

MASTER THESIS

‘A systematic review: Knowledge and research implementation into
nursing practice through structural strategies’

‘Eine systematische Übersichtsarbeit: Wissens- und
Forschungsimplementierung in die pflegerischen Praxis durch
strukturelle Strategien’

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Graz, am 22.11.2011

Handl Mamuda, BSc

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Abbreviation list

α	Alpha, Type 1 error
CBA	Controlled before and after trial
CCRC	Continuing Care Retirement Center
e.g.	For example
EBN	Evidence based nursing care
EPOC	Cochrane Effective Practice and Organisation of Care Group
IADL	The Index of Independence in Activities of Daily Living
LTC	long-term care
MDS	Minimum Data Set
MMSE	Mini Mental State Examination
N	Number of participants of the whole study
n	Number of participants for the measurements
n.p.	No page available
NRS	Numerical Rating Scale
OVID	Research solution database
p	Probability of a Type 1 error
PICO	Population – intervention - control and outcome –scheme
RCT	Randomised controlled trial
RU	Research Utilization

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‘Eine systematische Übersichtsarbeit: Wissens- und Forschungsimplementierung in die pflegerischen Praxis durch strukturelle Strategien’

Abstract

Hintergrund: Implementierungsstrategien streben an Innovationen effektiv in die pflegerische Praxis einzuführen und die Ausführung von evidenzbasierter Pflege zu fördern.

Ziel: Die Identifikation und Beurteilung der Effektivität von strukturellen Strategien als Implementierungsstrategien in der aktuellen Pflegeliteratur.

Suchstrategie: Für den Zeitraum von 1990 bis 2010 wurde in verschiedenen Datenbanken recherchiert, eine Handsuche durchgeführt sowie Referenzlisten gesichtet. Die Schlüsselbegriffe der Suchstrategie bezogen sich auf strukturelle Strategien, Forschungs- und Wissenstransfer, sowie Effektivität und die pflegerische Praxis.

Auswahlkriterien: Randomisierte kontrollierte Studien sowie kontrollierte Vorher- Nachher Studien, wenn: 1. Pflegende eingeschlossen waren, 2. die Intervention eine strukturelle Strategie war und 3. die Resultate explizit gemessen wurden.

Datensammlung und –analyse: Zwei unabhängige BeurteilerInnen extrahierten die Daten und beurteilten die Qualität der Studien.

Ergebnisse: Acht Studien wurden dem Assessment unterzogen, aber die Qualität dieser Studien war generell sehr niedrig. Eine randomisierte kontrollierte Studie, bei der mittels Computer eine neue Pflegedokumentation implementiert wurde, erfüllte die Einschlusskriterien. Bei den PatientInnenresultaten gab es keine signifikanten Ergebnisse. Die Anzahl der Pflegeinterventionen und -aktivitäten war signifikant höher in der Interventionsgruppe. Die Interventionsgruppe brauchte signifikant länger für das Schreiben der Pflegedokumentation und die Zeit um diese zu schreiben, nahm über die drei Messpunkte hinweg signifikant ab.

Schlussfolgerungen: Es gibt wenig Evidenz über die Effektivität struktureller Strategien, die von Pflegenden ausgeführt werden, bezüglich Veränderungen von organisationalen Prozessen und Ergebnissen. Daher ist, bei der Generalisierbarkeit der Resultate auf andere Settings, Vorsicht geboten. Außerdem sollten vermehrt in der pflegerischen Forschung und Praxis ein Augenmerk auf strukturelle Strategien als Implementierungsstrategien gelegt werden.

‘A systematic review: Knowledge and research implementation into nursing practice through structural strategies’

Abstract

Background: Implementation strategies aim to adopt innovations effectively into nursing practice and to support the delivery of evidence based nursing care.

Aim: To identify and assess the effectiveness of structural strategies as implementation strategies in the current nursing literature.

Searchstrategy: The author searched, beside a hand search, in different databases (1990 to 2010). Reference lists of articles were also searched. For the main topics structural strategies, research and knowledge transfer, effectiveness and nursing, keywords were developed.

Selection Criteria: Randomized controlled trials and controlled before- and after-studies, when: 1. they included nurses, 2. the intervention was explicitly a structural intervention and 3. the outcome was measured explicitly.

Datacollection and analysis: Two reviewers independently extracted data and assessed study quality.

Results: Eight studies underwent the methodological quality, but the quality of these studies was generally low. One randomized controlled trial, which implemented a computerized care plan, met the inclusion criteria. There were no statistically significant results for the patient outcomes. The number of nursing interventions and the number of nursing activities were significant higher in the intervention group. In the organizational outcome category the intervention group needs longer to prepare the computerized care plan and the times for writing the computerized care plan decreased significant over the three points of time measured.

Conclusion: There is some evidence that structural strategies are effective in changing the organizational process and organizational outcome of care provided by nurses. However, caution is needed in generalising findings to other settings.

Further research is required, focusing on structural interventions as implementation strategies in nursing practice.

1. Introduction

The process of decision making is one part of the daily work in nursing practice. Bucknall and Adams (2000) stated that every 30 seconds nurses make patient oriented decisions. Nursing process itself is the instrument for collecting informations for the decision making process. Nurses have got a big pool of sources for knowledge and information. Beginning with traditions, informations from the patients themselves, the clinical expertise of the nurses, intuition and research based knowledge are available sources (Polit & Beck 2008). Implementation of such information as clear, concrete and short recommendations in terms of a systematic review, through effective strategies is one big challenge in nursing research and practice. Studies have shown that 30 to 40 percent of the patients in the USA and in Netherlands receive medical care that is not based on current scientific evidence. Beside this, the studies describe that 20 to 25 percent of the received care either is not needed or potential harmful (Grol 2001; Schuster, McGlynn & Brook 1998). One can assume that it is the same for nursing practice. Using structural strategies for implementing current scientific evidence into nursing practice can be one way of encouraging nursing practice and for that reason is the core theme of this master thesis.

The first part of this master thesis is focusing on the background, relevance of the problem, the research questions, and the aims of this systematic review.

1.1. Background

In terms of evidence based nursing care it is expected from the nurse to build up their daily work on current scientific evidence. With over thousand biomedical publications a year and millions of references in databases, it is not possible anymore for the nurses to be constantly up to date on every scientific development (JBIEBNM 2001). Systematic reviews allegorize a possibility to concentrate this volume of literature for the nursing practitioners. DiCenso, Guyatt and Ciliska (2005) define a systematic review as *'a rigorous summary of all the research evidence that relates to a specific question...or the effectiveness of health care interventions'* (DiCenso, Guyatt & Ciliska 2005, p. 138). Systematic reviews aim to unify all evidence to answer a specific research question and the results of the

systematic review have to suit to the eligibility criteria that are established before the search strategy begins (Higgins & Green 2011). The objective of systematic reviews is to develop clear, concrete and short recommendations for the stakeholders in nursing practice (Higgins & Green 2011). These clear, correct and short recommendations give nurses the possibility to build up their daily work on current scientific evidence. The challenge is to bring these recommendations into nursing practice. Grimshaw and Eccles (2004) picture in a systematic review made of 235 studies about guideline dissemination and implementation strategies that there is only a ten percent median option for improving indicators of quality. Further research in the range of guideline dissemination and implementation strategies have to be done in accordance with Grimshaw and Eccles (2004). Furthermore the choice of adequate interventions should depend on the effectiveness of these interventions in improving dissemination and implementation (Bero et al. 1998). The uptake and the use of evidence based practice are dependent on the one hand on individual factors and on the other hand on the organisational context in which evidence based practice should be implemented (Aarons 2005; Greenhalg et al. 2004).

1.2. From Research to Structural Interventions

In the next chapter the most important terms are defined and an overview of the main themes of this master thesis is made.

1.2.1. Research Utilization and Evidence Based Practice

In the current literature evidence based practice and the use of research findings are still used in an interchangeable manner (Polit & Beck 2008). However there are different kinds of definitions used for these terms (Estabrooks 1999; Estabrooks 2004; Mayer 2004; Polit & Beck 2008). The use of research findings in nursing practice is defined in this master thesis as:

'Research Utilization (RU) is the process of synthesizing, disseminating, and using research-generated knowledge to make an impact on or a change in the existing practices in society.' (Burns & Grove 2005, p. 750).

In contrast to the use of research findings evidence based practice is: *'Evidence-based practice (EBP) is a clinical problem-solving strategy that emphasizes the integration of best available evidence from disciplined research with clinical expertise and patient preferences'* (Polit & Beck 2012, p.727).

The difference between these definitions is the focus on clinical expertise and patient preferences that is not included in the definition of RU. The interference between these two terms is the best evidence, which could be approached through the transaction and junction on the best available research findings.

1.2.2. Implementation

In the field of nursing practice using research findings as basis for clinical decision making is increasing. Different theories and models of the implementation process were developed in the last years. The three most popular in the field of nursing practice are the Diffusion of Innovation Model from Rogers, the Stetler Model and the Iowa Model (Polit & Beck 2008). The main elements of the process of implementation of research findings in nursing practice are described as a three-step process (Burns & Grove 2005), as shown in figure one.

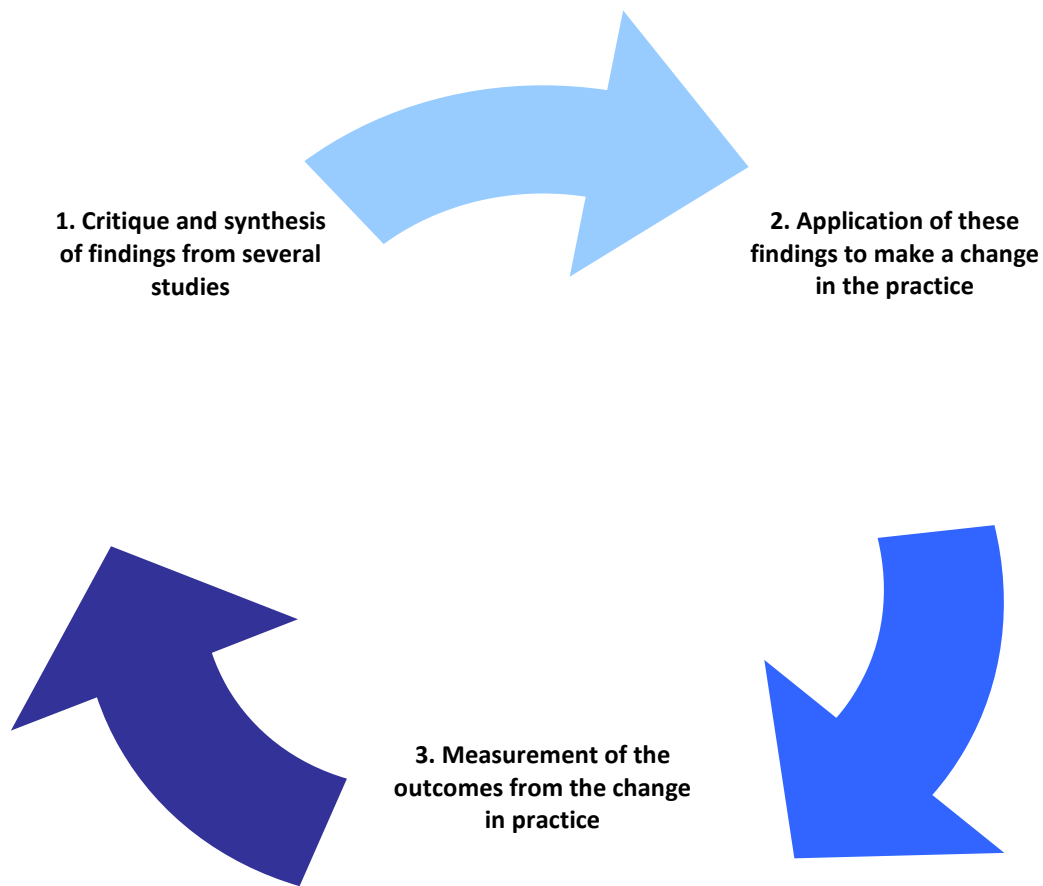


Figure 1: Main elements of the implementation process

The focus of this master thesis are implementation strategies within the process of implementation. Therefore the application of these findings to make a change in the practice as referred to as Step 2 is of main interest. Thomas et al. 2009 defined ‘... *the aim of implementation strategies [is] to turn knowledge and understanding into changes in practice*’ (Thomas et al. 2009, p. 41). Therefore implementation strategies are activities that are accomplished to achieve changes in practice.

1.2.3. EPOC Classification

Different classification systems were conducted in the last decade. The substructure of this master thesis is the Classification System of the Cochrane Effective Practice and Organisation of Care Group- abbreviated as EPOC (EPOC 2010). The EPOC is a review group of the Cochrane Collaboration with

international experts that prepare and work on systematic reviews with the main focus on interventions conducted to increase delivery, practice and organisation of health care services (EPOC 2010).

Figure two shows the classification system of interventions defined through EPOC (EPOC 2011).

Type of intervention	
1. Professional interventions	
2. Financial interventions	
3. Organisational interventions	
I Provider orientated interventions	
II Patient oriented interventions	
III Structural interventions	
a) Changes to the setting/site of service delivery	
b) Changes in physical structure, facilities and equipment	
c) Changes in medical records systems	
d) Changes in scope and nature of benefits and services	
e) Presence and organisation of quality monitoring mechanisms	
f) Ownership, accreditation, and affiliation status of hospitals and other facilities	
g) Staff organisation	
h) Other	
4. Regulatory interventions	

1.2.4. Organisational Interventions

Organisational and specifically structural strategies are the last core themes needed for this master thesis. EPOC defines and explains organisational strategies as (EPOC 2009, n.p.):

‘Organisational interventions are those which involve a change in the structure or delivery of health care. In other words, an organisational intervention is a change in who delivers health care, how care is organised, or where care is delivered. Examples of relevant organisational interventions include case management, revision of professional roles, use of multidisciplinary teams, formularies and changes in medical records systems’.

There are three subtopics summarized by the EPOC among organisational strategies (EPOC 2009):

1. provider oriented interventions: eg. (for example) Case management
2. patient oriented interventions: eg. Handling of patient complaints
3. and structural interventions.

1.2.5. Structural Interventions

Structural interventions are defined as: *‘An organisational intervention involving a change to the way in which health care is structured’* (OVID 2011).

For further understanding structural strategies are for example ‘Care home versus hospital and own home environments for rehabilitation of older people’ (Ward et al 2008), or ‘The effect of smart home technologies to support people at home’ (Martin et al 2008) or ‘Effects of interventions aimed at changing the length of primary care physicians’ consultation’ (Pariyo et al. 2009). In summary, structural strategies are interventions that change the structure of medical or nursing care and address how and where these services are delivered (EPOC 2010).

1.2.6. Structural Interventions as Implementation Strategies

To bring down to a round figure in the next chapter structural interventions are consolidated with implementation strategies.

As already described: *‘implementation strategies are all interventions or activities that tend to turn knowledge and understanding into changes in practice’* (Thomas et al. 2009, p. 41). In terms of this definition, structural interventions can also be used as implementation strategies. Following examples explain this once more:

- Smart home technologies as implementation strategies for nursing assessment instruments;
- Medical record systems as implementation strategies for a new pain management scale;
- The change of service delivery as implementation strategy for Case management;
- A quality monitoring mechanism as implementation strategy for a new assessment instrument;
- A specific type of nursing staff organisation/nursing concept - for example primary care - as implementation strategy for a new assessment instrument.

In figure three the coherence of the core themes is illustrated.

