (Björvell 2002). In the past decades, the nursing profession changed progressively towards independent nursing practice based on explicit evidence-based nursing knowledge. Nurses are now required not only to document performed interventions but also to explain why an intervention was selected (Wilkinson 2007). This became a paramount responsibility of nurses, so that information can be forwarded to colleagues and other health care professionals (Björvell 2002, Wilkinson 2007). In 1974, the American Nurses’ Association (ANA) developed a five-step nursing process: a framework of how nurses work that includes as a separate step nursing diagnoses. During the 1970s and 1980s the nursing process—a relational, systematic, problem-solving method—was introduced internationally (NANDA-I 2004). The national and international consensus is that nurses assess, diagnose, plan, implement, and evaluate (American Nurses Association 2009). The World Health Organization (1982) promoted the use of the nursing process as the foundation for nursing documentation, as it was seen as a theory that underlies that development of a systematic approach based on patients’ health problems, which nurses address (Müller-Staub 2007, 2009, Björvell 2002).

Starting in the early 1970s in the United States of America (USA), the nursing diagnosis increasingly has become an integral part of professional nursing practice and is seen from the perspective of being a ‘clinical judgment’ (Gordon 1994). Although the analysis and identification of human responses is a complex process involving the interpretation of human behaviour related to health (Lunney 2001, 2009), nursing diagnoses ought to be the key component of nursing documentation. It is essential for selecting and planning interventions and for providing high-quality nursing care (Gordon 1994, NANDA-I 2009).

The Greek term diagnōsis (διάγνωσθ) means ‘to distinguish’, and is derived from ‘dia’ (δια), meaning ‘apart’, and gignōskein or gnō- (γνώση), meaning ‘to come to know’ (Bandman & Bandman 1995, p. 90, Duijn et al. 2004, p. 113). Bandman and Bandman (1995) refer to the philosopher Ludwig Wittgenstein (1952), who defined both aspects of diagnosis as ‘an inner process’ that stands in need towards ‘outward criteria’: a sound, verifiable inference in the form of knowledge as to what accounts for that internal process” (Bandman & Bandman 1995, Wittgenstein 1952).

A nursing diagnosis is defined as “A clinical judgment about individual, family or community responses or experiences to actual or potential health problems
or life processes. Nursing diagnoses provide the basis for selection of nursing interventions to achieve outcomes for which the nurse has accountability” (NANDA-International 2009). A nursing diagnosis is based on patients’ individual physical, social, and psychological response to an illness or health problem that have an impact on activities of daily living (Ehrenberg & Ehnfors 2006). Accurate (complete and precise) nursing diagnoses describe a patient’s problem and include related factors (aetiology of the problem) and defining characteristics in terms of signs and symptoms. This way of documenting diagnostic findings is called the PES structure (P = problem label, E = aetiology (related factors), and S = signs/symptoms) (Gordon 1994). “Both the problem and aetiology refer to distinct clusters of signs and symptoms. The observed signs and symptoms contain the critical defining characteristics for the problem and aetiological factors” (Gordon 1994). Aetiological factors can be predicted to change with nursing interventions intended to resolve the problem. Aetiological factors should include conditions that are usually resolved by nursing intervention (Iyer et al. 1986, Gordon 1994). It is nurses’ professional responsibility to verify their diagnoses with the patient, ‘to be sure that, in the patient’s judgement, the cue cluster represents a problem’ (Wilkinson 2007, p.239). Not validating data can be a cause of irrelevant issues in the documentation. In that case, it might be possible that the diagnosis is documented in the PES-format accurately, but may be in content irrelevant. A statement can be clear, accurate and precise but not relevant to the issue. Therefore accuracy in the PES-format can be subdivided from relevancy in content (Carpenito 2008, Wilkinson 2007).

The objective of nursing diagnoses is to name problems, risk states, readiness for health promotions, and strengths as bases for developing a plan of interventions based on predetermined outcome(s), which are derived in collaboration with an individual, family, and community, if appropriate (NANDA-I 2009). Nursing diagnoses focus on human responses to health problems or life processes, enabling health care workers to develop, implement, and evaluate the nursing care plan (Gordon 1994).

Nevertheless, internationally, the quintessence of the nursing diagnosis is still under discussion. According to Thompson (1999), two main nursing theory paradigms on decision making and nursing diagnostics exists. The first is the systematic-positivist stance, also known as the information-processing theory (Banning 2005, Lee 2006). This paradigm is related to the hypothetico-deductive rational process, having a foundation in cognitive psychology. From the cognitive psychology perspective, cognitive errors are not solely the result of ignorance or incompetent diagnosticians but may be predictable and preventable (Redelmeier 2005). The second is the intuitive-humanist paradigm, which is less systematic and predictable in processing information and is based on empirical expertise (Dreyfus and Dreyfus 1986, Benner & Tanner 1987). Both paradigms may be vital in order to document clinical phenomena of nursing importance such as nursing diagnoses (Easen & Wilkockson 1996). Accordingly, the purpose of the
analysis, identification, and documentation of nursing diagnoses is to categorize the problem area, related factors, and signs and symptoms so that nurses can correctly plan nursing care.

In nursing education programs in the Netherlands, since the mid 1990s, the nursing process—and more specifically diagnosis documentation according to the PES structure—has been implemented in all basic nursing education curricula and in numerous postgraduate programmes. Documentation of nursing diagnoses in terms of the PES structure became part of the nursing standard curriculum in the Netherlands (CBO 1999, p. 9).

In the Netherlands, in clinical hospital practice; the context in which the studies in this dissertation were accomplished, analysis and description of present (actual) or at-risk (potential) diagnostic findings must be precisely for understanding the reasons for the recommended intervention. The problem label describes the general area of the problem, and the diagnostician describes the specific type of problem in that area (CBO 1999, p. 9, Wilkinson 2007). The problem label, as well as the aetiology and the signs/symptoms, need to be documented accurately, well structured, and written in unambiguous, clear language (Kautz et al. 2006, Lee et al. 2006). Since 1999 this way of documenting nursing diagnoses is a professional standard in the Netherlands as well (CBO 1999).

**Nursing documentation in general hospitals**

Internationally, nursing documentation is acknowledged as a part of nurses’ communication that is in the form of charting and reporting (Eggland & Heinemann 1994). The purpose of documentation is to document the nursing care of individuals in such a way as to promote optimal continuity of care (Iyer & Camp 2005). Inaccurate nursing documentation can cause nurses’ misinterpretations and might put patients in unsafe situations (Koczmar 2005, 2006, Zeegers 2009). Underreporting might result in a lack of recognition of patients’ needs or adverse events (World Health Organization 2008).

Several studies examining the accuracy of nursing documentation were carried out in a limited number of hospitals in the USA, Sweden, Iceland, and Switzerland. These studies used different measurement instruments. Most of these studies reported that patient records contain relatively few accurately formulated nursing diagnoses, related factors, and pertinent signs and symptoms. The details of their interventions were poorly documented as well (Müller-Staub et al. 2006, Ehrenberg et al. 1996, Nordström & Gardulf 1996, Moloney & Maggs 1999).

Studies on the nature of nursing reports contribute to the development of resources for documentation accuracy improvements internationally. Additionally, these studies can support the development of an internationally accepted gold standard for nursing documentation accuracy (Florin et al. 2005, Müller-Staub et al. 2006,
Müller-Staub 2007). Knowledge regarding the accuracy of nursing documentation in patient records is needed for improving the structure and quality of the content of handwritten and electronic patient records (Kurihara et al. 2001, Kurashima 2008). On the basis of their systematic review, Saranto & Kinnunen (2009) concluded that nursing documentation has received little research attention. As stated by the World Alliance for Patient Safety (2008), the lack of standardised nomenclature for reporting hampers good written documentation. Müller-Staub et al. (2009) noted a lack of psychometrically tested instruments for use in general hospitals to measure the quality of and the relationships between diagnoses, interventions, and outcomes. To assess the accuracy of nursing documentation in general hospitals, a reliable and valid instrument is needed to quantify accuracy variables. As none of the instruments described in the literature were originally developed to measure documentation in general hospital environments or were tested in this context, we concluded that no such instrument was available.

Existing studies that examined influences on documentation accuracy used mostly questionnaires, interviews, observations, and descriptive evaluations about methods of data collection. A few of these studies described the relationship between the accuracy of reported admission information, nursing diagnoses, interventions, and progress and outcome evaluations in hospital settings (Bostick et al. 2003, Müller-Staub et al. 2006, Saranto & Kinnunen 2009). Most of the studies examined the accuracy of nursing reports, focussed on the influences of education programmes, focussed on record improvements, or focussed on the implementation of a nursing model in a specific hospital setting. Indeed, knowledge of the current status of the accuracy in nursing documentation is lacking in most countries. It is unknown whether current nursing documentation in clinical practice in the Netherlands is generally structured according to the phases of the nursing process and whether diagnoses in patient records are presented according to the PES structure.

For nurses in daily hospital practice, the documentation of nursing diagnoses is vital if we are to evaluate the contribution of care for which nurses are accountable. Therefore, knowledge on the subject associated with determinants influencing nursing diagnosis documentation may provide a foundation to support nurses in documenting their diagnostic findings accurately (Thoroddsen & Thorsteinsson 2001, Lee 2005, Saranto & Kinnunen 2009).

**Determinants of the accuracy of nursing diagnoses**

Little information is available on what factors affect the description of accurate nursing diagnoses. There seems to be an association between influences of nurses’ documentation process, the diagnostic decision-making process, and the prevalence of accurate nursing diagnoses in patient records of general hospitals. Several studies have shown that nurses’ decision-making process is determined
Chapter 1

by work procedures, allocation of work, disrupted working conditions, and time pressure (Hedberg & Satterlund-Larsson 2004, Coiera & Tombs 1998, Björg & Kirkevold 2000); doctors’ treatment orders, ward protocols, and policies; conflicting personal values; and ‘knowing the patient’ (Bucknall & Thomas 1997, Bucknall 2000, Currey & Worrall-Carter 2001, Radwin 1995, 1998). Nurses’ documentation is determined by disruption of documentation activities, limited nurses’ competence in documenting, confidence in documentation skills, inadequate supervision (Cheevakasemsook et al. 2006); and electronic nursing process documentation systems (Ammenwerth et al. 2001). These studies evaluated the impact of the decision-making process and the documentation process on nursing documentation in general. To date, no overview exists of what factors influence documented nursing diagnoses. It is unknown what factors affect the prevalence and accuracy of nursing diagnosis documentation.

Specific reasoning skills and knowledge sources for planning nursing care, such as electronic patient records, seem to affect the formulation of nursing diagnoses. The accuracy of diagnoses seems to be related to a nurse’s capacity for critical thinking and for applying his/her reasoning skills (Profetto-McGrath et al. 2003). Thus, a factor that may influence the accuracy of nursing diagnoses is one’s disposition towards critical thinking and reasoning skills. Dispositions towards critical thinking include attitudes such as open-mindedness, truth-seeking, analyticity, systematicity, inquisitiveness, and maturity (Facione 2000). Reasoning skills include inductive and deductive skills such as skills in analyzing, inference, and evaluation. These skills are essential for the diagnostic process (Facione 2000).

From a cognitive perspective, knowledge needed to derive diagnoses can be subdivided into ‘declarative knowledge’ and ‘procedural knowledge’ (Gulmans 1994). Declarative knowledge is ‘know that’ and is related to the ability of a diagnostician to associate facts, concepts, and procedures. Nevertheless, ‘knowing that’ is insufficient: a nurse needs to ‘know how’ as well. “Know how” is the kind of knowledge recognised as procedural knowledge. Procedural knowledge refers to having the skills and knowing the rules on how to apply declarative knowledge. One needs procedural knowledge to use declarative knowledge in different and new situations, in particular (Gulmans 1994, Scheer, van der 1994). Knowledge about a patient’s case history and knowledge about how to analyze relevant patient data appears to be a central factor in being able to derive accurate diagnoses (Cholowski & Chan 1992; Hasegawa et al. 2007, Lunney 2008).

A distinction between ‘ready knowledge’ and ‘knowledge obtained through the use of knowledge sources’ can be made as well. Ready knowledge is previously acquired knowledge that an individual can recall to mind. It is achieved through education programmes and situational experience in changing nursing contexts (Gulmans 1994, Ozsoy & Ardahan 2007). Knowledge obtained through knowledge sources is acquired through the use of handbooks, protocols, pre-
structured data sets, assessment formats, pre-structured report forms, and clinical pathways. This type of knowledge is looked up and recognised as relevant and useful at that moment. The literature indicates that knowledge sources may help nurses derive diagnoses that are more accurate than those derived without the use of such resources (Goossen 2000, Spenceley et al. 2008). For deriving nursing diagnoses in an educational context, knowledge sources prove to be valuable guides for nurses. However, no studies have been published that describe the effects of knowledge sources on the accuracy of nursing diagnoses in hospital practice.

Aims and outline of the dissertation

This dissertation had two main objectives. The first objective was to describe factors that influence the accuracy of documented nursing diagnosis. The second objective was to describe the prevalence of accurate nursing documentation in the patient record.

The research questions that were addressed are as follows:

1. What factors influence the prevalence and accuracy of the nursing diagnosis documentation in hospital practice?
   - Do knowledge sources and a predefined record structure affect the accuracy of nursing diagnoses?
   - Does ready knowledge influence the accuracy of nursing diagnoses?
   - Do dispositions towards critical thinking influence the accuracy of nursing diagnoses?
   - Does reasoning skills influence the accuracy of nursing diagnoses?

2. What is the prevalence of accurate nursing documentation in patient records in hospitals in the Netherlands?

The aim of the study presented in chapter two was to review what factors influence the prevalence and accuracy of nursing diagnosis documentation in hospital practice. A systematic literature search of the electronic databases MEDLINE and CINAHL for articles published between January 1995 and October 2009 was performed. The prevalence of accurate nursing documentation in patient records is presented in chapters three and four. The purpose of the study presented in chapter three was (1) to develop a measurement instrument (the D-Catch) to assess nursing documentation, which includes record structure, admission data, nursing diagnoses, interventions, progress data, and outcome evaluations in various hospitals and wards, and (2) to test the validity and reliability of this instrument. The aim of the study presented in chapter four was to describe the accuracy of nursing documentation in patient records in hospitals. The D-Catch instrument was used to measure the accuracy of nursing documentation in hospitals in the Netherlands.
Chapter 1

The second objective of this dissertation—to describe factors influencing the accuracy of nursing diagnosis documentation—is further addressed in chapters five and six. The purpose of the pilot study presented in chapter five was to determine how knowledge sources, ready knowledge, and disposition towards critical thinking, and reasoning skills influence the accuracy of student nurses’ diagnoses. This pilot study, which used a two-group randomised design, examined our methodological approach to studying how nursing students document diagnoses. The aim of the next study, in chapter six, which used a four-group randomised factorial design and involved registered hospital nurses, was to determine the effect of knowledge sources and a predefined record structure (problem label, aetiology, signs/symptoms [PES] format) on the accuracy of nursing diagnoses, to determine the association between ready knowledge, dispositions towards critical thinking, and reasoning skills, and the accuracy of nursing diagnoses. Chapter seven contains the general discussion of the results and methodological considerations of this dissertation as well as suggestions for further research.
References


Chapter 1


CHAPTER 2

What factors influence the prevalence and accuracy of nursing diagnoses documentation in clinical practice? A systematic literature review


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Introduction

Accurate documentation of nursing diagnoses is vital to nurses in daily hospital practice. The aim of diagnoses documentation is to help nurses to correctly plan, intervene, and evaluate nursing care for individuals and to accomplish optimal continuity of care and patient safety (Needleman & Buerhaus 2003).

Several authors have reported that patient records contain relatively few formulated nursing diagnoses, related factors, and pertinent signs and symptoms (Björvell et al. 2002, Florin et al. 2005, Müller-Staub et al. 2007). Furthermore, the accuracy of nursing diagnoses documentation has been found to be moderate to poor (Ehrenberg et al. 1996; Moloney & Maggs 1999, Müller-Staub et al. 2006). Several studies have shown that the prevalence and accuracy of nursing diagnoses have an indirect impact on the decision-making processes and documentation of nurses (Brunt 2005, Banning 2007). The nurses’ decision-making process is determined by work procedures, allocation of work, disrupted working conditions, and time pressures (Hedberg & Satterlund-Larsson 2004, Coiera & Tombs 1998, Björg & Kirkevold 2000); doctors’ treatment orders, ward protocols, and policies; conflicting personal values; and ‘knowing the patient’ (Bucknall & Thomas 1997, Bucknall 2000, Currey & Worrall-Carter 2001, Radwin 1995, 1998). Nurses’ daily documentation in the patient’s record is negatively influenced by several factors, such as being disrupted during documentation activities, nurses’ limited competence regarding documenting, lacking motivation to enter information into the patient record and receiving inadequate supervision (Cheevakasemsook et al. 2006). A positive influence on the documentation in the patient record is the use of electronic nursing process documentation systems (Ammenwerth et al. 2001). These studies evaluated the general impact of these factors on the decision-making process and the documentation process. However, how these various factors affect the prevalence and accuracy of nursing diagnoses documentation is less known. Thus, the aim of this review was to study the factors that determine the frequency and accuracy of nursing diagnoses documentation.
What factors influence the prevalence and accuracy of nursing diagnoses?

Background

In the 1970s the nursing process was introduced into nursing educational programmes and hospital nursing practice worldwide as a systematic method of planning, evaluating, and documenting nursing care (Gordon 1994). The nursing process facilitates problem solving, reflective judgement, and decision making, which in turn results in a desired outcome. Nurses are trained to document their knowledge and judgements explicitly according to the nursing process (Warren & Hoskins 1990, Lee et al. 2006). A central element of the nursing process is how nurses derive a nursing diagnosis based on clinical assessments, interviews, and observations (Wilkinson 2007). In 1990, the North American Nursing Diagnosis Association (NANDA) defined nursing diagnosis as “a clinical judgement about individual, family, or community responses to actual or potential health problems/life processes” (NANDA 2004). Diagnoses contain a problem label (P), a concise term or phrase that represents a pattern of related cues; an aetiology or related factors (E); and signs/symptoms (S). This diagnostic structure is known as the “PES structure” (Gordon 1994).

Nurses have to analyse a patient’s responses to health problems using interviews and observations. These analyses can be complex since there is a large variety in responses to illness and diseases (Müller-Staub et al. 2006).

Although nursing educators acknowledge the importance of developing skills in diagnostic reasoning, the majority of graduate and undergraduate programmes in nursing education do not focus on factors that affect reporting diagnostic inferences in the ward in daily practice (Smith Higuchi et al. 1999). From the mid 1990s nurse researchers have increasingly studied factors that influence nursing diagnoses, such as education programmes and electronic documentation devices to improve diagnoses documentation (Kurashima et al. 2008). Evidence shows that educational programmes geared to improving diagnostic-reasoning skills significantly increase the prevalence and accuracy of documented nursing diagnoses (Björvell et al. 2002, Müller-Staub et al. 2006, Cruz et al. 2009, Saranto & Kinnunen 2009). Moreover, the development and implementation of electronic documentation resources and pre-formulated templates have been demonstrated to positively influence the frequency of diagnoses documentation (Smith Higuchi et al. 1999, Gunningberg et al. 2009).
Chapter 2

The Study

Aim
The aim of this study was to review what factors influence the prevalence and accuracy of nursing diagnosis documentation in hospital practice.

Methods
We conducted a systematic literature search of the electronic databases MEDLINE and CINAHL for relevant articles published between January 1995 and October 2009. We used MeSH terms for the MEDLINE search and thesaurus terms for the CINAHL search. Four sets (I, II, III, and IV) of search terms were used. The sets were subdivided into two groups: Sets I & III (MEDLINE) and sets II & IV (CINAHL) (Figure 1).

Figure 1 Database search

- I: MEDLINE ("nursing diagnosis"[MeSH Terms] OR "nursing diagnosis"[All Fields]) AND "nursing documentation"[All Fields] AND "hospitals"[MeSH Terms] OR "hospitals"[All Fields] OR "hospital"[All Fields])

- II: CINAHL: MH nursing diagnosis AND nursing documentation AND hospital

- III: MEDLINE: ("nursing diagnosis"[MeSH Terms] OR "nursing diagnosis"[All Fields]) AND (Influence OR influenceable OR influenced OR influences OR "utilization"[Subheading] OR quality OR implementation[All Fields] OR accuracy[All Fields])

- IV: CINAHL: MH nursing diagnosis AND (influenc* or utili?ation or quality or accuracy or implementation)

Our search returned 1032 titles. We applied the following inclusion criteria to the articles: (1) published in English, (2) primary research, (3) addressed factors influencing the prevalence and accuracy of the documentation of nursing diagnoses, and (4) related to registered nurses in hospital practice. We excluded studies conducted in non-hospital environments or those involving nursing students and studies on diagnostic inferences in emergency room triage situations. Studies on the decision-making process or reasoning process were included only if a clear connection to nursing diagnoses documentation was described. Studies describing the validation or evaluation of measurement instruments or guidelines dealing with the accuracy of nursing diagnoses in patient records were
included if influences on the documented nursing diagnoses were described. We excluded studies that discussed possible influencing factors without research-based evidence (Figure 2). In total, 63 articles were retained for full-text analysis. To assess the quality of the selected studies, we followed the meta-synthesis approach of Paterson et al. (2001).

**Figure 2 Search strategy and number of records identified**

<table>
<thead>
<tr>
<th>MEDLINE (Set I): n= 18</th>
<th>MEDLINE (Set III): n= 556</th>
<th>CINAHL (set II): n= 9</th>
<th>CINAHL (set IV): n= 613</th>
</tr>
</thead>
</table>

Set I & Set III, after duplicates removed: n= 567

Set II & Set IV, after duplicates removed: n= 615

Set I, II, III, and IV after duplicates removed: n= 1032

Excluded:

* Published < 1995 to > October 01, 2009: n= 454
* Non-English language: n= 173
* Nursing students / professions other than nurses: n= 21
* Non-hospital settings / triage settings: n= 51
* Influences on reasoning / decision making / attitudes: n= 122
* Validation and/or evaluation of instruments and guidelines: n= 9
* Level of evidence 5: n= 55

Perceived to be relevant to the study based on title and abstract and included for full-text assessment: n= 63

Papers excluded based on title and abstract: n= 969

Analysis of full text: n= 63

Papers excluded based on full-text analysis: n= 39

Total papers included: n= 24
While examining the included articles, two independent reviewers systematically abstracted the focus of the studies, design, sample size, data analysis, and general and key findings concerning factors that influence the prevalence and/or accuracy of nursing diagnoses in patient records. In addition, two reviewers assessed the methodology used in each study. For instance, reports of randomised, controlled trials were assessed according to the recommendations of the Consolidated Standards of Reporting Trials (CONSORT) statement (Moher et al. 2001). For the assessment of reports of non-randomised studies, the Transparent Reporting of Evaluations with Non-randomised Designs (TREND) statement was used (Des Jarlais et al. 2004). For cohort or case control studies Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) was applied (Vandenbroucke et al. 2007). In our appraisal, we categorised each article according to the level of evidence contained within the article. For this purpose, we used the updated version of the Oxford Levels of Evidence, as published by the Centre for Evidence Based Medicine (Phillips et al. 2009). Based on Müller-Staub et al. (2006), slight adaptations were made for research in nursing or studies with qualitative research methods. The following categories were used:

Level 1. Randomised trials  
Level 2. Cohort studies, cross-sectional designs, pre-test/post-test designs, quasi-experimental designs, record reviews  
Level 3. Case-controlled studies  
Level 4. Observational studies, database research, qualitative interviews, systematic analyses of qualitative studies  
Level 5. Expert opinions  

Critical appraisal revealed that the design of most of the research papers included in our review did not employ highest level of evidence. There were three Level 1 studies, 16 Level 2 studies, one Level 3 study and four Level 4 studies. We excluded Level 5 studies. The Level 1 studies were clinically relevant randomised studies. The Level 2 studies used a variety of designs and were described in papers examining nursing diagnoses documentation; these Level 2 studies used pre-test/post-test designs, quasi-experimental designs, cross-sectional designs, exploratory study methods, and record reviews. The Level 3 study was a case-controlled study. The Level 4 studies used qualitative interview methods and qualitative descriptive designs, representing more than expert opinion. The Level 1, 2, and 3 studies used adequate sample sizes and an acceptable reference standard/clinical decision rule. Based on the quality analysis, 24 articles were included for further analysis. Next, we performed an in-depth analysis of the papers’ contents using the approach of Paterson et al. (2001) and Cooper (1998), in which papers were re-read purposively in order to identify influencing factors. To categorise the factors influencing the prevalence and accuracy of nurses’ diagnoses documentation, two reviewers qualitatively structured the factors independently into ‘themes’. In order to compose a more distinct categorisation of influencing factors, the reviewers compared and discussed their themes until they reached consensus. The consensus discussions enabled us to construct a categorisation of domains, which in turn enabled us to present
a conceptual framework of determinants that influence the prevalence and accuracy of nursing diagnoses, as described in the literature.

**Reliability and validity**
We identified various instruments previously used to measure factors that influence the prevalence and accuracy of nursing diagnoses documentation: the Cat-ch-Ing instrument (Björvell et al. 2002, Darmer et al. 2006); the PES format of Gordon (1976) (Thoroddsen & Thorsteinsson 2002, Thoroddsen & Ehnfors 2006); the Quality of Nursing Diagnoses (QOD) (Florin et al. 2005); the Scale for Degrees of Accuracy compiled by Lunney (2001) (Kurashima et al. 2008, Cruz et al. 2009); and the Quality of Nursing Diagnoses Interventions and Outcomes (Q-DIO) (Müller-Staub et al. 2006). These studies reported on aspects of content validity and reliability. Inter-rater reliability outcomes were described for all of the aforementioned instruments. Reported over all inter-rater reliability scores were .61 or higher and therefore, according to Fleiss et al. (2003), acceptable.

All the aforementioned instruments included the PES structure as the theoretical basis for quantifying accuracy of diagnoses, even though the PES structure was used in various scoring ranges and scales. In studies that used questionnaires in surveys, validity and reliability were often unclear or not mentioned at all.

**Results**
We included 24 articles that examined factors that influence the prevalence and accuracy of nursing diagnoses documentation. Four domains were identified: (1) the nurse as a diagnostician, (2) diagnostic education and resources, (3) complexity of a patient’s situation, and (4) hospital policy and environment. These four themes were subdivided into 18 sub-themes that influence diagnoses documentation (Figure 3).

**The nurse as a diagnostician**
In the literature, we identified four sub-themes related to the individual nurse as a diagnostician as a factor that influences the prevalence and accuracy of nursing diagnoses documentation: (1) attitude and disposition towards diagnosis, (2) diagnostic experience and expertise, (3) case-related and diagnostic knowledge, and (4) diagnostic reasoning skills.

The attitude or disposition of nurses towards nursing diagnoses and the critical-thinking approach of nurses may influence the way they document diagnostic findings. Based on the findings of Armitage (1999) and Hasegawa et al. (2007) it seems that nurses do not examine how they should reflect on their critical-thinking approach and their diagnostic findings in clinical practice. Smith Higuchi et al. (1999) suggest that to be able to document diagnoses accurately and to perform at satisfactory levels of diagnostic competency, nurses may have to learn how to examine their critical-thinking disposition in areas such as open-mindedness. The development of such disposition can be explored by providing a formal education program in hospital practice, because nurses do not document nursing diagnoses on their own initiative.
Chapter 2

(Smith Higuchi et al. 1999). In hospital practice, the degree of nurses’ experience in diagnosing significantly and positively influences the accuracy of nursing diagnoses documentation (Reichman & Yarandi 2002, Hasegawa et al. 2007). Using a qualitative research approach, Armitage (1999) and Axelsson et al. (2005) also reported that diagnostic experience positively influences the prevalence of accurate diagnoses. Several factors affect nurses’ knowledge and experience: the presence of case-related knowledge and reasoning skills acquired in formal education programmes (Smith Higuchi et al. 1999); the motivation to learn diagnostic tasks (Whitley & Gulanick 1996); and the frequency of studying diagnostics (Hasegawa et al. 2007, Cruz et al. 2009).

Figure 3 Determinants that influence the prevalence and accuracy of nursing diagnosis documentation
What factors influence the prevalence and accuracy of nursing diagnoses?

Diagnostic education and resources
From the included articles, we extracted five educational or resources-related sub-themes that influence the accuracy of nursing diagnosis documentation: (1) guided clinical reasoning, (2) nurses’ educational background in nursing process application, (3) pre-structured record forms, (4) implementation of classification systems, such as NANDA, and (5) computer-generated care plans and patient records. Nursing process education (Björvell et al. 2002, Florin et al. 2005 Cruz et al. 2009) and guided clinical reasoning (Müller-Staub et al. 2006, 2008) are examples of educational programmes for registered nurses intended to improve the accuracy of diagnoses documentation significantly. Consistent theoretical teaching and practical training in ongoing educational programmes may offer procedural and conceptual knowledge as a basis for accurate diagnostic documentation (Müller-Staub et al. 2006, Cruz et al. 2009). Educational programmes related to patient populations are needed to educate nurses on how to derive and report diagnoses in the actual hospital information structure in which they work (Darmer et al. 2006). Educational programmes intended for both novice and experienced nurses can give both the opportunity to reflect on how to document diagnoses in the present hospital environment of their own ward (Kawashima & Petrini 2004, Turner 2005). This approach has a significant positive effect on the accuracy of nursing diagnoses documentation (Björvell et al. 2002, Lee 2005, Müller-Staub et al. 2006). Resources that reduce the lack of clarity in diagnostic statements—for instance, specific computer-generated standardised nursing care plans—may support nurses in their administrative work (Smith Higuchi et al. 1999). Kurashima et al. (2008) found that the time needed to derive a diagnosis was significantly shorter when nurses used a computer aid. Classification structures, e.g., NANDA-I classification (Thoroddsen & Ehnfors 2006), and new forms for recording in the PES format (Florin et al. 2005, Darmer et al. 2006) in combination with applicable electronic resources facilitate more accurate diagnoses documentation (Smith Higuchi et al. 1999).

Complexity of a patient’s situation
Factors that indicate the complexity of a patient’s situation in clinical practice may influence the accuracy of the nursing diagnosis documentation. These factors, as the current literature indicates, can be categorised into three themes: (1) cultural differences in expressing patients’ needs, (2) patients’ severe medical diagnosis in specialty areas, and (3) patients’ way of expressing severe diagnoses.

