Malnutrition in nursing home residents in the Netherlands, Germany and Austria

Exploring and comparing influencing factors

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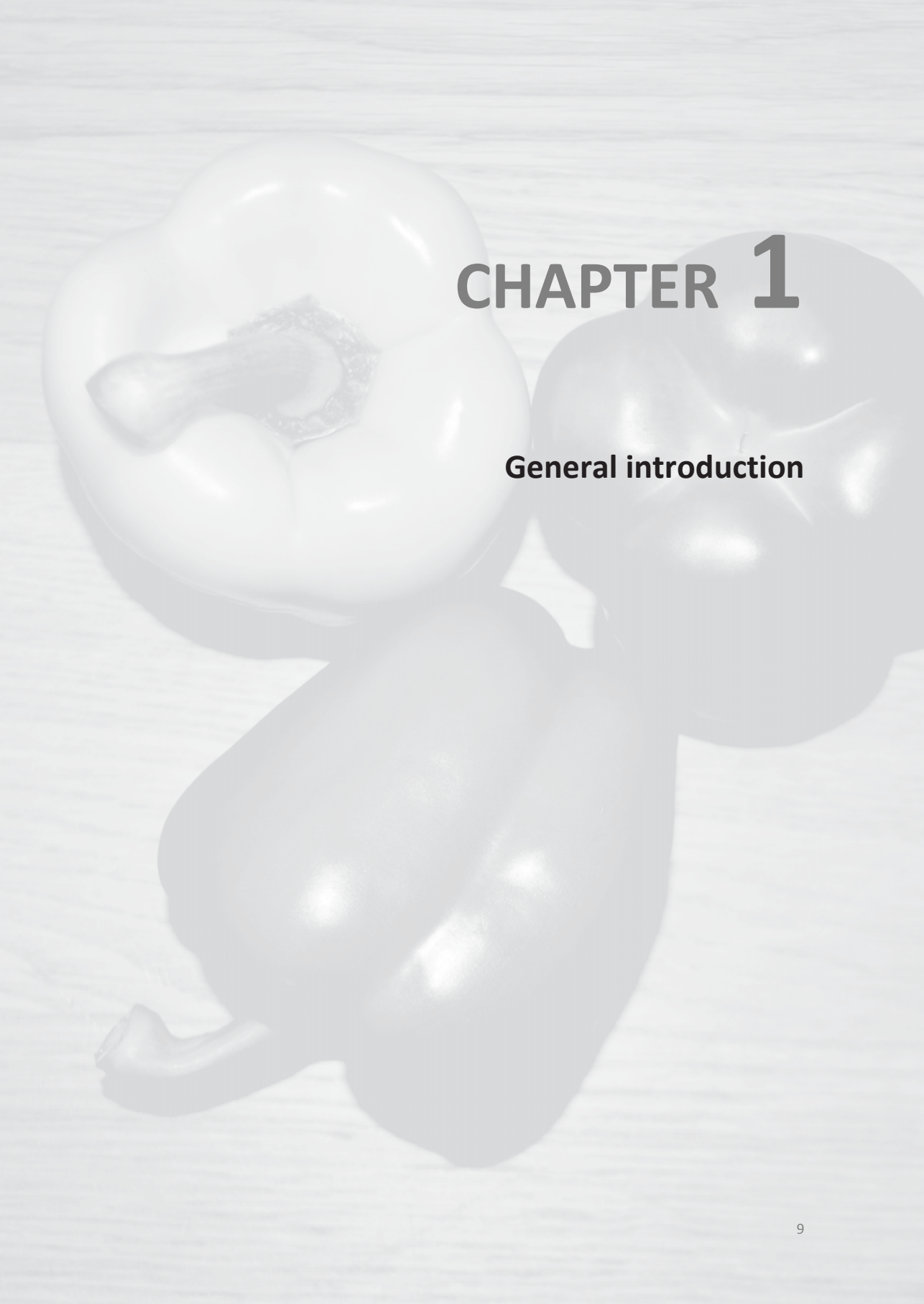
"Love is the longing for the half of ourselves we have lost."
Milan Kundera, The Unbearable Lightness of Being

Voor Amy

Voor mijn ouders

CONTENTS



CHAPTER 1

General introduction

INTRODUCTION

Mrs Rohrbach from Eschweiler, Germany told me: "A week ago Mrs Janssen had a car accident and broke her hip, right wrist and two fingers of her left hand. A week after surgery she became roommates with my Dutch mother-in-law in this nursing home. She couldn't walk and both her hands were healing in plaster. The first day at mealtime a nursing-assistant rushed in with lunch followed by a physiotherapist who came to check on her hip. I was busy helping my mother-in-law to eat her lunch when an hour later another nursing-assistant came in and to my surprise she took away the plate of Mrs Janssen, despite the fact that she hadn't eaten anything. Afterwards I discussed it with the Head Nurse of the department who told me that freshly served food is not allowed to be out in the open and has to be eaten within one hour after serving, due to the hygiene code HACCP of the Dutch food and wares authority. Poor Mrs Janssen, I was astonished and thought: Dass würde bei uns nicht passieren! Jetzt verstehe ich warum es so viel Mangelernährten gibt in den Niederlande."