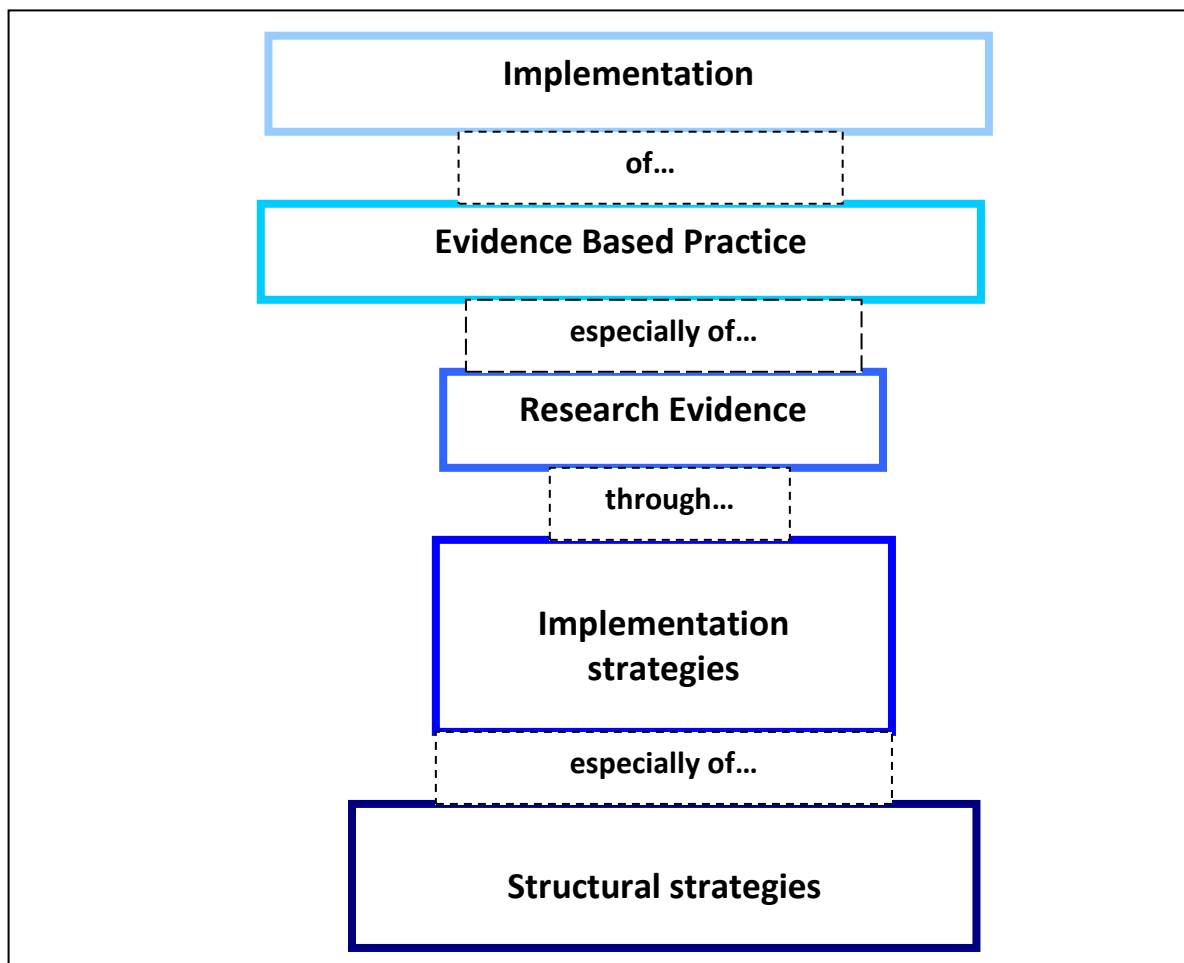


Figure 3: Summary of the main topics

1.3. Problem Statement

In the last years nursing research is focusing on barriers that exacerbate utilization of research results in nursing practice as part of evidence based nursing care - abbreviated as EBN (Adamsen & Larsen 2003; Estabrooks et al. 2003; McClearly & Brown 2003; Parahoo 2000; Parahoo, Barr & McCaughan 2000). Polit and Beck (2008) delineate three categories of barriers for research utilization in nursing practice: (1) characteristics of the nurses, (2) organisational support and (3) the quality of the research results. Organisational support as one main barrier in research utilization is a challenge for all stakeholders in nursing care practice. Implementation research is one way of overcoming these barriers in research utilization. Foy, Eccles and Grimshaw (2001) defines implementation research as *'... the scientific study of methods to promote the systematic uptake of clinical research findings into routine clinical practice, and hence to reduce inappropriate care'* (Foy, Eccles & Grimshaw 2001, p.353). To bridge the uptake from research to clinical practice, for example with effective structural strategies, is indispensable. There are limited scientific results available focusing on the implementation of research results or knowledge on organisational level in nursing practice (Foxcroft & Cole 2009). But without these scientific results focusing on the implementation of research results or knowledge on organisational level in nursing practice a change in nursing care practice in terms of evidence based nursing practice can not be done (Foxcroft & Cole 2009). This master thesis concentrates on structural strategies - based on organisational level - as implementation strategies of research results or knowledge in nursing practice.

More and more research focuses on the organisational strategies for implementing research into practice. Nevertheless less knowledge is available, which factors have an affect on the use of research findings in nursing practice and how these factors have an impact on the implementation process (Estabrooks 2008).

In comparison with provider or patient oriented strategies, structural strategies are so far not a primary focus of research (Foxcroft & Cole 2009). At the moment there is only one systematic review (Urquhart et al. 2009) emphasizing on one specific structural strategy in nursing practice - but in this review structural strategies were

not used as implementation strategies. Taking this into account, it is indispensable to scrutinize the effectiveness of structural strategies as implementation strategies in the context of knowledge and research transfer in nursing practice. This systematic review closes this gap and focus on structural strategies with the target group of nurses.

The purpose of this systematic review is to find out, (1) which structural strategies are described in current literature and (2) if and how effective are these structural strategies as implementation strategies in nursing practice.

1.4. Aim and Research Questions

Aim of this systematic review is to give an overview for stakeholders in nursing practice over structural strategies in the current literature and to describe the effectiveness of these as implementation strategies.

Hence there are two research questions:

- **Which structural strategies are described in line with knowledge and research implementation in nursing practice in the current literature?**
- **How effective are these structural strategies in line with knowledge and research implementation in nursing practice?**

2. Methods

In the following chapter criteria for inclusion for studies are described, the search strategy is explained and data collection and analysis are characterized.

2.1. Election of the Studies

There are different levels of evidence in which studies could be ordered (Polit & Beck, 2012). For Polit and Beck (2008) the aim of nursing research is to achieve the highest possible evidence hierarchy. However a lot of research questions can not be answered by Level I studies, and in the case of this master thesis, it is anticipated to find too few 'high quality studies' for conducting a systematic review with evidence qualifying as Level I. Another reason for including 'low quality studies' is the EPOC classification, that is the basis for this master thesis, that also includes other types than Level I studies (EPOC 2011).

2.2. Election of the Participants

In this systematic review studies with nurses as participants are included. There are no limitations on the setting nor the age, gender or level of education of the nurses.

2.3. Election of the Intervention

In this master thesis all types of structural interventions were reviewed since, as we flagged in the introduction, there is a lack of information regarding structural strategies in the context of nursing. The different structural strategies are (EPOC 2011):

- a) Changes to the setting/site of service delivery
- b) Changes in physical structure, facilities and equipment
- c) Changes in medical records systems
- d) Changes in scope and nature of benefits and services
- e) Presence and organisation of quality monitoring mechanisms
- f) Ownership, accreditation, and affiliation status of hospitals and other facilities
- g) Staff organisation

For this reason, a specific search chain was conducted for every subtheme of the structural interventions.

The other side of the intervention belongs to the implementation process - specifically to the implementation strategy. Therefore a number of keywords were established to search the whole field of implementation science.

Other inclusion criteria: In this systematic review studies were included if they were written in English or German. Another restriction was the timeline. The search was conducted on articles written between 1990 and 2010 as EPOC exists since 1994 and therefore it would make no sense to search before 1990 (OVID 2011). Another reason for restriction of the timeline was that implementation science as a scientific field has become more and more popular in the last 20 years in the field of nursing research (Estabrooks, Winther & Derksen 2004). Another limitation was that abstracts had to be available for title and abstracts screening. There was no other restriction for inclusion in this master thesis.

2.4. Election of the Outcome Measurement

The focus of this master thesis was to describe the effectiveness of structural interventions as implementation strategies. For this reason specific keywords were established. The effectiveness of the structural interventions has to be measured in the included studies with a reliable and validated instrument. Self reported measurements from patients and/ or provider were included if the instrument was psychometrically tested.

2.5. Search Strategy

In the next chapter the development of the whole search strategy with the different search chains is described. This development was accomplished from May to July 2010.

2.5.1. The Databases

The three main databases CINAHL (Cumulative Index to Nursing and allied health literature), ISI Web of Knowledge (Institute for Scientific Information) and Medline (Medical Literature on-line) indexed in OVID were searched (Polit & Beck, 2008). Furthermore, the ACP Journal Club, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Cochrane Methodology Register, Database of Abstracts of Reviews of Effects and the Health Technology Assessment, the NHS Economic Evaluation Database, Ovid MEDLINE(R) In-

Process & Other Non-Indexed Citations and Ovid MEDLINE(R), ERIC (Education Resources Information center database) and PASCAL all indexed in OVID were also searched to improve the probability to find relevant information. Hand search was made in Implementation Science and the Cochrane Consumers and Communication Group since there were possible connections with the EPOC. A list of journals with a focus on implementation science was listed 2002 from Estabrooks (Estabrooks, Winther & Katz 2002). All of these journals were indexed in one of the above named databases.

2.5.2. Development

In this master thesis the search strategy was developed in multiple steps. Each step was developed in consultation with the second reviewer (Gabriela Steinwider GS) and tutors.

The main parts of the search strategy are:



Figure 4: Main parts of the search strategy

To guide the development of the search strategy, the research questions were first divided into a population, intervention, control and outcome – the PICOscheme (Higgins & Green 2011).

Based on the two research questions the PICOscheme is:

P= nurses
I= structural strategies
C= not structural strategies
O= effectiveness in nursing practice

The development of the keywords started on the basis of this scheme. Different online dictionaries and the Issa Social Security Thesaurus were used to find

synonyms (Free Dictionary 2011; ISSA 2011; One Look 2010; Thesaurus 2011). A specific schedule of the keywords found in the dictionaries and thesaurus is presented in the supplement A.

The development of the keywords is described according to the PICOscheme:

a. Population: nurse(s)

To broaden the meaning of the keyword nurse(s) the truncation * is used at the end of the word 'nurs' in the search strategy. This truncation means that all endings of the word 'nurs' are included, for example nurs-es, nurs-ing, nurs-e.

b. Intervention

For each structural intervention keywords were developed and, if necessary, annotated with a truncation. Afterwards, the keywords were discussed with the second reviewer. Keywords were excluded if they were not common in health and nursing science, the meaning of this word was not matching to the structural strategy, or it had already been found as a keyword in another search chain. A list of the deleted keywords is presented in the supplement B.

The remaining keywords for each search chain belonging to the specific structural intervention were:

- Structural intervention: structural* OR contextual* OR formal

Even though there were initially keywords defined for strategy or intervention, it was later on decided to omit them to broaden the search strategy.

- Setting /site of service delivery: setting or station or department or site or ward* AND service delivery.

In this search chain the different keywords for service delivery were not taken into account given the specific meaning of service delivery. No other combination of keywords could be found that signified service delivery.

- Physical structure, facilities and equipment: facilit* or ward or station or equipment*
- Medical records systems: medica* errors or prescription errors or diagnostic errors or medical records or nursing records or computerized or documentation or point-of-care systems or patient care planning or hospital information systems or automatic data processing or medical informatics or electronics or information technolog* or information infrastructur* or ehealth or e-health or patient track*

Due to the lack of keywords found for Medical records online, other sources were consulted. The process to develop these further keywords is shown in the supplement C.

- Scope and nature of benefits and services: scope or intention or purpose or nature or description or type AND benefit* or advantage* or profit* or achievement or effort or improvement
- Presence and organisation of quality monitoring mechanisms: being* or existence or presence or inhere* or occurrence or attendance or occupancy or appearance AND qualit* or improvement AND assessment or assurance or control or analysis or evaluation or observation or audit or check or surveillance or quality maintenance or process or instrument or mechanism or system or support or components or tool or structure or procedure or technique or arrangement or construction or regulation or adaption
- Ownership, accreditation, and affiliation status of hospitals and other: ownership or holding or accreditation or certification or authentication or license or affiliation or alliance or coalition or partnership or relationship or union or collaboration or cooperation
- Staff organization: staff or employ* or crew or team AND organi*ation or management or plan* or recruit* or coordination

c. Control: This part of the PICOscheme is not necessary as the inclusion criteria already describe the designs of the studies which will be included (see inclusion criteria).

d. Outcome: Effectiveness in context of research and knowledge transfer

Nursing practice is already included in the keyword nurs* therefore it does not need to be created here once more.

For effectiveness following synonyms were found: effectuality, effectualness, effective, efficacious, effectualness, effectivity, effect, impact, impression, influence, capability. In order to shorten the search chain once more the truncation * was used. The finished keywords for effectiveness are effect* or impact or impression or influence or capability.

To cover the research and knowledge transfer the following keywords were generated with reference to Thompson et al. (2007):

utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat* AND evidence or research or knowledge.

The last step brings the keywords together. For this, a guideline was developed.

The main parts of the search strategy that are combined with AND as a Boolean phrase are shown in figure five:

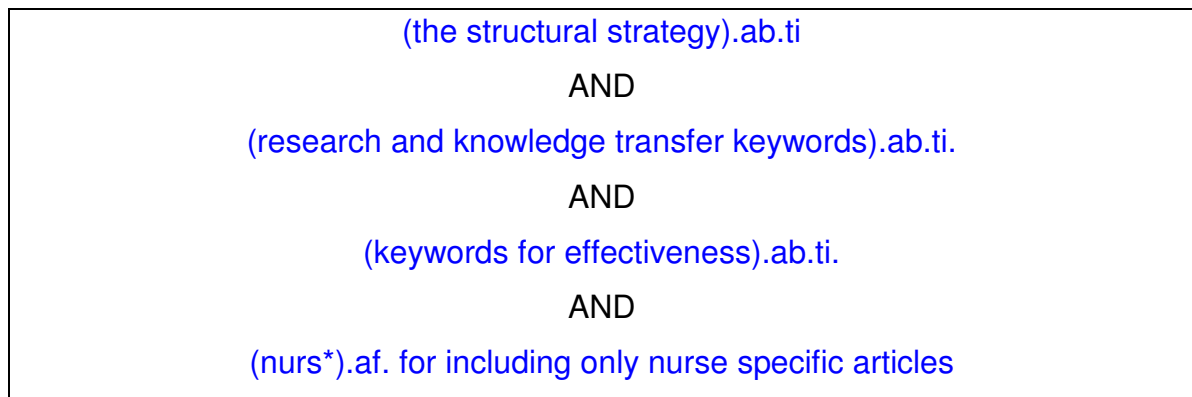


Figure 5: Main parts of the search strategy

The abbreviation 'ab' stands for abstract, 'af' for all fields, 'ti' for title and 'hw' for keyword and headingword. An example of one search chain - here for structural strategies- is shown below. The other remaining search chains are registered in the supplement D.

1. (struct* or organi*ation* or contex* or formal).ab. or (struct* or organi*ation* or contex* or formal).ti.
2. (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ab. or (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ti.
3. (evidence or research or knowledge).ab. or (evidence or research or knowledge).ti.
4. (effect* or efficacious* or impact).ab. or (effect* or efficacious* or impact).ti.
5. 1 and 2 and 3 and 4
6. structured abstract.ab. or structured abstract.ti.
7. (s5 not s6).af.
8. nurs*.af.
9. (s7 and s8).af.
10. limit 9 to abstracts
11. limit 10 to (english or german)

12. limit 11 to yr='1990 -Current'

13. remove duplicates from 12

The results of the search strategy are shown in figure 6.