Kilgus et al. (1995) and Hamers et al. (1996) stated that, especially in complex patient situations or in specialty areas, it is important for nurses to be aware of their subjectivity in diagnostic judgements and to develop mental abilities that reflect this subjectivity. Hamers et al. (1996) showed in a study of newborns that nurses attributed the highest pain score to a child when the medical diagnosis was severe and the child vocally expressed his/her pain. On the basis of a record review, Kilgus et al. (1995) found significant cultural differences in the discharge diagnoses of adolescents hospitalised for psychiatric disorders. The authors of this
study pointed out that some of these differences may reflect ethnocentric clinician bias in the diagnostic assessment of youths with different cultural backgrounds.

There may be an association between length of stay, severe medical diagnosis in specialty areas and complexity of the patient situation, as Thoroddsen & Thorsteinsson (2002) suggested, although, based on the results of their study, this association was not clear. Nevertheless, length of stay seems to be an influencing factor with respect to the number of documented diagnoses, as was reported by Thoroddsen & Thorsteinsson (2002). In complex patient situations nurses’ confidence in the diagnostic task in cases of severe diagnoses, interpretation difficulties of cues, and difficulties in analysing diagnoses in specialty areas are factors influencing nursing diagnosis documentation as well (Whitley & Gulanick 1996, Armitage 1999).

Hospital policy and environment
We identified six sub-themes concerning the influence of the hospital environment on nursing diagnoses: (1) the number of patients per nurse, (2) nurses’ workload level and time to spend on diagnostic tasks, (3) the use of a medical model, (4) the number of administrative tasks nurses have to carry out, (5) physicians’ disposition towards nursing diagnoses, and (6) the information structure used in the ward. The medical-situational context appears to be one of the important factors that influences the prevalence and accuracy of nursing diagnoses documentation. According to Griffiths (1998), the way nurses process the diagnostic opinions of physicians is a factor that influences how nurses document their own diagnostic findings. Nurses appear to adopt medical language instead of nursing language. Physicians’ objections or rejections toward the implementation of nursing diagnoses, as mentioned by (Whitley & Gulanick 1996), can obstruct, or at least hinder the implementation of nursing education courses or resource innovations in documentation. Martin (1995) and Paganin et al. (2008) identified the number of administrative tasks, lack of administrative support, lack of time, and workload level as the main barriers nurses face when documenting nursing diagnoses. One possible measure providing administrative support is the implementation of a pre-structured information approach, since pre-structuring information by using, for instance, pre-structured care plans or schemes appears to be helpful (Björvell et al. 2002, Brannon & Carson 2003, Müller-Staub et al. 2006).

Discussion
Factors that influence diagnoses documentation
We identified four themes that characterise factors that influence the prevalence and accuracy of nursing diagnoses documentation. However, our review of the literature failed to identify arguments distinguishing major and minor factors of influence. It seems that each domain comprises important influencing factors. Different designs and sample sizes were used in various studies; however, no
What factors influence the prevalence and accuracy of nursing diagnoses?

Major contradictions in outcomes were found. We found representative record reviews that reported factors influencing diagnoses documentation: 1103 charts (Thoroddsen & Thorsteinsson 2002); 427 charts (Smith Higuchi 1999); 352 records (Kilgus et al. 1995); 225 records (Müller-Staub et al. 2006); and 600 journals (Darmer et al. 2006). We found results from qualitative research to be comparable to those obtained from quantitative methods. For instance, both Armitage (1999) and Reichman and Yarandi (2002) arrived at the same conclusion—nurses’ experience is an important factor that influences the accuracy of nursing diagnoses documentation—even though the former study was based on in-depth interviews of ten nurses and the latter was based on analysis of 184 written patient simulations.

We only included studies that had examined nursing diagnosis documentation as a research topic. In our analyses, however, we distinguished two classes of factors that influence nursing documentation: (1) general factors, which influence the reasoning and documentation process in general; and (2) specific factors, which specifically influence the prevalence and accuracy of nursing diagnoses documentation, as stated in a conceptual framework (Figure 3), which is based on the influencing factors mentioned in the included papers (Table 1). Examples of general factors that influence nursing decision-making procedures and documentation include work procedures, allocation of work, disrupted work conditions, conflicting personal values, knowing the patient, motivation, and staff development. The differentiation of general versus specific factors that influence diagnoses documentation may have common characteristics that need to be investigated more intensely, since the terms used in the literature denote subjective notions. For example, a clear and uniform definition or consistent description of the meaning of ‘knowing the patient’, ‘intuition’, ‘motivation’, ‘inadequate staff development’ was not found. As a result, a comprehensible description of activities that disrupt nurses as they document diagnoses was missing. Also missing was information about the background of conflicting personal values. We hypothesise that there might be a number of underlying issues that influence nurses’ decision making and diagnoses documentation. These issues need to be investigated in more depth in future research.

With regard to specific factors that influence diagnoses documentation, we hypothesise that the influencing factors positioned within the four domains may be interrelated. For instance, the knowledge of individual nurses partly depends on education programmes provided in hospital practice. The provision of these programmes depends on a hospital’s policy on offering educational courses and resources. These courses and resources may only be successful if there are restrictions in workload, clear diagnostic expectations regarding documenting accurate nursing diagnoses, and interdisciplinary support to give nurses the opportunity to learn and to carry out their diagnostic tasks. Consequently, we assume that a single innovation, such as an education programme dealing with diagnostics or a computerised care plan, without taking other factors that influence
diagnoses documentation into account, may not be as effective as it could be in the long term.

The distinction between medical diagnoses and nursing diagnoses appears to be unclear for both physicians and nurses (Whitley & Gulanick 1996). Therefore, healthcare professionals may not fully accept a nurse’s responsibility to make diagnoses. Still, in general, there may be no interdisciplinary agreement on what an accurate nursing diagnosis is and what it is not. In hospital practice, nurses usually do not perceive a sharp distinction between ‘diseases’ and ‘levels of wellness’ (Bandman & Bandman 1995, Hasegawa et al. 2007).

Being unfamiliar with the nursing diagnosis domain and the diagnostic language used by nurses may lead to uncertainties and misunderstandings both for nurses and physicians. In contrast, knowledge and a positive attitude towards the use of diagnoses by nurses, physicians, and the hospital administration may stimulate nurses to derive accurate diagnoses (Whitley & Gulanick 1996, Björvell et al. 2002). Reducing the nurse-to-patient ratio and limiting additional administrative tasks in order to give nurses enough time to accomplish their diagnostic tasks creates limits in the hospital environment and will give nurses the notion that hospital management support them in their diagnostic responsibilities. Nurses’ impression of the hospital policy in the case of diagnostic tasks may sometimes reflect their motivation for learning how to document and for documenting nursing diagnoses (Whitley & Gulanick 1996).

In the ‘nurse as a diagnostician’ context, Hamers et al. (1996) and Shapiro (1993) found that nurses’ perceptions or misperceptions of a newborn’s pain affected how much analgesics they gave the newborn. This observation suggests that nurses’ ‘misperceptions’ could affect their diagnoses and ultimately the amount of medication dispensed. Indeed, in the Hamers et al. (1996) and Shapiro (1993) studies, nurses’ ‘misperceptions’ caused newborns to receive inadequate pain medication. Research on nurse’s interpretation and judgement of frequently documented or severe diagnoses, such as pain, is rare and further research is required. Educational programmes, as suggested by Müller-Staub et al. (2006) and Cruz et al. (2009) that focus on recognising the signs and symptoms of severe diagnoses may help nurses to avoid diagnostic misperceptions, since education in diagnostic documentation skills can enhance the quality of documented nursing diagnoses. Higher quality of diagnoses documentation correlates with qualitative improvements in the documentation of nursing-sensitive patient outcomes, as mentioned in the implementation study of Müller-Staub et al. (2007). However, studies discussing the possible effects of education programmes intended for accurate diagnostic documentation in terms of patient safety and quality of care are lacking and may be needed as well (Lunney 2007).

Limitations

The present review is limited in several respects. We only included papers published in English. Therefore, we focused more on papers written by authors who carried
out their research in the North American and North-western European context. Despite the advanced literature search, we may have overlooked some papers due to the search strategy or database filters used. We assessed papers qualitatively. No statistical procedures to aggregate data were used, since the instruments and methods described in the reviewed articles differed. Therefore, it was not feasible to perform statistical procedures on the aggregated data.

**Conclusion**

Despite the lack of knowledge about factors that influence diagnoses documentation, we conclude that nursing diagnosis documentation is not limited to classification in an autonomous nursing domain but is limited to inference to an individual process influenced by a number of internal and external factors (Bandman & Bandman 1995, Wilkinson 2007). The outcomes of an individual diagnostic process ought to be documented by nurses in such a way that patients, colleagues, physicians, and other healthcare workers can understand it and can rely on the content of the documentation. Also lacking is research about the influences of interdisciplinary exchange of knowledge concerning the essentials of medical and nursing diagnosis. Moreover, there might be an association between a nurse’s level of education, nurse staffing in hospitals, and accuracy in diagnostic documentation. However, this possible association is still unclear and needs to be researched.
### Table 1 Factors that influence the prevalence and accuracy of nursing diagnoses documentation

<table>
<thead>
<tr>
<th>Reference</th>
<th>Focus</th>
<th>Research Design/ Level of Evidence (LE)</th>
<th>Data Collection/Sample Size</th>
<th>Key Findings</th>
<th>Factors That Influence Diagnoses</th>
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</thead>
<tbody>
<tr>
<td>Armitage (1999)</td>
<td>The nursing assessment of respiratory distress in infants</td>
<td>Cross-sectional design using qualitative interviews and a survey LE: 4</td>
<td>Qualified children’s nurses (n= 10) completed questionnaires and partook in qualitative interviews</td>
<td>Nurses’ assessment was influenced by the medical model The concept ‘nursing diagnosis’ was poorly understood</td>
<td>Medical model Nurses’ diagnostic experience</td>
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<tr>
<td>Axelsson et al. (2005)</td>
<td>Incentives for using nursing diagnoses in clinical practice</td>
<td>Qualitative descriptive design LE: 4</td>
<td>Qualitative interviews of registered nurses (n= 12)</td>
<td>Incentives for using nursing diagnoses originated from effects generated from performing a deeper analysis of the patient’s nursing needs</td>
<td>Motivation to provide individual and holistic nursing care Experiencing that diagnoses facilitate decisions in terms of actions Recorded nursing diagnoses perceived as time saving Experiencing that diagnoses facilitate evaluation of nursing care Support from the management in using diagnoses</td>
</tr>
<tr>
<td>Björvell et al. (2002)</td>
<td>Long-term effects of a nurse-documentation intervention</td>
<td>Quasi-experimental longitudinal design LE: 2</td>
<td>A two-year intervention composed of theoretical training, supervision, exchange of information during conferences, and organisational support regarding nursing documentation based on the Swedish VIPS Model, followed by a record review of 269 records in three acute-care wards in one hospital using the Cat-ch-Ing instrument</td>
<td>A comprehensive intervention of nursing documentation significantly improved the quality of nursing diagnoses documentation in the short term and the long term</td>
<td>Theoretical training in documentation of diagnoses Individual supervision and support Information exchange Development of structured forms and standardised care plans</td>
</tr>
<tr>
<td>Reference</td>
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<tr>
<td>Brannon &amp; Carson (2003)</td>
<td>The influence of nursing expertise and information structure on certainty of diagnostic decision making</td>
<td>Quasi-experimental / case-controlled design</td>
<td>Nurses (experts), student nurses (novices), and non-nurse (naive) participants (n= 216) read patient scenarios either high in information structure or low in information structure and rated their certainty about what the potential diagnosis might be Afterwards, each participant was asked to generate a diagnosis and rate their level of confidence in their own diagnosis from 0%-100%</td>
<td>By using pre-existing cognitive schemata for processing patient information, participants were more certain about their decision making when using structured information than they were about using unstructured information</td>
<td>Nurses’ diagnostic expertise Use of structured information</td>
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<tr>
<td>Cruz et al. (2009)</td>
<td>Continuing education courses related to critical thinking and clinical reasoning</td>
<td>Pre-test / post-test design LE: 2</td>
<td>Nurses completed a pre-test and a post-test consisting of two written case studies designed to measure the accuracy of nurses’ diagnoses (n= 39)</td>
<td>Significant differences were found in accuracy on the pre-test and the post-test due to the education courses related to critical thinking and clinical reasoning</td>
<td>Continuing education courses (16 hours) related to critical thinking and clinical reasoning</td>
</tr>
<tr>
<td>Darmer et al. (2006)</td>
<td>Nurses’ adherence to the VIPS model, a systematic method of nursing documentation to improve the accuracy of the nursing report</td>
<td>Longi-tudinal retrospective nursing journal review LE: 2</td>
<td>Nursing documentation (journals, n= 50) of four departments were randomly selected and audited annually for three years using the Cat-ch-Ing instrument (n= 600)</td>
<td>Nursing documentation improved significantly during the course of the study</td>
<td>A pragmatic approach: reversed ‘problems’ and consequences and reduced diagnostic statements to problem, etiology, description of signs and symptoms in the nursing status</td>
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<tr>
<td>Florin et al. (2005)</td>
<td>Effects of education on the nursing process and implementation of new forms for recording on the quality of nursing diagnostic statements in patient records</td>
<td>Pre-test / post-test design LE: 2</td>
<td>The intervention consisted of a 3-hour, five-meeting educational program Randomly selected patient records were reviewed before and after the intervention Data analyses using a measurement scale with 14 characteristics pertaining to nursing diagnoses named: quality of nursing diagnosis used in two experimental units (n= 70) and one control unit (n= 70)</td>
<td>Quality of nursing diagnostic statements improved significantly in the experimental units, whereas no improvement was found in the control unit Education in the nursing process and implementation of new forms for recording might improve RNs’ skills in expressing nursing diagnoses</td>
<td>Implementation of new forms for recording Education in the nursing process</td>
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<td>Reference</td>
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<td>Griffiths (1998)</td>
<td>An investigation into the description of patients' problems by nurses using two different needs-based nursing models</td>
<td>Qualitative descriptive study design and literature review</td>
<td>Two wards were investigated in one hospital: Ward A utilized the nursing model of Roper, Logan and Tierney (1980), whereas Ward B utilized the model of Dorothea Orem (1980). Data collected were subjected to content analysis using Gordon’s Functional Health Patterns to order the data</td>
<td>Nurses most commonly used medical diagnoses or the medical reasons for admission</td>
<td>Medical diagnoses</td>
</tr>
<tr>
<td>Gunningberg et al. (2009)</td>
<td>Improved quality and comprehensiveness in nursing documentation of pressure ulcers after implementing an electronic health record in hospital care</td>
<td>Cross-sectional retrospective review of health records</td>
<td>Analysis of recorded data on pressure ulcers. Paper-based records (n=59) identified by notes on pressure ulcers and electronic health records (n=71) with pressure ulcer recordings were retrospectively reviewed</td>
<td>Electronic patient records showed significantly more diagnostic notes on pressure ulcer grade</td>
<td>Pre-formulated templates in electronic health records</td>
</tr>
<tr>
<td>Hamers et al. (1996)</td>
<td>The influence of task-related factors on nurses' pain assessments and decisions regarding interventions</td>
<td>Randomised experimental design</td>
<td>Paediatric nurses (n=202) from 11 hospitals were randomised into four groups. Each group was exposed to four sequential cases, each of which consisted of a vignette and a videotape with different factors. The child’s expressions were operationalised via videotapes of the same child.</td>
<td>Paediatric nurses attributed more pain to and were more inclined to administer non-narcotic analgesics to children who vocally expressed their pain than to children who were less expressive. Nurses also attributed the most pain to a child when the diagnosis was severe.</td>
<td>Vocally expressing pain</td>
</tr>
<tr>
<td>Hasegawa et al. (2007)</td>
<td>Measuring diagnostic competency and the analysis of factors influencing competency using written case studies</td>
<td>Cross-sectional study design based on written case studies</td>
<td>Two written case studies were used to measure the diagnostic competencies of the subjects. A convenience sample of 376 nurses practicing in medical-surgical nursing positions was obtained from nine different hospitals.</td>
<td>Japanese nurses in the sample, in general, did not perform satisfactory levels of diagnostic competency.</td>
<td>Length of clinical experience</td>
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</table>
## What factors influence the prevalence and accuracy of nursing diagnoses?

<table>
<thead>
<tr>
<th>Reference</th>
<th>Focus</th>
<th>Research Design/ Level of Evidence (LE)</th>
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<tbody>
<tr>
<td>Kilgus et al. (1995)</td>
<td>Influence of race on diagnoses</td>
<td>Record review</td>
<td>Data were abstracted from patients’ records and nursing incident reports</td>
<td>Significant racial differences were found in the discharge diagnoses of adolescents hospitalized for psychiatric disorders</td>
<td>Racial differences in patients</td>
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<tr>
<td></td>
<td></td>
<td>LE: 2</td>
<td>DSM-III-R discharge diagnoses were assigned to five non-mutually exclusive groups</td>
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<td>Cultural backgrounds in patients</td>
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<td></td>
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<td>Hospital medical records (n= 352); whites (n= 251), African Americans (n= 101) in one hospital</td>
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<td>Kurashima et al. (2008)</td>
<td>Whether a computer-aided nursing (CAN) diagnosis system improves diagnostic accuracy and efficiency</td>
<td>Randomised crossover trial</td>
<td>Registered nurses (n= 42) were divided into groups: one using the CAN diagnosis system and the other using a handbook of nursing diagnosis</td>
<td>No significant difference was found between the two groups in terms of diagnostic accuracy</td>
<td>Using a computer aid significantly shortens the time needed to derive diagnosis</td>
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<td></td>
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<td>LE: 1</td>
<td>Degree of accuracy was judged by using Lunney’s seven-point interval scale, while efficiency was evaluated according to the time required for diagnosis</td>
<td>Time required for diagnosis was significantly shorter for subjects who used the CAN diagnosis system than for those who did not</td>
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<td>Lee (2005)</td>
<td>Factors that may affect nurses’ use of nursing diagnoses in charting standardised nursing care plans in their daily practice</td>
<td>One-on-one, in-depth interviews</td>
<td>Clinical nurses (n= 12) at a medical centre underwent one-on-one, in-depth interviews</td>
<td>Nurses do not regularly use objective data to record patients’ condition</td>
<td>Use of standardised care plans</td>
</tr>
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<td></td>
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<td>LE: 4</td>
<td>Data analysis was based on Miles and Huberman’s (1994) data reduction, data display, and conclusion-verification process to investigate the charting process</td>
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<tr>
<td>Martin (1995)</td>
<td>The independent nursing role of nurse practitioners (NPs) and the advantages and barriers of using nursing diagnosis in NP practice</td>
<td>Cross-sectional study design based on a survey</td>
<td>Self-administered questionnaires (n= 181) included biographical data and forced choice questions about knowledge of nursing diagnosis</td>
<td>No statistical significance was seen between NPs’ knowledge and use of nursing diagnoses and their educational background, specialty, years of practice as a NP, and practice setting</td>
<td>Lack of time</td>
</tr>
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<td></td>
<td></td>
<td>LE: 2</td>
<td>85 % of NPs’ surveyed reported they did not use nursing diagnoses in their clinical practice</td>
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<td>Lack of clarity of diagnostic statements</td>
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<td>Lack of administrative support for writing nursing diagnosis</td>
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<td>Müller-Staub et al. (2007)</td>
<td>Evaluation of the effects of the Nursing Diagnostics Educational Program (NDEP)</td>
<td>Pre-test/ post-test design LE: 2</td>
<td>Nurses of hospital wards (n= 12) of one hospital received an educational intervention called NDEP Before and after the intervention, a total of 72 randomly selected nursing records were evaluated The instrument Quality of Nursing Diagnoses, Interventions, and Outcomes was used to measure the quality of the nursing diagnoses</td>
<td>The guided clinical reasoning program significantly improved the formulation of nursing diagnostic labels and identification of signs/symptoms and correct aetiologies Post-test data showed almost no nursing diagnoses without signs/symptoms in comparison with the pre-test</td>
<td>NDEP Guided clinical reasoning</td>
</tr>
<tr>
<td>Müller-Staub et al. (2008)</td>
<td>The effect of guided clinical reasoning on nursing diagnoses, interventions, and outcomes</td>
<td>Cluster-randomised controlled experimental study in a pre-test / post-test design LE: 1</td>
<td>Nurses from three wards received guided clinical reasoning training Nurses of three other wards participated in classic case discussions and functioned as a control group The quality of 225 randomly selected nursing records, containing 444 documented nursing diagnoses corresponding to interventions and outcomes, was evaluated by the Q-DIO instrument</td>
<td>The mean scores of nursing diagnoses increased significantly in the intervention group Guided clinical reasoning led to significantly higher quality of nursing diagnosis documentation to aetiology-specific interventions and to enhance nursing-sensitive patient outcomes In the control group, the quality of the diagnoses was not significantly changed</td>
<td>Guided clinical reasoning</td>
</tr>
<tr>
<td>Paganin et al. (2008)</td>
<td>The impact of institutional, professional, and personal factors on nurses and on their efforts to derive nursing diagnoses</td>
<td>Cross-sectional study design based on a survey LE: 2</td>
<td>Responses of 21 nurses for each group of factors (institutional, personal, and professional) were evaluated and scored on a scale of 0 (none of the impact parameters identified) to 100 (all impact parameters) Data were collected using a closed, structured questionnaire during the work shift of 21 nurses</td>
<td>The professional factor scores were significantly lower among nurses with previous theoretical training in nursing diagnosis compared to those with no previous theoretical training The recognition of these factors and improved institutional support may facilitate the implementation of nursing diagnoses</td>
<td>Workload level Number of patients per nurse Number of administrative tasks Previous nursing diagnosis experience Previous theoretical training</td>
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</table>
## What factors influence the prevalence and accuracy of nursing diagnoses?

<table>
<thead>
<tr>
<th>Reference</th>
<th>Focus</th>
<th>Research Design/ Level of Evidence (LE)</th>
<th>Data Collection/Sample Size</th>
<th>Key Findings</th>
<th>Factors That Influence Diagnoses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reichman &amp; Yarandi (2002)</td>
<td>Diagnostic cue utilization between expert and novice critical care cardiovascular nurses (CCCV)</td>
<td>Experimental design LE: 2</td>
<td>Five written patient simulations (WPSs) served as instruments in the study</td>
<td>Of the 184 WPSs that were diagnosed, 88 were accurate</td>
<td>Level of experience</td>
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<td>Verbal recalls of the respondents were audio taped for analysis; expert (n=23) and novice (n=23) nurses were tested</td>
<td>Of the 88 accurate diagnoses, 63 (72%) were made by CCCV nurse experts, while 25 (28%) were made by nurse novices</td>
<td>Nurses’ background as an expert</td>
</tr>
<tr>
<td>Smith Higuchi et al. (1999)</td>
<td>Factors associated with nursing diagnosis utilisation</td>
<td>Cross-sectional study design based on a survey and a retrospective chart review LE: 2</td>
<td>Attitude survey included 47 Likert-scale items and 2 open-ended questions</td>
<td>In two hospitals in which nursing diagnosis implementation programs was not implemented, none of the 22 nurses documented nursing diagnoses</td>
<td>Attitude towards diagnosis utilisation</td>
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<td>All nurses (n=65) from four hospitals that cared for patients with respiratory conditions were invited to participate in the study</td>
<td>In the two hospitals in which nursing diagnosis was formally implemented through hospital educational programmes, 37 of 43 nurses (86%) documented nursing diagnoses</td>
<td>Knowledge</td>
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<td>In addition, a retrospective chart audit of discharged patients (n=427) was conducted</td>
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<td>Nursing administration expectations</td>
</tr>
<tr>
<td>Takahashi et al. (2008)</td>
<td>Difficult and easy aspects of performing the different stages of the nursing process, according to the reports of nurses</td>
<td>Cross-sectional study design based on a survey LE: 2</td>
<td>Eighty-three nurses from 20 different hospital units in which the nursing process was regularly implemented answered structured research questionnaires</td>
<td>Nurses had most difficulties with the phases nursing diagnoses and evaluations</td>
<td>Presence of formal hospital educational programmes in nursing diagnostics</td>
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<td>Most of the difficult and easy aspects reported were related to the nurses’ theoretical and practical knowledge needed to perform the phases of the process</td>
<td>Computer-generated nursing care plans</td>
</tr>
<tr>
<td>Thoroddsen &amp; Ehnfors (2006)</td>
<td>Differences in documented nursing diagnoses, signs and symptoms, and aetiological factors before and after an educational effort</td>
<td>Pre-test, post-test, cross-sectional study design LE: 2</td>
<td>For the pre-test, 355 nursing records in a hospital were reviewed</td>
<td>The number of diagnoses per patient increased, incomplete diagnoses decreased along with the use of medical diagnoses, and the documentation of signs and symptoms increased</td>
<td>Implementation of the NANDA classification for nursing diagnoses</td>
</tr>
<tr>
<td>Reference</td>
<td>Focus</td>
<td>Research Design/Level of Evidence (LE)</td>
<td>Data Collection/Sample Size</td>
<td>Key Findings</td>
<td>Factors That Influence Diagnoses</td>
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<tr>
<td>Thoroddsen &amp; Thorsteinsson (2002)</td>
<td>Expressions or terms used by nurses to describe patient problems</td>
<td>Retrospective chart review</td>
<td>The patient records in 1103 charts from a 400-bed acute-care hospital were analysed</td>
<td>Nurses failed to document the problems of patients in about 40% of the records</td>
<td>Patient length of stay is associated with the number of diagnoses</td>
</tr>
<tr>
<td>Whitley &amp; Gula-nick (1996)</td>
<td>The current status regarding utilisation of nursing diagnosis and the interest in educational consultation sessions that were provided by the nursing diagnosis council</td>
<td>Cross-sectional study design based on a survey</td>
<td>A survey instrument was mailed to all hospitals (n=239) in the state of Illinois, USA. The survey instruments were completed and returned by 139 agencies</td>
<td>Nursing diagnoses were performed in 109 of the 139 responding hospitals. Of the 109 respondents who performed nursing diagnoses, 88% included nursing diagnosis in a orientation program, and almost all utilised NANDA terminology (95%)</td>
<td>Limited ongoing education. Lack of motivation to learn. Difficulties in using diagnoses in specialty areas. Physician objections or resistance</td>
</tr>
</tbody>
</table>
What factors influence the prevalence and accuracy of nursing diagnoses?

References


What factors influence the prevalence and accuracy of nursing diagnoses?


CHAPTER 3

Development and psychometric testing of the D-Catch instrument, a measurement instrument for nursing documentation in hospitals


Chapter 3

Introduction

In clinical practice, documentation in the patient record is part of each nurse’s daily routine. It is considerate to be essential for adequate, safe and efficient nursing care (Wilkinson 2007). Inaccurate nursing documentation can be a cause of nurses’ misinterpretations, and may cause unsafe patient situations (Koczmara 2005, 2006). Therefore the World Alliance for Patient Safety recommends further research toward medical and nursing documentation to be able to identify and report potential areas for improvement. Subsequently, best practices can be established to provide decision-makers with options when shaping national strategies to improve patient safety (World Alliance for Patient Safety 2008). To provide safe care, nurses ought to describe the patient’s current health status and to reflect on the ongoing nursing process (Gordon 1994). On the basis of observations and the admission assessment, among other informational tasks, nurses derive nursing diagnoses in order to plan interventions and to evaluate outcomes (Carpenito-Moyet 1991, 2008, Johnson et al. 2007, Gordon 2003, 2005). The content and structure of the nursing process is internationally acknowledged as constituting the theoretical background of the elements needed for accurate nursing documentation (Delaney et al. 1992, Gordon 1994, McFarland & McFarlane 1997). Accurate nursing documentation ought to contain (1) patients’ personal information and a description of the admission data, such as information from the assessment interview (Curtis 2001, Arnold & Mitchell 2008), (2) Accurate nursing diagnoses. Diagnoses are reported in terms of a problem, aetiology, and signs and symptoms, also known as the PES structure. The PES structure explains the content of the nursing diagnosis: It contains a problem label (P), aetiology or ‘related factors’ (E), and signs and symptoms (S); the diagnosis implies the possibility of an intervention (Gordon 1994). The basis of a diagnostic concept in nursing was accepted by the North American Nursing Diagnosis Association (NANDA) in 1988. The nursing diagnosis can be seen as a core element of the nursing process; it is the basis of planning interventions and focuses nurses towards measurable outcomes (Doenges & Moorhouse 2003). (3) Accurate interventions (planned and implemented interventions). Nursing interventions are regarded as nursing treatments, which are based on education, knowledge, and knowledge sources -such as handbooks or protocols- and clinical reasoning (Johnson et al. 2007). Nursing interventions describe the actions of nurses on behalf of the patient to improve outcomes. (4) Outcomes have to be documented as well. An outcome can relate to the level of the family, community state, behaviour, or perception and can be measured along a continuum. Nursing outcomes refer to changes in a patient’s status, including symptoms, functional abilities, knowledge state, coping strategies, and self-care (Johnson et al. 2007). These outcomes are documented in nurses’ progress evaluations and outcome reports. This gives nurses the opportunity to evaluate what kind of care is given and to describe the results (Lunney 2001, Wilkinson 2007, Lunney 2007). (5) For nurses’ accountability, it is obvious that the nursing documentation not only has to be accurate and complete but also legible, either handwritten or typed. Poorly legible handwriting
Development and psychometric testing of the D-Catch instrument could obviously be harmful to the patient because, it might be misinterpreted (Koczmara et al. 2005, 2006, Whyte 2005). Knowledge about the accuracy of nursing documentation in patient records may be helpful in improving the structure and quality of the content of handwritten and electronic patient records (Goossen et al. 1997, Kurihara et al. 2001).

On the basis of their systematic review of nursing documentation, Saranto and Kinnunen (2009) concluded that this area of nursing has received little research attention. Published studies used mostly questionnaires, interviews, observations, and descriptive evaluations about methods of data collection. Müller-Staub et al. (2009) stated that there are no psychometrically tested instruments for use in general hospitals to measure the quality of and the relationships among diagnoses, interventions, and outcomes. To assess the accuracy of the nursing documentation in general hospitals, there is a need for a reliable and valid instrument to quantify accuracy variables.