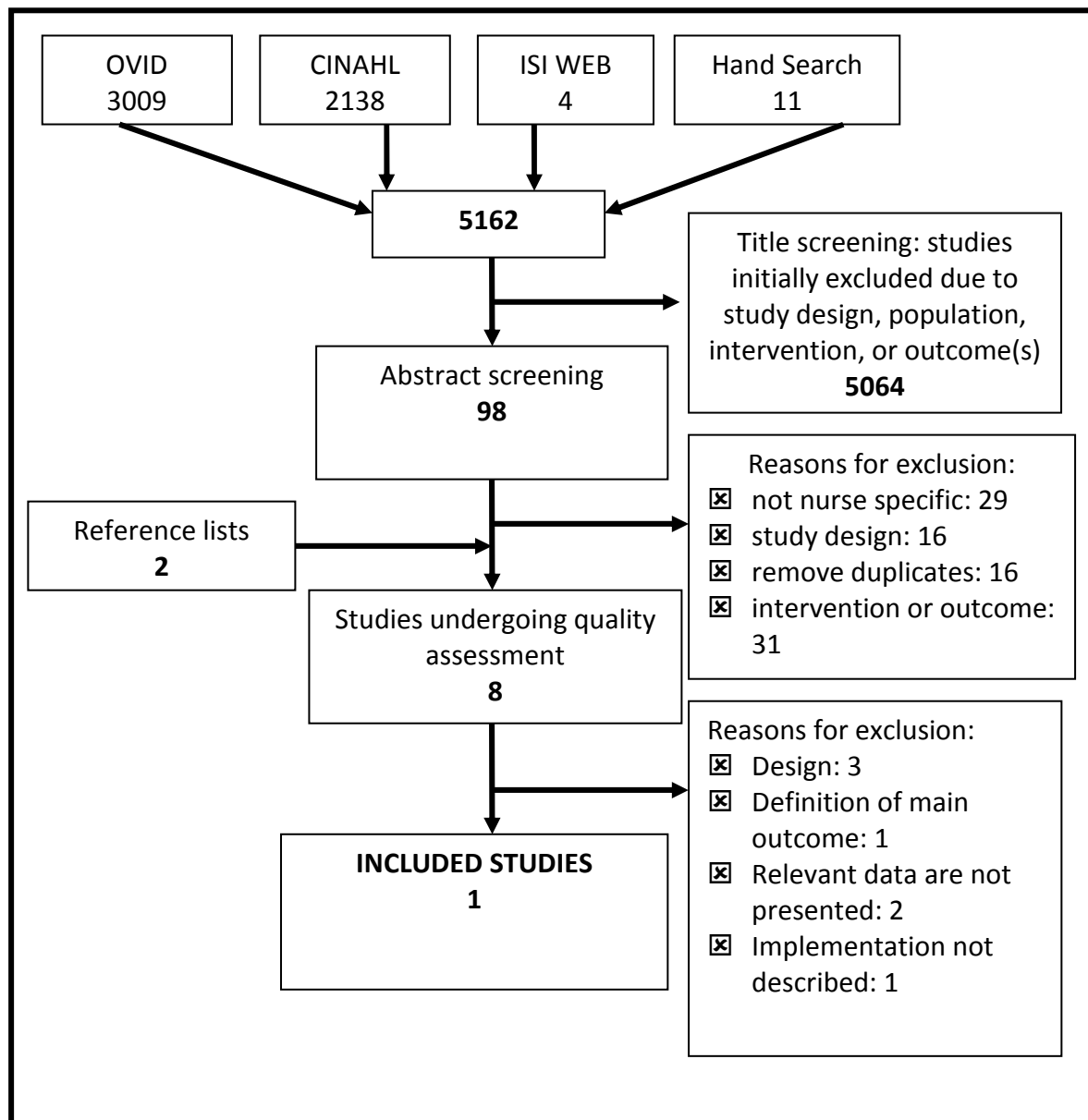


Figure 6: Flowchart of the search process

2.5.3. Screening Process

The search resulted in more than 5000 studies. The author of this master thesis reviewed all titles and abstracts. Two more articles were included in the review process after screening the initial reference lists and the only one existing systematic review about structural strategies in nursing practice (Daly, Buckwalter & Maas 2002, Doran et al. 2010, Guthrie et al. 2004, New et al. 2003, Quaglini et al. 2000, Sermeus et al. 1997 and Urquhart et al. 2009).

2.5.4. Excluded Studies

At the end, eight studies satisfied the quality assessment:

Daly, Buckwalter & Maas 2002, Doran et al. 2010, Guthrie et al. 2004, New et al. 2003, Quaglini et al. 2000, Sermeus et al. 1997, Spranzo-Keller, McDermott and Alt-White 1991 and Stephens 1990.

2.6. Methodological Quality by EPOC

In this master thesis the two reviewers evaluated the studies with a tool available from EPOC (2010) as this was also used by Thompson et al. (2007) for a systematic review on implementation science. After the studies to include were selected, another instrument was used to check other quality items (Consort 2010).

1. RCT Methodological Quality Assessment Results and Rating (EPOC 2010)

The RCT (Randomised controlled trial) Methodological Quality Assessment Results and Rating tool comprised of the following items: unit of analysis, power, baseline measure, concealment of allocation, blinded or objective assessment of outcome(s), protection against contamination, reliable outcome(s) and completeness of follow-up.

2. CBA Methodological Quality Assessment Results and Rating (EPOC 2010)

The CBA (Controlled before and after trial) Methodological Quality Assessment Results and Rating tool consisted of the same items as the RCT Methodological Quality Assessment Results and Rating tool, except for the concealment of allocation. This item was changed by EPOC (2010) because of the inherent method of a CBA to ensure comparability of groups.

In table one the different items for the methodological quality assessment are presented.

Table 1: Items of the methodological quality assessment

RCT	CBA
Unit of analysis	Unit of analysis
Power	Power
Baseline measures	Baseline measures
Concealment of allocation	Comparability of Groups
Blinded Outcome assessment	Blinded Outcome assessment
Protection Against Contamination	Protection Against Contamination
Reliable Outcomes Measure	Reliable Outcomes Measure
Completeness of follow up	Completeness of follow up
Rating	Rating

Each item was scored independently by the reviewers. There were three types of scoring: 'done', 'not done' and 'not clear'. Disagreements between the two reviewers were solved through discussion.

The three outcome classes for the rating were according to Thompson et al. (2007):

1. Low: from zero to four points,
2. Medium: five to six points,
3. High: seven and more points.

In this master thesis, the quality assessment ratings were not used to exclude studies given the general state of the science in this field was one research question. Each item in the methodological quality assessment tool that was scored with 'done' received one point. In the tables 3 and 4 the different studies are shown with each item from the methodological quality assessment tools and the scoring of both reviewers. The intercoder reliability for all the studies was 94.2 percent. Disagreement between the two reviewers was solved through discussion. The methodological quality assessment tools could only be fulfilled by six of eight studies. Quaglini et al. 2000 and Sermeus et al 1997 had to be excluded because important data were missing. This could not be anticipated through title or abstract screening.

Table 3: Methodological Assessment for RCTs, results and judgement for different studies

Quality Assessment for RCT

First Author	Unit of allocation	Unit of analysis	Power	Baseline measures	Concealment of allocation	Blinded Outcome assessment	Protection Against Contamination	Reliable Outcomes Measure	Provider Follow	Patient Follow Up	Rating
Daly 2002 (MM)	Patient	Patient	X	✓	?	?	?	?	?	X	LOW
Daly 2002 (GS)	Patient	Patient	X	✓	?	?	?	?	?	X	LOW
New 2003 (MM)	Patient	Patient	?	?	✓	✓	?	✓	?	?	LOW
New 2003 (GS)	Patient	Patient	?	✓	?	✓	✓	?	?	?	LOW
Stephens 1990 (MM)	Patient	Patient	?	✓	X	?	?	?	✓	✓	LOW
Stephens 1990 (GS)	Patient	Patient	?	✓	X	?	?	?	✓	✓	LOW

✓= DONE, X= NOT DONE, ?= Not Clear, ★= error!

MM= author, GS= Second reviewer

Table 4: Methodological Assessment for CBAs, results and judgement for different studies

Quality Assessment for CBA											
First Author	Unit of allocation	Unit of analysis	Power	Baseline measures	Comparability of Groups	Blinded Outcome assessment	Protection Against Contamination	Reliable Outcomes Measure	Provider Follow	Patient Follow Up	Rating
Doran 2010 (MM)	Provider	Provider	✓	?	?	X	?	✓	X	?	LOW
Doran 2010 (GS)	Provider	Provider	✓	?	?	X	?	✓	?	?	LOW
Guthrie 2004 (MM)	Provider	Patient & Provider ★	?	?	X	X	?	✓	?	?	LOW
Guthrie 2004 (GS)	Provider	Patient & Provider ★	?	?	X	X	?	✓	?	?	LOW
Spranzo 1991 (MM)	Ward	?	?	?	?	?	?	✓	?	?	LOW
Spranzo 1991 (GS)	Ward	?	?	?	?	?	?	✓	?	?	LOW

✓= DONE, X= NOT DONE, ?= Not Clear, ★= error!MM= author, GS= Second reviewer

Thompson et al. (2007) defined *'the unit of analysis error as the difference between the units of allocation and the unit of analysis'* (Thompson et al. 2007, p. 7). For example, if the unit of allocation is done through the type of setting, the unit of analysis is made for patients or providers and the author does not clearly report equitable statistical measurements, a unit of analysis error is made. Thompson et al. (2007) also reported that in such a context if the authors reported a power calculation inappropriately, the power item in the two Methodological Quality Assessment Tools was scored with done however a Unit of analysis error was stated in the overall rating. In Guthrie et al. 2004 a unit of analysis error was found (see table 4).

In table 2 all excluded studies, title and the reason for exclusion are stated.

Table 2: Excluded studies, with author/title and reasons for exclusion

First Author	Title	Reasons for exclusion
Doran et al. 2010	Supporting Evidence-Based Practice for Nurses through Information Technologies	1.definition of one main outcome differs between the pre- and the post test design
Guthrie et al. 2004	A patient lifting intervention for preventing the work-related injuries of nurses	1.investigator does not describe the implementation strategy 2.focussing on implementing a new equipment
New et al. 2003	Specialist Nurse–Led Intervention to Treat and Control Hypertension and Hyperlipidemia in Diabetes (SPLINT) A randomized controlled trial	1.data concerning the confounder variables are missing
Quaglini et al. 2000	A computerised guideline for pressure ulcer prevention	1.article is a protocol 2.data are missing
Sermeus et al. 1997	The WISECARE Project and the impact of information technology on nursing knowledge	1.the paper is an conference report 2.data are missing
Spranzo-Keller, McDermott & Alt-White1991	Effects of Computerized Nurse Careplanning on Selected Health Care Effectiveness Measures	1.investigator presents no results
Stephens 1990	Development and Testing of a pediatric Pain Management Sheet	1.development and testing of the pain management sheet was in focus, not the implementation with the computer

2.7. Appraisal Instruments by Consort

Different instruments were used. The first one was the EPOC Data Collection Checklist with which two reviewers (Mandl & Steinwider) independently from each other extract the data from the studies (EPOC 2011). Afterwards, the methodological quality assessment tool from the EPOC was used to check the quality of the studies. Disagreement between the two reviewers was solved by discussion. The second appraisal factor - the CONSORT 2010 CHECKLIST- was used as the first quality assessment only focuses on the methodological quality of the studies (Consort 2010). The chosen CONSORT 2010 CHECKLIST includes 25 items as empirical evidence indicates that not reporting information relating to these 25 items results in biased estimates of treatment effect. Also the information is essential to judge the reliability or relevance of the findings (Consort 2010). As the aspects methods and results have already been evaluated with the methodological quality assessment tool from the EPOC, only seven items (title and abstract- one item, introduction-one item, discussion- three items and other information- two items) from the 25 items were assessed for each relevant study with the CONSORT Checklist (Consort 2010):

- **Title and abstract**
 - Identification as a randomised trial in the title
 - Structured summary of trial design, methods, results and conclusions
- **Introduction** : Background and objectives
 - Scientific background and explanation of rationale
 - Specific objectives or hypotheses
- **Discussion**
 - Limitations Trial limitations, addressing sources of potential bias, imprecision and, if relevant, multiplicity of analyses
 - Generalisability Generalisability (external validity, applicability) of the trial findings
 - Interpretation Interpretation consistent with results, balancing benefits and harms and considering other relevant evidence
- **Other information**
 - Registration Registration number and name of trial registry
 - Protocol Where the full trial protocol can be accessed, if available

3. Results

At the end of this master thesis one study from Daly, Buckwalter & Maas (2002) was left for inclusion- see supplement F. This study is described in this master thesis in the following order:

- a. the intervention
- b. the results
- c. methodological assessment
- d. other critical appraisal factors

3.1. The Intervention

Daly, Buckwalter & Maas (2002) described in their study: 'Written and computerized care plans- organizational processes and effect on patient outcomes', the implementation of a new nursing care plan, through the computer in a long-term care (LTC) facility.

Method

An experimental design was used to compare the effect from the intervention group with the effect of the control group. In the control group the nursing process was documented with a written care plan.

A written care plan was defined as *'the usual or routine documentation of the nursing process, specifically, problems, goals, interventions and evaluation'* (p. 16). In the intervention group the nursing process was documented with a computerized care plan. A computerized care plan was defined as *'documentation of the nursing process, specifically problems, goals, interventions, and evaluation'* (p.16).

The specification of the new software in opposition to the written care plan, the nursing diagnosis and interventions were classified through standardized language.

Participants

Participants were each newly admitted residents from the age of 65 and older. They had to be permanent residents or at least a resident for 7 months. After giving their consent, they were randomly assigned to the intervention or to the

control group. The study setting was a Continuing Care Retirement Center (CCRC) with a 48-bed health center licensed for skilled and intermediate care (pp.18-19).

Thirty participants moved into the CCRC and met the inclusion criteria. Six of these participants were excluded as they were discharged and four were excluded as they died. A sample size from twenty participants (N=20) remained and was randomly assigned to the intervention group or the control group. There were no statistically difference between the participants in the two groups in terms of age, gender, education and marital status (p.19).

The intervention

A compatible computer was already on the ward of the CCRC. Four Nurses, who were computer literate, received an eight-hour training lesson administered by the director of nursing on the new software package for the care plan and minimum data set (MDS). In the control group four nurses, who were not computer literate, were not instructed in the new software therefore the usual written care plan was completed according to the usual practice. There were no statistically difference between the nurses (N=8) in the intervention and control group (p.19).

Every nurse in the intervention and control group got new patients depending on their workload. Each primary nurse had from three to five residents and developed their care plan depending on the group they were assigned to (p.19).

Data for this study were collected after each care plan completion, the written care plan as well as the computerized care plan. This took place within 21 days after admission and every third month afterwards (p.18).

Before we present the results, the measurement methods of the study outcomes are described.

3.2. Measurement Methods

There were three outcome classes identified in this study:

- Patient outcomes
- Organizational processes
- Organizational outcomes

Firstly to give clarity, we describe shortly the theoretical framework in which the three outcome classes are embedded. The theoretical framework is shown in figure 8.

The organizational processes and the organizational outcomes can be found at the quality health care level. In contrast, the patient outcomes are settled at the quality patient care level. The three main outcome classes are marked with an arrow in figure 8.

3.2.1. Measurement of Patient Outcomes

Patient outcomes are defined in the included study as *'a variable patient or family state, condition, or perception responsive to nursing intervention'* (Maas, Johnson & Kraus 1996, pp.25-26 IN: Kelly & Maas, 1996)

Patient outcomes are measured according to the results of the former study from Hardy, Maas and Akins (1989) through the following criteria: mobility, independence in activities of daily living (IADL), cognitive ability (Mini Mental State Examination MMSE), incidence of alteration in skin integrity, perception of pain (NRS), bowel function and nutritional status and were measured with different instruments (Hardy, Maas & Akins 1989 IN: Daly, Buckwalter and Maas 2002, p.17).

Three instruments (IADL, MMSE and NRS) were standardized tests with effective psychometric properties (Folstein, Folstein & McHugh 1975; Katz & Akpom 1976).

The Index of Independence in Activities of Daily Living

The Index of Independence in Activities of Daily Living, short IADL, described six functions: bathing, dressing, toileting, continence, ambulation and feeding (Katz & Akpom 1976). At the end of this test a summarized score on all six functions demonstrate the independency with zero as score and complete dependency with six points as score.

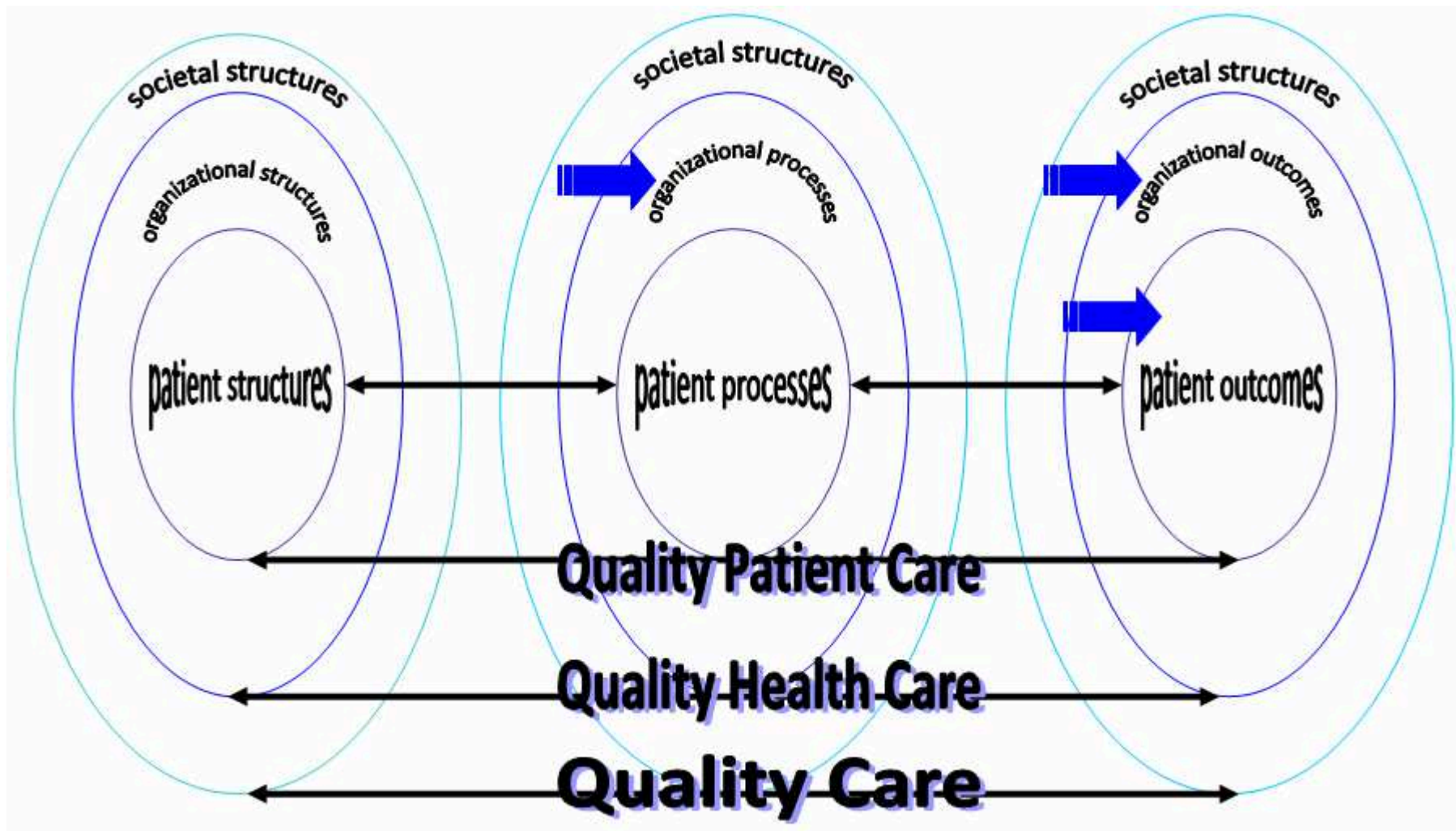


Figure 8: Conceptual framework of the included study from Daly, Buckwalter & Maas (2002) - permission see supplement E

NRS Numerical Rating Scale (Whitaker & Warfield 1988)

The patient outcome pain was measured with the Numeric Rating Scale (Whitaker & Warfield 1988). It is a self-reported measurement instrument where the patients or clients assess their pain intensity with zero as 'no pain' and ten as 'pain as bad as it could be'.

MMSE Mini Mental State Examination

The patient outcome cognitive ability was measured with the Mini Mental State Examination (MMSE). The MMSE scores from zero to thirty and includes eleven questions related to aspects such as recall, orientation and calculation (Folstein, Folstein & McHugh 1975).

Patient Medical record

The incidence of alteration in skin integrity was consigned on the patients Decubitus Pressure Ulcer Report form and was described in the included study with Yes stands for a skin alteration and zero for no alteration (p.18).

3.2.2. Measurement of Organizational Processes

Organizational process variables were described in this study through *'the set of activities in the nursing process involved in care plan and documentation'* (p.17). This organizational process was operationalized through the number of nursing diagnosis, interventions and activity statements tabulated for each patient.

3.2.3. Measurement of Organizational Outcomes

The organizational outcomes were defined for this study as *'the time nurses need to develop and write a care plan'* (p.17).

All of these outcomes - patient outcomes, the organizational process and the organizational outcomes - were collected every month for the following six months, except for the MMSE, the care plan data and the time for care plan development. These three variables were collected every three months after the care plan meeting.

3.3. Study Results

The next chapter describes the results from the included study ordered for the three main outcome classes.

3.3.1. Results of the Patient Outcomes

The patient outcomes were measured at seven points of times. Only the cognitive ability measured with the MMSE was measured at three moments. There were no statistically significant differences ($\alpha=0,05$)

- between the subjects in the two groups
- within the subjects in the two groups over time
- or interaction effects - between the subjects over time - between the two groups.

3.3.2. Results of the Organizational Process

The organizational process was operationalized through the number of nursing diagnosis, interventions and activity statements tabulated for each patient. The number of nursing interventions and number of nursing activities were found as statistically significant ($n=17$, $\alpha=0,05$) results between the subjects for the intervention group. Computerized care plan leads to more recorded nursing interventions and nursing activities in the care plan.

There were no other significant effects found for organizational process variables. Nursing diagnosis as another variable of the organizational process was similar between the intervention and control group.

3.3.3. Results of the Organizational Outcomes

The organizational outcomes were defined for this study as *'the nursing time to develop and write a care plan'* (p.17). There were two statistically significant effects reported ($\alpha=0,05$) between the subjects and within the subjects in the two groups in this outcome category. Below in table 5 the two statistically significant effects are summarized.

Table 5: Statistically significant effects for nursing time as organizational outcome

Time	
Source: for preparation	p
between the subjects (n=18)	0,002
within the subjects (n=38)	0,000
Source: for writing care plan	p
between the subjects (n=18)	
within the subjects (n=38)	0,001

Table 5 delineate a significant effect between the subjects ($p=0,002$, $n=18$) for the preparation time. The intervention group need statistically longer for preparing the computerized care plan. Another statistically significant effect was the time needed for preparation over time ($p=0,000$, $n=38$). That means that the intervention group needs longer to prepare the computerized care plan, although the time decreased over the three points of time measured.

Regarding the time for writing a care plan, there was a statistically significant effect ($p=0,001$, $n=38$) found within the subjects. This means that there is a difference within the subjects in the intervention group over time. The times for writing the computerized care plan decreased over the three points of time measured. No other statistically significant effect was found.

3.4. Results of the Methodological Quality Assessment

As already described, the EPOC methodological assessment was made for the included study 'Written and computerized Care plans- organizational processes and effect on patient outcomes' from Daly, Buckwalter & Maas (2002). In table 6 the results of the methodological assessment for the included study are shown.

The assessment from both reviewers was identical on all of the ten items. The intercoder reliability for the included study was 100 percent. The Score 'Low' for this study is the sum of the scores from the items power, baseline measure, comparability of groups, blinded or objective assessment of outcome(s), protection against contamination, reliable outcome(s) and completeness of follow-up.

Table 6: Methodological Assessment, results and judgement for the included study

Quality Assessment for RCT											
First Author	Unit of allocation	Unit of analysis	Power	Baseline measures	Concealment of allocation	Blinded Outcome assessment	Protection Against Contamination	Reliable Outcomes Measure	Provider Follow	Patient Follow Up	Rating
Daly 2002 (MM)	Patient	Patient	X	✓	?	?	?	?	?	X	LOW
Daly 2002 (GS)	Patient	Patient	X	✓	?	?	?	?	?	X	LOW

✓= DONE, X= NOT DONE, ?= Not Clear, ★= error!

MM= author, GS= Second reviewer

The unit of allocation was in the study from Daly, Buckwalter & Maas (2002) the patient. Patients were randomly assigned to the intervention or to the control group. The unit of analysis was also the patients and for this reason the patient outcome directly reflected the individuals. The variables of the organizational process were measured per patient (e.g. numbers of diagnosis per patient) and the organizational outcomes were also measured per patient through the individual care plan. For the power calculation both reviewers scored with 'not done' since there was no power calculation made in the study. Daly, Buckwalter & Maas (2002) explicitly reported in the article afterwards that the study was under-powered (p.19). The baseline measurement was the only item that the two reviewers appraised with 'done'. Baseline measurements for the patients as well as for the nurses were reported. The concealment of allocation item was scored with 'not clear' by both reviewers because the process of randomisation was not described explicitly. Blinded outcome assessment was scored with 'not clear', because the authors did not specify explicitly that the outcomes were blindly assessed, also there are outcome variables assigned from the patient record which were therefore not elevated as objectives (for example the Decubitus Pressure Ulcer Report form). The item protection against contamination was scored with 'not clear' because the patients were randomised, unlike the professionals, and it is likely that the control group could receive the intervention. The next item reliable outcome measurement was also scored with 'not clear'. The reason was that reliability is not reported for outcome measures that are obtained by chart extraction or collected by an individual. Provider follow up was noted as 'not clear'. The authors reported a 16%- turnover of the registered nurses during the study period and therefore the outcome measures obtained for more than 80% of subjects. But it was not stated in which group the nurse(s) turned over. Patient follow up, as the last item in the methodological assessment, was scored with 'not done' because, as the authors stated, 30 participants begun the study but only 20 participants finished and were randomized. Outcome measures were obtained for 66.7 percent of the patients who entered the trial.

3.5. Results of Critical Appraisal Factors

Besides the methodological quality assessment tool from the EPOC, other appraisal factors were introduced as the EPOC quality assessment only focus on the methodological quality of the studies.

The chosen CONSORT 2010 Checklist included 25 items. These items were selected because empirical evidence showed that, if they were not reported, bias could arise. Another reason for reporting these 25 items was that they were essential to assess the reliability or relevance of the findings (Consort 2010).

As the aspects methods and results from the CONSORT Checklist were already evaluated with the EPOC Data Collection Checklist and the methodological quality assessment tool from the EPOC, the information including title and abstract, introduction, discussion and other information were assessed with the CONSORT Checklist for the involved study (Consort 2010).

1. Title and abstract

Daly, Buckwalter and Maas (2002) entitled their study 'Written and computerized Care plans- organizational processes and effect on patient outcomes'. There was no reference in the title that this was a randomised trial. Regarding the second item the abstract was not structured according to trial design, methods, results and conclusions.

2. Introduction: Background and objectives

The next item discusses whether there is the scientific background and explanation of rationale as well as specific objectives or hypotheses reported in the study.

The scientific background is reported in a detailed way in the introduction, the chapter computerized systems and decision support, standardized language and definition of terms. The central theme is described and argued from the general into specific themes as shown in figure 9.

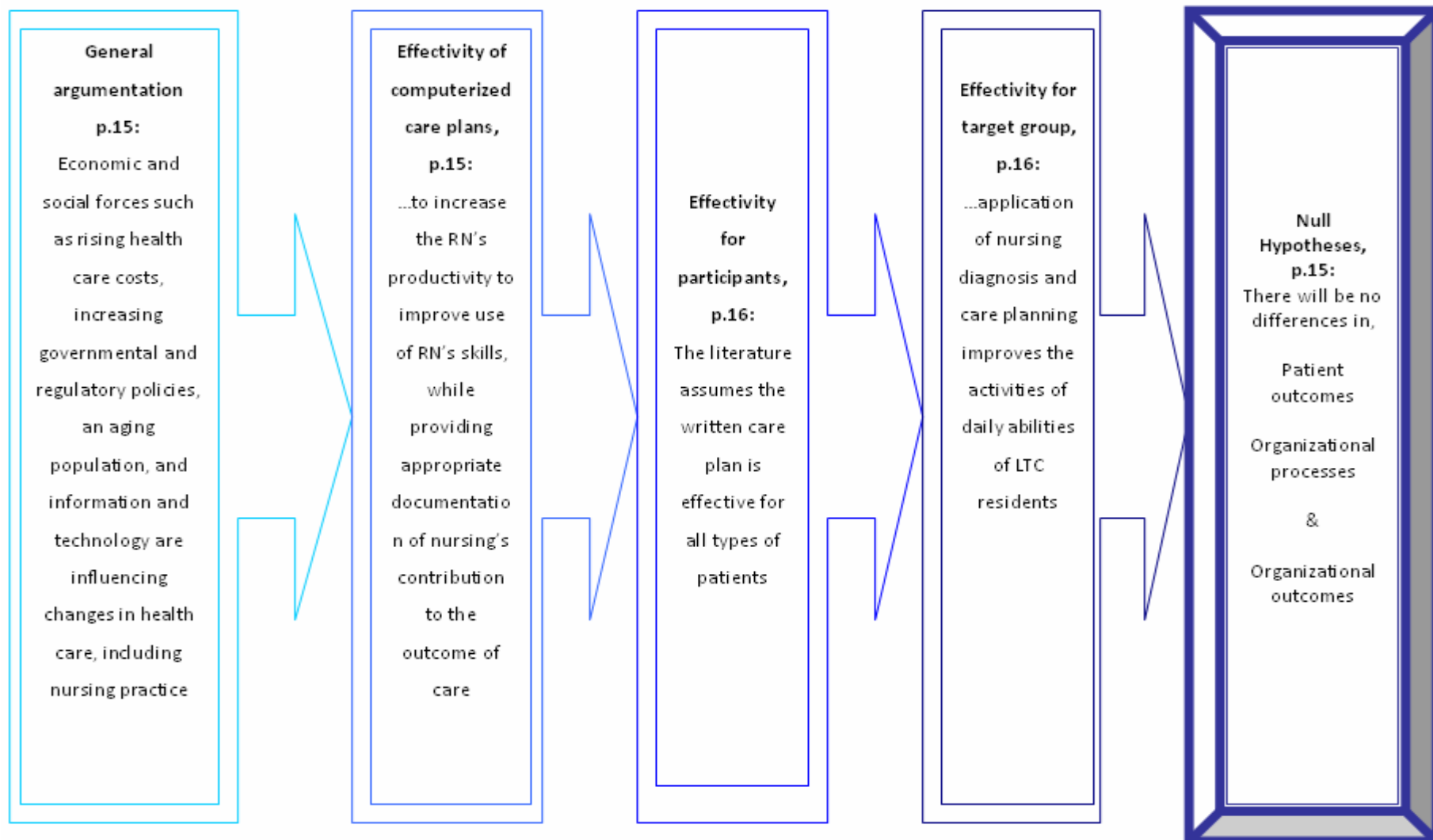


Figure 9: Central themes of the included study from Daly, Buckwalter & Maas (2002)

The objectives were not explicitly reported in this paper but the purpose of the study, from which the objectives can be deducted, is as follows (p.15):

'The purpose of this study was to determine how the use of standardized nomenclature for nursing diagnosis and intervention statements on the computerized nursing care plan in an LTC facility would affect patient outcomes, as well organizational process and organizational outcomes.'

3. Discussion

The next chapter of the CONSORT checklist addresses the limitations, the generalisability and the interpretation of the study.

Limitation: As already mentioned in the methodological assessment, the authors explicitly reported (p.19) that the sample size was too small. Another aspect that could have been influencing the organizational process is reported. The authors stated (p. 21) that the nurses in the written care plan group did not list every intervention they had done for or with the patients.