**Background**

In 2006, we carried out a systematic literature search with the goal of identifying research describing measurement instruments for quantifying the accuracy of nursing documentation. The articles were identified by searching the electronic databases CINAHL and MEDLINE for articles published from 1980 to 2007. The initial search using the keywords and search strategy “nurs* AND documentation AND patient record” produced 1320 hits on MEDLINE and 240 on CINAHL. After assessing the titles and/or abstracts of these articles for relevance, we refined the search strategy to “nurs* AND patient record AND instrument”, which produced 105 hits on MEDLINE and 16 hits on CINAHL. The abstracts yielded by this search were then studied. In order for papers to be included for further analysis, the paper had to be published in English; it had to describe a measurement instrument for assessing and quantifying the accuracy of nursing documentation; and at a minimum, it had to include the assessment of the nursing diagnosis. We also later included the publication of Müller-Staub (2007) in our analysis of relevant articles. Instruments for qualitative, descriptive evaluation of documents were excluded.

After thoroughly examining the abstracts, we identified six relevant articles from the first search and two additional articles from the second search. Review of the reference citations of the relevant articles yielded two additional articles. Thus, a total of 10 articles were included in the present study. From these we retrieved the following six instruments.

(1) The Ziegler Criteria for Evaluating the Quality of the Nursing Process (ZCEQNP) instrument (Ziegler 1984) is composed of 12 specific criteria. Its purpose is twofold: (1) to assess the overall diagnosis, and (2) to assess the response to the diagnosis and aetiology separately. The instrument was originally designed to measure the quality of nursing diagnoses derived by
nursing students (Ziegler 1984, Dobrzn 1995). We found no description of the psychometric properties of the ZCEQNP.

2. The NoGA instrument (Nördstrom & Gardulf 1996) is a quantitative instrument that evaluates the structure of nursing documentation. This instrument contains five domains: assessment, analysis, planning, implementation, and evaluation. Assessment takes place by using the terminology “exists” or “does not exist” (Nilsson & Willman 2000). NoGA was used to study nurses’ documentation in 380 records (Nördstrom & Gardulf 1996) and to study the effect of an educational intervention on nurses’ documentation in 515 records (Nilsson & Willman 2000). The latter study also compared the ability of NoGA and Cat-ch-Ing to assess the quality of the nurses’ documentation.

3. The Scale for Degrees of Accuracy in Nursing Diagnoses (Lunney 2001) is a 7-point ordinal scale that measures the accuracy of diagnoses relative to identified signs and symptoms. The scale ranges from -1 to + 5, with higher positive scores indicating higher accuracy. The scale is designed to measure nurses’ diagnostic competency and to analyze the factors that influence competency by using written case studies. The inter-rater reliability of this scale, which was calculated by using Pearson product-moment correlation, is 0.97 and 0.96 (Lunney 2001).

4. The Cat-ch-Ing (Björvell 2002) is an instrument that measures both quantity and quality criteria of documentation based on the nursing process and on Swedish regulations for documentation practice. The instrument is composed of 17 variables that reflect various issues relating to the nursing process, such as patient history, patient status, nursing diagnoses, interventions, and signature of notes. Measurement of quantity criteria is evaluated using a 4-point ordinal scale ranging from 0 (not at all) to 3 (always) on the various domains. Cat-ch-Ing was originally developed to evaluate a comprehensive intervention program based on a Swedish model (the VIPS model; an acronym formed from the Swedish words for wellbeing, integrity, prevention and security), which was designed for use in documenting a problem-based nursing care plan and discharge note (Björvell 2002). The inter-rater reliability of the Cat-ch-Ing, which was calculated by using Cohen’s kappa, is between 0.92 and 0.98 (See Addendum I & II in Björvell, 2002).

5. The Quality of Nursing Diagnosis (QOD) instrument (Florin et al. 2005) lists 14 criteria that are used to measure the accuracy of the written diagnoses of nurses. The QOD was based on the ZCEQNP (Ziegler 1984), containing modified wording from the ZCEQNP, and on Lunney’s 7-point Scale for Degrees of Accuracy in Nursing Diagnoses (Lunney 2001). It was initially developed for evaluating an educational intervention in a pre-post-test design, but is now used to analyze component signs and symptoms. The inter-rater reliability of the QOD, which was calculated by using Cohens’s kappa, is > 0.75, and its internal consistency, which was determined by using Cronbach’s alpha, is 0.863 (Florin et al. 2005).
(6) The Quality of Diagnoses, Interventions, and Outcomes (Q-DIO) instrument (Müller-Staub 2007) consists of 29 items categorised into four groups: (1) nursing diagnoses as a process, (2) nursing diagnoses as a product, (3) nursing interventions, and (4) nursing-sensitive patient outcomes. Group 1 items are rated on a 3-point scale, whereas group 2-4 items are rated on a 5-point scale. The Q-DIO was originally developed to evaluate the implementation of nursing diagnostics in a hospital in Switzerland (Müller-Staub 2007). Although the Q-DIO was implemented in a pilot study, its psychometric properties were not tested (Müller-Staub et al. 2009).

As none of the aforementioned instruments were originally developed to measure documentation in several general hospital environments nor were they tested in that context. We concluded that no such instrument was available (Figure 1).
Figure 1 Measurement instruments and their variables

<table>
<thead>
<tr>
<th>Instruments</th>
<th>1</th>
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<tbody>
<tr>
<td>ZCEQNP (Ziegler 1984)</td>
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<td>NoGA (Nördstrom &amp; Gardulf 1996)</td>
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<tr>
<td>Scale for Degrees in Accuracy of Nursing Diagnoses (Lunney 2001)</td>
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<tr>
<td>Cat-ch-Ing (Björvell 2002)</td>
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<tr>
<td>QOD (Florin et al. 2005)</td>
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<tr>
<td>Q-DIO (Müller-Staub 2007)</td>
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Measurement of the:
1. Accuracy of the record structure (according to the nursing process).
2. Accuracy of the admission, nursing diagnoses, interventions, and progress and outcome evaluations, separately in quantity and quality criteria.
3. Accuracy of the admission documentation and patients’ personal details.
4. Accuracy of the nursing diagnoses.
5. Accuracy of the nursing diagnoses, including the problem label, aetiology, and signs and symptoms (PES structure).
6. Accuracy of the interventions, and progress and outcome evaluations related to the nursing diagnoses.
7. Legibility.
8. Documentation related to international nursing standards (NANDA-I and/or NIC and/or NOC), without national-, regional-, or hospital-specific variables.
The Study

Aim
The purpose of this study was (1) to develop a measurement instrument for the assessment of nursing documentation (which includes record structure, admission data, nursing diagnoses, interventions, progress data, and outcome evaluations) in various hospitals and wards, and (2) to test the validity and reliability of this instrument.

Methods

Instrument development
We pre-selected three measurement instruments and presented them to two Delphi panels (n= 6 experts per panel); the panels assessed the available instruments for content, structure, specificity, and usability in general hospitals. For assessment of the nursing documentation we selected the Cat-ch-Ing instrument (Björvell 2002), and for assessment of nursing diagnoses, we selected the Scale for Degrees of Accuracy in Nursing Diagnoses (Lunney 2001) and the Q-OD (Florin et al. 2005). The ZCEQNP (Ziegler 1984, Dobrzyn 1995) and the NoGA instrument (Nördstrom & Gardulf 1996, Nilsson & Willman 2000) were excluded from the pre-selection and not presented to the panels, because these instruments did not allow the measuring of diagnoses in terms of the PES structure.
Since reliable outcomes can be obtained through Delphi panels consisting of a relatively small group of homogenous experts (Akins et al. 2005), we invited a limited number of experts who were willing to share their specialist knowledge and experience to participate as Delphi panelist in one of the two Delphi panels in our study. These six panelists per panel had a similar general understanding of nursing documentation and equally understood how to use effective and reliable discussion and consensus techniques. One of the Delphi panels consisted of six lecturers, all Dutch, and with expertise in nursing process evaluation; all members of this panel had a master’s degree in nursing. The other panel consisted of expert nurses that worked in hospital practices. Their expertise was in developing or implementing nursing documentation systems. Members of this panel either had a post-graduate specialization degree or a master’s degree in nursing science. The panellists were selected based on their nursing background and their personal expertise recognized by their (inter)national publications, contributions to (inter)national conferences, as author of book chapters or were acknowledged as contributor of implementation programs for computer software on behalf of nursing documentation or as lecturer with their specialty in nursing process application. To prepare the panellists for the panel discussion, we mailed to each panellist a letter containing an introduction to our study, the aim of the Delphi panels, a list of the three instruments they were to analyse, four questions on which to base their analyses, and instructions for taking notes as they analyse the
instruments. The four questions were as follows:

1. What is your opinion about the content of the instruments (including relevancy and completeness)?
2. What is your opinion about the structure of the instruments?
3. What is your opinion about the instruments’ specificity for measuring nursing documentation?
4. What is your opinion about the usability of the instruments in hospitals?

During the first plenary Delphi session, each member had the opportunity to present their opinion based on the aforementioned questions. The members then discussed each question during the next session.

On the basis of consensus discussions of both Delphi panels, the panel members concluded that the ideal nursing documentation instrument should have a quantifiable accuracy measurement scale subdivided into quantity and quality criteria, as does the Cat-ch-Ing instrument. The members also concluded that incorporating Lunney’s 7-point scale into our instrument would allow us to measure each nursing diagnoses separately in terms of a problem label, aetiology (or related factors), and signs and symptoms; that is the PES structure. Therefore, the two Delphi panels selected Lunney’s Scale for Degrees of Accuracy in Nursing Diagnoses as the basis for measuring nursing diagnoses, and the Cat-ch-Ing instrument for measuring intervention and outcome evaluations and legibility. Nevertheless, the panels surmised that the Cat-ch-Ing instrument was not directly applicable for measuring the accuracy of nursing documentation in hospitals, since it contains items specifically designed for use in a problem-based nursing care plan in the Swedish VIPS model (e.g., “Are VIPS keywords used?”) (Björvell 2002, p.12). Thus, these items needed to be modified to fit the broader hospital context.

Based on the Delphi panels’ comments, criteria of Lunney’s instrument were integrated into a modified version of the Cat-ch-Ing instrument (Björvell 2002) with regard to both quantity and quality criteria, ultimately leading to the formation of a new instrument—the D-Catch. The Delphi panels decided that consensus was obtained, because they agreed on the items of the new D-Catch instrument (Figure 2). The linguistic validation of the D-Catch was performed by forward and backward translation by two independent translators.

**Pilot study**

Using a draft version of the D-Catch instrument, two pairs of reviewers assessed 60 patient records from four different nursing wards in two hospitals. During the pilot study, the draft version of the D-Catch lacked guide A & B for Diagnoses, which we appended afterwards to the final version of the instrument. All patients gave written informed consent to have the documentation in their patient records assessed in our pilot study.

Four reviewers, all nurses selected for the measurement in the pilot study since they had their specialty in nursing documentation in hospital practice, and two
Delphi panellists evaluated the properties of the D-Catch instrument after the assessment of approximately every 20 records. Subsequently, a list was compiled of the reviewers’ experiences and achievements and of common flaws in their measurement approach while using the D-Catch instrument. This process provided valuable information enabling us to refine the measurement process and the instrument.

Reliability results from the pilot study indicated that the D-Catch instrument was suitable for measuring the accuracy of the record structure, admission data, interventions, and progress and outcome evaluations, and legibility (weighted kappa $> 0.62$). The reviewers agreed that they scored these items in a comparable way; thus, obtaining consensus scores based on brief consensus discussions was possible. The reviewers, however, differed in their interpretation of the quantity and quality criteria scores for the nursing diagnoses and concluded that this type of subjectivity was unacceptable.

The reviewers and two Delphi panelists reached consensus on how to improve the D-Catch instrument by developing a guide on scoring nursing diagnoses—Guide A & B for Diagnoses (Figure 3)—and by completing a 20-hour training course on how to score items on the D-Catch. The course was subdivided into the following sections: (a) an individual study of the theoretical background of nursing documentation and the use of the NANDA-I classification; (b) an individual review of the skills needed to use the D-Catch instrument, Guide A & B for Diagnoses, and the specific measurement form used for nursing diagnosis (this form can be used as a tool to achieve consensus on the accuracy score of each diagnosis found in a record); and (c) skills needed to discuss consensus. At the beginning of the training, most of the reviewers were not experts in nursing documentation and had to learn more about the theoretical background underlying documentation and the associated skills. Therefore, in preparation for implementing trial measurements in a hospital practice setting, the entire review process was considered in detail during a measurement training session supervised by an expert nurse.

The D-Catch instrument

The final version of the D-Catch instrument quantifies the accuracy of the (1) record structure (according to the nursing process); (2) admission data (information from the admission interview); (3) nursing diagnosis (PES structure, potential intervention based on the diagnosis); (4) nursing interventions (related to the nursing diagnoses); (5) progress and outcome evaluations (related to the nursing diagnoses); (6) legibility (readable handwriting or typewritten). Items 2-5 are measured as a sum score of quantity and quality criteria. Figure 3 contains Guide A & B for Diagnoses, which outlines scoring of the quantity and quality criteria of the D-Catch. Quantity criteria address the question: “Are the PES components of the diagnosis present?” Quantity criteria can be scored as follows: complete = 4 points; partially complete = 3 points; incomplete = 2 points; none = 1 point.
Quality criteria address the question: “What is the quality of the description with respect to relevancy, unambiguity, and linguistic correctness?” Quality criteria can be scored as follows: very good = 4 points; good = 3 points; moderate = 2 points; poor = 1 point. Items 1 and 6 are measured on a 4-point Likert scale according to the aforementioned quality criteria.

Sample
Of the 94 medical centres in the Netherlands in 2007 (86 general hospitals and 8 university hospitals), we randomly selected 7 of these hospitals, which were located in different parts of the country, to test the accuracy of the D-Catch in hospital settings. We invited manager directors of the hospitals to take part in our study. Two manager directors did not consent to participate; specific reasons for declining were not given. On the basis of the regional inclusion criterion, we invited two other hospital managers to take part. Each hospital manager in our sample was asked to contribute at least 10 patient records from at least one hospital ward. In total, 245 patient records from 25 wards were assessed with the D-catch instrument. This sample was a part of a larger study addressing the prevalence of the accuracy of the nursing documentation in the Netherlands.

Data collection
On the day of the measurement, we asked a nurse from the participating wards to select 10 records based on two criteria: (1) patient length of stay was at least 3 days; and (2) patients’ ability to give written informed consent. All components of the records of each consenting patient were included.
The 245 records were assessed by 8 pairs of reviewers (12 reviewers participated and some changed partners during the assessment, hence the 8 pairs). Two reviewers assessed each of the records independently. The reviewers were registered nurses (n= 4) or fourth-year bachelor’s degree nursing students (n= 8). All completed the 20-hour training course on how to score items on the D-Catch.

Statistical analyses
SPSS version 14 was used for factor analyses and for assessing internal consistency. Construct validity was assessed using explorative factor analysis with principal components, and varimax rotation was used to identify underlying constructs. Internal consistency was assessed using Cronbach’s alpha.
We compared the results of the intraclass correlation coefficients (one way, single) analyses—which were used if an overall agreement on a variable was obtained—and the results of weighted kappa (Kw) analyses with linear weighting, according to Fleiss et al. (2003). The outcomes were highly related, although Kw values were lower than the intraclass correlation coefficients. Since we used an ordinal scale, we presented the conventional inter-rater reliability of Kw. For our calculations we used VassarStats on-line statistics software (Lowry 2008).
Development and psychometric testing of the D-Catch instrument

Results

Construct validity
Three underlying constructs were identified in the D-Catch instrument. Construct 1 contained the following items: accuracy of the structure of the patient record, accuracy of the report on admission, the interventions, and nursing progress and outcome evaluations. We named this construct ‘chronologically descriptive accuracy’. Construct 2 contained only one item: accuracy of the nursing diagnoses. We named this construct ‘diagnostic accuracy’. Construct three was named ‘legibility accuracy’ (Table 1). Eigen values were 4.5 and 1.7 and the variance accounted for was 45.8% and 17.4%, respectively (cumulative variance accounted for was 63.2%; n = 245 records).

Reliability
Internal consistency of the D-Catch instrument, as determined by Cronbach’s alpha, was 0.722. The inter-rater reliability of the D-Catch was calculated using eight pairs (n= 245 records), resulting in a Kw between 0.742 and 0.896 (Table 2).

Table 1 Results of the factor loading of six items in the D-Catch instrument*

<table>
<thead>
<tr>
<th>Items</th>
<th>Component</th>
<th>Component</th>
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<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Accuracy of record structure</td>
<td>0.870</td>
<td>0.084</td>
</tr>
<tr>
<td>Accuracy of admission</td>
<td>0.480</td>
<td>-0.032</td>
</tr>
<tr>
<td>Accuracy of nursing diagnosis</td>
<td>0.230</td>
<td>0.907</td>
</tr>
<tr>
<td>Accuracy of intervention</td>
<td>0.707</td>
<td>-0.129</td>
</tr>
<tr>
<td>Accuracy of progress / outcome evaluation</td>
<td>0.878</td>
<td>0.075</td>
</tr>
<tr>
<td>Legibility</td>
<td>0.539</td>
<td>-0.448</td>
</tr>
</tbody>
</table>

*Extraction method: explorative factor analysis with principal components and varimax rotation.
Table 2 Cohen’s weighted kappa (Kw) inter-rater reliability of the D-Catch instrument

<table>
<thead>
<tr>
<th>Accuracy scale (1-4)</th>
<th>Kw (CI)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record structure</td>
<td>0.896 (0.849-0.942)</td>
</tr>
<tr>
<td>Admission report quantity</td>
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<td>Admission report quality</td>
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</tr>
<tr>
<td>Diagnosis report quantity</td>
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<tr>
<td>Diagnosis report quality</td>
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<tr>
<td>Intervention report quantity</td>
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<tr>
<td>Intervention report quality</td>
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</tr>
<tr>
<td>Progress &amp; outcome report quantity</td>
<td>0.856 (0.792-0.919)</td>
</tr>
<tr>
<td>Progress &amp; outcome report quality</td>
<td>0.836 (0.771-0.900)</td>
</tr>
<tr>
<td>Legibility</td>
<td>0.806 (0.743-0.868)</td>
</tr>
</tbody>
</table>

*CI: confidence intervals (95%-confidence intervals).

Discussion

This paper presents the results of a study that developed and psychometrically tested a new instrument (D-Catch) for measuring the accuracy of nursing documentation in general hospital settings.

Study limitations

This study had limitations in several aspects. The D-Catch instrument was tested in hospitals only. For the assessment of nursing documentation in other healthcare settings, for example nursing homes or primary healthcare settings, additional validity and reliability testing is needed. The results of the D-Catch measurement are based on a study in the national context of a single country. For international use of the instrument, more studies are needed to test the validation and reliability further, as the state of nursing documentation in other countries may be different from that in the Netherlands (Saranto & Kinnunen 2009).
Validity and reliability of the D-Catch instrument

The results show that the instrument had acceptable validity and reliability when used in general hospital settings. We used two Delphi panels to analyse the criteria of existing instruments. Reflecting on this qualitative approach, we found that interactions between the panellists during consensus discussions yielded the most valuable arguments that were ultimately used to choose the final criteria of the new D-Catch instrument. Elements of similar instruments have been evaluated in earlier studies in the United States (Lunney 2001) and Sweden (Björvell et al. 2000, Björvell 2002). These previous studies were valuable in discussing the foundation of the D-Catch instrument in rather small panels. The ability to separately assess each diagnosis in the nursing documentation, and then to determine the accuracy of interventions, and progress and outcome evaluations on the basis of both quantitative and qualitative criteria, was an efficient and systematic assessment approach that produced satisfactory reliability results.

On the basis of patterns of item loadings (Table 1), we noted that the item ‘diagnosis’ was the only variable with substantial loading on component two (0.907) and modest loading on component one (0.230). The reason for this finding may be that we measured a chronological, descriptive way of documenting admission information, interventions, and progress and outcome evaluations. According to Sermeus (1993), nursing documentation can be subdivided into chronological registration and problem-oriented registration. Therefore, a ‘chronological, descriptive component’ and a ‘diagnostic component’ may underlie the D-Catch instrument. Taking the communalities and the interpretation of the factors into account (Table 1), we conclude that the variable ‘accuracy of the admission documentation’ has little in common with the others, since its communality is low (0.224). However, this may be because the factor model we used does not work well in the case of this variable. Additional exploration of this variable is required in order to determine the reason for this finding. As we interpreted the factor loading of the variable ‘legibility’, we concluded that homogeneous scores might underlie the lack of discrimination between the components. Further validation of this item is required.

We conclude that the internal consistency of the D-Catch instrument, as determined by Cronbach’s alpha, was 0.722 (n=245 records), which is an acceptable index for estimating the homogeneity of the measure composed of the D-Catch subparts (Polit & Beck 2007). To obtain detailed information on the inter-rater reliability of the D-Catch, we calculated the Kw of each item. The Kw values and the results indicate that the reviewers disagreed mostly during the rating of two items: ‘accuracy of intervention report’ and ‘accuracy of progress and outcome report’, although these items also received high scores. From the results of the reliability analysis, we conclude that the reliability outcomes between pairs of reviewers differed, even though all the reviewers were trained the same way.
This suggests that measurement outcomes may be influenced by a reviewer’s personal interpretation of the documentation. Thus, we have to take into account this subjectivity. We recommend that future assessments should evaluate the inter-rater outcomes as a part of the assessment process evaluation. Differences in documentation complexity may be another factor that contributed to the variability in measurement outcomes. Documentation ranged from brief and structured summaries to 10-page or more unstructured patient accounts overflowing with redundancies; the latter type was often associated with long-stay situations. We conclude that there was no item with outstanding inter-rater reliability scores and that the scores were satisfactory (Fleiss *et al.* 2003, Polit & Beck 2007).

**Conclusion**

As stated by the World Alliance for Patient Safety (2008), the lack of standardized nomenclature for devices and reporting hampers good written documentation. Consequently the D-Catch instrument may be valuable to determine the quality of nurses’ documentation in more dept to distinguish areas for improvement. This appears to be achievable since the psychometric properties of the D-Catch are estimated to be satisfactory in general hospital settings. For the assessment of documentation in other health care settings, for instance, in nursing homes, or primary health care settings, additional reliability and validity testing is needed. As Saranto & Kinnunen (2009) have stated, nursing documentation is an important area of research. But an international gold standard for accurate nursing documentation is not yet acknowledged. International research collaborations should evaluate the existing nursing documentation measurement instruments for further validation in an international context. This may also contribute to the development of a standardized nursing language and facilitate further development of electronic nursing documentation devices.
There is always a certain amount of subjectivity when measuring patient records. It is important, therefore, that the measurement is performed independently by two different persons.

Complete the measurement form individually and compare scores afterwards to obtain consensus scores.

D-Catch magnitude:
D-Catch is available in a paper version and in an electronic version, usable as a stand alone application.
D-Catch

1) Is an accurate nursing record structure present?

4 points:
An individual record is present with a structure that allows describing:
1) Personal details of the patient
2) Assessment form and admission data
3) Nursing problem inventory (nursing diagnoses)
4) Nursing interventions inventory
5) Daily progress report with outcome evaluations inventory

3 points:
An individual record that contains 4 of the 5 items listed above

2 points:
An individual record that contains at least a note of personal details and a progress evaluation report form

1 point:
It is not possible to note details in an individual nursing record or the items are included in a collective record with other patients’ details.

<table>
<thead>
<tr>
<th>Score</th>
<th>4</th>
<th>3</th>
<th>2</th>
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</table>

<table>
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<th>Consensus score</th>
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<tbody>
<tr>
<td></td>
<td>◘</td>
<td>◘</td>
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<td>◘</td>
</tr>
</tbody>
</table>
Development and psychometric testing of the D-Catch instrument

D-Catch

2) Is an accurate nursing report about the admission present?

**Quantity**

4 points:
Personal details (name, address, date of birth, marital status), the reason for admission, and the patient’s state of health of the patient are fully documented.

3 points:
Personal details are partially available; the patient’s name and address or information about the reason for admission / state of health are missing.

2 points:
Personal details are incomplete; both name and address and information about the reason for admission / state of health are missing.

1 point:
Personal details and the reason for admission / state of health are not documented.

**Quality**

4 points:
The admission report contains the medical diagnosis and reason for admission with relevant aspects of recorded diagnoses. The notes are clear, linguistically correct, and contain all relevant information needed to admit the patient.

3 points:
The admission report contains the medical diagnosis and reason for admission but not a nursing diagnosis. Most of the notes are clear and contain relevant information needed to assess the patient.

2 points:
The admission report contains some medical issues but not a medical or a nursing diagnosis. There are some correct notes, but they are not always clear or linguistically correct.

1 point:
There is no admission report or reason for admission; or the notes are unclear, linguistically incorrect.

<table>
<thead>
<tr>
<th>Score (first quantity)</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
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</thead>
<tbody>
<tr>
<td>Consensus Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
D-Catch

3) Is an accurate nursing diagnosis structured in PES present?
(Please note: see also supplemental Guide A & B for Diagnoses)

**Quantity**

**4 points:**
A problem label, an aetiology / a cause (related factor), and a sign / symptom are clearly and unambiguously listed in the text; the diagnosis implies the possibility of an intervention.

**3 points:**
A problem label, an aetiology / a cause, and a sign / symptom are listed, but no (planned) intervention is listed. Alternatively, an aetiology / a cause or a sign / symptom is listed with reference to a possible intervention or with reference to a vaguely described intervention.

**2 points:**
A problem label and either an aetiology / a cause or a sign / symptom is listed with reference to either a planned intervention or a not clearly described intervention.

**1 point:**
A note relating to a problem label is listed with no further explanation. No reference is made to an intervention.

**Quality**

**4 points:**
The diagnosis is supported by one or more relevant notes from the report concerned. These notes are not contradicted by other notes in the same record. The diagnosis raises no other diagnostic questions and is linguistically correct.

**3 points:**
The diagnosis raises diagnostic questions, but these questions appear to be relevant. The diagnosis is not contradicted by other notes.

**2 points:**
A diagnosis label is suggested by a note from the report but is unclear or linguistically incorrect.

**1 point:**
A diagnosis label is mentioned but not supported by any note, or is contradicted by other notes in the same report, or is linguistically incorrect.

*Please score on additional form diagnosis accuracy*
4) Are accurate interventions present?

**Quantity**

4 points:
Each intervention in terms of nursing actions is linked to or can be directly related to a diagnosis. These interventions are described in terms of the aim for which they are used and are logical results of the diagnosis.

3 points:
At least 50% of the interventions in terms of nursing actions are linked to or can be directly related to a diagnosis. These interventions are described in terms of the aim for which they are used and are logical results of the diagnosis.

2 points:
Interventions have been noted, but less than 50% are related to the diagnosis. The aim for which the interventions are used is unclear.

1 point:
No interventions in terms of nursing actions are mentioned.

**Quality**

4 points:
Interventions are clear, linguistically correct, concise, and contain all relevant information needed to act. The intervention date is mentioned.

3 points:
At least 50% of the notes meet the above description. Some notes may contain unnecessary wording or relevant information is missing; the language in some notes is incorrect (e.g., incomplete sentences, use of non-standard abbreviations that can be misinterpreted).

2 points:
Less than 50% of the notes are written as described above; there are some correct notes.

1 point:
Generally, the notes are unclear, linguistically incorrect, and relevant information is missing.

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>4</th>
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</tr>
</thead>
<tbody>
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<td>Score (first quantity)</td>
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<tr>
<td>Consensus Score</td>
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<td>☐</td>
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</tr>
</tbody>
</table>
5) Are accurate progress & outcome evaluations present?

**Quantity**

4 points:
The progress evaluations report nursing outcomes related to nursing diagnoses. Interventions are described in terms of the patient’s health status and are logical results of the diagnosis and the intervention. The progress evaluations are fully available and updated daily.

3 points:
At least 50% of the progress evaluations in terms of nursing outcomes is linked to diagnoses. Interventions are described in terms of the patient’s health status and are logical results of the diagnosis and the intervention. The progress evaluations are not updated daily (but are updated at least 6 days a week).

2 points:
The progress evaluations are incomplete; in less than 50% of the evaluations, the patient’s health status is mentioned in terms of outcomes. There is no logical relationship between diagnoses and interventions. Updates for several days of the week are missing.

1 point:
The progress evaluations are not available. No outcomes are mentioned.

**Quality**

4 points:
The progress evaluations are clear, linguistically correct, concise, and contain all relevant information needed to understand the patient’s health status. The evaluation date is stated.

3 points:
At least 50% of the notes meet the above description. Some notes may contain unnecessary wording or relevant information is missing; the language in some notes is incorrect (e.g., incomplete sentences, use of non-standard abbreviations that can be misinterpreted).

2 points:
Less than 50% of the notes are written as described above; there are some correct notes.

1 point:
Generally, the notes are unclear, linguistically incorrect, and relevant information is missing.

4 3 2 1 4 3 2 1

Score (first quantity)  ◘ ◘ ◘ ◘ ◘ ◘ ◘ ◘ ◘

Consensus Score  ◘ ◘ ◘ ◘ ◘ ◘ ◘ ◘ ◘
6) Is the record legible?

4 points: The text is written clearly or typed legibly.
3 points: The handwriting forces the reader to reread the text, but some parts of the text are legible.
2 points: The text is written sloppily and is, overall, barely legible.
1 point: Most of the text is illegible, and the reader must guess what the text states or means

Score ◘ ◘ ◘ ◘
Consensus score ◘ ◘ ◘ ◘

END OF MEASUREMENT
GUIDE FOR DIAGNOSES A

**Quantity** (Main question: “Are the PES components of the diagnosis present?”)
(P= Problem, E= Aetiology, S= Signs and Symptoms, I= reference to a potential intervention)

4 points: \((P+E+S)\rightarrow(I)\) Complete

3 points: \((P)+(E)+(S)\rightarrow(?)\) Partially complete

or

\((P)+(E)+(?)\rightarrow(I)\)

or

\((P)+(?)+(S)\rightarrow(I)\)

2 points: \((P)+(?)+(?)\rightarrow(I)\) Incomplete

or

\((P)+(E)+(?)\rightarrow(?)\)

or

\((P)+(?)+(S)\rightarrow(?)\)

1 point: \((P)+(?)+(?)\rightarrow(?)\) None

**Quality** (Main question: “What is the quality of the description with respect to relevancy, unambiguity, and linguistic correctness?”)

4 points: (relevant) + (completely unambiguous) + (linguistically correct) Very good

3 points: (relevant) + (not unambiguous) + (linguistically correct) Good

2 points: (unclear but relevant) + (ambiguous) + (linguistically incorrect) Moderate

1 point: (not relevant) + (ambiguous) + (linguistically incorrect) Poor
D-Catch GUIDE FOR DIAGNOSES B

1. A diagnosis should form a textual whole. This means that the text should be clear and cohesive and should contain link words such as “because”, “owing to”, “subsequently”, “therefore”, “because of” “related to (r/t)”, etc. The diagnostic label should precede link words. (Link words may be substituted with arrows, commas, hyphens).