Generalisability: The next additional critical appraisal factor related to the generalisability. The first indication for a low generalisability was the small sample size. There were only 30 participants who met the inclusion criteria however only 20 participants were included in the study. Ten participants were excluded either because of death (n=4) or discharge (n=6). The author explicitly stated that the study was underpowered. Overall it was not possible to repeat this study to test the external validity by using the information contained in this paper.

Interpretation: In the section entitled discussion and nursing implication the results were compared to existing results from the literature. The interpretation was consistent with the results from the study as well as with research findings from already existing literature. Other relevant aspects were considered, discussed and argued when questions still remained. For example, the patient outcomes were not affected the way the authors assumed. This is the reason why the authors suspect that other factors such as staffing pattern, length of employment for nursing personnel or administration tolerance of abuse could have been influencing patient outcomes and should therefore be taken more into consideration in future research (p.20-21). Another point the authors stated was that through a computerized list of nursing diagnosis, goals and interventions, disciplines as well

as the family should be provided. The authors also discussed the time required for the computer written care plan. The computerized care plan group needed more time for preparation and other tasks (for example for collecting data for the MDS). There was no solution for this problem discussed.

4. Other information

Registration & protocol: The registration number and the name of the trial register were not reported in the paper. There was no evidence if and where the full trial protocol could be accessed. The aspect of funding in the category other information is described sufficiently in the EPOC Data Collection Checklist, and therefore will not be assessed once more.

4. Discussion

The purpose of this systematic review is to find out (1) which structural strategies are described in current literature and (2) find out about the effectiveness of these structural strategies as implementation strategies in nursing practice. One study that met the inclusion criteria could be found.

4.1. Classification into EPOC

Medical record systems as implementation strategies for new assessment instruments were already mentioned (chapter 1.2.6).

In the study of Daly, Buckwalter & Maas (2002) a new care plan was implemented through a computer. It was explicit stated that the computer was already on the ward. So, in this case, the computer was the strategy for implementing the new care plan into the daily nursing practice. In figure 7 the study is arranged in accordance with the EPOC Classification (2010).

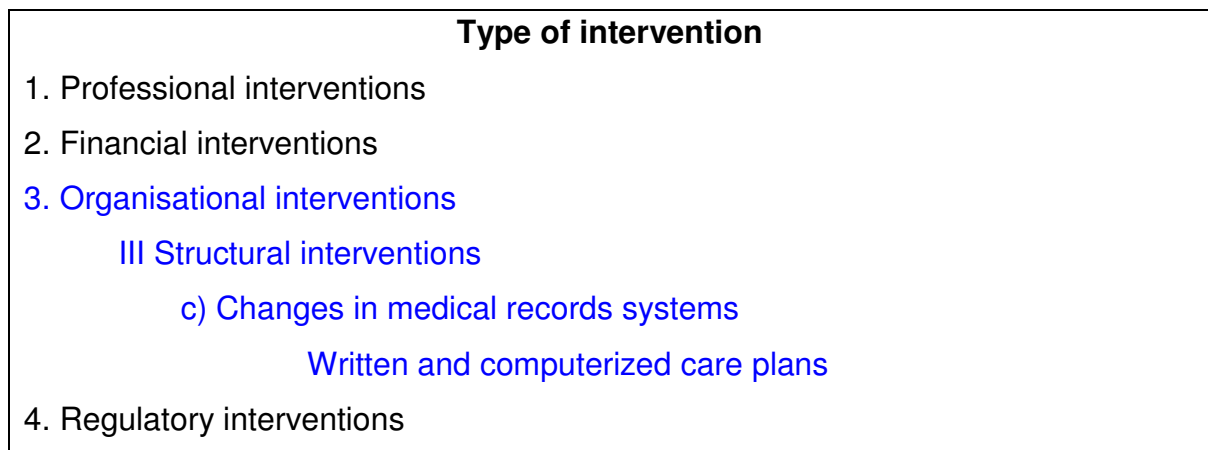


Figure 7: Arranging of the included study in the Classification System of EPOC (2010)

4.2. Comparison with Existing Reviews

Systematic reviews of accurate studies establish the best evidence on the effectiveness of different implementation strategies (Bero et al. 1998). But passive dissemination of information was tested as generally ineffective (Bero et al. 1998). The use of a computerized care plan - the intervention of the included study - could be seen as a passive dissemination strategy. Compared to the results from Bero et al. (1998), significant results for the computerized care plan were explored in the included study in this master thesis. In a study from Gilbody et al. (2003) no effect could be found for computer-based decision support systems on primary

care services for depression. Grimshaw and Eccles (2004) stated that most implementation strategies resulted in small to moderate improvements in care, which is in line with the results of the included study.

Another team of investigators reported that there was not sufficient evidence to decide which implementation strategies are efficient under different circumstances (Grimshaw et al. 2004). In accordance with Thompson et al. (2007) little was known about how to increase research use in nursing and the evidence to support or disapprove specific interventions was inconclusive. Before drawing a link between the use of research and patient outcomes Thompson et al. (2007) require to find effective implementation strategies.

The results from this systematic review were contrary to the current literature. Compared to results from different other investigators, significant results for the computerized care plan were explored in the included studies (Bero et al. 1998; Flanagan, Ramanujam & Doebbeling 2009; Gilbody et al. 2003; Grimshaw et al. 2004; Thompson et al. 2007).

Reasons for significant results could be the low methodological quality, the measurement methods or selection and detection bias that were found in the included study from Daly, Buckwalter & Maas (2002).

Flanagan, Ramanujam & Doebbeling (2009) reported that the provider compliance gain with the number of implementation strategies. Provider acceptance was not the main theme of the included study, but only computer illiterate registered nurses were allocated to the computerized care plan. This could impact the results, because the provider acceptance was very high from the beginning of the study. As a result significant results were found. The results from this master thesis are supported by findings from Thomas et al. (2009), which indicate that there is no sufficient evidence at the moment to make concrete decisions on the effectiveness of different implementation strategies.

4.3. Conceptual Challenges

The main aspects of this master thesis related to knowledge and research utilization and implementation strategies - here specified as structural interventions - that bridge the gap between theory and practice. Estabrooks, Wallin & Milner (2003) already described that implementation strategies depended on the conceptual theories of knowledge and research utilization. Nevertheless the foundations for measuring implementation itself are still missing (Estabrooks, Wallin & Milner 2003).

Majumdar, McAlister and Furberg (2004, p.1741) stated that bringing knowledge and research into practice is *'unpredictable, inconsistent and complex'*. They reported that strategies relating to the structural intervention could be potentially effective strategies: *'continuous quality improvement strategies, computerized decision support and other 'E-health' strategies, incentives, financial or otherwise, to promote best practice, and disincentives, financial or otherwise, to restrict suboptimal practice'* (Majumdar, McAlister & Furberg 2004, p.1740). Although more than 5000 studies were found, a lack of conceptual clarity and the lack of focus on implementation science were the reasons to exclude most of the studies.

As already mentioned the three main outcome classes identified in this study were:

- Patient outcomes
- Organizational processes
- Organizational outcomes

The included study measured the outcomes on different levels, as seen in figure 8. The conceptual framework in the included study from Daly, Buckwalter & Maas (2002) was a model for quality care in health care system and included structure, process and outcome.

Structures were defined in this study as *'the mechanism available for documenting the care plan- whether written or computerized care plan'*(p.17).

Patient process was defined as *'the patient's admission and permanent residence in the health center'* (p.17).

Patient outcomes were defined as '*a variable patient or family state, condition, or perception responsive to nursing intervention*' (Maas, Johnson & Kraus 1996, pp.25-26 IN: Kelly & Maas, 1996).

The conceptual challenges are within this model. As marked with an arrow in figure 8 patient outcomes, organizational processes and organizational outcomes were the primary outcomes in the included study. At first the three main outcome classes were measured in the process and the outcome dimensions. The reason why the three main outcome categories were measured at two different dimensions was not clear. The next challenges were the different levels on which the three outcome classes were measured. The organizational processes and the organizational outcomes can be found at the quality health care level. In contrast the patient outcomes are settled at the quality patient care level. The inherent challenge thereby was to find the link between the two levels of measurement - quality health care level and quality patient care level - and the effectiveness of the implementation strategy.

Other factors, as already mentioned in the discussion, could influence the results. Three instruments used for measuring primary outcomes were reported as standardized tests with effective psychometric properties. For other instruments, for example the Decubitus Pressure Ulcer Report form or assessment instruments for bowel function and nutritional status, it was not reported how or where these items are assessed and if the instruments were psychometrically tested. These findings are in line with the results of Estabrooks, Wallin and Milner (2003) which highlight a lack of measurement theory and a lack of advanced psychometric testing.

4.4. Methodological Challenges

As shown in table 6, the methodological quality of the included study is rated low by both reviewers. Thompson et al. (2007) has made a systematic review aimed at interventions that increased research use in nursing practice. In the article from Thompson et al. (2007) all of the included studies had a low methodological quality and three of the four included studies had made a unit of analysis error. Compared to the systematic review of Thompson et al. (2007), the findings of this master thesis promote interpreting the results with caution because of the weak

methodological quality. Another point was that the connection between the implementation strategy and the primary outcomes in the included study is unclear. Thompson et al. (2007) described the use of research and improving nursing practice as the links of interest for the investigators. Daly, Buckwalter & Maas (2002) intended to evaluate the computer as an implementation strategy for a new assessment instrument. A clear assignment of the effects to the implementation strategy was not possible. Grol (1992) has already recommended that future dissemination and implementation activities should be informed by theoretical perspectives and by evidence of those strategies shown to be effective. These suggestions from Grol (1992) coincide with the results of this master thesis.

4.5. Use of Multiple Outcomes

Primary outcomes, as the outcomes of interest in each study, are one of the most important aspects in research. As Thompson et al. (2007) already highlighted explicit and accurate definition of the primary outcomes helped to decide whether there is enough evidence for the effectiveness of the intervention and to allocate the research findings to the target group, setting and so on. In the included study the primary outcomes were patient outcomes, organizational processes and organizational outcomes. Not all of the items contained in the three categories were reported. For example the number of constipation episodes or the number of meals eaten were defined as patient outcomes, but they were not reported as results in the paper. So it is unclear if there is enough evidence for the effectiveness of the intervention and whether we could allocate the research findings to the target group or setting.

4.6. Application of the Intervention

The results of this master thesis have to be used with caution. As Thompson et al. (2007) already reported that the measurement of the effectiveness of an intervention is difficult when there were effects in some but not in all of the outcomes. In the study from Daly, Buckwalter & Maas (2002) there were significant outcomes for the computerized care plan in, for example, the number of nursing interventions, the number of nursing activities and the time required to prepare the computerized care plan.

There were no statistically significant differences found for all of the patient outcomes. For nursing diagnosis - as a variable of the organizational process - no statistically significant difference was found between the groups. Organizational outcomes were not statistically significant for the time required to write the care plan between the groups. So the effectiveness of the intervention has to be interpreted with caution. Wensing et al. (2009) describe that organisational interventions can change the nursing practice effectively. The included study shows effects in different outcomes but not in all. So the effectiveness of this intervention cannot be stated for all settings or participants.

The process of randomisation in the included study from Daly, Buckwalter & Maas (2002) has also reduced the applicability of the intervention. It was reported that the participants are allocated to the intervention and to the control group per randomisation. Certainly it was not reported how the randomisation was made. The authors indicated that there were no statistically significant difference between the groups based on age, gender, education and marital status. Although all patient outcomes were measured between the groups and no difference was found, randomisation, as a central process, should be described as accurate.

Another challenge with using the results was the effect size as no power calculation was made in the involved study. The authors do not report for example how many numbers of nursing interventions have to be more in the intervention group than in the control group to establish an effect. The sample size was very small therefore the reported significant effects could be influenced for instance by the nurses, who were not blinded, and as a result a possible difference in daily care could emerge.

Other problems with the use of the results from the included study were the characteristics of the participants. The mean level of care in the two groups scored with 2 (N=20, range 1-3). The results were not representative for participants with a mean level of care scored one or three. Another problem within the level of care was that it was not reported if the instrument for the level of care was standardized and passed psychometric tests. Therefore the results indicated a restricted applicability.

Another problem could be stated because only nurses that were computer literate were allocated to the computerized care plan group. This could lead to a selection

bias. Another imprecision was that the authors noted that turnover of the registered nurses during the study period was 16 percent. The total number of nurses that was reported in the paper was eight people. Therefore only one registered nurse turned over. It was not described in which group the registered nurse turned over.

A few other discrepancies were found. At first, the definition of the computerized care plan varies in the paper from Daly, Buckwalter & Maas (2002):

- A computerized care plan was defined as '*documentation of the nursing process, specifically problems, goals, interventions (i.e., Iowa Intervention project classification system) and evaluation*' (p. 17).
- '*Nurses who use the computer wrote Nursing Interventions Classification (NIC) interventions and highlighted each NIC activity relevant to the care plan under preparation*' (p. 21).

At this point it was not clear if the Iowa Intervention Project Classification System works with the Nursing Interventions Classification (NIC) interventions.

One aspect that also weakens the generalisability of the study findings was that it was not reported if the participants were informed in an adequate way. The authors only state that the consent of the participants was received. The authors do not characterise the form of the informed consent (written or oral) and if the relatives of the participants were also informed. The information of the relatives has to be done by this special participants group.

4.7. Unit of Analysis Errors

Whiting-O'Keefe, Henke & Simborg (1984) defined an Unit of analysis error '*as a result of inappropriately using patient-related observations as the unit of analysis to form conclusions about provider behavior or outcomes determined jointly by patients and providers*' (Whiting-O'Keefe, Henke & Simborg 1984, pp.1101)

In the study of Daly, Buckwalter & Maas (2002) the participants were allocated in the intervention and control group. The analysis of the results was made for both groups. The groups for allocation and the groups for analysis were the same and no unit of allocation error was made.

The inherent problem in the included study was that participants clustered into the intervention group and the control group could have been similar to each other. For example, the nurses in the study from Daly, Buckwalter & Maas (2002) (N=8) could have similar attitudes, ways of working, abilities and skills.

The biggest challenge in the included study was the small sample size, as already mentioned. A too small sample size could be the reason for no significant result for the patient outcomes in the included study.

4.8. Structural Interventions as Implementation Strategies

Structural interventions as implementation strategies were the main theme of this master thesis in the context of nursing. The first challenge was the broad sense of structural interventions, defined by the EPOC and in addition connecting these structural interventions with the field of implementation science. The focus was to find out if there were any structural interventions used as implementation strategies in nursing practice described in current literature. The study from Daly, Buckwalter & Maas (2002) was the only study that fulfilled the inclusion criteria. With the computer – the structural intervention as implementation strategy - a new care plan was implemented. The findings from this study have to be interpreted with caution. Although it is reported in the article that the computer was already on the ward, it was not mentioned if it was already used. This is a grey area. It could have been possible, that the computer was already on the ward, but not used. Then the use of the computer could not be seen as the implementation strategy as the use of the computer would also have been newly implemented.

In the list of EPOC (2010) of already existing systematic reviews, no other systematic review or study was found that focussed on structural interventions as implementation strategies in nursing context. There were several studies excluded after title screening because the structural interventions were newly implemented. But the main theme in this master thesis was to use structural interventions as implementation strategies. Another challenge was to find studies focusing on the nursing context. Most of the studies were excluded after the title screening as they were focusing on a mix of health professionals specialised in medicine or on one specific group of health professionals- but not nurses.

Foxcroft and Cole (2009) had made a systematic review focusing on organisational infrastructural interventions in nursing context. They found no study that met the inclusion criteria for their systematic review.

4.9. Limitations

There were several limitations that have to be mentioned in this systematic review. The first limitation was a language restriction. Both independent reviewers can speak German and English and for that reason no other language was included. It is possible that articles reported in other languages than in English and German were ignored. The next limitation was inherent with the language restriction and called Tower of Babel bias (Egger et al. 1997). There were more positive findings published in English and this could also influence the findings of this systematic review (Egger et al. 1997).

Another limitation was the narrative approach which was chosen in this master thesis as way of reporting, because the studies were of poor methodological quality and only one study was included (Magarey 2001). Otherwise study results could have been compared and a metaanalysis could have been carried out, which would have brought the results on a higher evidence level.

The so called 'black box phenomenon' was another restriction to draw conclusions in a larger extent (Thompson et al. 2007). It was not clear whether the significant effects of the involved study were effects relating to the intervention. In the included study it was reported that the nurses part of the intervention group had a training session. An increased awareness concerning the nursing diagnosis, interventions or goals could also have an impact on the results.

The next limitation was that the EPOC Classification was established for all professions in health science (EPOC 2010). The context of this master thesis was nursing practice. Because of this, it was possible that studies from other health professionals focusing on structural interventions as implementation strategies were ignored. Using assumptions from research findings from other health disciplines to the nursing context or comparing findings from other disciplines with the findings from this master thesis should be made with great attention.

Another limitation was that systematic reviews are summaries of all past research on a topic of interest (JBIEBNM 2001). This means that the reported studies are

influenced by the time they were reported. Standards for reporting such as the CONSORT used in this master thesis have been used in the last ten years. Hartling et al. (2004) reported that the quality of reporting studies influences the readers and their way of interpreting. The narrative approach used in this master thesis is also described as per above as a limitation. Overall the results of this master thesis should be interpreted with caution.

5. Conclusion

Altogether it is not possible to give any recommendation based on the results of this master thesis regarding the effectiveness of structural interventions as implementation strategies in nursing context. Structural strategies were mostly reported in current literature as newly implemented interventions but not as implementation strategies. Several systematic reviews were made about the effectiveness of common implementation strategies in health science. There was a lack of evidence and attention in taking the organizational or specifically the structural interventions into account as implementation strategies in the health context. Further research has to focus on structural interventions as implementation strategies. The lack of evidence was much greater in the field of nursing science than in other fields, specifically on implementation strategies. Implementation research as one main aspect of nursing research should come to the fore. One main aspect should be the deployment of the outcomes of interest. Whether the outcome of interest should be the changes in provider/ practice/ patient outcomes, or whether the changes in the use of research findings in nursing practice should be the outcome of interest (Hakkenes & Green 2006; Thompson et al. 2007). Basic assumptions have to be that the conceptual challenges relating to research utilization in nursing context can be resolved.

The results of the included study from Daly, Buckwalter & Maas (2002) should be interpreted with caution. Methodological and conceptual failings could not lead to the generalization of results or to any specific recommendation. The statistically significant results in the included study give small evidence to support the computer as an effective implementation strategy in nursing context.

In summary, nursing science and especially implementation science in the context of nursing is still at the beginning of a long road. But implementation through structural strategies can bring us:

‘...the best available evidence, to practise as well as we can with the intent of making it better in some way for patient or client’

(Estabrooks 1999, p.299).

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Supplement

A. Deployment of the KEYWORDS

1. Structural intervention

KEYWORD	www.thefreedictionary.com	http://thesaurus.reference.com	www.onelook.com	ISSA SST
structural	contextual, organizational	0	formal	0
intervention	involvement, participation, engagement, treatment,	activity, action, mechanism	mediation, intervene, intercession, interference, intermission, intermediation,	0
strategies	scheme, plan of action, policy, procedure, plan, program, approach,	method, performance, management, undertaking,	plot	0

2. Changes to the setting /site of service delivery

KEYWORD	www.thefreedictionary.com	http://thesaurus.reference.com	www.onelook.com	ISSA SST
setting	position, place, station, location, department, context, environment site, surrounding (s), ward	background, ambience	framework	0
service	duty (ies), labor	maintenance, treatment	0	0
delivery	transfer, commitment, distribution,	0	0	0

3. Changes in physical structure, facilities and equipment

KEYWORD	www.thefreedictionary.com	http://thesaurus.reference.com	www.onelook.com	ISSA SST
facilities	building, place, accommodation, ward, station, court, office, establishment	company, enterprise, house, institute	residence, workplace	0
equipment	supplies, apparatus, machinery, utensils	appliances, appurtenances, articles, attachments, devices	fixtures, material, provisions, tools	0

4. Changes in medical records systems

KEYWORD	www.thefreedictionary.com	http://thesaurus.reference.com	www.onelook.com	ISSA SST
medical records	0	case study,	0	0

5. Changes in scope and nature of benefits and services

KEYWORD	www.thefreedictionary.com	http://thesaurus.reference.com	www.onelook.com	ISSA SST
scope	intention, purpose, intended purpose, function, end, object, aim, goal	area, comprehensiveness, field	0	0
nature	character, disposition, constitution, description, quality, change	type, shape, framework, sort	0	0

benefits	advantage, profit, benediction, improvement	betterment, prosperity, achievement	effort, performance, accomplishment	0
service	account, applicability business, duty	employment, labor, labour, ministration, supply, work	0	0

6. Presence and organisation of quality monitoring mechanisms

KEYWORD	www.thefreedictionary.com	http://thesaurus.reference.com	www.onelook.com	ISSA SST
presence	being, beingness, existence, presence, inherence, inherency, immanence, immanency, occurrence, attendance	occupancy, attendancy, existence, omnipresence, appearance,	appearance	0
“quality” monitoring	assessment, assurance, control, management, quality improvement, analysis, evaluation	observation, audit, check, maintenance , support	quality surveillance	0
mechanism	process, instrument, mechanism, system	components, machinery, tool, structure, procedure, technique, arrangement, construction	regulation, adaption	0

7. Ownership, accreditation, and affiliation status of hospitals and other

KEYWORD	www.thefreedictionary.com	http://thesaurus.reference.com	www.onelook.com	ISSA SST
ownership	ownership, holding, possessorship, possession	settlement, holding, habitation	occupation, tenure	0
accreditation	permission, certification, authentication	authority	license, proof, permit, endorsement	0
affiliation	alliance, coalition, combination	confederation, collaboration, cooperation, membership, concurrence	conjunction connection, partnership, relationship, union	0

8. Staff organisation

KEYWORD	www.thefreedictionary.com	www.thesaurus.reference.com	www.onelook.com	ISSA SST
staff	employees, crew, team, workers	personell, work force, provider	suppliers, professions	0
organization	institution, management, regulation, structure	planning, recruitment, assembly, coordination, alliance	0	0

9. Effectiveness

KEYWORD	www.thefreedictionary.com	www.thesaurus.reference.com	www.onelook.com	ISSA SST
effectiveness	effectuality, effectualness, effective, efficacious,	capability, effect, impact, impression, influence, effectualness,	effectivity, effectuality, effectualness	0

10. Research and knowledge transfer

For the context of research and knowledge-transfer following keywords were generated in dependence on Thompson et al. (2007):
utilizat*, utlisat*, uptake, transfer*, implement*, disseminat*, diffusion*, translat* AND evidence, research and knowledge.

B. Deletion of the KEYWORDS

Keywords were deleted, because:

- ☒ not common in health and nursing science or
- ☒ the meaning of this word was not matching to the search chain it was found for or
- ☒ it has already been found as a keyword in another search chain

1. Deleted keywords in the search chain: Structural intervention

Although at first there were also keywords generated for strategy or intervention, it was decided for broadening the search strategy to omit them.

involvement, participation, engagement, treatment, activity, action, mechanism, mediation, intervene, intercession, interference, intermission, intermediation, scheme, plan of action, policy, procedure, plan, program, approach, method, performance, management, undertaking and plot.

2. Deleted keywords in the search chain: Changes to the setting /site of service delivery

position, place, location, context, environment, surrounding (s), background, ambience, framework, duty (ies), labor, maintenance, treatment, transfer, commitment and distribution.

3. Deleted keywords in the search chain: Changes in physical structure, facilities and equipment

building, place, accommodation, court, office, establishment, company, enterprise, house, institute, residence, workplace, supplies, apparatus, machinery, utensils, appliances, appurtenances, articles, attachments, devices, fixtures, material, provisions and tools.

4. Deleted keywords in the search chain: Changes in medical records systems

case study- Because of the lack of keywords other sources were searched.

5. Deleted keywords in the search chain: Changes in scope and nature of benefits and services

intended purpose, function, end, object, aim, goal, area, comprehensiveness, field, character, disposition, constitution, quality, change, shape, framework, sort, benediction, betterment, prosperity, performance, accomplishment, account, applicability, business, duty, employment, labor, labour, ministration, supply and work.

6. Deleted keywords in the search chain: Presence and organisation of quality monitoring mechanisms

immanence, immanency, omnipresence, management and machinery.

7. Deleted keywords in the search chain: Ownership, accreditation, and affiliation status of hospitals and other

possession, settlement, holding, habitation, occupation, tenure, permission, authority, proof, permit, endorsement, combination, confederation, membership, concurrence, conjunction and connection.

8. Deleted keywords in the search chain: Staff organisation

Workers, personell, work force, provider, suppliers, professions, institution, regulation, structure, assembly and alliance.

C. Development keywords for medical records

1. Deleted keywords in the search chain: Changes in medical records systems

case study.

Because of the lack of keywords other sources were searched. Five different sources were used to generate keywords for the medical records system search chain.

A. Wording from EPOC was used: Medical records, Patient tracking.

B. PubMed Mesh Term Database was searched: Computerized, Patient Care planning.

C. A systematic Review: Uruquhardt 2009

Nursing Records, Documentation, Point-of-Care Systems, Hospital Information Systems.

D. In the Canadian Agency for Drugs and Technologies in Health Database (CADTH 2011) adequate articles for medical records were found. The last keywords were found in Shekkel 2003 and Ioannidis 2001 in the above named database.

I. Shekkel, PG, Morton, SC & Keeler, EB 2006:

automatic data processing, medical informatics, electronics, information technolog*, information infrastructure*, ehealth, e-health.

II Ioannidis & Lau 2001

medical errors, prescription errors, diagnostic errors.

D. Remaining search chains

I. Search chain: Structural intervention

1. (struct* or organi*ation* or contex* or formal).ab. or (struct* or organi*ation* or contex* or formal).ti.
2. (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ab. or (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ti.
3. (evidence or research or knowledge).ab. or (evidence or research or knowledge).ti.
4. (effect* or efficacious* or impact).ab. or (effect* or efficacious* or impact).ti.
5. 1 and 2 and 3 and 4
6. structured abstract.ab. or structured abstract.ti.
7. (s5 not s6).af.
8. nurs*.af.
9. (s7 and s8).af.
10. limit 9 to abstracts
11. limit 10 to (english or german)
12. limit 11 to yr="1990 -Current"
13. remove duplicates from 12

II. Search chain: Changes to the setting /site of service delivery

1. (setting or station or department or site or ward*).ab. or (setting or station or department or site or ward).ti.
2. service delivery.ab. or service delivery.ti.
3. (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ab. or (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ti.
4. (evidence or research or knowledge).ab. or (evidence or research or knowledge).ti.
5. (effect* or efficacious* or impact).ab. or (effect* or efficacious* or impact).ti.

6. nurs*.ab. or nurs*.ti.
7. 1 and 2 and 3 and 4 and 5 and 6
8. limit 7 to abstracts
9. limit 8 to (english or german)
10. limit 9 to yr="1990 -Current"
11. remove duplicates from 10

III. Search chain: Changes in physical structure, facilities and equipment

1. (facilit* or ward or station or equipment*).ab. or (facilit* or ward or station or equipment*).ti.
2. (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ab. or (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ti.
3. (evidence or research or knowledge).ab. or (evidence or research or knowledge).ti.
4. (effect* or efficacious* or impact).ab. or (effect* or efficacious* or impact).ti.
5. 1 and 2 and 3 and 4
6. nurs*.ab. or nurs*.ti.
7. 5 and 6
8. limit 7 to abstracts
9. limit 8 to (english or german)
10. limit 9 to yr="1990 -Current"
11. remove duplicates from 10

IV. Search chain: Changes in medical records systems

1. (medica*errors or prescription errors or diagnostic errors or medical records or nursing records or computerized or documentation or point-of-care systems or patient care planning or hospital information systems or automatic data processing or medical informatics or electronics or information technolog* or information infrastructur* or ehealth or e-health or patient track*).ab. or (medica*errors or prescription errors or diagnostic errors or medical records or nursing

records or computerized or documentation or point-of-care systems or patient care planning or hospital information systems or automatic data processing or medical informatics or electronics or information technolog* or information infrastructur* or ehealth or e-health or patient track*).ti.

2. (utilizat* or utlisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ab. or (utilizat* or utlisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ti.
3. (evidence or research or knowledge).ab. or (evidence or research or knowledge).ti.
4. (effect* or efficacious* or impact).ab. or (effect* or efficacious* or impact).ti.
5. 1 and 2 and 3 and 4
6. nurs*.ab. or nurs*.ti.
7. 5 and 6
8. limit 7 to abstracts
9. limit 8 to (english or german)
10. limit 9 to yr="1990 -Current"
11. remove duplicates from 10

V. Search chain: Changes in scope and nature of benefits and services

1. (scope or intention or purpose or nature or description or type).ab. or (scope or intention or purpose or nature or description or type).ti.
2. (benefit* or advantage* or profit* or achievement or effort or improvement).ab. or (benefit* or advantage* or profit* or achievement or effort or improvement).ti.
3. (utilizat* or utlisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ab. or (utilizat* or utlisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ti.
4. (evidence or research or knowledge).ab. or (evidence or research or knowledge).ti.
5. (effect* or efficacious* or impact).ab. or (effect* or efficacious* or impact).ti.

6. 1 and 2 and 3 and 4 and 5
7. nurs*.ab. or nurs*.ti.
8. 6 and 7
9. limit 8 to abstracts
10. limit 9 to (english or german)
11. limit 10 to yr="1990 -Current"
12. remove duplicates from 11

VI. Search chain: Presence and organisation of quality monitoring mechanisms

1. (being* or existence or presence or inhere* or occurrence or attendance or occupancy or appearance).ab. or (being* or existence or presence or inhere* or occurrence or attendance or occupancy or appearance).ti.
2. (qualit* or improvement).ab. or (qualit* or improvement).ti.
3. (assessment or assurance or control or analysis or evaluation or observation or audit or check or surveillance or quality maintenance or process or instrument or mechanism or system or support or components or tool or structure or procedure or technique or arrangement or construction or regulation or adaption).ab. or (assessment or assurance or control or analysis or evaluation or observation or audit or check or surveillance or quality maintenance or process or instrument or mechanism or system or support or components or tool or structure or procedure or technique or arrangement or construction or regulation or adaption).ti.
4. (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ab. or (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ti.
5. (evidence or research or knowledge).ab. or (evidence or research or knowledge).ti.
6. (effect* or efficacious* or impact).ab. or (effect* or efficacious* or impact).ti.
7. 1 and 2 and 3 and 4 and 5 and 6

8. nurs*.ab. or nurs*.ti.
9. 7 and 8
10. limit 9 to abstracts
11. limit 10 to hausa
12. limit 11 to yr="1990 -Current"
13. remove duplicates from 12

VII. Search chain: Ownership, accreditation, and affiliation status of hospitals and other

1. (ownership or holding or accreditation or certification or authentication or license or affiliation or alliance or coalition or partnership or relationship or union or collaboration or cooperation).ab. or (ownership or holding or accreditation or certification or authentication or license or affiliation or alliance or coalition or partnership or relationship or union or collaboration or cooperation).ti.
2. (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ab. or (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ti.
3. (evidence or research or knowledge).ab. or (evidence or research or knowledge).ti.
4. (effect* or efficacious* or impact).ab. or (effect* or efficacious* or impact).ti.
5. 1 and 2 and 3 and 4
6. nurs*.ab. or nurs*.ti.
7. 5 and 6
8. limit 7 to abstracts
9. limit 8 to (english or german)
10. limit 9 to yr="1990 -Current"
11. remove duplicates from 10

VIII. Search chain: Staff organisation

1. (staff or employ* or crew or team).ab. or (staff or employ* or crew or team).ti.
2. (organi*ation or management or plan* or recruit* or coordination).ab. or (organi*ation or management or plan* or recruit* or coordination).ti.
3. (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ab. or (utilizat* or utilisat* or uptake or transfer* or implement* or disseminat* or diffusion* or translat*).ti.
4. (evidence or research or knowledge).ab. or (evidence or research or knowledge).ti.
5. (effect* or efficacious* or impact).ab. or (effect* or efficacious* or impact).ti.
6. 1 and 2 and 3 and 4 and 5
7. nurs*.ab. or nurs*.ti.
8. 6 and 7
9. limit 8 to abstracts
10. limit 9 to (english or german)
11. limit 10 to yr="1990 -Current"
12. remove duplicates from 11

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Figure: A model for quality of care in health care system, page 17

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Jeanette

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F. Included Article



Written and Computerized Care Plans

ORGANIZATIONAL PROCESSES AND EFFECT ON PATIENT OUTCOMES

ABSTRACT

The purpose of this study was to determine how use of a standardized nomenclature for nursing diagnosis and intervention statements on the computerized nursing care plan in a long-term care (LTC) facility would affect patient outcomes, as well as organizational processes and outcomes. An experimental design was used to compare the effects of two methods of documentation: Computer care plan and paper care plan. Twenty participants (10 in each group) were randomly assigned to either group. No statistically significant differences were found by group for demographic data.