2. Consecutive sentences and/or phrases without link words but clearly forming comprehensive whole text may be read as one diagnosis. E.g., “Patient was in acute pain. Patient was fumbling with the sheets. Patient was restless.” It is clear from this example that the diagnostic label is acute pain and that the subsequent sentences refer to signs / symptoms.

3. Vague sentences without link words are not considered as a coherent whole but as separate sentences. Therefore, each of these types of sentences is scored separately.

4. Diagnostic terms associated with parentheses, brackets, or commas—for example, “tissue damage (wound)” or “tissue damage, wound”—are scored as diagnostic labels not as signs / symptoms. However, signs / symptoms can be enclosed within parentheses or brackets—for example, “tissue damage, wounds on feet (poor blood circulation peripheral vessels, varying blood sugar levels)”. In this example, the diagnostic label is followed by the basis for the diagnosis, which is stated within parentheses. Assess the use of brackets on a case-by-case basis.

5. In records in which the diagnoses and resulting interventions are stated in different places but it is evident that these diagnoses are part of the identified interventions, text is treated as clear and coherent text, as in point no. 1, and scored accordingly.

NO SCORE:
- All nursing entries that clearly report an observation without a diagnostic label. For example: “250 ml urine in container”, “patient smokes”, “patient walked in the corridor”.
- All nursing entries that refer to technical activities. For example: “cannot insert drip”, “drain is blocked”, “dressing has leaked”.
**References**


CHAPTER 4

Prevalence of accurate nursing documentation in the patient record in Dutch hospitals


This chapter is published and reproduced with the kind permission of Wiley and Sons: Prevalence of accurate nursing documentation in the patient record in Dutch hospitals, Journal of Advanced Nursing, 66 (11), 2481-2490, doi:10.1111/j.1365-2648.2010.05433.x
Chapter 4

**Introduction**

The ability to document both patients’ responses to an illness and information regarding the care given is a core competence of nurses (Wilkinson 2007). It is internationally acknowledged that a nurse’s ability to report a patient’s problems or complaints, additional clinical signs, and patients’ responses is important for the patients’ safety and well being (Carpenito-Moyet 2008, Saranto & Kinnunen 2009). Needleman & Buerhaus’ review (2003) led them to conclude that the greatest conceptual issue impeding better nursing-related patient safety is failure to recognize that nursing processes are not well documented, and failures in these processes that lead to adverse outcomes often fail to be observed or documented in patient charts. Indeed, poor layout of communication technologies reduces the amount of time nurses have to provide direct care, thereby adversely affecting efficiency and patient safety (Committee on the Work Environment for Nurses and Patient Safety 2004).

Although there is no internationally accepted gold standard for measuring the accuracy of nursing documentation, the phases of the nursing process are internationally acknowledged as having the theoretical elements needed for accurate nursing documentation (Gordon 1994, McFarland & McFarlane 1997, Doenges & Moorhouse 2008). Accurate nursing documentation allows nurses to evaluate nursing outcomes as a logical result of nursing diagnoses and interventions (Delaney et al. 1992). Moreover, accurate documentation addresses admission data, nursing diagnoses, interventions and progress and outcome evaluations. The documentation needs to be coherent, relevant, and unambiguous, as well as linguistically correct.

Knowledge based on studies completed in several different countries on the nature of nursing reports might contribute to the development of international resources for documentation accuracy improvements. Additionally, these studies might encourage the development of an internationally accepted gold standard for nursing documentation accuracy as well (Florin et al. 2005, Müller-Staub et al. 2006, Müller-Staub 2007). Nevertheless, several studies have reported that the patient records they examined contained relatively few precisely formulated diagnoses, pertinent signs and symptoms, and related factors (Martin 1995, Björvell 2002), and that the details of interventions and outcomes were poorly documented (Ehrenberg et al. 1996, Nordström & Gardulf 1996, Moloney & Maggs 1999, Müller-Staub et al. 2006).

The above-mentioned studies were carried out in the United States of America, Sweden, and Switzerland in a limited number of hospitals, and a few of these studies described the relationship between the accuracy of reported admission information, nursing diagnoses, interventions, and progress and outcome evaluations in hospital settings (Bostick et al. 2003, Müller-Staub et al. 2006, Saranto & Kinnunen 2009). Moreover, most studies examined the accuracy of nursing reports, focused on the influences of education programmes, on report improvements, or on the implementation of a nursing model in a specific hospital setting.
Background

The introduction of the nursing process to hospitals in the United States and Europe, combined with information on the value of nursing diagnoses from the North American Nursing Diagnosis Association (NANDA) in the early 1980s, prompted nurses to think seriously about the importance of systematic, standardized, and accurate nursing reports in the patient record (Gordon 1994, McFarland & McFarlane 1997, NANDA-I 2004, Johnson et al. 2007). Nurses initiated international exchanges with the goal of developing standardized nursing diagnoses (e.g. NANDA), interventions (e.g. Nursing Intervention Classification, NIC), and outcomes (e.g. Nursing Outcome Classification, NOC) (Johnson et al. 2007). They also supported multidisciplinary classification systems such as the International Classification of Functioning, Disability, and Health (ICF) and the Systemized Nomenclature of Medicine Clinical Terms (SNOMED CT). As a result in clinical practice, the use of standardized nursing language is increasing in electronic versions of patient records (Saranto & Kinnunen 2009). However, it is unclear whether the problem-oriented nursing process leads to accurate nursing reports (Heartfield 1996, Cheevakasemsook et al. 2006).

In 1978, Henderson and Nite remarked that a common flaw in narrative problem-oriented notes was that the notes tended to be confined to physical manifestations and abnormalities. Pathologic signs were recorded, whereas moods, attitudes, favourable signs, and normal behaviour were neglected (Henderson & Nite 1978, p. 371). Pesut and Herman (1999, p. 10, p. 24) mention that using the diagnosis-oriented nursing process in clinical practice is not effective. Furthermore, understanding techniques and methods that support nurses in writing their reports is important, because receiving training on how to apply the nursing process does not guarantee accurate documenting performance (Pesut & Herman 1999, Kautz et al. 2006, Cheevakasemsook et al. 2006). Assessment of nurses’ reports in the patient record can also be helpful for determining the content and structure of future electronic report systems, if the accuracy of nurses’ reports is to improve (Kurihara et al. 2001, McCargar et al. 2001, Törnvall et al. 2004).

The Study

Aim

The aim of the present study was to describe the accuracy of nursing documentation in hospital nursing records.

Methods and instruments

We used the D-Catch instrument to measure the accuracy of nursing documentation. The D-Catch instrument quantifies the accuracy of the following items:

1. Record structure (according to the phases of the nursing process)
2. Admission data (information of the admission interview)
3. Nursing diagnosis (problem label, aetiology or related factors, signs and
symptoms, also known as the diagnostic PES structure; a diagnosis establishes the prospect of an intervention)

(4) Nursing interventions (related to the nursing diagnoses)
(5) Progress and outcome evaluations (related to the nursing diagnoses)
(6) Legibility (readable handwriting or typed)

Items 2-5 are measured as a sum score of questions addressing quantity and quality criteria. Quantity criteria address the question: “Are the components of the documentation present?” Quality criteria address the question: “What is the quality of the description with respect to relevancy, unambiguity, and linguistic correctness?” Quantity criteria can be scored as follows: complete = 4 points; partially complete = 3 points; incomplete = 2 points; none = 1 point. Quality criteria can be scored as follows: very good = 4 points; good = 3 points; moderate = 2 points; poor = 1 point. Item 1 and 6 are measured on a 4-point Likert scale, the same as the aforementioned quality criteria.

The D-Catch instrument is a modification of the Scale for Degrees in Accuracy of Nursing Diagnoses (Lunney 2001, p. 36, p. 276) and the Cat-ch-Ing instrument (Björvell 2002), with respect to criteria and information structure. The D-Catch instrument consists of a chronological descriptive accuracy construct (record structure, admission data, interventions, progress and outcome evaluations, and legibility) and a diagnostic accuracy construct (nursing diagnosis). The inter-rater reliability of the D-Catch instrument was tested on a convenience sample of the first seven hospitals (25 wards and 250 records), Cohen’s weighted kappa ($K_w$) varies from: 0.742 – 0.896. Internal consistency reliability for 245 patient records was calculated by Cronbach’s Alpha: 0.722.

Population and sample
Of the 94 medical centres in the Netherlands, (86 general hospitals and 8 university hospitals), we randomly selected 10 of these hospitals, stratification by province was applied. As four hospital manager directors declined, they were replaced by other hospital directors from that region with a response rate of 4 out of 6.

In 10 hospitals—35 wards—341 records were assessed, comprising the sample size of the study. The selection of the wards was carried out by the manager director of the hospital in question. The manager directors were asked to select at least one ward per hospital. It appeared to be unfeasible to take a random sample of wards per hospital; therefore, the manager directors asked heads of the nursing staff to volunteer in reviewing records. On the day of the measurement, a nurse of the ward was asked to select 10 records out of all records available in the ward on the basis of two criteria: (1) patients’ length of stay was at least 3 days; and (2) patients’ ability to give written informed consent. In case of rather large wards it was possible to take an additional sample of ten records to review from the same ward. The records were assessed by individual external reviewers who worked in pairs. Each record was assessed by both reviewers independently. Afterwards they discussed their scores until a consensus and final accuracy score were reached.
To be qualified as a reviewer, it was required to accomplish a 20-hour training addressing the theoretical background of nursing documentation and measurement skills. Training also included a skill program on how to reach consensus by using discussion techniques after each record is assessed separately. Ward nurses were not familiar with the content of the D-Catch instrument and were not informed about when and where the assessments were to take place. Registered nurses (n= 4) and fourth-year bachelor’s degree nursing students (n= 8) who received the 20 hours training reviewed the records.

**Statistical analyses**
For the statistical analyses, the SPSS Benelux software package version 14 was used. Frequencies in percentages scores, means and standard deviations were calculated. Explorative factor analysis with principal components and varimax rotation was performed to confirm underlying constructs. We aggregated and transformed construct scores according to a 100-point scale.

**Results**
We assessed patient records (n= 341) from 10 hospitals, including 35 wards (Table 1) and seven different specialties (Table 2).

**Table 1 Sample accuracy of the nursing reports**

<table>
<thead>
<tr>
<th>Hospital category</th>
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<th>n of Wards</th>
<th>n of Records</th>
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<tr>
<td>General</td>
<td>9</td>
<td>32</td>
<td>296</td>
<td>1746</td>
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<tr>
<td>University</td>
<td>1</td>
<td>3</td>
<td>45</td>
<td>175</td>
</tr>
<tr>
<td>Total General &amp; university</td>
<td>10</td>
<td>35</td>
<td>341</td>
<td>1921</td>
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</table>
Table 2  Nursing wards in sample

<table>
<thead>
<tr>
<th>Wards</th>
<th>n of Hospitals</th>
<th>n of Wards</th>
<th>n of Records</th>
<th>n of Diagnoses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal medicine(^a)</td>
<td>9/10</td>
<td>11</td>
<td>110</td>
<td>710</td>
</tr>
<tr>
<td>Intensive care</td>
<td>2/10</td>
<td>2</td>
<td>17</td>
<td>77</td>
</tr>
<tr>
<td>Neurology</td>
<td>6/10</td>
<td>6</td>
<td>70</td>
<td>458</td>
</tr>
<tr>
<td>Obstetrics</td>
<td>1/10</td>
<td>1</td>
<td>18</td>
<td>40</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td>4/10</td>
<td>4</td>
<td>48</td>
<td>176</td>
</tr>
<tr>
<td>Paediatric medium care(^b)</td>
<td>1/10</td>
<td>1</td>
<td>10</td>
<td>117</td>
</tr>
<tr>
<td>Surgery(^c)</td>
<td>10/10</td>
<td>10</td>
<td>68</td>
<td>343</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>10/10</strong></td>
<td><strong>35</strong></td>
<td><strong>341</strong></td>
<td><strong>1921</strong></td>
</tr>
</tbody>
</table>

\(^a\)Internal medicine wards include specific care units for medical oncology, haematology, cardiology, and pulmonology.

\(^b\)Paediatric ward with units for specialized care for children under 16 years of age.

\(^c\)Surgical wards include specific care units for surgical oncology, urology, and plastic surgery.

Highest accuracy scores were found on the admission report and the progress and outcome evaluations: resp. 80% and 64% of the records revealed a score over 5 (range: 2-8). Lowest scores were found on the accuracy of the documentation of the interventions: 5 percent of the records revealed a score higher than 5 (2-8) (Table 3). The mean (SD) number of diagnoses was 6 (4.3) diagnoses per record. Five records described no diagnoses, and eight records contained 20 diagnoses, which was the maximum number of diagnoses observed.

Of the 341 records examined, 28% contained all of the nursing process phases, 34% were more or less structured according to the nursing process phases, and 38% were not structured at all according to these phases. The personal details of patients (name, address, date of birth, marital status) were present in over 95% of the nursing records. More than 50% of the admission information was complete and contained medical diagnoses and reasons for admission. In these records, most of the notes were clear and contained relevant information.

At least 50% of the progress evaluations were linked to diagnoses and interventions and appeared to logically result from the diagnosis. In more than 50% of the notes, however, the evaluations contained unnecessary wording or lacked relevant
information. Thus, on the basis of quantity and quality criteria for diagnoses, these records were scored as “incomplete” and “ambiguous.” This translated to an accuracy sum score of 4 (range: 2-8 points) for records that listed diagnostic labels but no related factors or diagnostic labels and no signs and/or symptoms. Less than 50% of the interventions were related to diagnoses, and in more than 50% of the intervention notes, the purpose of the intervention was unclear. Although some correct notes did exist, in over 50% of the intervention notes, the reports contained unnecessary wording or lacked relevant information. Notes were incorrect, for example, if they consisted of incomplete sentences and non-standard abbreviations that could be misinterpreted.

Factor analyses confirmed our previous findings that the D-Catch captures three constructs (Paans et al. 2010). Based on patterns of item loadings, the item ‘diagnoses’ was the only variable with substantial loading on component two (0.907) and a low loading on component one (0.230). The chronological descriptive accuracy construct contains the following items: accuracy of the structure of the nursing record; the accuracy of the nursing report on the admission, the interventions, and the nursing progress and outcome evaluations. The diagnostic accuracy construct contains only one item: the accuracy of the nursing diagnoses. The legibility accuracy construct contains only one item as well. As a result of recoding the scale scores to a 100-point scale, we found that nursing documentation was more chronologically descriptive than diagnoses based. The chronological descriptive construct had a mean (SD) score of 54 (15), whereas the diagnostic construct had a mean score of 40 (27) and the legibility construct had a mean score of 41 (27).

Table 3 D-Catch Scores of Accuracy of Documentation in the Nursing Record

<table>
<thead>
<tr>
<th>Items of the D-Catch instrument</th>
<th>Scale</th>
<th>Scale Scores in Percentages</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy of the Record Structure</td>
<td>1-4</td>
<td>1 2 3 4</td>
<td>341</td>
</tr>
<tr>
<td>Accuracy of the Admission Documentation</td>
<td>2-8</td>
<td>&lt;3 &gt;3 &lt;5 &gt;5 &lt;6 &gt;6 &lt;8</td>
<td>341</td>
</tr>
<tr>
<td>Accuracy of the Diagnosis Documentation</td>
<td>2-8</td>
<td>&lt;3 &gt;3 &lt;5 &gt;5 &lt;6 &gt;6 &lt;8</td>
<td>336</td>
</tr>
<tr>
<td>Accuracy of the Intervention Documentation</td>
<td>2-8</td>
<td>&lt;3 &gt;3 &lt;5 &gt;5 &lt;6 &gt;6 &lt;8</td>
<td>341</td>
</tr>
<tr>
<td>Accuracy of the Progress and Outcome Evaluation</td>
<td>2-8</td>
<td>&lt;3 &gt;3 &lt;5 &gt;5 &lt;6 &gt;6 &lt;8</td>
<td>341</td>
</tr>
<tr>
<td>Legibility</td>
<td>1-4</td>
<td>1 2 3 4</td>
<td>341</td>
</tr>
</tbody>
</table>

a Note: D-Catch measurement variable one and six on a four-point scale, variable 2-5 as a sum score of a four-point quality and quantity criteria scale (2-8).

b Scale scores: 1, poor; 2, moderate; 3, good; 4, very good.
Discussion

Limitations of the study
This study had limitations in several aspects. We reviewed nurses’ documentation in seven specialties (35 wards) that differed in the conditions of the patients, patient-to-staff ratio, and the nursing staff’s educational background and years of experience. These and other factors, such as interdisciplinary or environmental characteristics of the ward, might influence or confound accuracy scores. The influence of these factors was not assessed in our study.

The ward-level sampling method we used in the present study required that managers to ask heads of ward staff to volunteer in reviewing the records. This way of sampling may have caused potential selection bias at the ward level. Therefore, the records we included in our study may have been reviewed by nurses that oversaw nursing documentation (i.e., nurses that had a specific interest in nursing documentation).

The measurement process
This study presents our findings on the accuracy of nursing documentation in various hospitals and wards in the Netherlands. We used a random sample in the case of 6 out of 10 hospitals. Manager Directors of 4 of the 10 hospitals included in the first sample declined to participate in our accuracy measurement study and had to be replaced. Manager Directors did not explain their reasons for declining, and we did not pursue this issue. We replaced the hospitals that declined by approaching hospital managers in the same region as those that declined. This may have confounded random sampling. However, we found no significant differences between the nursing documentation accuracy scores of the four replacement hospitals and those of the six randomly selected hospitals. Therefore, we believe that our sampling method did not affect representativeness due to selection bias.

Initially, we had planned to assess 10 records from each of the participating wards; however, this was not possible. In the intensive care and surgical wards, not all patients were able to give informed consent. Also, in small wards with few patients, the number of available records was sometimes insufficient.

Twelve pairs of reviewers assessed the nursing documentation. This approach was feasible in hospital practice despite differences in the documentation.

Accuracy of nursing documentation
Although the records were mainly structured according to the phases of the nursing process, the reports tended to be written and organized in chronological order. That is, the first registrations were located at the beginning of the report, whereas new information was located towards the end of the report. We found that records containing several accurate diagnoses also contained inaccurate ones. Generally, progress and outcome evaluations were linked to diagnoses.
However, the evaluations represented more general appraisals of the patients’ current state of health rather than reflections based on diagnoses. Indeed, we mainly observed reflections on interventions, rather than documentation related to specific diagnoses.

The higher score of the chronological descriptive construct (54 ± 15) compared to that of the diagnostic construct (40 ± 27) confirms our observation that nurses tend to use a more descriptive approach in documenting than a diagnoses-based approach. This may be further explained by the presupposition that, despite using pre-structured record forms based on nursing process phases, nurses do not systematically report their findings according to these phases. For example, nurses can report evaluations of the effect of interventions in progress and outcome reports without mentioning any diagnoses. In this case, it is evident that there may be no logical relationship between interventions and diagnoses (Martin 1995, Nordström & Gardulf 1996).

Benner and colleagues (1996, 2006) and Pesut and Herman (1999, p.10, p. 24) noted that expert nurses especially are more outcome focused and less problem focussed. If this is indeed the case, nurses may first choose nursing actions that will most likely achieve an outcome. Thus, on the basis of a patient’s history, expert nurses reason on how and what type of care to deliver to the patient, putting together possible outcomes and making clinical decisions in terms of interventions (Pesut & Herman 1999). However, nurses may not check or properly verify whether their chosen interventions are linked to a patient’s problems. Moreover, nurses generally do not describe these verifications in their reports. This may also suggest that nurses usually do not verify their diagnoses with their patients as well (Wilkinson 2007).

In the present study, most of the records we assessed included only diagnostic labels but not related factors or signs and symptoms. One reason for this finding may be that diagnostic inference requires more than just naming and classifying. Deriving diagnoses can be complex because deriving diagnoses involves a search for or a verifiable discovery of the related factors of a health problem that may not always be easily accessible (Bandman & Bandman 1995, p. 91). We found that, in particular, reports involving extended-stay situations were repetitious and contained redundancies of evaluative information. The sequential nature of the documentation may explain why these reports contained redundant information. Additionally, as an aid to retaining information, nurses may rephrase information that they had previously documented.

Choosing nursing diagnoses as the core element of nursing documentation may be helpful for avoiding redundancy and may stimulate nurses to structure their reports (Wilkinson 2007). On the other hand, revising the nursing process into a more flexible process that would make the core element focus on nursing interventions and progress and outcome evaluations may be helpful for experienced nurses (Pesut & Herman 1998, 1999, p. 71-96, Kautz et al. 2006). The latter scenario may only be feasible when nurses become accountable for verifying their documentation in terms of a diagnostic hypothesis or a current diagnosis and when nurses report these verifications accurately (Pesut & Herman 1999).
There are diverse reasons why nurses’ reports are in general unsystematic and incoherent (Alfaro-Lefevre 2004, p. 30, Smith et al. 2008, p. 89-100, Carpenito-Moyet 2008, p. 2-8). The findings of our study led us to hypothesize that the use of a nursing process-based documentation system is insufficient to achieve accurate nursing documentation. Despite such a documentation system, nurses fail to systematically document their findings according to the nursing process. Knowledge about how to derive and to report diagnoses and interventions may be insufficient as well (Lunney 2001, 2003, Björvell 2002, Müller-Staub 2007). A second reason relates to the hypothesis that reasoning skills and nurses’ disposition towards diagnostic reasoning influence the accuracy of nursing diagnoses and the way nurses structure their reports (Facione et al. 1994, Facione 2000, Lunney 2001, 2003, Kautz et al. 2006). Yet another reason may relate to the idea that the way nurses report their clinical judgment may reflect the characteristics of nurses’ clinical judgment; for instance, the ability to recognize patterns in clinical situations that are linked to patterns in the nursing process (Kautz et al. 2006, Wilkinson 2007).

One way to address the problem of inaccurate nursing documentation is to use the PES structure as a guideline for nursing documentation. When nurses formulate diagnoses based on the PES structure, the diagnoses contain a problem label (P); a cause, related factor, or aetiology (E); and signs and/or symptoms (S). Interventions should be described in terms of nursing actions and should be linked to a diagnosis (Carpenito-Moyet 1991, 2008, Johnson et al. 2007). Nurses can learn how to use diagnostic structures such as the PES structure to report accurately. Novice nurses may need to learn how to use the PES structure as a tool to aid them in cultivating diagnostic reasoning, which in turn will enable them to document accurately. The influence of the PES structure on the accuracy of nursing diagnoses may be more apparent when a nurse is specifically asked to use this structure consciously and actively when deriving diagnoses.

With respect to expert nurses, precept structures may impede or hinder their reasoning process, since expert nurses use the nursing process in a flexible and dynamic way (Benner 2006). Expert nurses know what steps can be safely skipped, combined, or delayed. Their reasoning approach may not always be transparent and understandable to other nurses or novice nurses that read the expert nurses’ reports. Novice nurses need to follow steps more rigidly, carefully reflecting on each step (Alfaro-LeFevre 2004, p. 63). Expert and novice nurses may benefit differently from a pre-structured record content. Expert nurses do not have to use diagnostic structures to analyse a patient’s problems, apart from using the structure to convey their findings in a way that the resulting nursing documentation is accurate. Nursing documentation must be understandable and must be presented in a logical order, if it is to be understood by patients and by nurses of various levels of experience.

Several factors might influence nurses’ documentation, such as disruption of documentation activities, limited competence in documenting, confidence in
documentation skills, and inadequate supervision or inadequate staff development (Cheevakasemsook et al. 2006). Still, in general, there appears to be no interdisciplinary agreement on what accurate nursing documentation is and what it is not. For instance, in hospital practice nurses might not be capable of detecting sharp distinctions across different ‘diseases’ and ‘levels of wellness’ or might be completely unfamiliar with nursing diagnoses (Bandman & Bandman 1995, Hasegawa et al. 2007). Unfamiliarity with the nursing diagnosis domain and the diagnostic language used by nurses, may lead to uncertainties and misunderstandings by both nurses and physicians. In contrast, knowledge and a positive attitude towards nursing diagnoses by nurses, physicians, and hospital administrators may stimulate nurses to take responsibility for diagnoses documentation (Björvell 2002).

Recommendations

On the basis of the results of this study, we recommend that electronic record designers prepare systems that support nurses in improving the accuracy of their reports. If we are to reach the goal of attaining accurate nursing documentation in the future, the ideal system—a logically structured electronic documentation system—should have the following characteristics: (1) flexibility in using the phases of the nursing process, and (2) be supplemented with knowledge sources and guidelines that can aid nurses of various levels in combining all nursing process variables (Mason & Attree 1997, Goossen 2000, McCargar et al. 2001, Mayes 2001). The effect of this type of document innovation will be an interesting new area of research.

The outcomes of the present study are comparable to those of previous studies accomplished in Sweden, Switzerland, and the United States of America. Nevertheless, we recommend conducting an international cooperative study that will assess the accuracy of nursing documentation using a measurement instrument similar to the one used in the present study. This type of study will enable us to acquire additional knowledge and to explore the nature of nursing documentation in more depth.

Clinical implications

The present study may motivate and encourage nurse managers and nurses to develop, implement, and use documentation guidelines and flexible and efficient electronic documentation systems in their daily hospital practice. Moreover, the results of this study may be relevant in other countries that are in a similar situation as the Netherlands concerning the application of digital documentation systems instead of handwritten records.
Conclusion

On the basis of our findings, we conclude that, in general, nursing diagnoses did not comprise the core element of nursing documentation. In addition, we often encountered records that contained various levels of accuracy, indicating that the concept of “accuracy of nursing documentation” appears to be heterogeneous. Our findings suggest that nursing documentation accuracy needs to be improved in order to promote patient safety (Heartfield 1996, Needleman & Buerhaus 2003). Determinants influencing the documentation process might be multifactorial; thus, additional research is needed to enhance accuracy in wards of different specialties and nursing staff. The implementation and use of electronically produced documentation, supplemented with resources such as the PES format, might not be the only solution for obtaining accuracy. However, it might help nurses to organize their notes more accurately. Additional studies are required to analyze in more depth whether nurses’ diagnostic skills, the use of diagnostic structures, supplementary factors affecting the accuracy of nursing documentation, or a combination of these variables influenced our findings.
Prevalence of accurate nursing documentation in the patient record

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CHAPTER 5

Determinants of the accuracy of nursing diagnoses: influence of ready knowledge, knowledge sources, disposition toward critical thinking, and reasoning skills.


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Chapter 5

Introduction

Nurses use nursing diagnoses as the basis for providing adequate nursing care (Lunney 2001, 2007). An accurate nursing diagnosis is essential to provide high-quality nursing care (Lunney 2001, 2003). Inaccurate identification, analysis, and reporting of actual and potential problems in terms of an understandable diagnosis could have an adverse effect on the quality of patient care (Kautz, et al. 2006; Lunney, 2007).

Background

A nursing diagnosis is described as ‘A clinical judgment about individual, family, or community responses to actual or potential health problems/life processes’ (North American Nursing Diagnosis Association International; NANDA-I, 2004). Accurate diagnoses describe a patient’s problem, related factors (aetiology) and defining characteristics (signs and symptoms). Because of their relevance, diagnoses should also be written in unambiguous, clear language (Florin et al. 2005, Lunney 2001, Gordon 1994). Stating a problem in terms of its label without related factors and defining characteristics is a source of interpretation errors (Lunney 2001, 2003, Wilkinson 2007). Several factors are known to influence students’ and graduates’ diagnostic processes. Knowledge is an important factor, as suggested by Cholowski and Chan (1992) and Martin (1995). Hasegawa et al. (2007) and Ozsoy and Ardahan (2007) suggested that students might diagnose ailments more systematically if they had access to knowledge sources. Ozsoy and Ardahan (2007) and Gulmans (1994) differentiate ‘ready knowledge’ from ‘knowledge with the use of knowledge sources.’ Ready knowledge is knowledge that was acquired earlier and can be recalled by an individual.

Knowledge sources consist of information that can be looked up in reference works such as handbooks, protocols, datasets, assessment formats, and clinical paths (Goossen, 2000, Gulmans, 1994, Thompson et al. 2001). For nursing diagnoses, knowledge sources are useful for helping health care workers to formulate standardized terminology based on the North American Nursing Diagnosis Association International (NANDA–I).

The aim of using assessment formats based on functional health patterns and standard nursing diagnoses (labels), as included in the Handbook of Nursing Diagnoses (Carpenito 2002), is to achieve a greater number of accurate diagnoses (Carpenito 1991, Gordon 1994, 2005). Authors of handbooks suggest that greater standardization may lead to a less marked difference in interpretation of patient data (Carpenito 2002, Gordon 1994). To date, however, no known studies have been published that describe the effects of knowledge sources on the accuracy of nursing diagnoses.

One’s disposition toward critical thinking and reasoning skills should influence the accuracy of nursing diagnosis as well. Dispositions toward critical thinking include attributes, habits of mind, and attitudes toward using knowledge as well as
reasoning skills, such as open-mindedness, truth-seeking, analyticity, systematicity, inquisitiveness, and maturity (Facione & Facione 2006). Reasoning skills include inductive and deductive skills, such as skills in the analytical, inference, and evaluation fields. These skills are essential for the diagnostic process (Facione & Facione 2006, Fesler 2005, Gulmans 1994, Steward & Dempsey 2005).

Little information is available on how specific reasoning skills affect the formulation of accurate nursing diagnoses. Using knowledge sources to plan interventions based on a diagnosis seem to be related to nurses’ capacity for critical thinking and for applying their reasoning skills (Profetto-McGrath et al. 2003).

However, Lee (2006), Tanner (2005), and Turner (2005) concluded, based on their literature review, that no clear relationship has been demonstrated between specific reasoning skills and the quality of clinical nursing decisions. Several studies that focused on dispositions toward critical thinking and reasoning by nurses provided no information about whether nurses used their reasoning skills to attain the diagnoses reported (Edwards 2003, Lee et al. 2006, Stewart & Dempsey 2005).

The Study

The aim

The aim of the present study was twofold: (1) to determine how the use of knowledge sources affects accuracy of nursing diagnoses, and (2) to determine how knowledge, disposition toward critical thinking, and reasoning skills influence accuracy of nursing diagnoses. This was a pilot study that examined our methodological approach to studying how nursing students make diagnoses. If our approach proves to be feasible, then we will carry out a more comprehensive follow-up study of registered nurses throughout the Netherlands.