Repeated measures ANOVA was computed for each of the study variables with type of care plan, written or computerized, as the independent variable. There were no statistically significant differences between participants, group (care plan), within subjects (across time), or interaction (group and time) effects for the dependent variables: Level of care, activities of daily living, perception of pain, cognitive abilities, number of medications, number of bowel medications, number of constipation episodes, weight, percent of meals eaten, and incidence of alteration in skin integrity. There were significantly more nursing interventions and activities on the computerized care plan, although this care plan took longer to develop at each of the three time periods. Results from this study suggest that use of a computerized plan of care increases the number of documented nursing activities and interventions, but further research is warranted to determine if this potential advantage can be translated into improved patient and organizational outcomes in the long-term care setting.

In the current health care environment, with its emphasis on cost containment and optimal use of nurses' time, interventions are being scrutinized related to quality of care at minimal cost. Long-term care (LTC)

facilities and hospitals must achieve desired outcomes while operating within a complex and rapidly changing environment. Economic and social forces such as rising health care costs, increasing governmental and regulatory

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SEPTEMBER 2002

ry policies, an aging population, and information and technology are influencing changes in health care, including nursing practice (National Commission on Nursing Implementation Project, 1989). Increasingly, the changes focus attention on the nurses' documented clinical decisions, diagnoses, interventions, and outcomes achieved (Hildman & Ferguson, 1992; Krall, Chin, Dworkin, Gabriel, & Wong, 1997).

More than a decade ago, the Secretary's National Commission on Nursing (1989) set forth recommendations related to efficient and effective use of nursing resources. Technology, including the use of computerized information systems, was one mechanism to "increase the RN's productivity to improve use of the RN's skills, while providing appropriate documentation of nursing's contribution to the outcomes of care" (Barry & Gibbons, 1990). Information systems were projected to save 1.5 hours of time per nurse per shift, thus making more nursing time available for direct patient care, which, in turn, should improve patient outcomes. Most importantly, the use of computerized clinical planning and decision-making with standardized nomenclature was expected to enhance the quality of nurses' decisions in making nursing diagnoses and selecting interventions to yield optimal patient outcomes.

Further, because it is licensed professional nursing staff who make the clinical judgments necessary for assessment, diagnosis, intervention, and evaluation of desired outcomes, the use of information technology is especially important in LTC where the ratio of assistive non-licensed staff to licensed nursing staff is large. Ideally, information technology should conserve the limited availability and time of RNs and LPNs for the nursing process and documentation so they can devote more time to implementation of patient care. It should also encourage more thorough assessment and documentation of patient problems. With a computerized information system in place, assessment triggers cannot be ig-

nored, and identified problem areas must be addressed through nursing intervention and evaluation. Further, the computerized information system is not viable without standardized languages, which should make care planning more efficient.

Care plans for residents in LTC are mandated by the U.S. Department of Health and Human Services (DHHS) (USDHHS, 1991) and the steps of the nursing process are written as the individual patient's care plan. The DHHS also mandates a quarterly interdisciplinary team meeting for care plan development and continued evaluation. Proper development and documentation of the care plan is an essential but time consuming task, and one that is facilitated by use of standardized language to convey core issues to other health team members (Iowa Intervention Project, 2000).

Problem and Purpose Statement

The purpose of this study was to determine how use of a standardized nomenclature for nursing diagnosis and intervention statements on the computerized nursing care plan in a LTC facility would affect patient outcomes, as well as organizational processes and outcomes. The following null hypotheses were tested: There will be no differences in

- Patient outcomes (e.g., mobility, independence in activities of daily living, cognitive ability, incidence of alteration in skin integrity, perception of pain, bowel function, nutritional status).
- Organizational processes (e.g., number of nursing diagnoses, interventions, activities documented per patient).
- Organizational outcomes (e.g., nursing time to develop and write a care plan) when using a written versus a computerized care plan.

REVIEW OF LITERATURE

Clinical Decision-making

The nursing care plan was used early in the 1900s as a teaching aid for students. Its format has changed over time, but the purpose of providing current up-to-date information for care remains the same (Ackerly, 1939). The

literature assumes the written care plan is effective for all types of patients (Johnson, Stone, Larson, & Hromek, 1992). However, Hildman and Ferguson (1992) noted the written care plan is an effective learning tool for nursing students and new graduates, but not necessary for all nurses to provide high quality care. Determining appropriate nursing diagnoses and nursing intervention labels are regarded as learning exercises for nursing students. For more experienced nurses, the process becomes automatic and documentation of the nursing process is not necessary.

Contradicting the idea that care planning is for novices, Johnson et al. (1992) stated that application of nursing diagnosis and care planning improves the activities of daily living abilities of LTC residents. However, the application must be accurate to be effective. The authors found that a care plan is necessary for providing direction to caregivers and licensed professionals not only must document the care necessary for each LTC resident, but also convey this information to non-licensed staff who will likely implement the interventions.

Computerized Systems and Decision Supports

Documentation by nurses, including the care plan, takes up to 15% of their work time (Miller & Pastorino, 1995). Streamlining documentation can be performed by using pre-printed, standardized plans or computer-generated care plans (Gwozdz & Del Negro-Armasco, 1992), with problem lists written in plain language so all involved in the care can understand it (Johnson, 1991).

Pease, Guhde, and Guhde (1991) implemented an automated care planning system in their LTC setting, which contained approximately 1,400 statements of problems, goals, and approaches and allowed for individual input of alternatives. Difficulty using the software programs' language was noted. Powell (1989) found that a computerized format facilitated the record-

ing of the care plan, but a software program that uses standardized language and prompts decisions should do more than facilitate documentation.

According to Simpson (1991), any system that requires nurses to access clinical decision support systems and has reminders to fulfill certain tasks, as well as to account for care over time, will change the nature of the profession. Computerized care plan systems that trigger problems from a standardized assessment, proceed with a listing of potential nursing diagnoses, and continue with potential nursing intervention labels and outcomes will provide support for nurses' decisions and improve practice (Powell, 1989). Thus, a computerized approach should provide more complete and accurate identification of nursing diagnoses and interventions.

Standardized Language

Various problems are evident with current care plan documentation, including the fact that multiple terms are used to describe nursing diagnoses, such as patient "needs" or "wants." Confusion also exists when a nursing problem (i.e., not a patient problem), such as the unavailability of a walker, occurs. Ambiguity emerges when common terms such as "nursing order," "approach," or "treatment" are used to describe the same interventions on the care plan.

Non-standardized care plans are often vague related to diagnoses, for example, using the terms "delirium" and "acute confusion" interchangeably. Specifying the nursing diagnosis as an "alteration in thought process" and describing the etiology in standardized form is expected to increase gerontological nurses' choice of the most appropriate nursing intervention. Nursing experience, expanded knowledge, and critical thinking skills are needed to specify diagnoses and etiologies accurately as well as the best treatments to address them.

Care plans using standardized nursing languages that are computerized have the benefits of organizing knowl-

edge, providing knowledge and decision support, and allowing quicker choices because of the logic that is programmed. Thus, more useful diagnoses and prescribed interventions, as well as more helpful instructions for assisting staff, are enabled by the use of standardized languages (Iowa Intervention Project, 2000).

Bulechek and McCloskey (1990) suggest that if uniform terminology was used for care plans, patient outcomes could be enhanced, nursing knowledge advanced, and nursing practice developed. Among other benefits to using standardized nursing languages in nursing practice, education, and research are that they provide a common frame of reference so nurses in different specialty areas and health care settings can communicate better. For example, Impaired Mobility Level IV (totally dependent) means the same thing in pediatrics, rehabilitation units, orthopedic units, or LTC settings. Thus, standardized terminology for nursing diagnoses and interventions should make written communication easier and more efficient, and increase accountability for patient care (Bulechek & McCloskey, 1990).

DEFINITION OF TERMS

For purposes of this study the Written Care Plan was defined as the usual or routine documentation of the nursing process, specifically problems, goals, interventions, and evaluation. Computerized Care Plan was defined as documentation of the nursing process, specifically problems (i.e., North American Nursing Diagnosis Association [NANDA] nursing diagnoses), goals (not standardized), interventions (i.e., Iowa Intervention Project's classification system), and evaluation.

A nursing diagnosis is defined as "a clinical judgment about individual, family, or community responses to actual and potential health problems and life process" (NANDA, 1996). Currently, there are 128 NANDA nursing diagnoses statements. In a comparison of five studies of nursing diag-

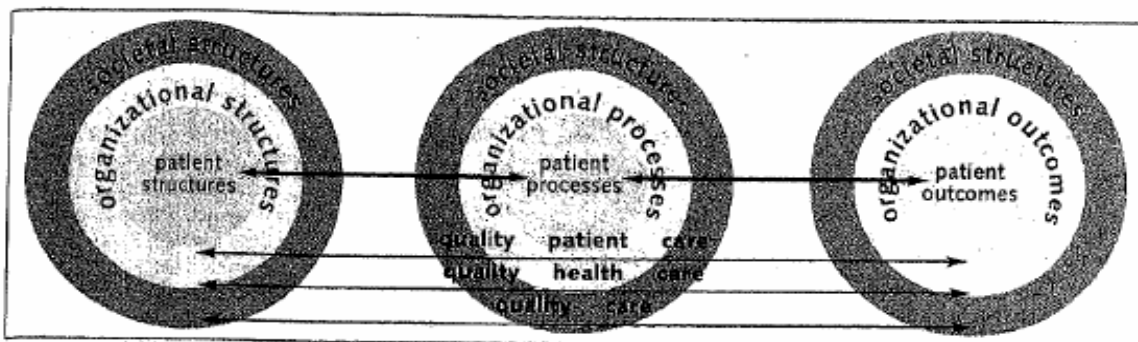


Figure 1. A model for quality care in the health care system.

nosis prevalence among older adults and LTC residents, Hardy, Maas, and Akins (1989) found that nursing diagnoses in the NANDA taxonomy reflected the problems of elderly individuals; NANDA standardized language captured those patient responses to illness that nurses treat. Seven nursing diagnoses were most prevalent:

- Impaired physical mobility.
- Total self-care deficit.
- Alteration in thought processes.
- Impaired skin integrity.
- Alteration in comfort (e.g., pain).
- Alteration in bowel elimination (e.g., constipation).
- Alteration in nutrition (e.g., less than body requirements).

A nursing intervention is defined as "any treatment, based upon clinical judgment and knowledge, that a nurse performs to enhance patient/client outcomes" (Iowa Intervention Project, 1996). These treatments include direct and indirect care interventions that can be nurse-initiated treatments for nursing diagnoses or physician-initiated treatments for medical diagnoses. To date, more than 440 interventions have been identified. Each has a label, definition, and a set of related activities describing the behaviors of the nurse implementing the intervention, and a short list of background readings. Examples of nursing interventions are Bathing, Cast Care, and Emotional Support (Iowa Intervention Project, 2000). The conceptual framework for the study illustrated the relationships between these concepts.

Conceptual Model for Quality Care in the Health Care System

To identify relevant concepts and their interrelationships, a model for quality care in the health care system that included structure, process, and outcomes was used (Figure) (Brett, 1989; Daly, 1993; Donabedian, 1966; Swearingen, 1997). The patient is the nucleus of the model surrounded by the organization fully encased by all factors of society. The model has three dimensions—structure, process, and outcome. The concept of quality of care flows through the three levels of the model (i.e., patient, organization, society) and across the three dimensions. Mechanisms available for documentation of the care plan are structures specific to this study and include both the written and computer-generated care plan. The patient process was the patient's admission to the health center and permanent residence there.

Patient outcome was defined as "a variable patient or family state, condition, or perception responsive to nursing intervention" (Maas, Johnson, & Kraus, 1996). Patient outcomes identified were mobility, independence in activities of daily living, cognitive ability, incidence of alteration in skin integrity, perception of pain, bowel function, and nutritional status.

The outcome variables for this study were organizational processes, patient outcomes, and organizational outcomes. The specific organizational processes identified were the series of actions in the nursing process involved in care plan development and documentation. The

results of this process are the list of nursing diagnoses, interventions, and activity statements, tabulated for each participant. The organizational outcomes measured were the nursing time to develop and write a care plan. These outcomes were calculated and compared between the two types of care plans.

INSTRUMENTS

Standardized instruments and objective data were used for data collection. The Index of Independence in Activities of Daily Living (IADL) (Katz & Akpom, 1976), Numerical Rating Scale for Pain (Whitaker & Warfield, 1988), and Mini-Mental State Examination (MMSE) are standardized tests with effective psychometric properties used in previous studies (Folstein, Folstein, & McHugh, 1975; Katz & Akpom, 1976). The remaining data were collected from the patients' medical record: level of care (i.e., complete, partial, minimal), total number medications, number of bowel medications, number of constipation episodes, weight, percent of meals eaten, and decubitus and pressure ulcer measurement.

The IADL scale (Katz & Akpom, 1976) reflects profiles of six functions: bathing, dressing, toileting, continence, ambulation, and feeding. Adequacy of these functions are expressed as a grade summarizing the performance. The end result ranges from independent in all six functions to dependent in all six functions with numerical scores ranging from 0 to 6.

The patient outcome "cognitive ability" was measured by the MMSE,

TABLE 1
PATIENT OUTCOME RESULTS BY GROUP PER EACH TIME PERIOD

	Time 1	Time 2	Time 3	Time 4	Time 5	Time 6	Time 7
Group I (Computer care plan)							
IADL Mean	3.6	3.5	3.9	3.4	3.2	3.8	3.5
IADL Range	0 to 6	0 to 6	0 to 6	0 to 6	0 to 6	0 to 6	0 to 6
MMSE Mean	20			22			25
MMSE Range	6 to 28			16 to 30			15 to 30
Level of Care Mean	2	2	2	2	2	2	2
Level of Care Range	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3
Pain Score Mean	4	4	5	5	5	4	5
Pain Score Range	0 to 10	0 to 10	0 to 10	0 to 10	0 to 10	0 to 10	0 to 9
Medications Mean	7	7	7	8	8	9	9
Medications Range	0 to 13	1 to 13	1 to 13	1 to 14	1 to 14	1 to 14	1 to 15
Bowel Medications Mean	2	2	2	2	2	2	2
Bowel Medications Range	0 to 3	0 to 3	0 to 4	0 to 5	0 to 5	0 to 5	0 to 6
Weight Mean	136	139	132	133	132	133	131
Group II (Written care plan)							
IADL Mean	2.9	2.4	2.3	2.3	2	2.5	2.4
IADL Range	0 to 6	0 to 5	0 to 6	0 to 6	0 to 6	0 to 6	0 to 6
MMSE Mean	20			23			21
MMSE Range	6 to 28			16 to 29			11 to 26
Level of Care Mean	2	2	2	2	2	2	2
Level of Care Range	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3
Pain Score Mean	5	2	3	0	5	4	4
Pain Score Range	1 to 10	0 to 8	0 to 10	0 to 2	0 to 10	0 to 10	0 to 10
Medications Mean	7	8	9	9	9	9	9
Medications Range	0 to 13	1 to 13	0 to 13	0 to 13	0 to 13	0 to 13	0 to 13
Bowel Medications Mean	2	2	2	2	2	2	2
Bowel Medications Range	0 to 4	0 to 4	0 to 4	0 to 4	0 to 4	0 to 4	0 to 4
Weight Mean	137	134	134	133	136	136	137

Note: IADL = Index of Independence in Activities of Daily Living; MMSE = Mini-Mental State Examination

which includes 11 questions focusing on the cognitive aspects of mental functions, such as recall, orientation, and calculation (Folstein, Folstein, & McHugh, 1975). Scores range from 0 to 30.