Research Questions

We addressed the following research questions related to the accuracy of nursing diagnoses:

1. What is the effect of knowledge sources?
2. What is the influence of knowledge?
3. What is the influence of disposition toward critical thinking?
4. What is the influence of reasoning skills?

Subjects and Methods

Design

A randomized, controlled trial design (RCT) was used to determine how knowledge sources affect the accuracy of nursing diagnoses. Two groups of nursing students were asked to formulate diagnoses based on an assessment interview with a standardized simulation patient (a professional actor). One group of students was allowed to use knowledge sources, while the other group was not.
To determine how knowledge, disposition toward critical thinking, and reasoning skills influence the accuracy of nursing diagnoses, we subsequently asked the participants to complete the following assessments: (1) knowledge inventory, (2) questionnaire that maps disposition toward critical thinking, and (3) reasoning test (Figure 1).

Population and Random Sample
Of the 300 third- and fourth-year students enrolled in the Bachelor of Nursing program at Hanze University, Groningen, the Netherlands, 100 students volunteered to take part in our study. All participants had at least 40 weeks of practical nursing experience. Group allocation took place by randomization: Each participant was given two sealed envelopes from which they had to choose one. The form inside the envelopes described whether the student was allocated to group A or group B. The researchers were unaware of the group allocation. 50 students were allocated to the experimental group (group A), and 50 students were allocated to the control group (group B). Group A students had access to knowledge sources, whereas group B students did not.

Students (n= 100) were sent to different admission rooms and were instructed to prepare for 10 minutes for an assessment interview with either a diabetes mellitus type 1 patient (n= 56) or a chronic obstructive pulmonary disease patient (COPD) (n= 44). The students were asked to formulate accurate diagnoses based on the assessment interview. On the basis of video recordings of the assessment interviews and on the notes of observers, we identified several script inconsistencies. Therefore, data from four respondents, allocated in group A, were excluded. Finally, 96 students were included in our study: 46 in group A, with knowledge sources and 50 in group B, without sources. Of the 96 students, 52 that assessed a diabetes patient (24 students in the experimental group and 28 students in the control group) and 44 students that assessed a COPD patient (22 students in the experimental group and 22 students in the control group). The interviews lasted at most 30 minutes. After the interviews, the students were given an additional 10 minutes to formulate diagnoses. The students were allowed to take notes during the interview.

In preparation for the assessment interviews, all students were given the following written information about the patient: name, gender, age and address; profession, family situation, and hobbies; medical history; reason for hospital admission; and description of the current situation. In addition, group A (n= 46) students were allowed to review the following knowledge sources as they prepared for the assessment interview, interviewed the patients, and formulated diagnoses:

1. An overview table with functional health patterns and standard nursing diagnoses (labels) per pattern as included in the Handbook of Nursing Diagnoses (Carpenito, 2002), hereafter referred to as “assessment format”;
2. The Handbook of Nursing Diagnoses (Carpenito, 2002)
3. The Handbook of Nursing Diagnoses, NANDA-I classification (NANDA-I, 2004) (all items were within reach on the table, including pen, notebook, and paper).
Group B (n= 50) students, however, did not have access to any reference material or to the assessment format. They were given a pen, notebook, and paper.

The entire procedure, starting from preparations for the assessment interview to noting on paper the diagnoses, was recorded on film and tape. During the interviews, an observer noted whenever the simulation patient failed to adhere to the script.

At the beginning of the study, the students were told that part of the study would be experimental, that they would be asked to complete questionnaires, and that the entire study would take about 2.5 hours of their time. All students gave informed consent. To ensure that the students would not prepare for the study ahead of time or discuss the details of the study among themselves, we asked each student to keep the contents and methods of the investigation confidential and to sign a confidentiality agreement form to this effect.
Chapter 5: Determinants of the accuracy of nursing diagnoses

To determine the effect of knowledge sources on the accuracy of nursing diagnoses and to determine the influence of ready knowledge, disposition toward critical thinking, and reasoning skills on the accuracy of nursing diagnoses.

**Figure 1 Research framework**

Determinants of the accuracy of nursing diagnoses

N= 100

Group A
With knowledge sources
N= 46

Group B
Without knowledge sources
N= 50

Measurement:
- Knowledge inventory
- Critical thinking disposition & Reasoning skills (CCTDI & HSRT)

N= 96
Instrumentation

Case Development
Two cases scenarios were developed. Both cases, along with an accompanying script for the simulation patient, were developed by two different groups of lecturers from Hanze University; there were four lecturers in each group. The development process was based on the Guidelines for Development of Written Case Studies (Lunney, 2001). The cases were subsequently assessed for specificity by two external Delphi panels on the basis of a semi-structured questionnaire. It was important that there were exactly six diagnoses per script; other diagnoses were demonstrably assessed as incorrect diagnoses. The script was also assessed for clarity (clear language and sentence structure) and nursing relevance. One of the Delphi panels consisted of lecturers that had a master’s degree in nursing science (n= 6) and fourth-year bachelor’s degree nursing students (n= 2). The other panel consisted of experienced nurses working in clinical practice that had either a post-graduate specialization or a master’s degree in nursing science (n= 6). A physician screened the case scenarios for medical correctness. Subsequently, the simulation patients were questioned during practice rounds by lecturers and students and assessed for script consistency. These practice rounds were recorded on film and tape and analyzed by two lecturers and two bachelor’s students for script consistency and behavior during the interviews. The simulation patients were instructed to act like an introverted, adequately responding patient who answered questions put to him and who provided only an occasional brief elaboration; everything was included in the script. After the last practice rounds, the script was considered fully consistent and it was adopted for the study. Following these rounds, the four patients—all of them professional actors with over five years of experience as simulation patients in nursing allied health and medical education programs—were attuned to one another, also with respect to behavior. All participants had attended courses on diabetes and COPD, and their knowledge in these fields had been assessed by examinations. The students were assumed to possess basic knowledge of the problem areas to be diagnosed.

Accuracy of Nursing Diagnoses
The accuracy of nursing diagnoses was measured by D-Catch, an instrument that quantifies the degree of accuracy in written diagnoses. The D-Catch instrument is an integration of the Cat-ch-Ing instrument (Björvel et al. 2000, Björvel 2002) and the Scale for Degrees of Accuracy in Nursing Diagnosis (Lunney 2001).

Initially, both scales were independently tested in a pilot study that screened 60 nursing records in two hospitals at four different nursing wards in the Netherlands. Due to low inter-rater reliability in the Dutch study, even after the screeners had practiced for quite a while, we decided to integrate the two instruments. The combined instrument, D-Catch, was tested in five hospitals by screening 100 records. Cohen’s weighted Kappa inter-rater reliability of the quantitative criteria was between .4 and .843 and that of the qualitative criteria was between .436
and .886. The D-Catch instrument is composed of two sections: (1) Quantity, which addresses the question, are the components of the diagnosis present? and (2) Quality, which addresses the question, what is the quality of the description with respect to relevancy, unambiguity, and linguistic correctness? The D-Catch instrument is shown in Figure 2.

Because qualitative and quantitative criteria appear to be associated, the total score for the accuracy of the reported diagnoses was calculated as the sum of the quantitative and qualitative scores (Cronbach’s alpha 0.94). Therefore, for each student, the number of relevant diagnoses was calculated. Adequate disposition toward critical thinking and reasoning skills are thought to be key in the process of diagnostic reasoning. Therefore, we hypothesized that this disposition and skills are associated with the degree of accuracy in reported diagnoses in the sense that positive scores on critical thinking disposition and reasoning skills are associated with more accurate diagnoses.
Figure 2 D-Catch Diagnoses Criteria

Quantity (Main question: are the components of the diagnosis present?) (P = Problem, E= Aetiology, S= Signs and Symptoms, I= reference to a potential intervention)

4 points: \((P+E+S) \rightarrow (I)\) Complete

3 points: \((P)+(E)+(S) \rightarrow (?)\) Partly

or

\((P)+(E)+(?) \rightarrow (I)\)

or

\((P)+(?)+(S) \rightarrow (I)\)

2 points: \((P)+(?)+(?) \rightarrow (I)\) Incomplete

or

\((P)+(E)+(?) \rightarrow (?)\)

or

\((P)+(?)+(S) \rightarrow (?)\)

1 point: \((P)+(?)+(?) \rightarrow (?)\) Hardly

Quality (Main question: what is the quality of the description with respect to relevancy, unambiguity and linguistic correctness?)

4 points: (relevant)+(completely unambiguous)+(linguistically correct) Very good

3 points: (relevant)+(not unambiguous)+(linguistically correct) Good

2 points: (unclear but relevant)+(ambiguous)+(linguistically incorrect) Moderate

1 point: (not relevant)+(ambiguous)+(linguistically incorrect) Poor
Ready Knowledge
A knowledge inventory was used to determine the association between knowledge and the accuracy of nursing diagnoses. The knowledge inventory comprised four case-related multiple-choice questions having four derivatives; only one answer was correct. The questions focused on content of the case presented. Two lecturers in nursing together with two fourth-year nursing students developed the questionnaire. A physician screened the questionnaire for medical correctness.

Disposition Toward Critical Thinking
The California Critical Thinking Disposition Inventory (CCTDI) was used to assess the influence of disposition toward critical thinking on the accuracy of nursing diagnoses. The CCTDI consists of 75 statements and measures respondents’ attitudes toward the use of knowledge and their disposition toward critical thinking. The respondents indicated the extent to which they agreed or disagreed with a certain statement on a six-point scale. This inventory was selected because it has been validated in a nursing context (Facione et al. 1994, Facione 2000).

The CCTDI consists of seven domains:
1. Truth-seeking: being eager to seek the truth, being flexible in considering alternatives and opinions.
2. Open-mindedness: being open-minded and tolerant of divergent views with sensitivity to the possibility of one’s own bias.
3. Analyticity: being alert to potentially problematic situations, anticipating certain results or consequences.
4. Systematicity: being orderly and focused, aiming to correctly map out the situation both in linear and in non-linear problem situations, looking for relevant information.
5. Self-Confidence: being confident, trusting oneself to make good judgments, and believing that others trust you as well.
6. Inquisitiveness: wanting to be well informed, wanting to know how things work and fit together, and being willing to learn.
7. Maturity: making reflective judgments in situations where problems cannot be properly structured.

The CCTDI has eight scores: the seven scale scores and the total score. Each scale score ranges from 10 to 60. Total scores range from 70 to 420. Scores ranging from 10 to 30 indicate an increasingly negative disposition; scores ranging from 40 to 60 indicate an increasingly positive disposition; scores between 30 and 40 indicate ambivalence, i.e. no clear expression of either a positive or a negative disposition. The recommended cutoff scores for each scale is 40. A score of less than 40 shows weakness. A total score of less than 280 could be used as a cutoff indicator of overall deficiency in one’s disposition toward critical thinking (Facione 2002).
Various studies show a sufficient degree of validity and reliability for the CCTDI (Kakai 2003, Kawashima & Petrini 2004, Smith-Blair & Neighbors, 2000, Stewart & Dempsey 2005, Tiwari et al. 2003, Yeh 2002). The Expert Consensus Statement describes the validation process (Facione 2000). Reliability was quantified by Cronbach’s alpha and was 0.90 for the entire instrument, varying between 0.60 and 0.70 for the seven subscales (n = 1019).

**Reasoning Skills**

We used the Health Science Reasoning Test (HSRT) to determine the association between reasoning skills and accuracy of nursing diagnoses. The HSRT consists of 33 questions and assesses the reasoning capacity of healthcare and nursing professionals (Facione & Facione 2006). We selected the HSRT for our study because its contents were used in a context that is easily recognizable for nurses. The HSRT covers the following domains:

1. **Analyses (two kinds of meanings):**
   a. understanding the significance of experiences, opinions, situations, procedures, and criteria;
   b. understanding connections between statements, questions, descriptions or presented convictions, experiences, reasons, sources of information, and opinions that may lead to a conclusion.

2. **Evaluation (two kinds of meanings):**
   a. ability to assess the credibility of statements, opinions, experiences, convictions, and being able to determine relationships;
   b. ability to reflect on procedures and results, to judge them, and to be able to provide convincing arguments for such.

3. **Inference:** ability to formulate assumptions and hypotheses and to consider which information is relevant.

4. **Deductive:** ability to refine the truth of a conclusion; for example, the correct nursing diagnosis is guaranteed by the reasoning.

5. **Inductive:** ability to arrive at a general rule, which is more or less probable on the basis of a finite number of observations.

The HSRT subscales use six items to provide a guide for test takers’ abilities in the measured areas of analysis, inference, and evaluation. For each of these subscales, a score of 5 or 6 indicates strong reasoning skills, a score of \( \leq 2 \) indicates weak reasoning skills, and a score of 3 or 4 indicates average reasoning skills. Deductive and inductive scales each use 10 items. For each of these subscales, a score of 8, 9, or 10 indicates strong deductive and inductive skills, and scores from 0 to 3 indicate weak deductive and inductive skills (Facione & Facione 2006).

Various studies show a sufficient degree of validity and reliability for the HSRT (Facione & Facione 2006). The HSRT test manual is based on the consensus definition of critical thinking that was developed in the Delphi Study (Facione & Facione 2006). Overall, the reliability quantified by Cronbach’s alpha was 0.81, ranging between 0.78 and 0.84 for the specific domains (n=444).

Linguistic validation of the CCTDI and the HSRT was done by forward and
backward translation by two independent translators. The final translation was assessed by a third translator and approved to be relevant in the Dutch nursing context by a panel of nursing scientists (n = 6). Reliability of the Dutch version of the CCTDI quantified by Cronbach’s alpha was 0.73. Reliability of the Dutch version of the HSRT was 0.64, also quantified by Cronbach’s alpha (n=96).

**Data Analysis**

Group means and standard deviations were calculated, along with medians and ranges. Differences between the groups were analyzed by Mann-Whitney and Kruskal Wallis tests for ordinal data and Chi-Square test. The association between the accuracy of nursing diagnoses and knowledge was analyzed by Kendall’s Tau.

**Results**

**Demographic Data**
Third-year nursing students (n=42) and fourth-year nursing students (n=54) were included. Their mean (SD) age was 23 (3) years, and 81% were female.

**Accuracy of Nursing Diagnoses**
The median (range) score of the accuracy of nursing diagnoses (n=414) was 4 (2–8). Both cases—diabetic and COPD cases—included six relevant diagnoses. The mean (SD) number of relevant diagnoses for each student was 4 (1.6). There were no significant differences between the two cases concerning the accuracy of the nursing diagnoses and the number of relevant diagnoses. Cohen’s Kappa inter-rater agreement of the first diagnoses varied between .811 and .518.

**The Effect of Knowledge Sources on Diagnoses Accuracy**
No significant difference was found in the accuracy of the diagnoses between group A (access to knowledge sources) and group B (no access to knowledge sources) (Table 1). Based on a mean score of 4, a SD of 1.1, and a sample size of 96, the power to detect a minimal difference of 1 was 99%. The number of relevant diagnoses by each student in group A was significantly higher than that by each student in group B (Table 1).
The mean (SD) length of time group A students actually used knowledge sources was 4.5 (3.5) minutes. We were able to determine the length of time by analyzing the videotape record in 36 of 46 cases.
Table 1 Comparison of the number of relevant diagnosis by students with access to knowledge sources (Group A) and without access to knowledge sources (Group B)

<table>
<thead>
<tr>
<th></th>
<th>Group A median (range)</th>
<th>Group B median (range)</th>
<th>P-Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative criteria diagnoses</td>
<td>2.2 (1.0 - 4.0)</td>
<td>2.1 (1.0 - 4.0)</td>
<td>.498</td>
</tr>
<tr>
<td>Qualitative criteria diagnoses</td>
<td>2.0 (1.0 - 4.0)</td>
<td>1.7 (1.0 - 4.0)</td>
<td>.204</td>
</tr>
<tr>
<td>Accuracy of the diagnoses</td>
<td>4.0 (2.0 - 7.0)</td>
<td>4.0 (2.0 - 8.0)</td>
<td>.955</td>
</tr>
<tr>
<td>Number of relevant diagnoses</td>
<td>4.0 (1.0 - 6.0)</td>
<td>3.0 (1.0 - 6.0)</td>
<td>.041*</td>
</tr>
</tbody>
</table>

* Mann-Whitney test.
* P < .05.

The Influence of Ready Knowledge on the Accuracy of Diagnoses
A very weak, insignificant correlation was found between ready knowledge and the degree of accuracy of the diagnoses. Kendall’s Tau correlation coefficient was .090, p=.258. The median (range) score on the knowledge inventory was 3 (0–4) for groups A and B.

The Influence of Disposition Toward Critical Thinking on the Accuracy of Diagnoses
The mean (SD) score on each domain of the CCTDI was 42.3 (5.1). The mean (SD) score on all seven CCTDI domains was 300 (22). Students scored lowest on the open-mindedness domain, with 57% of all students scoring below the cutoff score of 40. Students scored highest on the inquisitiveness domain, with 9% of all students scoring below 40 (Table 2).
Table 2 Percentage of nursing students that scored below the cutoff scores for the CCTDI (N = 96)

<table>
<thead>
<tr>
<th>Scale</th>
<th>% of scores below the cutoff score(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truth-seeking</td>
<td>52</td>
</tr>
<tr>
<td>Open-mindedness</td>
<td>57</td>
</tr>
<tr>
<td>Analyticity</td>
<td>19</td>
</tr>
<tr>
<td>Systematicity</td>
<td>22</td>
</tr>
<tr>
<td>Self-confidence</td>
<td>12</td>
</tr>
<tr>
<td>Inquisitiveness</td>
<td>9</td>
</tr>
<tr>
<td>Maturity</td>
<td>17</td>
</tr>
<tr>
<td>Total CCTDI</td>
<td>17</td>
</tr>
</tbody>
</table>

Note: CCTDI = California Critical Thinking Disposition Inventory.
\(^a\)Cutoff score for individual scales of the CCTDI is 40; cutoff score for the total CCTDI is 280.

No significant differences were found between the CCTDI scores and groups A and B. There were no significant differences in the accuracy of nursing diagnoses and the number of relevant diagnoses between students with total CCTDI scores of less than 280 (cutoff indicator) and students with total CCTDI scores ranging from 280 to 420.

No significant difference was found on the accuracy of nursing diagnoses of students scoring < 40 and that of students scoring ≥ 40 on the subcategories of the CCTDI (Table 3).
### Table 3 CTDI Scores of nursing students: the effect of disposition toward critical thinking on the accuracy of diagnoses

<table>
<thead>
<tr>
<th>Scale(^a)</th>
<th>Students scoring above or below the cutoff score(^b)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truth-seeking</td>
<td>&lt; 40</td>
<td>&gt; 40</td>
</tr>
<tr>
<td>Accuracy of the ND</td>
<td>4.0 (2-7)</td>
<td>4.0 (2-8)</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>3.0 (1-6)</td>
<td>3.0 (1-6)</td>
</tr>
<tr>
<td>Open-mindedness</td>
<td>&lt; 40</td>
<td>&gt; 40</td>
</tr>
<tr>
<td>Accuracy of the ND</td>
<td>4.0 (2-7)</td>
<td>4.0 (2-8)</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>4.0 (1-6)</td>
<td>3.0 (1-6)</td>
</tr>
<tr>
<td>Analyticity</td>
<td>&lt;40</td>
<td>&gt;40</td>
</tr>
<tr>
<td>Accuracy of the ND</td>
<td>4.0 (2-7)</td>
<td>4.0 (2-8)</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>3.0 (1-6)</td>
<td>4.0 (1-6)</td>
</tr>
<tr>
<td>Systematicity</td>
<td>&lt;40</td>
<td>&gt;40</td>
</tr>
<tr>
<td>Accuracy of the ND</td>
<td>3.7 (2-7)</td>
<td>4.0 (2-8)</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>3.0 (1-6)</td>
<td>3.0 (1-6)</td>
</tr>
<tr>
<td>Self-confidence</td>
<td>&lt;40</td>
<td>&gt;40</td>
</tr>
<tr>
<td>Accuracy of the ND</td>
<td>3.8 (2-5)</td>
<td>4.0 (2-8)</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>5.0 (1-6)</td>
<td>3.0 (1-6)</td>
</tr>
<tr>
<td>Inquisitiveness</td>
<td>&lt;40</td>
<td>&gt;40</td>
</tr>
<tr>
<td>Accuracy of the ND</td>
<td>4.0 (3-5)</td>
<td>4.0 (2-8)</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>4.0 (1-6)</td>
<td>3.0 (1-6)</td>
</tr>
<tr>
<td>Maturity</td>
<td>&lt;40</td>
<td>&gt;40</td>
</tr>
<tr>
<td>Accuracy of the ND</td>
<td>3.9 (2-6)</td>
<td>4.0 (2-8)</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>3.0 (1-6)</td>
<td>4.0 (1-6)</td>
</tr>
<tr>
<td>Total score</td>
<td>&lt;280</td>
<td>&gt;280</td>
</tr>
<tr>
<td>Accuracy of the ND</td>
<td>3.9 (2-7)</td>
<td>4.0 (2-8)</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>3.5 (1-6)</td>
<td>3.0 (1-6)</td>
</tr>
</tbody>
</table>

Note: CTDI = California Critical Thinking Disposition Inventory; ND = nursing diagnoses.
\(^a\)Cutoff score for individual scales of the CTDI is 40; cutoff score for the total CTDI is 280.
\(^b\)Median (range).
Chapter 5

The Influence of Reasoning Skills on the Accuracy of Diagnoses

On average, students scored highest on the evaluate and inductive domains of the HSRT. Students scored lowest on the analysis and inference domains (Table 4).

Table 4 Percentage of nursing students that scored weak, average, or strong on the HSRT (N=96)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Weak (%)</th>
<th>Average (%)</th>
<th>Strong (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis</td>
<td>35</td>
<td>49</td>
<td>16</td>
</tr>
<tr>
<td>Inference</td>
<td>41</td>
<td>51</td>
<td>8</td>
</tr>
<tr>
<td>Evaluate</td>
<td>1</td>
<td>34</td>
<td>65</td>
</tr>
<tr>
<td>Deductive</td>
<td>28</td>
<td>60</td>
<td>12</td>
</tr>
<tr>
<td>Inductive</td>
<td>0</td>
<td>46</td>
<td>54</td>
</tr>
</tbody>
</table>

Note: HSRT = Health Science Reasoning Test.

No significant differences were found between the HSRT domains and groups A and B. Students that scored high on the analysis domain of the HSRT scored significantly higher on the accuracy of their diagnoses (5 vs. 4; p= .013) than students that scored low on the analysis domain. No significant differences were found in the accuracy of diagnoses of students that scored low, average, or high on the other subcategories of the HSRT (Table 5).
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Table 5 HSRT scores of nursing students: the effect of reasoning skills on the accuracy of diagnoses

<table>
<thead>
<tr>
<th>Scale</th>
<th>HSRT Scores&lt;sup&gt;a&lt;/sup&gt;</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis</td>
<td>Weak</td>
<td>Average</td>
<td>Strong</td>
<td>P-value</td>
</tr>
<tr>
<td>Accuracy of the ND</td>
<td>4.0 (2-6)</td>
<td>3.8 (2-6)</td>
<td>5.0 (3-8)</td>
<td>.013*</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>4.0 (1-6)</td>
<td>4.0 (1-6)</td>
<td>3.0 (1-6)</td>
<td>.607</td>
</tr>
<tr>
<td>Inference</td>
<td>Weak</td>
<td>Average</td>
<td>Strong</td>
<td>P-value</td>
</tr>
<tr>
<td>Accuracy of the ND</td>
<td>4.0 (2-8)</td>
<td>4.0 (2-6)</td>
<td>3.9 (2-5)</td>
<td>.662</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>3.0 (1-6)</td>
<td>4.0 (1-6)</td>
<td>5.0 (1-6)</td>
<td>.518</td>
</tr>
<tr>
<td>Evaluate</td>
<td>Weak</td>
<td>Average</td>
<td>Strong</td>
<td>P-value</td>
</tr>
<tr>
<td>Accuracy of the ND</td>
<td>2.8 (2-3)</td>
<td>4.0 (2-8)</td>
<td>4.0 (2-6)</td>
<td>.158</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>6.0 (6-6)</td>
<td>3.0 (1-6)</td>
<td>4.0 (1-6)</td>
<td>.113</td>
</tr>
<tr>
<td>Inductive</td>
<td>Weak</td>
<td>Average</td>
<td>Strong</td>
<td>P-value</td>
</tr>
<tr>
<td>Accuracy of the ND</td>
<td>—</td>
<td>4.0 (2-7)</td>
<td>4.0 (2-6)</td>
<td>.763</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>—</td>
<td>3.0 (1-6)</td>
<td>3.0 (1-6)</td>
<td>.973</td>
</tr>
<tr>
<td>Deductive</td>
<td>Weak</td>
<td>Average</td>
<td>Strong</td>
<td>P-value</td>
</tr>
<tr>
<td>Accuracy of the ND</td>
<td>4.0 (2-6)</td>
<td>4.0 (2-8)</td>
<td>4.0 (2-6)</td>
<td>.977</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>3.0 (1-6)</td>
<td>4.0 (1-6)</td>
<td>3.0 (1-5)</td>
<td>.902</td>
</tr>
</tbody>
</table>

Note: HSRT = Health Science Reasoning Test; ND = nursing diagnoses.
<sup>a</sup>Median (range).
*P < .05.
Chapter 5

Discussion and conclusion

Methods
This pilot study was feasible, as far as the methods employed were concerned. The instruments D-Catch, knowledge inventory, CCTDI, and HSRT have proven to be useful within the framework of the study. The simulation patients generally acted in accordance with the case and the script.

The Effect of Knowledge Sources on the Accuracy of Diagnoses
Access to knowledge sources did not improve the accuracy of diagnoses. Even if students had access to knowledge sources, the recorded diagnoses were incomplete and poorly formulated. One possible explanation for the relatively low accuracy of the recorded diagnoses is that students may have not been familiar with the knowledge sources in the NANDA-I classification. Even if students were familiar with the NANDA-I classification, they may have been unable to apply this information to the context of an assessment interview. Various methods to help nurses apply standardized diagnoses in practice are still under development (Brunt 2005, Christensen 2003, Müller-Staub et al. 2006). The students that participated in our study may have not yet been sufficiently prepared to use available tools, such as knowledge sources, to help them make standardized diagnoses. Access to knowledge sources, however, resulted in a higher number of recorded relevant diagnoses. This may be due to the fact that the assessment format and the handbooks have a structure based on categorized problem labels, which may have guided students during the interview, causing them to formulate more focused and complete questions about the problem (Carpenito 1991, Gordon 1994).

The Influence of Ready Knowledge on the Accuracy of Diagnoses
The finding that ready knowledge did not correlate with the accuracy of nursing diagnoses could be explained by the fact that the students did not possess skills needed to derive accurate diagnosis. In this study, knowledge of the problem area might lead to an accurate diagnosis only if the students had had sufficient skills to formulate diagnoses. Our findings are supported by those of Ronteltap (1990), Gulmans (1994), and Müller-Staub (2007). These authors differentiated case-related knowledge from diagnostic knowledge as two essential separate bases of ready knowledge and found that both types of knowledge are needed to report accurate diagnoses.

The Influence of Disposition Toward Critical Thinking on the Accuracy of Diagnoses
Our students scored relatively low on the CCTDI truth-seeking and open-mindedness domains. Scores of the current sample are not very different from scores of other samples of nursing students. Four other samples had similarly low subscale scores in the area of truth-seeking and open-mindedness (Colucciello 1997, Wan et al. 2000, Smith-Blair & Neighbors, 2000, Nokes et al. 2005). The
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age and experience of individuals seems to be an important factor (Profetto-McGrath 2003).

Higher CCTDI scores were found in samples composed of older and more experienced nurses with nursing degrees (Nokes et al. 2005, Facione et al. 1994). Perhaps, the CCTDI scores of older and more experienced individuals may contribute to a higher accuracy of diagnoses. In the present study, only young, obviously inexperienced, students were included and no significant relationship was found between a disposition for critical thinking and the accuracy of diagnoses. Substantiating the presupposition that the accuracy of diagnoses is determined by a nurse’s age and experience will require additional research.

The Influence of Reasoning Skills on the Accuracy of Diagnoses

Although, based on a weak, but significant, association, we presume that students with strong analysis scores did stand out in the accuracy of their diagnoses. In a study of physicians, Barrows et al. (1982) found that the ability to analyze and substantiate information relating to a patient is prerequisite for formulating an accurate diagnosis. Barrows et al. (1982), Gordon (1994), and Gulmans 1994 suggested that a diagnosis based on the used of analytical skills is more accurate as opposed to a diagnosis based on experience and intuition alone. Understanding information and connections between statements is the first analytical step toward formulating accurate diagnoses (Gulmans 1994, Pesut & Herman 1998).

In the present study, the analysis of the accuracy of diagnoses was based on what the students recorded, not on what they thought or what they might have meant. Their ability to express themselves in writing diagnoses was found to be moderate. Gordon (1994) and Ronteltap (1990) suggested that hypothesis testing is a key component of the diagnostic process and is required for an individual to be able to express the outcomes of clinical judgment in an accurate way. In our study, students scored poorly on the HSRT domains analyses and inference. In spite of the fact that we did not find a significant relationship between the accuracy of diagnoses and the inference domain, still there may be a plausible connection between the quality of analytical thinking, hypothesis testing, and the way students record diagnoses (Facione 2000, Gulmans 1994, Gordon 1994). However, this hypothetico-deductive, rational, and analytic approach is argued.

From a phenomenological perspective, Dreyfus and Dreyfus (1986) and Benner and Tanner (1987) suggested that intuition forms the major core of diagnostic practice in nursing. The failure to apply analytical skills when doing problem inventories is called the “non-analytical process” or “intuitive process” (Benner, 2001; Gordon, 2003).

This process is based on one’s recognition of situations and on making the most obvious choices based on one’s recognition (Benner 2001, Gordon 2003, Paley 1996). Nevertheless, no studies offer conclusive explanations of how intuitive reasoning directs accurate nursing diagnoses (Lee et al. 2006). In our study, we assumed that the students were unable to rely on their intuition, because they lacked experience. It is possible that some of the students used their analytical skills as a first step toward formulating accurate diagnoses, whereas most of the
students failed to use indispensable inference and deductive skills when deriving diagnoses. The influence of these skills on the accuracy of nursing diagnoses may be more apparent when a student is specifically asked to use these skills consciously and actively when deriving diagnoses (Pesut & Herman 1999, Worrell & Profetto-McGrath 2007). Follow-up research must examine this assumption in greater depth.

Implications

The results of this study have possible implications for nursing education. Improving nursing students’ skills in using knowledge sources and in reasoning could be a step forward to improving the accuracy of nursing diagnoses. This could be achieved by training students in reason-giving and fact-finding analytical skills and by asking them specific questions related to the aetiology (related factors) and signs and symptoms (defining characteristics) of health care problems (Müller-Staub 2007). Nurses may benefit by pre-structuring the diagnoses report form to specifically include these factors and characteristics. Whether the use of such diagnoses report forms as a tool to support the diagnostic reasoning process would improve the accuracy of diagnoses is unknown. This could be a starting point for a follow-up study.

The present study can be viewed as a starting point for developing more stimulating knowledge sources, for encouraging the use of specific reasoning skills, such as analytical and inference skills, and for cultivating an open-minded and truth-seeking disposition.
References


Determinants of the accuracy of nursing diagnoses


CHAPTER 6

The effect of a predefined record structure and knowledge sources on the accuracy of nursing diagnoses: a randomised study


This chapter is submitted for publication.
Introduction

Nurses constantly make knowledge- and skill-based decisions on how to manage patients’ responses to illness and treatment. Their diagnoses should be founded on the ability to analyze and synthesize patients’ information. Accurate formulation of nursing diagnoses is essential, since nursing diagnoses guide intervention (Gordon 1994, 2005, Lunney 2001, 2008). Based on a comparison of four classification systems, Müller-Staub (2007, p. 22-39) concluded that the NANDA-I (North American Nursing Diagnoses Association International), classification is the best-researched and internationally most widely implemented classification system. The definition of ‘nursing diagnosis’ is: “A clinical judgment about individual, family or community responses to actual and potential health problems/life processes. A nursing diagnosis provides the basis for selection of nursing interventions to achieve outcomes for which the nurse is accountable” (NANDA-I 2004, p. 22). An accurate diagnosis describes a patient’s problem (label), related factors (aetiology), and defining characteristics (signs and symptoms) in an unequivocal, clear language (Gordon 1994, Lunney 2001). Describing a problem solely in terms of its label in the absence of related factors and defining characteristics can lead to misinterpretation (Lunney 2001, 2003, Wilkinson 2007). Imprecise wording, lack of scrutiny, and expression of patient problems in terms of an incomprehensible diagnosis could have an undesirable effect on the quality of patient care and patient well-being (Kautz et al. 2006, Lunney 2007). Nevertheless, several authors have reported that patient records contained relatively few precisely formulated diagnoses, pertinent signs and symptoms, and related factors and poorly documented details of interventions and outcomes (Ehrenberg et al. 1996, Moloney & Maggs 1999, Müller-Staub et al. 2006¹).

Background

Numerous aspects related to cognitive capabilities and knowledge influence diagnostic processes (Smith et al. 2008, Reed & Lawrence 2008). Knowledge about a patient’s history and about how to interpret relevant patient information is a central factor to derive accurate diagnoses (Cholowski & Chan 1992, Hasegawa et al. 2007, Lunney 2008). A distinction between ‘ready knowledge’ and ‘knowledge obtained through the use of knowledge sources’ can be made. Ready knowledge is previously acquired knowledge that an individual can recall to mind. Ready knowledge is achieved through education programmes and experience in situations in different nursing contexts (Gulmans 1994, Ozsoy & Ardahan 2007). Knowledge obtained through knowledge sources is acquired through the use of handbooks, protocols, pre-structured data sets, assessment formats, pre-structured record forms, and clinical pathways. Knowledge sources may help nurses derive diagnoses that are more accurate than those derived without the use of such resources (Goossen 2000, Spenceley et al. 2008). The purpose of using assessment formats based on Functional Health Patterns and standard nursing
diagnoses, as included in the Handbook of Nursing Diagnoses (Carpenito 1991, 2002), is to attain higher accuracy in diagnoses.

Other factors influencing the accuracy of nursing diagnoses are nurses’ disposition towards critical thinking and reasoning skills. Dispositions towards critical thinking include open-mindedness, truth-seeking, analyticity, systematicity, inquisitiveness, and maturity (Facione & Facione 2006). Reasoning skills comprise induction and deduction, as well as analysis, inference, and evaluation. These skills are vital for the diagnostic process (Facione and Facione 2006, Fesler 2005, Steward & Dempsey 2005).

There are two kinds of diagnostic arguments: deductive and inductive. In a deductive argument the premises (foundation, idea, or hypothesis) supply complete evidence for the conclusion so that the conclusion necessarily follows from the premises. In an inductive (diagnostic) argument the premises provide some evidence, but are not completely informative with respect to the truth of the conclusion (Bandman & Bandman 1995).

Although, several studies focused on nurses’ dispositions for critical thinking, these yielded little information about nurses specific reasoning skills to attain high levels of accuracy of nursing diagnoses (Edwards 2003, Stewart & Dempsey 2005, Tanner 2005).

The study

Aim
The aim of the study was twofold: (1) to determine whether the use of a predefined record structure and knowledge sources does affect the accuracy of nursing diagnoses; (2) to determine whether knowledge, disposition towards critical thinking, or reasoning skills are associated with, or can explain, the accuracy of nursing diagnoses.

Research Questions
We addressed the following research questions about the accuracy of nursing diagnoses:
1. What is the effect of a predefined record structure and knowledge sources?
2. What is the influence of ready knowledge?
3. What is the influence of dispositions towards critical thinking?
4. What is the influence of reasoning skills?

Methods

A randomised, factorial design was used to determine whether knowledge sources and a predefined record structure affect the accuracy of nursing diagnoses. Clinical nurses were invited to derive diagnoses based on an assessment interview with a simulation patient (a professional actor) using a standardized script.
Participants were randomly allocated to one of four groups—group A, B, C, and D. Group A could use knowledge sources (an assessment format with Functional Health Patterns and standard nursing diagnoses (labels) and handbooks nursing diagnoses), and free text format (blank paper), group B could use a predefined record structure (hereafter referred to as the “PES-format”), without knowledge sources, and group C could use both knowledge sources and a predefined record structure Group D used neither knowledge sources nor the predefined record structure; they acted as a control group.

The entire procedure—starting from preparing for the assessment interview to writing the diagnoses—was recorded both on film and audiotape. During the interviews, an observer noted whenever the simulation patient failed to adhere to the script. Possible determinants—knowledge, disposition towards critical thinking, and reasoning skills—that could influence the accuracy of nursing diagnoses were measured by the following questionnaires: (1) a knowledge inventory; (2) the California Critical Thinking Disposition Inventory (CCTDI), a questionnaire that maps disposition towards critical thinking (Facione et al. 1994, Facione 2000), and (3) the Health Science Reasoning Test (HSRT) (Facione & Facione 2006).

Sample
Of all 94 medical centres (86 general hospitals and 8 university hospitals) in the Netherlands in 2007, we randomly selected 11 hospitals, using stratification by province. Five hospital directors declined to participate. To replace these, we requested six additional hospital directors from the same region to participate. Out of the latter, only one director refused to cooperate. The hospital directors approached the heads of nursing staff to participate. The heads of staff were asked to distribute registration forms to nurses to enrol in the study. We requested at least 20 registered nurses per hospital to participate. By using the registration form, distributed in wards, nurses could subscribe voluntarily for participation. It was guaranteed that participation was during work time. Each of the participating nurses (n= 249) gave informed consent.

Data collection
First, the nurses were told that part of the study would be experimental, that they would be asked to complete questionnaires, and that the entire study would take about 2.5 hours of their time. None of the participants had any specific training in using NANDA-I diagnoses as a part of this study. We did not test whether the participating nurses had on before hand knowledge of the NANDA classification or experience in the use of a PES-format.
Nurses allocation to each of the four groups took place by randomization i.e. by choosing one of four sealed envelopes. The form inside each envelope indicated allocation to group A, B, C, or D. The researchers were unaware of group allocation. Seventy nurses were allocated to the control group D. Nurses in this group were given only a pen, notebook, and paper. Group A nurses (n= 49)
were allowed to review the following knowledge sources as they prepared for the assessment interview, and the formulation of diagnoses:

1. An assessment format with Functional Health Patterns and standard nursing diagnoses (labels) as described in the Handbook of Nursing Diagnoses (Carpenito 2002).
2. The Handbook of Nursing Diagnoses (Carpenito 2002).
3. The Handbook of Nursing Diagnoses and NANDA-I classification (NANDA-I 2004).

Seventy-nine nurses were allocated to Group B. They did not have access to the aforementioned reference material. Instead, they had the opportunity to use a document with pre-structured sections to write down their diagnostic findings. One section of this document consisted of the ‘problem label’ (P, fill in...), the next section consisted of ‘related factors or aetiology’ (E, fill in...), and the last section consisted of ‘signs and symptoms’ (S, fill in...). It was required that the participants did state the problem label, related factors (aetiology) and the signs/symptoms or defining characteristics, as these matched with the patient situation. Based on the information in the script, represented by the actors, it was made possible for nurses to complete information about P, E and S per diagnosis. The PES-format used by group B nurses listed one example of a nursing diagnosis noted in the PES-format and a brief introduction related to the example and ended with the following request: “Please note your diagnostic findings in the PES-format”. The example was not related to the case histories.

The 51 nurses in group C were allowed to review the knowledge sources along with the PES-format. They could take notes during the interview.

For all groups, all items were within reach on the table, including pen, notebook, and paper. Each nurse was directed to an admission room and instructed to prepare for 10 minutes an assessment interview with either a simulated diabetes mellitus type 1 patient (n= 71), a chronic obstructive pulmonary disease (COPD) patient (n= 84), or a Crohn’s disease patient (n= 93). Preparing for the assessment interviews, all nurses were given the following written information about the patient: name, gender, age and address; profession, family situation, and hobbies; medical history; the current medical diagnosis; reason for hospital admission and description of the current situation. Nurses were asked to derive accurate diagnoses based on the assessment interview and to note these on paper. Each participant assessed one professional actor representing a patient suffering from COPD, Crohn’s disease or diabetes mellitus type 1. Each of the three actors’ scripts contained six nursing diagnoses which should be identified by the nurses based on the assessment interview.

Nurses in groups A and D documented their findings on blank paper. Nurses in groups B and C wrote their findings in the PES-format. After the interviews, the nurses were given 10 minutes to formulate their diagnoses. Based on video recordings, data of two control group nurses, two group A nurses, three group B nurses, and one group C nurse were excluded for the reason that the actors did
not strictly adhere to the script in these cases. Finally, data of 241 nurses were analysed: 68 in the control group, D, 47 in group A, 76 in group B, and 50 in group C. Of the 241 nurses, 68 assessed a diabetes patient, 82 assessed a COPD patient, and 91 assessed a patient with Crohn’s disease (Figure 1). The interviews lasted maximum 30 minutes (range: 10 – 30 minutes).

To ensure that participants could not prepare themselves or discuss any details of the study with others, all were asked to keep the contents and methods of the investigation confidential and to sign a corresponding agreement. For ethical reasons, the participants were acknowledged that all information would be used for research purposes only and that data would be anonimized.

**Instrumentation**

*Case development*

Three case scenarios were developed. This was based on the Guidelines for Development of Written Case Studies (Lunney 2001). The cases were assessed by two external Delphi panels using a semi-structured questionnaire. The script was also assessed for clarity (clear language and sentence structure) specificity as well as nursing relevance. One of the Delphi panels consisted of lecturers with a master’s degree in nursing science (n= 6) and fourth-year bachelor’s degree nursing students (n= 2). The other Delphi panel consisted of experienced nurses working in clinical practice that had either a post-graduate specialization or a master’s degree in nursing science (n= 6). A physician screened the case scenarios for medical correctness. Any nursing diagnosis not belonging to the script was considered to be incorrect. Subsequently, lecturers and students questioned the simulation patients during testing rounds after which their answers were assessed for script consistency. All the four actors involved, had over five years of professional experience as simulation patients in nursing or medical education. Their acting was attuned with respect to behaviour according to the script. They were instructed to act like introverted, adequately responding patients to questions posed. The testing rounds were recorded both on film and tape and analysed by two lecturers and two bachelor’s students for script consistency and behaviour during the interviews.

After the last practice rounds, the script was considered to be fully consistent and was adopted for the study.
Accuracy of nursing diagnoses: a randomised study

Figure 1 Research design

Randomisation of participants (n = 249) into four groups and three case histories

<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
<th>Case history</th>
<th>Excluded</th>
<th>N</th>
</tr>
</thead>
</table>
| A     | Handbooks & Assessment format | -Diabetes: n= 18  
- COPD: n= 15  
- Crohn: n= 14 | n= 2 | n= 49 |
| B     | PES format | -Diabetes: n= 14  
- COPD: n= 24  
- Crohn: n= 38 | n= 3 | n= 79 |
| C     | PES format & Handbooks & Assessment format | -Diabetes: n= 19  
- COPD: n= 15  
- Crohn: n= 16 | n= 1 | n= 51 |
| D     | Control Group (no sources / no PES format) | -Diabetes: n= 17  
- COPD: n= 28  
- Crohn: n= 23 | n= 2 | n= 70 |

Questionnaires:
1. Knowledge Inventory based on case history
2. CCTDI (California Critical Thinking Disposition Inventory)
3. HSRT (Health Science Reasoning Test)

N= 241

(1) Effect of knowledge sources on the accuracy of nursing diagnoses
(2) Influence of dispositions of critical thinking and reasoning skills on the accuracy of the nursing diagnoses
Chapter 6

Accuracy of the nursing diagnoses
For measuring the accuracy of the nursing diagnoses, the D-Catch was used; an instrument that quantifies the degree of accuracy in written diagnoses (Paans et al. 2010). This instrument consist of two sections: (1) Quantity, which addresses: “Are the components of the diagnosis present?” (scale: 1- 4) and (2) Quality, which addresses: “What is the quality of the description with respect to relevancy, unambiguity, and linguistic correctness?” (scale: 1- 4). For each diagnosis (out of six available) documented by each nurse, the sum of the quantity and quality criteria score was computed. From the six possible sum scores, the mean was taken and in the sequel will be referred to as diagnoses accuracy score. The number of relevant diagnoses documented for each participant was determined out of six in total in each script.

Ready knowledge
A knowledge inventory was used only to determine the association between case-based conceptual, ready knowledge and the accuracy of nursing diagnoses. The knowledge inventory comprised of four case-related multiple-choice questions each consisting of four alternatives; with one correct answer. The Handbook of Enquiry & Problem Based Learning (Barrett et al. 2005) was used as a guideline for development. The questions focused on content of the case presented. After assessors’ agreement was reached, the questions were adopted to the inventory.

Disposition towards critical thinking
The CCTDI, validated in a nursing context (Facione et al. 1994, Facioine 2000, Insight Assessment, 2002) was used to assess the influence of disposition towards critical thinking on the accuracy of nursing diagnoses. The CCTDI consists of 75 statements and measures respondents’ attitudes towards the use of knowledge and their disposition towards critical thinking. On a six-point scale, respondents indicate the extent to which they (dis)agree with a certain statement.

The CCTDI consists of seven domains:
1. Truth-seeking: being flexible in considering alternatives and opinions.
2. Open-mindedness: being tolerant of divergent views with sensitivity to the possibility of one’s own bias.
3. Analyticity: being alert to potentially problematic situations, anticipating certain results or consequences.
4. Systematicity: being orderly and focused, aiming to correctly map out the situation both in linear and in non-linear problem situations.
5. Self-confidence: to be trusted upon for making adequate judgments.
6. Inquisitiveness: wanting to be well informed as well as having a desire to know how things work and fit together.
7. Maturity: making reflective judgments in situations where problems cannot be properly structured.
The scores of the CCTDI scales range from 10 to 60. The score indicates the degree of which nurses have a disposition toward critical thinking. Facione (2002) found scores ranging from 10 to 30 to indicate an increasingly negative disposition; scores ranging from 40 to 60 to indicate an increasingly positive disposition; scores between 30 and 40 to indicate ambivalence (i.e. expression of positive or negative disposition). The recommended cut-off score for each scale is 40. A score of less than 40 reveals weakness (Facione 2002).

Various studies have demonstrated the CCTDI scales to have a sufficient degree of reliability and validity (Kakai 2003, Kawashima & Petrini 2004, Smith-Blair & Neighbors 2000, Stewart & Dempsey 2005, Tiwari et al. 2003, Yeh 2002).

Linguistic validation of the CCTDI was done by forward and backward translation by two independent translators. The final translation to the Dutch language was assessed by a third translator and approved to be relevant in the Dutch nursing context by a panel of nursing scientists (n= 6). Reliability of the Dutch version of the CCTDI quantified by Cronbach’s alpha was 0.74 (n= 241).

**Reasoning skills**

We used the HSRT to measure reasoning skills. The HSRT consists of 33 questions and assesses the reasoning capacity of healthcare and nursing professionals (Facione & Facione, 2006). The HSRT was selected because its contents are usable in a context that is easily recognizable for nurses. The HSRT covers the following domains:

1. **Analysis:**
   a. understanding the significance of experiences, opinions, situations, procedures, and criteria;
   b. understanding connections between statements, questions, descriptions or presented convictions, experiences, reasons, sources of information, and opinions that may lead to a conclusion.
2. **Inference:** ability to formulate assumptions and hypotheses and to evaluate the relevancy of the information.
3. **Evaluation:**
   a. ability to assess the credibility of statements, opinions, experiences, convictions, and to be able to determine relationships;
   b. ability to reflect on procedures and results, to judge them, and to be able to provide convincing arguments for such.
4. **Induction:** ability to arrive at a general rule, which is more or less probable on the basis of a finite number of observations.
5. **Deduction:** ability to refine the truth of a conclusion; for example, the correct nursing diagnosis is guaranteed by the reasoning.

The HSRT subscales consist of six items to provide a guide for test takers’ abilities in the measured areas of Analysis, Inference, and Evaluation. For each of these subscales, a score of 5 or 6 indicates strong reasoning skills; a score of ≤ 2
indicates weak reasoning skills; and a score of 3 or 4 indicates average reasoning skills. Deductive and inductive scales consist of 10 items. For each of these subscales, a score of 8, 9, or 10 indicates strong deductive and inductive skills; and scores from 0 to 3 indicate weak deductive and inductive skills (Facione & Facione, 2006).

The HSRT test manual “The Health Sciences Reasoning Test” (Facione & Facione, 2006), is based on the consensus definition of critical thinking that was developed in the Delphi study described in the Expert Consensus Statement of Facione (2000). The final translation was assessed by a third translator and approved to be relevant in the Dutch nursing context by a panel of nursing scientists (n= 6). Based on our study, reliability of the Dutch version of the HSRT was 0.72, quantified by Cronbach’s alpha (n= 241).

Statistical analyses
Demographic data were calculated by using SPSS version 14.0 and summarised by group means and standard deviations, along with percentages. Insight Assessment / The California Academic Press are the distributors of the CCTDI and HSRT. The scale scores of the CCTDI and HSRT were computed by Insight Assessment.

For the following statistics we used R version 2.10.1 (R Development Core Team 2009). Inter-observer agreement of the D-Catch was estimated by Cohen’s quadratic weighted kappa, intra-class correlation coefficient and Pearson’s product moment correlation coefficients of the first diagnoses listed by all of the participants. Cohen’s kappa with quadratic weighting was used to measure the proportion of agreement greater than that expected by chance. The intra-class correlation coefficient based on analysis of variance of the ratings gives the proportion of variance attributable to the objects of measurement (McGraw & Wong 1996). The main and interaction effects of knowledge sources and PES-format on accuracy of nursing diagnoses were estimated by two-way analysis of variance (ANOVA). The association between accuracy of diagnoses and knowledge (knowledge inventory) dispositions towards critical thinking (CCTDI) and reasoning skills (HSRT), was estimated by Kendall’s tau. To estimate the amount of explained variance for accuracy of nursing diagnoses (depended variable) we used linear regression taking as independent variables the CCTDI domains and the HSRT scales as the knowledge inventory, presence of PES-format, knowledge sources and age of the participants.

Results

Demographic data
Licensed practical nurses (n= 53), hospital-trained nurses (n= 120), and bachelor’s degree nurses (n= 68), all working as qualified, registered nurses were included in our study; 64% had over 10 years of nursing experience. 92% Of the nurses worked at least 50% of full-time employment. Their mean (SD) age was 38 (10) years, and 212 (88%) were female.
We did not find significant differences between the four simulation patients on the accuracy of nursing diagnoses using two-way analysis of variance (p = 0.679), nor on the number of relevant diagnoses (p = 0.196). No significant differences were found between the three cases concerning the accuracy of the nursing diagnoses (p = 0.083) and the number of relevant diagnoses (p = 0.739). No significant differences were found between the CCTDI scores, the HSRT scores, and groups A, B, C, and D. We found no significant differences in the pairs of reviewers (n = 5), in the accuracy of the nursing diagnoses (p = 0.156), or on the number of relevant diagnoses (p = 0.546). These results are in line with the random assignment of nurses to groups.

Cohen’s weighted kappa, the intra-class correlation coefficient and Pearson’s product moment correlation coefficient, as well as their 95% confidence intervals are presented in Table 1. All of the coefficients are larger than .70 and have their left boundary of the confidence interval greater than .50. The values of the coefficients as well as their confidence intervals are highly similar. We conclude that the inter-rater agreement is substantial (Fleiss et al. 2001).

Table 1 Inter-rater agreement measured Cohen’s Kappa with quadratic weighting, intra class correlation coefficient and Pearson’s product moment correlation coefficient with 95% confidence intervals of quantity and quality criteria of the first diagnosis of each participant

<table>
<thead>
<tr>
<th>Raters</th>
<th>Objects N(^a)</th>
<th>Kw (K_w)</th>
<th>Intra Class Correlation</th>
<th>Pearson’s Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 vs 2</td>
<td>61</td>
<td>.82 (.70 ,.90)</td>
<td>.82 (.72 ,.89)</td>
<td>.82 (.72 ,.89)</td>
</tr>
<tr>
<td>3 vs 4</td>
<td>60</td>
<td>.83 (.75 ,.89)</td>
<td>.83 (.73 ,.89)</td>
<td>.84 (.74 ,.90)</td>
</tr>
<tr>
<td>2 vs 4</td>
<td>57</td>
<td>.72 (.55 ,.83)</td>
<td>.73 (.58 ,.83)</td>
<td>.73 (.57 ,.83)</td>
</tr>
<tr>
<td>5 vs 6</td>
<td>38</td>
<td>.82 (.65 ,.91)</td>
<td>.83 (.69 ,.91)</td>
<td>.82 (.68 ,.91)</td>
</tr>
<tr>
<td>7 vs 8</td>
<td>25</td>
<td>.75 (.61 ,.87)</td>
<td>.75 (.53 ,.88)</td>
<td>.75 (.53 ,.88)</td>
</tr>
<tr>
<td>Quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 vs 2</td>
<td>61</td>
<td>.75 (.59 ,.85)</td>
<td>.75 (.62 ,.84)</td>
<td>.76 (.63 ,.85)</td>
</tr>
<tr>
<td>3 vs 4</td>
<td>60</td>
<td>.76 (.55 ,.83)</td>
<td>.76 (.63 ,.85)</td>
<td>.76 (.63 ,.85)</td>
</tr>
<tr>
<td>2 vs 4</td>
<td>57</td>
<td>.73 (.59 ,.84)</td>
<td>.73 (.59 ,.83)</td>
<td>.73 (.59 ,.84)</td>
</tr>
<tr>
<td>5 vs 6</td>
<td>38</td>
<td>.74 (.51 ,.87)</td>
<td>.75 (.57 ,.86)</td>
<td>.74 (.56 ,.86)</td>
</tr>
<tr>
<td>7 vs 8</td>
<td>25</td>
<td>.79 (.55 ,.91)</td>
<td>.80 (.61 ,.90)</td>
<td>.80 (.60 ,.90)</td>
</tr>
</tbody>
</table>

\(^a\)Quality and quantity criteria of the accuracy measurement based on the D-Catch instrument
The influence of knowledge, handbooks/assessment format reasoning skills and the PES-format on the accuracy of diagnoses

In order to facilitate the interpretation of two-way ANOVA the means of the (in)dependent variables over the experimental groups with PES-format and without PES-format are presented in Table 2. These means correspond to the main effects in two-way ANOVA, the significance of these are measured by the P-values. There is no significant main effect of PES-format or Handbooks/Assessment format on any of the CCTDI or HSRT domains on the number of relevant diagnoses. A significant PES-format effect was found on accuracy of nursing diagnoses ($F = 118.5079$, df $= 1,237$, $p = < 0.0001$). More specifically, the PES-format has an estimated increasing effect of 1.5 on mean diagnosis accuracy. There is no significant effect for Handbooks/Assessment format ($F = 0.0786$, df $= 1,237$, $p = 0.7795$) nor any significant interaction effects. The only exception to this is a significant interaction effect for Systematicity (CCTDI) but, neither its estimated size nor its corresponding main effects are significant. For these reasons we refrain from interpreting this effect.

Ready knowledge correlates with the main effect of handbooks and the assessment format because of higher mean scores as no handbooks or assessment format were available ($P = 0.025$, Table 2).

In order to estimate the degree of association between the dependent variable ‘Diagnoses Accuracy’ and the independent variables from the CCTDI and HSRT scales and the knowledge inventory, Kendall’s tau coefficients were computed. The resulting coefficients are presented in Table 3 together with the corresponding P-values. Following the custom of using 0.05 as cut-off value for significance, it can be inferred from the P-values that there is a positive association between diagnoses accuracy and the CCTDI scales Systematicity and Maturity, and the HSRT scales Analysis, Inference, Induction, and Deduction.

That is, these scales have a positive association with diagnoses accuracy in the sense that an increase on either of these scales would result in an increase of accuracy of nursing diagnoses.
### Table 2 Group means (SD) and P-values from two-way ANOVA

<table>
<thead>
<tr>
<th>Scale</th>
<th>Experimental conditions</th>
<th>Groups</th>
<th>A &amp; D</th>
<th>B &amp; C</th>
<th>B &amp; D</th>
<th>A &amp; C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>No PES-Format</td>
<td>PES-Format</td>
<td>No Handbooks and no Assessment</td>
<td>Handbooks &amp; Assessment format</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td>PES-Format</td>
<td>No</td>
<td>Handbooks &amp; Assessment format</td>
</tr>
<tr>
<td>Accuracy of ND</td>
<td>4.0 (1.1)</td>
<td>5.4 (1.0)</td>
<td>4.8 (1.3)</td>
<td>4.7 (1.2)</td>
<td>&lt;0.001*</td>
<td>0.780</td>
</tr>
<tr>
<td>Number of relevant ND</td>
<td>4.0 (1.3)</td>
<td>3.8 (1.2)</td>
<td>3.9 (1.3)</td>
<td>3.9 (1.3)</td>
<td>0.148</td>
<td>0.956</td>
</tr>
<tr>
<td>Knowledge Inventory</td>
<td>3.4 (1.1)</td>
<td>3.5 (1.2)</td>
<td>3.6 (1.2)</td>
<td>3.3 (1.2)</td>
<td>0.553</td>
<td>0.025*</td>
</tr>
<tr>
<td>CCTDI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truth-seeking</td>
<td>41.5 (5.9)</td>
<td>40.2 (5.5)</td>
<td>41.4 (4.9)</td>
<td>40.4 (6.1)</td>
<td>0.065</td>
<td>0.168</td>
</tr>
<tr>
<td>Open-Mindedness</td>
<td>37.9 (3.7)</td>
<td>37.3 (4.5)</td>
<td>37.2 (4.1)</td>
<td>37.8 (4.1)</td>
<td>0.303</td>
<td>0.308</td>
</tr>
<tr>
<td>Analyticity</td>
<td>43.5 (4.7)</td>
<td>44.2 (4.6)</td>
<td>44.4 (4.7)</td>
<td>43.5 (4.7)</td>
<td>0.259</td>
<td>0.174</td>
</tr>
<tr>
<td>Systematicity</td>
<td>44.8 (6.1)</td>
<td>46.2 (5.5)</td>
<td>45.9 (5.9)</td>
<td>45.3 (5.8)</td>
<td>0.063</td>
<td>0.441</td>
</tr>
<tr>
<td>Self-confidence</td>
<td>44.2 (5.6)</td>
<td>44.2 (5.0)</td>
<td>44.8 (5.3)</td>
<td>43.9 (5.3)</td>
<td>0.953</td>
<td>0.186</td>
</tr>
<tr>
<td>Inquisitiveness</td>
<td>48.0 (5.8)</td>
<td>47.4 (5.3)</td>
<td>47.6 (6.0)</td>
<td>47.7 (5.2)</td>
<td>0.438</td>
<td>0.879</td>
</tr>
<tr>
<td>Maturity</td>
<td>44.0 (6.6)</td>
<td>44.3 (5.4)</td>
<td>44.3 (5.4)</td>
<td>44.0 (6.4)</td>
<td>0.693</td>
<td>0.754</td>
</tr>
<tr>
<td>HSRT</td>
<td>Analysis</td>
<td>3.0 (1.4)</td>
<td>2.9 (1.2)</td>
<td>3.0 (1.4)</td>
<td>2.9 (1.2)</td>
<td>0.617</td>
</tr>
<tr>
<td>Inference</td>
<td>2.6 (1.1)</td>
<td>2.8 (1.4)</td>
<td>2.7 (1.2)</td>
<td>2.8 (1.3)</td>
<td>0.135</td>
<td>0.553</td>
</tr>
<tr>
<td>Evaluation</td>
<td>4.8 (1.1)</td>
<td>4.8 (1.0)</td>
<td>4.8 (1.1)</td>
<td>4.7 (1.0)</td>
<td>0.693</td>
<td>0.507</td>
</tr>
<tr>
<td>Induction</td>
<td>7.0 (1.4)</td>
<td>7.2 (1.5)</td>
<td>7.2 (1.5)</td>
<td>7.1 (1.4)</td>
<td>0.311</td>
<td>0.683</td>
</tr>
<tr>
<td>Deduction</td>
<td>4.6 (2.1)</td>
<td>4.7 (2.1)</td>
<td>4.8 (2.0)</td>
<td>4.6 (2.2)</td>
<td>0.521</td>
<td>0.373</td>
</tr>
</tbody>
</table>

<sup>a</sup>Mean (SD)
<sup>b</sup>Group A had the opportunity to use handbooks and assessment format and free text format (blank paper)
Group B had the opportunity to use a predefined record structure (PES-Format)
Group C had the opportunity to use handbooks and assessment format and a predefined record structure (PES-Format)
Group D did not have the opportunity to use handbooks and assessment format or PES-Format at all (control group)
<sup>c</sup>ANOVA * < P= 0.05

Note: ND = nursing diagnoses; CCTDI = California Critical Thinking Disposition Inventory; HSRT = Health Science Reasoning Test
Table 3 Kendall’s tau coefficients with corresponding P-values between mean diagnoses accuracy and the knowledge inventory, the CCTDI and the HSRT scales

<table>
<thead>
<tr>
<th>Variable</th>
<th>Kendall’s tau</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge inventory</td>
<td>0.04</td>
<td>0.401</td>
</tr>
<tr>
<td>CCTDI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truth-seeking</td>
<td>0.01</td>
<td>0.756</td>
</tr>
<tr>
<td>Open-Mindedness</td>
<td>0.08</td>
<td>0.076</td>
</tr>
<tr>
<td>Analyticity</td>
<td>0.07</td>
<td>0.135</td>
</tr>
<tr>
<td>Systematicity</td>
<td>0.13</td>
<td>0.003*</td>
</tr>
<tr>
<td>Self-Confidence</td>
<td>0.07</td>
<td>0.121</td>
</tr>
<tr>
<td>Inquisitiveness</td>
<td>-0.01</td>
<td>0.899</td>
</tr>
<tr>
<td>Maturity</td>
<td>0.11</td>
<td>0.016*</td>
</tr>
<tr>
<td>HSRT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analysis</td>
<td>0.19</td>
<td>&lt; 0.0001*</td>
</tr>
<tr>
<td>Inference</td>
<td>0.16</td>
<td>&lt; 0.0001*</td>
</tr>
<tr>
<td>Evaluation</td>
<td>0.08</td>
<td>0.099</td>
</tr>
<tr>
<td>Induction</td>
<td>0.15</td>
<td>0.002*</td>
</tr>
<tr>
<td>Deduction</td>
<td>0.24</td>
<td>&lt; 0.0001*</td>
</tr>
</tbody>
</table>

*P < .05.