The patient outcome "pain" was measured by the Numerical Rating Scale for Pain (Whitaker & Warfield, 1988). The degree of pain is indicated by having the participant choose the number that best represents their pain, with 0 as "no pain" and 10 as "pain as bad as it could be."

The incidence of alteration in skin integrity was noted from the patient's Decubitus Pressure Ulcer Report

form. "Yes" indicated there was a skin alteration, otherwise a score of 0 was given for no alteration. Demographic data were collected at admission along with all other study variables. Every month for the following 6 months, all data were collected except the MMSE, care plan data, and time for care plan development, which were collected by the investigator every 3 months after the care plan meeting.

METHODS

An experimental design was used to compare the effects of two meth-

ods of documenting clinical decisions and plans on patient outcomes, organizational processes, and outcomes:

- Group I—computer care plan.
- Group II—paper care plan.

Because contamination of participants' care plans was a potential problem with current residents of the health center, each newly admitted resident who met the study's inclusion criteria was asked to participate. Participants were:

- Age 65 or older.
- A permanent resident in the health center.
- A resident for at least 7 months.

If residents were discharged from the health center prior to the end of 7 months, they were no longer considered a participant in the study. After consent to participate was received, residents were randomly assigned to group. The study setting was a Continuing Care Retirement Center (CCRC) with a 48-bed health center licensed for skilled and intermediate care.

An IBM (White Plains, NY) compatible computer was in place at the study site and RNs ($n = 4$) who were computer literate were given an 8-hour training session by the Director of Nursing on the new software package for the care plan and minimum data set assessment. Those RNs ($n = 4$) who were not computer literate were not instructed in use of the computer so the written care plan could be completed in the usual manner. Nurses were assigned a new patient based on their caseloads. Each primary nurse had 3 to 5 residents and developed their care plans at admission and every 3 months thereafter. Data for this study were collected after each care plan completion, which was within 21 days of admission and every 3 months thereafter. Registered nurse turnover was 16% during the study period (Daly, 1997). Nurses who worked in the CCRC had a mean length of employment stay of 8 years and had a mean age of 46 years. The nurses were all women. There were no significant demographic differences between nurses in the two groups.

Sample

Over a 30-month period, 30 residents moved into the health center and met inclusion criteria. Ten of those residents admitted to the health center started in the study but were later excluded because of death ($n = 4$) or discharge ($n = 6$). No one refused to participate in the study.

The remaining 20 participants were randomly assigned to either Group I or Group II, resulting in 10 residents in each group. Their mean age was 86 years with a range of 74 to

TABLE 2
NUMBER OF NURSING DIAGNOSES, INTERVENTIONS, ACTIVITIES, AND TIME IN HOURS FOR CARE PLAN BY GROUP

	Group I (Computer care plan)	Group II (Written care plan)
Time Period 1		
Nursing Diagnoses	12	9
Nursing Interventions	22	9
Nursing Activities	421	29
Preparation Time	2.65	1.8
Writing Time	2.28	2.08
Other Time	2.52	0.4
Total Time	7.6 hours	4.27 hours
Time Period 4		
Nursing Diagnoses	11	9
Nursing Interventions	22	9
Nursing Activities	233	29
Preparation Time	1.8	0.75
Writing Time	1.55	1.18
Other Time	1.48	0.4
Total Time	4.35 hours	2.13 hours
Time Period 7		
Nursing Diagnoses	11	8
Nursing Interventions	22	9
Nursing Activities	235	29
Preparation Time	1.4	0.78
Writing Time	1.48	1.31
Other Time	0.90	0.23
Total Time	3.78 hours	2.31 hours

97 years. All participants were White, seven were men, and 13 were women. No statistically significant differences were found by group for age, gender, education, and marital status.

LIMITATIONS

The sample size was only 20 participants for two groups. This small sample size may have influenced the lack of differences on the repeated measures analysis.

RESULTS

Patient Outcomes

Patient outcomes are reported for the sample and then listed by group. There were no significant group differences in terms of patient outcomes (Table 1). Repeated measures ANOVA was computed for each of the study variables with type of care plan as the

independent variable. There were no statistically significant differences ($p > .05$) between subjects group (care plan), with subjects (across time), or interaction (group and time) effects for any of the following dependent variables: level of care, ADLs, perception of pain, cognitive abilities, number of medications, number of bowel medications, number of constipation episodes, weight, percent of meals eaten, and incidence of alteration in skin integrity.

Organizational Processes

Number of nursing diagnoses, interventions, and activities by group are reported in Table 2. A significant main effect for the experimental (computerized) care plan group (the between subjects factor) was observed for two dependent variables—nursing interventions ($p = .001$) and activities

TABLE 3
REPEATED MEASURES ANOVA FOR DEPENDENT VARIABLE
AND NUMBER OF NURSING INTERVENTIONS

Source	df	MS	F	p
Between Subjects (17)				
Care Plan	1	2150.533	15.024	0.001
Error	16	143.144		
Within Subjects (36)				
Time	2	0.226	0.084	0.920
Care Plan × Time	2	3.633	1.346	0.275
Error	32	2.700		

TABLE 4
REPEATED MEASURES ANOVA FOR DEPENDENT VARIABLE
AND NUMBER OF NURSING ACTIVITIES

Source	df	MS	F	p
Between Subjects (17)				
Care Plan	1	931147.200	9.379	0.007
Error	16	99982.269		
Within Subjects (36)				
Time	2	53018.090	0.726	0.491
Care Plan × Time	2	50405.053	0.691	0.509
Error	32	72988.170		

TABLE 5
REPEATED MEASURES ANOVA FOR DEPENDENT VARIABLE
AND TIME FOR PREPARING CARE PLAN

Source	df	MS	F	p
Between Subjects (18)				
Care Plan	1	10.674	12.763	0.002
Error	17	0.836		
Within Subjects (38)				
Time	2	6.533	15.538	0.000
Care Plan × Time	2	0.230	0.547	0.584
Error	34	0.420		

($p = .007$) (Table 3 and 4). No interaction effect was noted for group and time (i.e., pattern for nursing interventions and activities over time was consistent across groups). A non-significant main effect of time (within subjects factor) was observed ($p > .05$).

Organizational Outcomes

A complete breakdown of care plan preparation time by group is provided in Table 2. There was considerable variation in the range of preparation time required across the time periods. Repeated measures ANOVA was

computed for all preparation time factors. A statistically significant finding for three dependent variables (preparation time [$p = .002$], other time [$p = .003$], and total time [$p = .000$]) was noted for the between-subjects factor. Thus, it took longer at every time period to produce the computerized care plan, although preparation time for the computerized care plans decreased over the three times periods measured.

A significant within-subjects factor ($p = .01$) was noted for all four time variables (i.e., preparation time, care plan writing time, other time for care plan, total care plan time). No significant interaction effects were observed for group and time (see Tables 5, 6, 7, and 8 for these ANOVA results).

DISCUSSION AND NURSING IMPLICATIONS

The purpose of this study was to examine the effects of two types of care plans—written and computerized—on patient outcomes, organizational outcomes, and processes. Findings are discussed according to these outcomes.

Patient Outcomes

The null hypothesis that there would be no difference in patient outcomes when using a written care plan or computerized care plan was upheld. That is, regardless of how the care plan was written, patient outcomes were not affected. Patients received similar care and outcomes did not change by type of care plan. Standardized language for the computerized care plan also did not affect patient outcomes. However, the more comprehensive nature of the plan of care suggests that the use of standardized language made the nurses who were writing the care plans aware of all nursing diagnoses and interventions used for their specific patient plan of care (Hawes, et al., 1997).

The patient's plan of care is established based on patient assessment documented on the Minimum Data Set (MDS). If patient outcomes are not affected by the plan of care, other factors may be influencing the quality of care for residents in LTC. Investigation

of these factors, as well as the overall value of the care plan, is necessary to determine their effect on patient outcomes. Those factors could include: staffing pattern, length of employment for nursing personnel, administration tolerance of abuse, nurse aid assignment forms, and staff attendance at shift report. In addition, future research may expand the list of patient outcomes evaluated, and include a broader range of nurse-sensitive outcomes, as well as those primarily influenced by other disciplines or services such as social work, dietary, and activity therapy.

Organizational Processes

The null hypothesis that there would be no difference in organizational processes when using a written care plan or computerized care plan was not supported. Nursing diagnoses by group were similar with only two to three more nursing diagnoses in the computerized group than the written care plan group. However, nursing interventions and activities were substantially different by group.

Nurses who used the computer wrote Nursing Interventions Classification (NIC) interventions and highlighted each NIC activity relevant to the care plan under preparation; whereas nurses who hand wrote the care plan only listed a few activities. According to data supplied to investigators by the Director of Nursing at the study site, nurses in the written care plan group did not list everything done for the patient, unlike nurses who used the computerized care plan. The NIC activities are comprehensive for each intervention. Thus, only the individualized relevant activities would be transferred to the nurse aid assignment form. For example, patients may prefer to wear a hospital gown to sleep in rather than their own personal gown.

According to Simpson (1991), a more complete number of nursing diagnoses and recording of nursing interventions are likely to be effected by computerization. This assertion was partially supported by this study,

TABLE 6

REPEATED MEASURES ANOVA FOR DEPENDENT VARIABLE AND TIME WRITING CARE PLAN

Source	df	MS	F	p
Between Subjects (18)				
Care Plan	1	0.632	0.489	0.494
Error	17	1.291		
Within Subjects (38)				
Time	2	4.635	8.985	0.001
Care Plan $\times$ Time	2	0.106	0.206	0.815
Error	34	0.516		

TABLE 7

REPEATED MEASURES ANOVA FOR DEPENDENT VARIABLE AND OTHER TIME FOR CARE PLAN

Source	df	MS	F	p
Between Subjects (18)				
Care Plan	1	19.521	11.727	0.003
Error	17	1.665		
Within Subjects (38)				
Time	2	4.603	4.540	0.018
Care Plan $\times$ Time	2	2.944	2.904	0.069
Error	34	1.014		

TABLE 8

REPEATED MEASURES ANOVA FOR DEPENDENT VARIABLE AND TOTAL CARE PLAN TIME

Source	df	MS	F	p
Between Subjects (18)				
Care Plan	1	72.980	9.530	0.007
Error	17	7.658		
Within Subjects (38)				
Time	2	49.966	18.745	0.000
Care Plan $\times$ Time	2	3.820	1.433	0.253
Error	34	2.666		

where the average number of nursing interventions and activities (but not diagnoses) documented per patient was significantly greater for the computerized care plan group. Also, having a more thorough care plan should provide all the disciplines (e.g., activities, dietary, social work), as well as the

family, with a more comprehensive list of the resident's problems and, thus, the potential opportunity to conduct more relevant interventions for the resident. This assumption requires further testing related to application of the care plan by ancillary care providers and family members.

Organizational Outcomes

Study results revealed there was a significant difference in preparation (Table 5) and writing time (Table 6) between the two care plan documentation methods. Use of the computer did not save care plan preparation time or actual writing time. The difference was most pronounced for preparation time, and "other" time (chiefly data gathering for MDS and care plan use), which may reflect lack of staff familiarity with the computer.

As noted earlier, nurses who wrote care plans by hand did not list all interventions or activities pertinent to a particular patient's plan of care. For example, if Impaired Mobility was a nursing diagnosis on the written care plan, the activities listed may be "walk the patient twice daily," and "up in the chair TID." The computerized care plan, on the other hand, would list the intervention "Exercise Therapy: Ambulation and Positioning" and highlight a large number of activities to complete this intervention.

Because nurses who hand wrote the care plan did not include all activities performed for the patient, their writing time was diminished regardless of the number of the activities completed for residents. That is, although the written plan of care required less time to develop compared to the computerized care plan, it was less comprehensive (Table 2). Time was the longest total time for both groups and took

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This approach is different from other nursing homes that may have one nurse complete the MDS and care plan for all residents, but who is not working on the floor, as were the nurses in this study. The MDS assessment and care planning are time consuming activities, and facilities need to allot appropriate time to complete this work. Moreover, after the paperwork has been completed, additional time and effort must be given to implementation of the appropriate nursing interventions identified.

***To be effective,
interventions on the
care plan need to be
conveyed to the front-
line staff who, in turn,
must implement the
interventions in order
to affect patient out-
comes and provide
quality patient care.***

The Nursing Commission on Nursing Implementation Project (1989) suggested information systems could save 1.5 hours of time per nurse per shift, and the time saved would enhance productivity because nurses could spend more time with patients, resulting in improved outcomes. This study found nurses' care plan preparation and writing time was reduced over time in both the handwritten and computerized groups when a care plan had been developed. Thereafter, less time was spent on that plan of care. In contrast to the National Commission assumption, however, the patient outcomes measured in this study were not effected by this time savings.

CONCLUSION

In comparing residents who had their care plans written or computer generated, results of this study suggest that the computer-generated care plans yielded more nursing interventions (22 versus 9) and activities (235 versus 29). Nurses who prepared the computerized care plan and presented it at the interdisciplinary conference had developed a more thorough care plan than those who had written a care plan by hand. However, the type of care plan, written or computerized, had no impact on patient outcomes, which is the variable of most interest and relevance in terms of improved quality of care.

As noted earlier, care plans are mandated by law for all patients residing in LTC facilities. Annual survey reviews intensively evaluate the written care plan and its follow-through for patient care. Paper compliance is a given, but follow-through by staff is not. Nurses and nursing assistants often do not know what is written for each resident on their individualized plan of care.

In some LTC facilities, a "care plan nurse" writes all the plans, but may not educate the staff on implementing the recommended interventions. Thus, future research in this area should investigate the extent to which activities and interventions listed on the plans of care are actually implemented for each resident, by nurses as well as ancillary (e.g., dietary, social work) staff.

Subsequent studies should also determine if time differences in preparation of written versus computerized care plans diminish as nurses in LTC settings become more "computer capable" and accustomed to using available software packages. The care plan is here to stay and is mandated by law, but results from this study suggest that type of care plan (computerized versus hand written) had no effect on patient care. To be effective, interventions on the care plan need to be conveyed to the frontline staff who, in turn, must implement the interventions in order to affect patient outcomes and provide quality patient care.

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Results from this study also suggest use of a computerized plan of care increases the number of documented nursing activities and interventions. Further research is warranted to determine if this potential advantage can be translated into improved patient and organizational outcomes in LTC. Indeed, more detailed and comprehensive plans of care and increased numbers of recommended activities and interventions are only important if they affect, in some meaningful way, the quality of resident care and influence outcomes important to this population.

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KEYPOINTS

WRITTEN AND COMPUTERIZED CARE PLANS

Daly, J.M., Buckwalter, K., and Maas, M. Written and Computerized Care Plans: Organizational Processes and Effect on Patient Outcomes. *Journal of Gerontological Nursing*, 2002, 28(9), 14-23.

- 1 Care plans for residents living in long-term care facilities are mandated by the U.S. Department of Health and Human Services.
- 2 Nursing standardized language is available for care plan development: Nursing diagnoses, nursing interventions, and nursing homes.
- 3 Patient outcomes are not affected by the method of preparing a care plan, whether handwritten or computerized.

- 87 nursing home regulations and implementation of the resident assessment instrument: Effects on process quality. *Journal of the American Geriatrics Society*, 43, 977-985.
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