Note: CCTDI = California Critical Thinking Disposition Inventory; HSRT = Health Science Reasoning Test

Relationship of PES-format, handbooks/assessment format, age, CCTDI and HSRT scales, ready knowledge and diagnoses accuracy

By a regression analysis we investigated the degree in which variation in diagnoses accuracy can be explained by the variables age, the CCTDI and HSRT scales, as well as the knowledge inventory and the dichotomized variables PES-format and Handbooks/Assessment format (absence 0, presence 1). Using these (15) independent variables resulted in a multiple squared correlation of 0.4923, but also in a non parsimonious model with several non-significant beta coefficients. To obtain a parsimonious linear regression model we used the stepwise approach according to Akaike’s information criterion and proceeded by manually dropping non-significant coefficients (Venables & Riply 2002, p. 175). -We merely note that doing this in different orders, resulted in one and the same model, reported in Table 4.- The resulting estimated linear model contains the dichotomized variable presence of PES-format, and the continuous variables age and the
reasoning skills Deduction and Analysis (HSRT), see Table 4. Visual inspection of the fitted values by residuals as well as the normal quantile-quantile plot of residuals reveals that the latter is normally distributed with constant variance (normality is not rejected by the Shapiro-Wilk test). The model has a multiple squared correlation of 0.4702 and, therefore, explains 47.02% of the variance in the independent variable diagnoses accuracy. Almost half of the variance of diagnoses accuracy is explained by the presence of PES-format, nurse age and reasoning skills deduction and analysis. More specifically, the resulting model (Table 4) implies an increase of diagnoses accuracy by 1.37 if PES-format is present, a decrease of .025 if age increases by one year, an increase by .13 if deduction increases by one scale point, and an increase by .14 if analysis increases by one point. For a proper interpretation of these effects it is relevant to keep in mind the range of the (in)dependent variables. This is for diagnoses accuracy (2-8), for age (23-62), for deduction (0-10) and for analysis (0-6). Thus, according to the model, a nurse being 20 years younger has a larger mean accuracy of .5 (20 times 0.025). Similarly, an increase of deduction skills by 4 scale points yields an increase of mean diagnoses accuracy of 0.5 and an increase of analysis skills by 3 scale points yields an increase of mean accuracy by 0.43.

Table 4 Model found by stepwise AIC* followed by dropping non-significant coefficients*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Unstandardized Coefficients</th>
<th>t</th>
<th>P-Value²</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>4.0574</td>
<td>12.67</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>PES-format</td>
<td>1.3658</td>
<td>11.26</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Age</td>
<td>-0.0251</td>
<td>-4.00</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>HSRT Deduction domain</td>
<td>0.1272</td>
<td>3.66</td>
<td>0.0003</td>
</tr>
<tr>
<td>HSRT- Analysis domain</td>
<td>0.1442</td>
<td>2.55</td>
<td>0.0113</td>
</tr>
</tbody>
</table>

* Dependent variable: accuracy of nursing diagnosis  
*AIC: Akaike’s Information Criterion  
²P < .05  
Note: HSRT = Health Science Reasoning Test
Discussion

Because the PES-structure is taught in nursing education programs in the Netherlands from the mid 1990’s, this may explain that age was a significant predictor; younger nurses had higher accuracy scores than older nurses. We did not find a significant main effect of using knowledge sources and the PES-format and the number of relevant diagnoses (Table 2). A possible explanation why PES did not affect the number of relevant diagnoses is that this format primarily guides the reasoning process of nurses, helping them to differentiate and document accurately.

Ready knowledge
The finding that ready knowledge did not correlate with accuracy of nursing diagnoses can be explained by the fact that the participants did not possess sufficient diagnostic skills needed to derive accurate diagnoses. In this study, knowledge of the problem area might have lead to more accurate diagnoses if the nurses had sufficient diagnostic skills to formulate these. Our findings are supported by Ronteltap (1990) and Müller-Staub (2006², 2007) who differentiated case-related knowledge from diagnostic skills as two essential aspects needed to report accurate diagnoses (Gulmans 1994). Ready knowledge did significantly correlate with the main effect of handbooks and the assessment format because of higher scores if no handbooks or assessment format were available. This significant finding was unexpected, since handbooks might be a knowledge stimulant and therefore, knowledge looked up in handbooks might have given a positive effect on the latter inventory scores. On the other hand, it might be possible that nurses are in retrospect more activated to use ready knowledge due to the absence of handbooks and the assessment format. It is unknown if this explanation is correct, or if our finding is coincidental, caused by multiple testing.

Disposition towards critical thinking
Based on our findings, we assume nurses may need to be more aware of the importance of being sensitive to one’s potential bias and being alert to potentially problematic situations (Alfaro-LeFevre 2004). Nurse educators may need to teach students to reflect on dispositions, to be orderly and focused, to aim to correctly map out situations, and to look in more depth for relevant diagnostic information. Several studies have reported that nurses trained in analytical skills score relatively high on the CCTDI (Colucciello 1997, Wan et al. 2000, Smith-Blair & Neighbors 2000, Profetto-McGrath 2003, Profetto-McGrath et al. 2003, Nokes et al. 2005). Therefore nurses as well as lecturers may have to focus more on thinking dispositions in daily hospital practice and in diagnostic training programs (Björvell et al. 2002, Cruz et al. 2009).

Reasoning skills
Nurses with strong analysis, inference and deductive scores did stand out in
the accuracy of their diagnoses. Previous studies in physicians (Barrows et al. 1982) and physical therapists (Ronteltap 1990) suggest that a diagnosis based on the use of deductive skills is more accurate as opposed to a diagnosis based on knowledge and experience alone. The relatively high scores on the inductive domain of the HSRT suggest that the nature of nurses’ reasoning is, to a certain extent, inductive. To properly determine which previous empirical information is relevant for a given clinical situation, nurses may use their inductive skills as well as their deductive and analytical skills (Lee 2005).

**Limitations**

Nurses in our sample did voluntarily participate in a study in diagnostics, even though they were uncertain of what to expect in the case history contents and questionnaires. This way of sampling may have introduced a selection bias, since a number of nurses in our sample might have been more focussed on nursing diagnoses.

**Conclusion**

Based on the results of this study it can be concluded that the PES-format has a main positive effect on the accuracy of the nursing diagnoses. Almost half of the variance of diagnoses accuracy is explained by the presence of PES-format, nurse age and reasoning skills deduction and analysis. As far as we know this result is new and puts pre-structured formats and reasoning skills in a new perspective. More analytical and deductive reasoning needs to be taught to accurate use the PES-structure. Part of the 53% unexplained variance is likely to be random in the sense that it cannot be explained by systematic variance from independent variables. Personal knowledge, experience, and (subjective) individual reflections are part of nurses’ diagnostic process as well (Benner & Tanner 1989, Cutler 1979, Lunney 2006).

The results of this study should have implications for nursing practice and education. Improving nurses’ disposition towards critical thinking, improving nurses’ reasoning skills, and encouraging them to use the PES-structure, could be a step forward to improving the accuracy of nursing diagnoses.
References


California Critical Thinking Disposition Inventory, *Journal of Nursing Education*, 33 (8), 345-350.


Chapter 7

Introduction

The nurses’ admission interview usually represents the start of a patient-to-nurse relationship. The purpose of the interview is to exchange appropriate information that will be used for planning and delivering daily care in hospital practice (Johnson et al. 2007, Wilkinson 2007). Patient data are supposed to be documented in the patient record so that colleagues and other health professionals can inform themselves. This information is vital for continuity of care as well as for patient safety (World Alliance for Patient Safety 2008). The nursing care plan is the main legal source of information for nurses. It offers them information on nursing diagnoses, planned interventions, and interventions previously carried out. Thereby, it provides information about the results of the care delivered in terms of outcome (Doenges & Moorhouse 2008). A well-structured and unambiguous report should therefore facilitate efficient information transfer and is directly available for use (Egland & Heineman 1994).

If we focus on the key component of the nursing process—the nursing diagnosis—the use of the NANDA-I classification implies that classification criteria for the documentation of nursing diagnoses are to be found in the patient record (Lavin et al. 1999). A nursing diagnosis should be documented in terms of a definition, clarifying the diagnostic domain called ‘the diagnostic label’. Part of the diagnosis documentation is the listing of aetiology or related factors, and signs and symptoms or defining characteristics, with reference to an attainable nursing intervention, also known as the PES structure (Gordon 1994, NANDA 2004). Over the last two decades, nursing documentation has gained increased attention from policy makers and hospital managers (McCormick 2007, Welton et al. 2005), whose focus is mainly on the development and implementation of electronic documentation devices (Ball et al. 2003). Nevertheless, the current status of the quality of nursing documentation in the patient record and influences on the accuracy of documentation were not studied intensively during this period (Gunningberg et al. 2009).

By using several methodological designs, our studies evaluated factors influencing the accuracy of the nursing diagnosis documentation, the prevalence of accurate nursing documentation in hospital patient records, and specific influencing factors: knowledge sources, critical thinking dispositions, and reasoning skills and whether they affect the accuracy of nursing diagnosis documentation. The contributions of these studies to the domain of nursing diagnoses and nursing documentation can be summarised as follows.

First, as a result of the systematic literature review, we proposed a conceptual basis to explain the reasons for (in)accurate diagnoses and intervention documentation. We distinguished two classes of factors that influence nursing documentation: (1) general factors that influence the reasoning and documentation process in general, and (2) specific factors that specifically influence the prevalence and accuracy of nursing diagnosis documentation. Examples of general factors that influence nursing documentation include work procedures, work allocation, disrupting
work conditions, conflicting personal values, knowing the patient, motivation, and staff development. Specific influencing factors were subdivided into four conceptual domains: (1) the nurse as a diagnostician, (2) diagnostic education and resources, (3) complexity of a patient’s situation, and (4) hospital policy and environment. To support nurses in documenting their diagnoses accurately, we recommend an in depth, integrative view of factors that influence diagnoses documentation. A conceptual model of determinants that influence nursing diagnosis documentation, as presented in this dissertation, may be helpful for nurse managers and nurse educators to use as a reference.

Second, to determine whether nursing documentation in clinical practice is accurate, we used the NANDA-I, NIC, and NOC as a conceptual basis (Johnson et al. 2007). As we did not find a psychometrically tested measurement instrument for assessing the accuracy of nursing documentation, we developed a new instrument: the D-Catch. Based on a study of 245 patient records in 25 wards in seven hospitals, the D-Catch was found to be a feasible and reliable instrument for use in a general hospital context. For clinical purposes at the hospital ward level, the D-Catch may in future research facilitate the review of patient records for determining the accuracy of nursing documentation. Because the D-Catch is based on international nursing standards, it can be used on regional, national, or international levels.

Third, on the basis of a cross-sectional record review and using the D-Catch instrument, we showed that nursing diagnoses were poorly documented according the PES structure. Even though NANDA-I criteria were incorporated into almost all nursing school curricula in the Netherlands since the mid 1990s, we found that documented nursing interventions were mainly unrelated to documented nursing diagnoses. Furthermore, we established that nursing documentation was mainly chronological instead of systematic and hardly problem or diagnoses based. Based on our record review, it was unclear what factors influence accurate and inaccurate documentation.

Fourth, based on the results of the systematic review, we concluded that important influences were described toward nurses themselves, but that these influences were not further researched in depth. Therefore we chose to the nurse related determinants for further research. We selected the following determinants out of the Diagnostician domain: diagnostic reasoning skills and case related and diagnostic knowledge, and we decided to focus on pre-structured record forms and the use of classification structure i.e. NANDA-I, related to the domain, Diagnostic education and resources in nursing practice. We performed a study based on a randomised factorial experimental design, in which we compared four groups of hospital nurses (n= 241). One group used handbooks and an assessment format, the second group used a PES-format, the third group used a PES-format and handbooks and an assessment format. The fourth group acted as control group. Using the D-Catch instrument as a measurement tool for accuracy of
nursing diagnoses, we found that the use of a PES format had a significant positive effect on the accuracy of nursing diagnosis documentation. The opportunity to use handbooks on nursing diagnoses or a pre-structured assessment format did not significantly affect the accuracy of diagnoses. These results suggest that knowledge and reasoning skills acquired in previous educational programmes do not automatically result in the use of this knowledge and these skills without specific sources. We found that nurses who scored low on critical thinking dispositions and reasoning skills documented diagnoses with lower accuracy than nurses who scored higher on these dispositions and skills.

**Methodological considerations**

*Factors influencing the prevalence and accuracy of nursing diagnosis documentation in hospital practice*

The conceptual definition of accuracy of a nursing diagnosis and a description of the characteristics of accuracy emphasise the relativistic nature of the concept (Lunney 2008, 2009). This means that “accuracy of nurses diagnoses of human responses is too complex and relative to be considered as a dichotomous (i.e., either / or) variable” (Lunney 2009, p. 28). Instead, accuracy of diagnoses is to be judged as ordinal, as the D-Catch instrument provides. Accuracy in nursing diagnoses is also considered to be relativistic in nature, because there seems to be a web of relationships between various independent variables and the dependent variable ‘nursing diagnosis accuracy’. We propose a conceptual model comprising four domains of factors that influence diagnoses documentation accuracy. As we included papers written in English only, we missed several papers, mostly published in Spanish, Portuguese or Japanese. The information we found in English abstracts related to these articles was in many cases insufficient to obtain enough clarity addressing the focus of the study, the research design, the level of evidence, the data collection, and factors that influence diagnoses. Therefore we decided not to include these papers. Although we might have overlooked some papers due to the search strategy or database filters used, we presume that our model is consistent and contains the foremost influencing factors described in the literature. It was impossible to aggregate data by performing statistical procedures, since the measurement instruments and methods described in the reviewed articles differed. Therefore, we assessed papers qualitatively and were thus unable to associate the influencing factors or to distinguish major influences from minor ones. We used the Oxford Levels of Evidence as a reference guide for assessing study validity. Designs, sample sizes, and methods were assessed. Nevertheless, these levels of evidence do not accommodate fully the wide range of qualitative research we found, and so we modified these levels. Our modification of the Oxford Centre criteria was not further validated.

Although our review has its limitations, we are convinced that the overview of influencing factors on diagnoses accuracy is important for hospital managers,
nurse educators, and staff nurses, who are all accountable for continuity and quality of care and patient safety. On the basis of our review, we present evidence that the cause of low accuracy in nursing diagnosis documentation in clinical practice is multi-factorial. Therefore, a management approach with the aim of improving diagnoses documentation should be integrative in nature. To move forward in developing strategies for accuracy in diagnoses documentation, it is necessary to address the whole field of influencing factors, instead of carrying out only single-issue implementations, such as training in deriving diagnoses or computer tools in nursing documentation. Although single implementations might have short-term effects, their long-term effects are often uncertain. Therefore, single implementations could be a disinvestment, as the ultimate aim is to positively influence the quality of care and to decrease the amount of adverse events in clinical practice by providing accurate nursing documentation.

As we focus on the model containing determinants that influence the prevalence and accuracy of nursing diagnosis documentation as developed based on the results of the literature review, this model may not be transferrable to other health care settings as for instant nursing homes. Policy, environmental and cultural aspects as well as patient characteristics may differ from the hospital situation with other influencing factors as result. Nevertheless, there may be similarities between the hospital context and other healthcare settings related to the model as well. Completion of an additional review of the literature toward influencing factors in other settings can provide the basis to evaluate the model representing the hospital context, with the aim to develop a model for use more general.

The prevalence of accurate nursing documentation in hospital patient records in the Netherlands

To get an idea of available instruments that have been used to assess nursing documentation, we performed an exhaustive literature search for quantitative measurement instruments used in hospitals. We assume that our overview of instruments represents the foremost instruments published. We found that none of the instruments were psychometrically tested for use in general hospitals.

On the basis of the content of two measurement instruments and by using Delphi panel techniques, we determined the content of the D-Catch instrument. However, the qualitative Delphi panel approach of two small panels we used has limitations for content validity testing (Lynn 1986, Akins 2005). Also, we were unable to calculate consensus scores or agreement rates. Reflecting on this qualitative approach, despite limitations, we found that interactions among the panellists throughout consensus discussions yielded valuable opinions that were used to decide on the ultimate criteria of the D-Catch instrument.

At the time we had carried out the review toward the instruments available from the literature and had started a pilot study using the D-Catch instrument (2007),
concurrently the amount of publications toward measurement instruments was increasing. We had several contacts with some of the researchers developing instruments for research in the same area, such as the Cat-ch-Ing (Björvell 2000) and the Q-DIO (Müller-Staub 2007, Müller-Staub et al. 2008). These contacts were helpful and positively influenced the simultaneous procedure of development and testing of the D-Catch.

The D-Catch was used to measure accuracy in nursing documentation in a prevalence study. A record review was carried out using a random sample from 6 of 10 general hospitals. We replaced the hospitals that declined participation by approaching hospital managers in the same region as those that declined. We found no significant differences between the nursing documentation accuracy scores of the four replacement hospitals and those of the randomly selected hospitals. Therefore, we believe that our sampling method did not affect representativeness due to selection bias. Twelve pairs of reviewers assessed the nursing documentation. This approach was feasible in hospital practice despite differences in documentation formats and patient records. We reviewed nurses’ documentation (341 patient records) in 10 hospitals and seven specialties (35 wards) that differed in the conditions of the patients, the patient-to-staff ratio, and the nursing staff’s educational background and years of experience. These and other factors, such as interdisciplinary or environmental characteristics of the ward, were not assessed in our study and might have influenced accuracy scores.

As we were not able to review whether the documentation was relevant related to the actual or potential existence of nursing diagnoses in that particular patient situation at that time, since we did not assess patients in our prevalence study, the issue ‘relevant’ in the quality criteria of the D-Catch may be a cause of subjectivity. The understanding of relevancy of documented nursing diagnoses in patient records was a particular subject of consideration in the training session ahead of the measurement in hospital practice, with the result that the inter-rater reliability was acceptable and raters had comparable understanding whether the information was relevant in the context of the additional content of the documentation. Still, this can be seen as a limitation of the study.

We assume that the data acquired with the D-Catch instrument resulted in reliable information on the accuracy of nursing documentation and should seriously be taken into consideration by hospital managers, nurse educators, and staff nurses, since low accuracy in nursing documentation, as found in this dissertation, has a negative effect on the quality of care and could be a cause of severe adverse events hampering patient safety (Zeegers 2009).

Not only hospital managers, nurse educators and staff nurses in a hospital context could benefit from the D-Catch instrument. Standards for nursing documentation are equal in all settings, therefore the D-Catch instrument may be suitable to
evaluate the accuracy of the documentation in other settings as well. As the documentation approach and documentation systems in other settings may be different compared to the hospital setting, feasibility, reliability and validity testing of the D-Catch instrument seems to be required in case of use in other settings.

The effect of knowledge sources and predefined record structure on the accuracy of nursing diagnoses

We were able to provide evidence based on a randomised factorial design that a predefined record structure and reasoning skills (deductive and analytical skills) significantly contribute to the accuracy of nursing diagnoses. Several studies associate critical thinking and reasoning to diagnostic inference. None of these studies, however, describe the relationship between the accuracy of nursing diagnoses and critical thinking and reasoning.

Using actors as simulation patients, we were able to create an experimental environment that closely resembled the participants’ work setting. However, actors are not the same as patients. We have to consider the possibility that the information presented by the actors had more internal coherence than information obtained from real patient situations, and therefore was easier to assess. On the other hand, working with actors provided us with natural nurse-to-patient interactions. Compared to pre-produced video cases, for instance, real-life simulations are, despite costs and time-consuming face-to-face acting, preferable in researching the effect of nurse-to-patient interactions (Cioffi 2001, Williams & Gossett 2001, Jeffries 2005). Kruijver et al. (2001) stated, “The advantage of the simulated patient technique is that it directly assesses nurses’ communication skills that are important during the daily performance in nursing practice”. Nurses have to use their expertise to ask patients relevant, in depth, questions in order to be able to analyse, interpret, and document patients’ information in terms of nursing diagnoses. A patient-to-nurse relationship is essential for deriving diagnoses (Wilkinson 2007). As this relationship or ‘connection’ is required for deriving accurate nursing diagnoses in clinical practice, it is essential in an experimental environment as well. Otherwise this may hamper generalisation of the results to clinical practice. To limit bias, we took time to intensively rehearse the case histories and script. Thereby we were able to work with the same four actors from the pilot study in the follow-up study. Most of the assessment interviews were videotaped and reviewed for reliability reasons. Retrospectively, we conclude that script consistency was satisfactory.

It may seem that providing a PES-format for diagnoses documentation is receiving diagnostic results in a PES-format. Based on the analysis of the documentation in the PES-format in our experiment, we found that 8 (6%) of the 126 participants did not use the format as it was purposed, and that the structure was ignored completely; the documentation was descriptive in nature and problem label, related
factors and signs and symptoms were not accurately documented. Therefore their scores were \( \leq 4 \) (2-8). For some nurses it seemed to be complex to use the format appropriately and to document their findings correctly in the format. However, we found that providing a PES-format offered results significantly positive: 90 (71\%) participants out of 126 scored \( \geq 5 \) (2-8) in these groups. Out of the 115 participants allocated in groups without the possibility to use a PES-format, 17 (15\%) participants used the PES-structure and scored \( \geq 5 \) (2-8) and 53 (46\%) participants scored \( \leq 4 \) (2-8) in these groups. Although the use of a PES-format is not obviously resulting in higher accuracy scores in all cases, we have to take into account that the results in our study may be, to some extent, caused by an overlap between intervention and outcome measure, which is hardly to avoid in this type of experimental designs.

We paid attention to relevancy of the nursing diagnosis in the experimental studies. To be able to analyse whether nurses derived relevant diagnoses (accurate content), each of the three actors’ scripts contained six actual nursing diagnoses which should be identified based on the assessment interview (Table 1). The scripts were specifically designed to represent exactly six actual nursing diagnoses. Any actual nursing diagnosis not fitting the script was considered to be irrelevant. Independent raters (n= 8; four registered nurses and four fourth year bachelor students in nursing) scored in pairs whether the diagnosis was considered to be relevant or not based on the listed six diagnoses after they had received a 20 hour training in reviewing accuracy and relevancy of nursing diagnoses. Based on a consensus discussion, if necessary, raters gave a definite score. In almost all cases, the raters’ scores of relevant or irrelevant diagnosis lead to no discussion and the scores were found to be equal, because it was apparent whether it was relevant related to the six actual diagnoses in the script. Therefore no scores for inter-rater reliability calculation were noted in the case of the six diagnoses from the fixed scripts.

The estimated time needed to do the assessment interview and to document the diagnoses seemed to be sufficient. Participants did not report lack of time. Nearly all participants stated that the environment and the performance of the simulation patients were natural and did not hamper their interviewing.
Table 1 Nursing diagnoses in actors’ script

<table>
<thead>
<tr>
<th>Diagnostic labels(^1) incorporated in the case history and script</th>
<th>Diagnostic labels(^1) incorporated in the case history and script</th>
<th>Diagnostic labels(^1) incorporated in the case history and script</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes patient</td>
<td>COPD patient</td>
<td>Crohn’s disease patient</td>
</tr>
<tr>
<td>1</td>
<td>Fatigue (p. 253)</td>
<td>Activity intolerance (p. 66)</td>
</tr>
<tr>
<td>2</td>
<td>Grieving (p. 280)</td>
<td>Anxiety (death anxiety) or fear (p. 72 / p. 260)</td>
</tr>
<tr>
<td>3</td>
<td>Impaired tissue or skin integrity (p. 464 / p. 471)</td>
<td>Deficient fluid volume (p. 266)</td>
</tr>
<tr>
<td>4</td>
<td>Inactive self-health management (p. 579)</td>
<td>Disturbed sleep pattern (p. 602)</td>
</tr>
<tr>
<td>5</td>
<td>Ineffective activity planning (p. 71)</td>
<td>Impaired gas exchange (p. 516)</td>
</tr>
<tr>
<td>6</td>
<td>(Risk for) unstable blood glucose (p. 88)</td>
<td>Ineffective airway clearance (p. 511)</td>
</tr>
</tbody>
</table>

\(^1\) Diagnostic labels as published in: Nursing Diagnosis, Application to Clinical Practice, Edition 13, Carpenito-Moyet (2010), Lippincott Williams & Wilkins.

The influence of ready knowledge, dispositions towards critical thinking, and reasoning skills on the accuracy of nursing diagnoses

A number of student nurses and registered nurses in our samples may have been especially interested in nursing diagnoses, as compared to those who did not participate, since students and nurses in our samples were invited to voluntarily participate in our study. This may have introduced a selection bias and a restriction of variance.

We used the CCTDI and the HSRT to estimate the association between critical thinking dispositions and diagnoses accuracy.

The HSRT test manual is based on the consensus definition of critical thinking that was developed in a Delphi Study (Facione & Facione 2006). Linguistic validation of the CCTDI and the HSRT was done by forward and backward translation by two independent translators. The final translation was assessed by a third translator and approved to be relevant in the Dutch nursing context by a
panel of nursing scientists (n = 6). Reliability of the Dutch version of the CCTDI quantified by Cronbach’s alpha was 0.73. Reliability of the Dutch version of the HSRT was 0.64, also quantified by Cronbach’s alpha (n= 96).

Based on the experiment toward students we found a weak, but significant, association between the Analysis domain of the HSRT and the accuracy in nursing diagnoses documentation, (p= 0.013). This significant result may be due to multiple testing, since after Bonferroni correction this finding does not fall below 0.05 significant level. Although we found significance in this domain as well as in the experiment of hospital nurses, we can not conclude that, in general, students’ reasoning skills influence the accuracy of nursing diagnoses.

We found the sampling, the research design and the use of the D-Catch, the knowledge inventory, the CCTDI, and the HSRT instruments to be useful within the framework of this study. On the basis of our findings from the two studies in which we used the knowledge inventory, the CCTDI, and the HSRT, we concluded that case-related knowledge, critical thinking, and reasoning skills need to be taught and assessed comprehensively in nursing schools and in postgraduate education programmes if nurses are to avoid inaccurate diagnoses and incorrect interventions in clinical practice.
Conclusion

This study shows that the accuracy of the nursing documentation, in general, needs improvement, and that several factors are influencing the accuracy of nurses’ (diagnosis) documentation.

The following findings are concluded:

- The D-Catch instrument proved to be a reliable and valid instrument for measuring the accuracy of nursing documentation in the patient record. This instrument may be of use in an international context as well.

- Particularly the accuracy of the documentation of nursing diagnoses and interventions, were found to be poor to moderate in the Netherlands. These findings are comparable with several findings in other countries. It seems that an international approach is required for further developing international documentation standards and accuracy in nursing documentation.

- On the basis of a systematic review it was concluded that the cause of low accuracy in nursing diagnosis documentation in clinical practice is multifactorial. A distinction between general and specific factors of influence can be made. Further research is needed to distinguish minor from major influences. A conceptual model of influencing factors, provided in this dissertation, may be helpful for nurses, facilitators, administrators and record designers.

- In general, a positive critical thinking disposition and well developed reasoning skills, in particular analytical, deductive reasoning skills, influence accuracy of nursing diagnoses positively. The evidence for the relationship between specific reasoning skills and accuracy in nursing diagnoses is new and may contribute to the development of nursing education programs and assessments addressing these reasoning skills in several countries in which these skills have less attention.

- The PES-format as a tool may be beneficial for use in electronically patient records, since this format proved to be helpful in requiring accurate nursing diagnoses documentation.
Chapter 7

**Implications for practice**

This study provides instruments and methods to investigate the prevalence of accurate documentation as well as factors that influence nursing diagnosis documentation. The result of an international record review of 7926 randomly selected hospital records, reported by Zeegers (2009) revealed that “inadequate content in patient records is associated with higher rates of adverse events. Also, a lower overall report-mark for the nursing and medical record is associated with a higher rate of adverse events. Thus, the adequacy of patient record contents seems to be a predictor of the quality of health care”. The results of the study of Zeegers (2009) and the results of our study on accurate nursing documentation show the importance of taking action in clinical practice. Hospital managers, nurses, and nurse educators in hospital practice are accountable for patient safety and quality of care. Therefore, they have to find strategies to improve nursing documentation in clinical practice.

**Knowledge, critical thinking, and reasoning in nursing**

The first step to improving the accuracy of nursing diagnosis documentation is to create awareness of the need to make reflective judgements in complex situations. Nurses may need to be more aware of being sensitive to one’s potential bias, being alert to potentially problematic situations, and being able to anticipate certain results or consequences that influence their diagnoses (Alfaro-LeFevre 2004). Nurses as well as teachers have to focus more on critical thinking dispositions in daily clinical practice and in diagnostic training programmes (Björvell et al. 2002; Cruz et al. 2009).

Teaching nursing students and registered nurses how to employ strategies on using ready knowledge and knowledge sources (‘on-paper-knowledge’ or ‘database-knowledge’) is an important objective for nursing faculty. However, patient situations in nursing are diverse. Nurses are employed in numerous specialty areas, and consequently, the complexity of patient situations that nurses have to deal with in daily practice differs. Therefore, what nurses ought to recall to mind depends on several determinants, such as their responsibilities relating to their individual diagnostic inference as members of a multidisciplinary team, the level of knowledge needed in specific patient situations, and experience and training in the specialty area in which the nurse is employed. Ongoing critical evaluation of what is expected from nurses, related to their tasks and responsibilities in clinical practice, might deliver essential information on what knowledge is lacking or on what knowledge sources might be needed in specific nursing areas.

In our study we provide evidence that a nurse’s dispositions towards critical thinking and diagnostic reasoning skills are vital for obtaining accurate nursing diagnoses. This study confirms the need to develop students’ critical thinking dispositions and reasoning skills in nursing schools to enhance the accuracy of nursing diagnosis documentation (Björvell et al. 2002; Cruz et al. 2009, Lunney 2009). It
is also imperative to cultivate these skills in nursing staff in clinical practice. As educators focus on developing critical thinking disposition and reasoning skills in aspiring nurses, deriving and documenting nursing diagnoses should be part of all nursing education programmes. Improving nurses’ disposition towards critical thinking, improving nurses’ reasoning skills, and using knowledge sources will likely be a step forward in improving the accuracy of nursing diagnoses.

**Documentation resources**

This dissertation gives evidence that using the PES format increases accuracy in nursing diagnosis. This finding is important for software designers and implementers of electronic documentation systems. The use of the PES format should be incorporated into all digital nursing documentation systems. The implementation of such systems ought to be supported by experts in nursing diagnoses education and in critical thinking and diagnostic reasoning. Experts in nursing diagnoses education have to offer training intended for the nursing staff in clinical practice in how to use the PES format in an electronic documentation system.

Computer tools and software can increase the efficiency in exchanging patient information on an inter-institutional level. As mentioned by Keenan et al. (2008), software that quantify data in electronic documentation systems can address evaluative questions about what are the most prevalent problems, the most successful interventions, and the most observed outcomes. Nevertheless, what goes into the system must be relevant and precise, since care plan information documented in the system needs to be reliable. All staff nurses are individually accountable for deriving and documenting accurate nursing diagnosis, related interventions, and progress and outcome evaluations. Electronic nursing documentation also helps nurses in systematically evaluating the care plans based on a structured and legible documented patient history (Keenan et al. 2008). Resources to reduce the lack of precision of diagnostic reports as, for instance, detailed computer-generated standardised nursing care plans, may support nurses in their administrative work (Smith Higuchi et al. 1999). The development and implementation of electronic documentation resources and pre-formulated templates have positive influences on the frequency of diagnoses documentation (Smith Higuchi et al. 1999, Gunningberg et al. 2009). Kurashima et al. (2008) found that time needed to obtain a diagnosis is significantly shorter when nurses use a computer aid. Classification structures, such as the NANDA-I classification (Thoroddsen & Ehnfors 2006), are helpful in combination with electronic resources to provide accurate diagnoses documentation (Smith Higuchi et al. 1999). The use of electronic information systems designed to achieve systematically and logically structured information that is directly available to all health care professionals may overcome the time-consuming, useless redundancies, as the ones we found in chronologically, mostly handwritten documentation systems.
Taking all aforementioned issues into consideration, we highly recommend the implementation of computer tools for digital care plan documentation in clinical practice and in nursing schools. These tools must be based on nursing standards and software resources that will help nurses to use these standards. Nevertheless, the findings of DesRoches et al. (2010) suggest that “to drive substantial gains in quality and efficiency, simply adopting electronic health records is likely to be insufficient. Instead, policies are needed that encourage the use of electronic health records in ways that will lead to improvements in care”. Thereby, as was found by Ammenwerth et al. (2002), when implementing computer tools, even as a fit between nursing workflow and the functionality of a digital nursing documentation system, it is important to consider whether nurses agree to use electronic care plans in their wards. Coaching and support are needed, mainly because the use of classification principles and the PES format may be unfamiliar to a number of nurses, especially to nurses educated before the mid 1990s.

Nursing documentation in education programmes

Some authors are concerned on whether there are an adequate numbers of well-prepared and capable nurse educators to teach the nursing process (Davies et al. 2005, Hinshaw 2001). Nurse educators that are experts in nursing diagnosis derivation and documentation are a prerequisite for accurate nursing documentation in clinical practice. Therefore, we recommend the development of a competency statement that lists the essential core knowledge, skills, and abilities that all nurse educators must possess if they are to teach courses on nursing and diagnoses documentation and electronic documentation systems.

Standardized nursing language facilitates the collection and use of data for measuring and monitoring quality of care. Furthermore standardized language not only facilitates the development of practice standards at the unit level but they also do so at larger levels. Software for use in nursing education programmes can assist educators to teach students how to plan their care in a consistent way while using standardisation (Keenan et al. 2008).

Hospital policy and management

For hospital management, accurate nursing documentation would show the full range of nursing practice, including how nursing contributes to health promotion and prevention of illness (Clark 1997, Keenan et al. 2008). Improvements in nursing documentation that use an internationally acknowledged classification system offer opportunities to establish a nationwide or state-wide database that incorporates medical and nursing data. These data can be used for the retrospective analysis of quality and safety issues as well as costs. Since health care expenditures vary greatly because of different health care settings, populations, diseases, and conditions, there may be cost controlling reasons from a political perspective for implementing standardised language in nursing. Accurate nursing diagnosis
documentation can open up possibilities for exploring the nature of the costs of nursing care, for instance, by benchmarking hospital expenditures.

For reliable data on quality and efficiency, external hospital accreditation is increasingly important for hospital management. External hospital accreditation is not only valuable for receiving an independent quality and efficiency statement; it is also valuable for achieving compliance with safety requirements. It gives hospital management an indication of possible quality improvements that need to be undertaken.

Audit staffs observe mostly documentation procedures, processes, instructions, and protocols in a variety of indicators. However, accreditation reflects the origins of systematic assessment of hospitals against explicit standards (Shaw 2000). Thus, to adopt quality indicators in international accreditation programmes based on nursing documentation standards is highly recommendable. In this manner, both procedures and the quality of documentation content must be measurable and audited. On the basis of our findings, we presume that hospital accreditation is awarded based on incomplete accreditation standards in nursing documentation, since we found that in many cases nursing documentation was inaccurate. Using incomplete or incorrect accreditation criteria in nursing documentation might put forth a counterfeit image of documentation accuracy that misleads hospital management and that results in the perpetuation of low documentation accuracy. Accreditation based on uniform standardised accreditation criteria gives hospital management the exact direction for improvements. We are convinced that this will make a real difference between safe and unsafe patient situations in clinical practice. Thus, the development of uniform accreditation criteria in nursing documentation provides hospital management and nursing staff with a tool for measuring identically documentation quality in several hospitals, with the opportunity to do hospital benchmark research. This might stimulate them to improve documentation procedures as well as the content of the documentation. Hospital benchmark research positively influences quality of care and patient safety (Donaldson et al. 2005).

**Future research**

*Paradigm shift in nursing diagnosis research*

In the literature, we found that several factors that influence diagnoses documentation were investigated as a single influencing factor. Probably, there is no single determinant that solely can attribute to the accuracy of nursing diagnosis documentation. The combination of factors presumed to affect the accuracy of nursing diagnosis documentation has to be taken into consideration as a topic for further research. Previously obtained case-related diagnostic knowledge, experience; the use of diagnostic resources, critical thinking dispositions, reasoning skills; and cultural characteristics, hospital policy, and environmental
aspects will result in additional knowledge that will serve as a useful basis for future documentation improvement strategies.

The results of our study emphasise that positive critical thinking dispositions and extended reasoning skills (especially analytical and deductive reasoning skills) are positively associated with the accuracy of nursing diagnosis documentation. But nurses’ general inductive and evaluative thinking with their focus on patient’s possibilities as alternative ways of analysing the problems of patients may cause nurses to become dissatisfied with the use of nursing diagnoses and to resist systematic data documentation (Henderson & Nite 1978, p. 371, Benner & Tanner 1987, Doering 1992, Heartfield 1996). This may be a reason why nurses write about observations and responses in a chronological and passive manner; thus, what health problems nurses actually are engaged in, in clinical practice is unclear; the reality of nursing remains hidden and will not be recorded as suggested by Heartfield (1996). Henderson mentioned in 1980 that the role of subjective or intuitive aspects of nursing and the role of experience, logic and expert opinion as the basis for nursing practice may be ignored by using the nursing process with the purpose of problem-solving (Halloran 1995, p. 199-212). Since the 1980’s nurses are developing a more flexible use of the nursing process (Pesut & Herman 1998, Alfaro-LeFevre 2004, Wilkinson 2007), and therefore, it might be that the current dichotomy—the non-analytical and humanistic stance (Benner 2001, Benner & Tanner 1987, Dreyfus & Dreyfus 1986, Tanner 2005) versus the cognitive, positivistic stance related to the conceptual basis of Gordon (1994), Carpenito-Moyet (2008), Facione (2000, 2006) —has to be abandoned as a conceptual distinction for researching the accuracy of nursing diagnoses documentation.

The contemporary view is that nursing documentation must be logically written, dichotomizing objective and subjective elements as signs and symptoms, according to the ethical, legal, and institutional, empiricists’ view on nursing care. A third stance—the pluralistic diagnoses accuracy paradigm, which combines aspects of the aforementioned paradigms with cultural characteristics, hospital policy, and hospital environmental attributes—might offer a new focus for researching the accuracy of nursing diagnoses. Therefore, when studied concurrently in a multifactorial design, these factors could be an option for further research.

Research collaboration

The instruments and the methods used in the studies reported in this dissertation might be useful in other research designs as pre- and post-tests to measure the outcome of implementations such as electronic documentation systems. As we focus on the content of the instruments used to measure the accuracy of nursing documentation in several countries such as the USA, Switzerland, Sweden, and Iceland, we presume that the basic principles defining accurate nursing documentation are quite similar. For instance, most of the instruments
use the NANDA-I and the PES structure as their conceptual basis for accuracy measurement in nursing diagnoses. The development of an instrument for accuracy measurement in nursing documentation in an international context could serve as a launching point for further international research on the prevalence of accurate nursing documentation. International collaboration in the field of accuracy measurement might provide additional information on minor and major factors that influence the accuracy of nursing documentation and on essential interventions that can enhance documentation accuracy. For instance, there might be an association between nurses’ level of education, nurses’ reasoning skills, nurse staffing, and availability of resources (paper and electronic) and accuracy in diagnostic documentation. However, this possible association is still unclear and needs to be investigated.

The impact of inaccurate and accurate nursing documentation on patient safety

Research is lacking on the effects of inaccurate and accurate nursing diagnosis documentation on the continuity of care, quality of care, and patient safety (Urquhart & Currell 2005, Lunney 2007). Additional research outcomes that link the quality of information in patient records to causes of adverse events will provide information that may stimulate documentation improvements (Zeegers 2009). The World Health Organization’s advice (2007) is to explore technologies and methods that can improve hand-over effectiveness, such as electronic medical records, automated medication reconciliation, streamlining information, using a common (standardised) language for communicating critical information, and providing patients with the opportunity to read their own medical record as a patient safety strategy (World Health Organization 2007). Although these suggestions are based on research on physician-to-physician communication during patient handoffs (Solet et al. 2005), on the basis of our results we recommend that this advice should also be applied to the nursing context as it relates to nursing and interdisciplinary hand-over effectiveness (Wong et al. 2008). Nevertheless, in order to support our recommendation, future research has to be carried out on nursing hand-over effectiveness relative to the accuracy of nursing documentation.

In order to determine whether omissions in patient records affect patient safety and adverse events, other sources need to be researched as well, such as databases for specific documentation of causes of adverse events in hospitals, since patient records may not provide enough pertinent information for reliable research data. Moreover, future research is needed to show how the use of documentation standards affects length of stay, quality of care, or the prevalence of adverse events.


Summary
In clinical practice, documentation in the patient record is part of each nurse’s daily routine. It is considered to be essential for adequate, safe, and efficient nursing care. Inaccurate nursing documentation can be a cause of nurses’ misinterpretations and may cause unsafe patient situations. Therefore, the World Alliance for Patient Safety recommends further research on medical and nursing documentation so that they can identify and report potential areas for improvement. The introduction of the nursing process to hospitals in the USA and Europe, combined with information on the value of nursing diagnoses from NANDA in the early 1980s, prompted nurses to think seriously about the importance of systematic, standardised, and accurate nursing reports in the patient record. From then on, nursing diagnoses became progressively more important as an element of nursing documentation. Therefore, how to derive and how to document nursing diagnoses received priority attention in nursing education programmes.

Nursing diagnoses provide the bases for selecting nursing interventions that achieve outcomes for which nurses are accountable. Nursing diagnosis is defined as “a clinical judgment about individual, family or community responses to actual and potential health problems/life processes. (NANDA-I 2004, p. 22). An accurate diagnosis describes a patient’s problem (label), related factors (aetiology), and defining characteristics (signs and symptoms) in unequivocal, clear language. This way of documenting diagnostic findings is called the PES structure (P = problem label, E = aetiology (related factors) and S = signs/symptoms). Describing a problem solely in terms of its label in the absence of related factors and defining characteristics could lead to misinterpretation. Although certain aspects of nursing documentation and diagnoses have been researched, gaps remain in the field of (1) measurement instruments for reviewing nursing documentation in the patient record, (2) the prevalence of accurate nursing documentation, and (3) factors influencing nursing diagnosis documentation.

This dissertation had two main objectives. The first was to describe factors that influence the accuracy of documented nursing diagnosis. The second objective was to describe the prevalence of accurate nursing documentation in the patient record.

The aim of the first study was to review factors that influence the prevalence and accuracy of nursing diagnosis documentation in hospital practice. To accomplish this aim, we performed a systematic literature search of the electronic databases MEDLINE and CINAHL of articles published between January 1995 and October 2009. Twenty-four articles that examined factors that influence the prevalence and accuracy of nursing diagnosis documentation were included in the review. Four domains were identified: (1) the nurse as a diagnostician, (2) diagnostic education and resources, (3) complexity of a patient’s situation, and (4) hospital policy and environment.

The aim of the second study presented was (1) to develop a measurement instrument to assess nursing documentation—which includes record structure, admission
data, nursing diagnoses, interventions, progress data, and outcome evaluations—in various hospitals and wards, and (2) to test the validity and reliability of this instrument. The aim of the third study was to describe the accuracy of nursing documentation in patient records in hospitals. The D-Catch instrument was used to measure the accuracy of nursing documentation in 341 patient records of 10 randomly selected hospitals and 35 wards in the Netherlands. We found that, in general, the quality of nursing diagnoses and the documentation of nursing interventions was moderate to poor.

The aim of the fourth study was to determine how knowledge sources, ready knowledge, and disposition towards critical thinking, and reasoning skills influence the accuracy of student nurses’ diagnoses. This pilot study, which used a two-group randomised design, examined our methodological approach to studying how nursing students (n= 100) document diagnoses.

The aim of the fifth study, which used a four-group randomised factorial design and included registered hospital nurses (n= 249), was to determine the effect of knowledge sources and a predefined record structure (problem label, aetiology, signs/symptoms [PES] format) on the accuracy of nursing diagnoses, and to determine the association between ready knowledge, dispositions towards critical thinking, and reasoning skills and the accuracy of nursing diagnoses. Based on the results of this study, it can be concluded that the PES format mainly has a positive effect on the accuracy of the nursing diagnoses. Almost half of the variance in diagnosis accuracy was explained by the presence of the PES format; nurses’ age; and nurses’ reasoning skills, deduction, and analysis. As far as we know, this result is new and places pre-structured formats and reasoning skills in a new perspective.

To use the PES structure more accurately, nurses need to enhance their analytical and deductive reasoning skills. This could be achieved through specialized courses geared towards building these skills. Part of the 53% unexplained variance was likely to be random in the sense that it cannot be explained by systematic variance from independent variables. Personal knowledge, experience, and (subjective) individual reflections are part of nurses’ diagnostic process as well. The results of this study have implications for nursing practice and education. Improving nurses’ disposition towards critical thinking, improving nurses’ reasoning skills, and encouraging them to use the PES structure could be a step forward to improving the accuracy of nursing diagnoses.

The results of this research project contributed to the research domain of nursing documentation and to the domain of nursing diagnoses. We developed a measurement instrument intended to measure the prevalence of accurate nursing documentation, and we added information on the prevalence of nursing documentation in the Netherlands. As a result, we developed a conceptual model of factors that influence nursing diagnosis documentation and that can
be used by hospital managers and nurse educators as a reference guide for developing management and educational strategies for improving nursing documentation. Moreover, we demonstrated that pre-structured record forms and analytical reasoning skills are factors that positively influence nursing diagnosis documentation. As we merge our findings to the findings of recently published research on the negative influence of inaccurate nursing documentation on patient safety and quality of care, we stress to health care leaders and educators the importance of investing in appropriate nursing documentation.

We presume that the basic principles defining accurate nursing documentation are quite similar internationally. For instance, internationally the NANDA-I and the PES structure are well-known conceptual bases for accurate measurements in nursing diagnoses. The testing of an instrument that measures the accuracy of nursing documentation in an international context could be a start for further international research on the prevalence of accurate nursing documentation and for defining international nursing standards in nursing documentation.

Research is lacking on the effects of accurate and inaccurate nursing diagnosis documentation on the continuity of care and patient safety. This kind of research is required for evidence-based organisation enhancement in clinical practice. Additional research outcomes that link the quality of information in patient records to causes of adverse events will provide knowledge that may stimulate documentation improvements and may have a positive influence on the quality of care.
Samenvatting (Dutch Summary)

Conform de richtlijn van de North American Nursing Diagnosis Association International (NANDA-I) behoort een verpleegkundige diagnose een kernprobleem van de patiënt te beschrijven dat deze patiënt in het dagelijks leven in bepaalde (fysieke, psychische of sociaal-maatschappelijke) opzichten belemmert. Oorzakelijke factoren of gerelateerde factoren en de kenmerken waaruit het bestaan van het probleem blijkt, dienen daarbij genoteerd te worden. In de verpleegkunde is de structuur van documenteren bekend onder de term ‘PES-structuur’ (P= probleemlabel, E= etiologie (oorzakelijke factoren / gerelateerde factoren), S= Symptomen / Signs (aanwijsbare kenmerken). Daarbij behoort een verpleegkundige diagnose zo omschreven te zijn dat er een verpleegkundige actie (interventie) op voorgeschreven kan worden; een concrete probleemaanpak. Deze probleemaanpak behoort evalueerbaar te zijn in termen van uitkomsten of effecten van de zorgverlening.

Deze studie bevat twee hoofdthema’s: (1) de factoren die van invloed zijn op de documentatie van de verpleegkundige diagnose, en (2) de prevalentie van accurate verpleegkundige documentatie in patiëntendossiers in ziekenhuizen in Nederland.

De eerste studie betreft een systematisch uitgevoerde literatuurstudie naar factoren die de verpleegkundige diagnose in de klinische praktijk van het ziekenhuis beïnvloeden. Op basis van deze literatuurstudie kunnen vier domeinen in een conceptueel model worden ondergebracht. Binnen het domein (1) ‘Invloed door de complexiteit van de patiëntensituatie’ valt ondermeer de mate waarin de patiënt
in staat is zijn gezondheidsproblemen te uiten. Ook de invloed van verschil in culturele achtergrond tussen patiënten en verpleegkundigen komt naar voren. Binnen het domein (2) ‘De invloed van de verpleegkundige als diagnosticus’ is de houding van verpleegkundigen ten opzichte van kritisch denken en diagnosticeren opgenomen. Ook diagnostische vaardigheden en verpleegkundige werkvaring blijken van invloed te zijn. Het domein (3) ‘Opleiding en gebruik van hulpmiddelen’ betreft factoren zoals het volgen van bij- en nascholingscursussen die betrekking hebben op het toepassen van verpleegkundige diagnostiek, het volgen van trainingen in redeneervoorwaarden en het gebruik van computerapplicaties en een diagnostische classificatiestructuur. Het domein (4) ‘Ziekenhuisomgeving en ziekenhuiscultuur’ omvat (randvoorwaardelijke) omgevingsfactoren en beleidsmatige en bestuursmatige aspecten die van invloed zijn zoals het aantal patiënten waarvoor een verpleegkundige zorg moet dragen binnen een dienst en de mate waarin leidinggevenden en medici verpleegkundigen ondersteunen en stimuleren in het gebruik van verpleegkundige diagnostiek.

Het doel van de tweede studie is (1) het ontwikkelen van een instrument om de prevalentie van accurate verpleegkundige documentatie in kaart te kunnen brengen. Het instrument (D-Catch) kwantificeert het oordeel over de structuur van het dossier, de opnamegegevens, de verpleegkundige diagnosen, de verpleegkundige interventies en de evaluatieve voortgang- en uitkomstrapportages op basis van een dossieronderzoek in ziekenhuizen en (2) het testen van de betrouwbaarheid en validiteit van dit instrument. Het D-Catch instrument bestaat uit 10 onderdelen die gerelateerd zijn aan de fasen van het verpleegkundig proces en een Likert-schaal die onderverdeeld is in kwantiteitscriteria en kwaliteitscriteria. Het instrument is als betrouwbaar, bruikbaar en valide beoordeeld op basis van de resultaten van interbeoordelaar-betrouwbaarheidsberekeningen, de interne consistentie en de consensusuitkomsten van twee Delphipanels aangaande de inhoudsvaliditeit. Op basis van een pilotstudy waarin 245 patiëntendossiers van zeven ziekenhuizen en 25 verpleegafdelingen werden bestudeerd, is vastgesteld dat de D-Catch bruikbaar is in een ziekenhuiscontext.

Het doel van de derde studie is het beschrijven van de accuraatheid van de verpleegkundige documentatie in ziekenhuizen in Nederland. De studie werd uitgevoerd door de accuraatheid van de verpleegkundige rapportage op 35 verpleegafdelingen in 10 ziekenhuizen met een spreiding over Nederland, op basis van 341 patiëntendossiers te beoordelen. De resultaten van dit prevalentieonderzoek wijzen uit dat de opnamegegevens van de patiënt over het algemeen volledig genoteerd worden in het patiëntendossier. De verpleegkundige diagnose echter, is in meer dan 50 procent van de bestudeerde dossiers incompleet en niet in de PES-structuur geformuleerd. De diagnostische notities van verpleegkundigen zijn niet eenduidig, tot vaag beschreven. In minder dan 50 procent van de dossiers sluiten de interventies aan op de genoteerde diagnosen. Dat wil zeggen dat in meer dan de helft van de bestudeerde dossiers, verpleegkundige interventies genoteerd staan waarvan de reden of de aanleiding onduidelijk is.
De vierde en vijfde studie zijn experimenteel van aard en beschouwen twee aspecten van de verpleegkundige diagnose: (1) het effect van hulpmiddelen die de diagnostiek en de documentatie van diagnosen kunnen ondersteunen en (2) de invloed van (parate) kennis, de houding ten opzichte van kritisch redeneren en redeneervaardigheden. Een pilotstudie werd uitgevoerd onder 100 derde- en vierdejaars studenten van de hogere beroepsopleiding voor Verpleegkunde. Deze studenten werden willekeurig ingedeeld in een van beide groepen. Deze studie had ondermeer als doel het bestuderen of de methode van onderzoek uitvoerbaar en passend zou zijn. Aansluitend werd een experimentele studie in een gerandomiseerd factorieel design in vier groepen met 249 gediplomeerde verpleegkundigen in 11 ziekenhuizen uitgevoerd. De verpleegkundigen schreven zich vrijwillig in voor het onderzoek, waaraan zij mochten deelnemen in werktijd. Het onderzoek vond plaats in het ziekenhuis waar de deelnemers werkzaam waren als verpleegkundige. Hen werd gevraagd een opnamegesprek met een simulatiepatiënt te voeren om op basis daarvan de relevante verpleegkundige diagnosen zo accuraat mogelijk te noteren, al dan niet met de mogelijkheid gebruik te maken van een voorgestructureerd dossierformulier (structuur volgens ‘PES’), handboeken verpleegkundige diagnostiek en een voorgestructureerd opnameformulier (structuur volgens 11 gezondheidspatronen). Aansluitend werd de verpleegkundigen gevraagd drie vragenlijsten in te vullen: een kennisinventarisatielijst, de California Critical Thinking Disposition Inventory (CCTDI, in vertaalde versie: Inventarisatie van de Kritische Denkhouding) en de Health Science Reasoning Test (HSRT, in vertaalde versie: Gezondheidswetenschappelijke Redeneertest). De kennisinventarisatielijst bevat vier meerkeuzevragen. De CCTDI bestaat uit 75 stellingen die de gezindheid ten opzichte van kritisch denken in kaart brengen en de HSRT betreft een test die 33 vragen omvat die het diagnostisch redeneervmogen in kaart brengen. Het blijkt dat het PES-format significante verhoging van de accuraatheid van de verpleegkundige diagnose tot gevolg heeft. Dit in tegenstelling tot het gebruik van handboeken over verpleegkundige diagnostiek en een voorgestructureerd opnameformulier. Op basis van een regressieanalyse blijkt dat 47% van de variantie op de afhankelijke variabele ‘Accuraatheid van de verpleegkundige diagnose’ verklaard kan worden door het PES-format, de leeftijd van de verpleegkundige evenals deductieve en analytische redeneervaardigheden, gebaseerd op een analyse van de HSRT.

De bijdragen van dit onderzoek binnen het onderzoeksdomein van de verpleegkundige diagnose zijn divers. We ontwikkelden een instrument om de accuraatheid van de verpleegkundige documentatie op basis van verpleegkundige standaarden in kaart te brengen. We brachten de prevalentie in kaart van accurate verpleegkundige documentatie, generaliseerbaar naar landelijk niveau. Aangetoond is, door gebruik te maken van een experimenteel gerandomiseerd design en vragenlijsten, dat met specifieke hulpmiddelen (PES-format), een positieve kritische denkhouiding en ontwikkelde (analytische en deductieve) redeneervaardigheden een hogere accuraatheid van de verpleegkundige diagnose te verkrijgen is. Deze onderzoeksresultaten tonen het belang aan van onderwijs in de
basisopleiding tot verpleegkundige en in specialistische vervolgopleidingen in het ontwikkelen van een kritische denkhouding, diagnostische redeneervaardigheden en het gebruiken van kennishulpmiddelen. Ook kunnen de resultaten van belang zijn voor ontwikkelaars van software voor elektronische patiëntendossiers. Vervolgonderzoek is gewenst om aanvullende kennis te verwerven over de mate waarin verschillende factoren van invloed zijn op de accuraatheid van de verpleegkundige diagnose. Om het brede palet van beïnvloedende factoren op de accuraatheid van de verpleegkundige diagnose te kunnen overzien lijkt een pluralistische visie op verpleegkundige diagnostiek aanbevelenswaardig; een visie waarbij individuele, culturele en omgevingsfactoren evenals factoren aangaande het ziekenhuisbeleid een plaats hebben.

De ontwikkeling van een internationale gouden standaard voor accurate verpleegkundige documentatie in het patiëntendossier vraagt om internationale samenwerking in theorievorming en onderzoek om tot instrumentontwikkeling te komen voor de evaluatie van patiëntendossiers in internationaal verband. Dit zou de verdere ontwikkeling van eenduidige en accurate verpleegkundige documentatie positief kunnen beïnvloeden.

Recent internationaal onderzoek heeft uitgewezen dat er een relatie bestaat tussen inaccurate verpleegkundige documentatie en fouten die gemaakt worden in de zorgverlening waardoor de patiëntveiligheid in gevaar komt. De uitkomsten van dat onderzoek, gecombineerd met de resultaten van deze studie geven aan dat verpleegkundigen, ziekenhuismanagers en verpleegkundig opleiders actie zouden moeten ondernemen om de verpleegkundige documentatie in ziekenhuizen te verbeteren. Zij zijn medeverantwoordelijk voor het scheppen van voorwaarden voor hoogwaardige kwaliteit van zorg en patiëntveiligheid.
Curriculum Vitae Wolter Paans
Wolter Paans was born on November 26, 1964, in Eindhoven, the Netherlands. In 1986 he received his degree as a hospital-trained nurse in Elkerliek Hospital, Helmond-Deurne, the Netherlands. After military service as a paramedic in 1986-1987, from 1988 to 1990, he studied to become a teacher in nursing while working as a nurse in hospital practice in several wards. In 1990 he received his certificate as a nurse educator at Hogeschool Utrecht, and in 1993 he received his first professional degree, certificate as a health care educator, at VU University, Amsterdam. From 1990 to 1999 he taught nursing students in hospital training programmes at de Wierde, a nursing school in Groningen. At that time Wolter developed and provided several educational programmes in nursing process application and implementation for postgraduate staff nurses and nurse administrators. In 1999 he obtained a Master of Science degree in nursing at the University of Wales, UK. His master’s dissertation was entitled, ‘The relationship between self-management and innovativeness in teams in nursing’. From 1999 to 2005 he was manager and team leader of Company Trainings, which focussed on developing, providing, and implementing postgraduate educational programmes in nursing, primary health care, and paramedical care (Noorderpoort Training & Advies, Hanze Connect Department, Hanze University of Applied Sciences, Groningen). In 2002, he became a member of the Research and Innovation Group in Health Care and Nursing, Hanze University of Applied Sciences, Groningen. In 2006 he commenced his PhD studies on the accuracy of nursing diagnoses at the Catholic University Leuven, Belgium, and the Research and Innovation Group in Health Care and Nursing, Hanze University of Applied Sciences, Groningen. In addition to his PhD studies, Wolter has been working as a lecturer at the Hanze University of Applied Sciences, School of Nursing. Wolter is a member of the Research and Education Committee of the North American Nursing Diagnosis Association International (NANDA-I), the Rho Chi Chapter of Sigma Theta Tau International (STT-I), and the Research Initiative for Qualitative Studies in Healthcare and Aging (RIQSHA; a collaboration of the University of Groningen, Department of Demography and the Hanze University of Applied Sciences Groningen). He is also a scholar of the European Academy of Nursing Sciences (EANS).