This little anecdote shows the complexity of the quality of care with respect to nutrition in nursing homes. Not only structure and process factors but also providers' and patients' characteristics influence the outcome of care, defined as the risk of getting malnourished. Is it really true that the quality of nursing home care is better in Germany? Are there different rules, regulations and guidelines? Do nurses in Germany pay more attention to the needs of patients? Are patient characteristics in German nursing homes comparable to those in Dutch nursing homes? And is it true that malnutrition is more prevalent in Dutch nursing homes than in German ones? More in general, is it possible to compare the prevalence or incidence of a care problem between countries? What instruments and definitions are used to measure malnutrition in different countries? And what about different patient populations?

These questions need answers! Perhaps countries can learn from one another, and from differences in the structure and process of healthcare in order to optimise the outcome and quality of care.
LPZ-International (derived from the National Prevalence Measurement of Care Problems of Maastricht University; in Dutch: Landelijke Prevalentiemeting Zorgproblemen (LPZ)) can be a useful instrument for finding answers to these questions. LPZ-International is based on a longer existing prevalence measurement of care problems performed in the Netherlands. LPZ is an annual, independent prevalence measurement, which has been carried out in Dutch healthcare since 1998 (Halfens *et al*. 1997). Initially focusing on pressure ulcers, the measurement was later extended to other care problems namely malnutrition, falls, restraints and incontinence. Since 2009, LPZ-International has been conducted annually on the same day in different healthcare settings in the Netherlands, Germany, Austria, Switzerland and New Zealand (Bartholomeyczik *et al*. 2010, Schönherr *et al*. 2012).

In this thesis, data from the LPZ-International study are used to answer the central question:
Is there a difference in malnutrition prevalence and the structure and process quality indicators of nutritional care in nursing homes between the Netherlands, Germany and Austria?
Furthermore, it will be investigated whether the outcome of malnutrition prevalence is influenced by differences in the structure and process indicators of nutritional care or whether it is the result of differences in characteristics of nursing home residents in the Netherlands, Germany and Austria.

In this chapter, first malnutrition is defined, followed by a sketch of the quality of care and particularly the Donabedian Model (1992) of the quality of care. Next the aim of this study is stated and the research questions are defined. Finally this chapter gives an outline of the thesis.

Malnutrition

Malnutrition is an important and still rather under-recognised problem in healthcare (Waizberg *et al*. 2001, Correia & Campos 2003, Kruizenga *et al*. 2003, Stratton *et al*. 2003, Pirlich *et al*. 2006, Valentini *et al*. 2009, Meijers *et al*. 2009a, Vanderwee *et al*. 2010). Malnutrition refers to negative deviations from a normal nutritional status and has been defined as inadequate nutritional status or undernourishment due to poor dietary intake, poor appetite, muscle wasting and weight loss (Chen *et al*. 2001). Elia (2000) defined malnutrition as a nutritional condition in which an insufficient or disproportionate intake of energy, protein, and other nutrients adversely affects tissue/body form (shape, size and composition) and function, as well as the clinical outcomes. According to both definitions, malnutrition could be either undernutrition or overnutrition. In this thesis, however, malnutrition is defined as undernutrition.
Malnutrition increases the chance of medical complications. It reduces the immune function, leading to a higher risk of infections, and it impairs wound healing. Moreover, malnutrition impairs the quality of life and increases the length of hospital stay and the costs of healthcare (Green 1999, Elia *et al*. 2005, Russel 2007, Arvanitakis *et al*. 2008, Norman *et al*. 2008, Banks *et al*. 2010, Meijers *et al*. 2012).
The prevalence of malnutrition varies greatly from one country to the other (Donini *et al*. 2007, Gaskill *et al*. 2008, Westergren *et al*. 2008, Meijers *et al*. 2009b, Kaiser *et al*. 2010). In European nursing homes, malnutrition prevalence rates vary from 2 to 74% (Volkert *et al*. 2004, Pauly *et al*. 2007, Meijers *et al*. 2009, Bartholomeyczik *et al*.2010, Schönherr *et al*. 2012). These variations can be explained partly by differences in methodology and instruments used to measure malnutrition, but also by population's characteristics (Westergren *et al*. 2009), structure indicators (Arvanitakis *et al*. 2008) and the process indicators (O'Flynn *et al*. 2006, Arvanitakis *et al*. 2009, Meijers *et al*. 2013) of nutritional care may also have an influence.

Quality of care

The quality of care is defined as the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge (Institute of Medicine, 2001). It includes safety, effectiveness, efficiency and equality and it is patient-orientated and delivered on time. Quality of care and patient safety are increasingly considered to be important with reference to the reduction of preventable adverse events in patients within healthcare organisations and to adherence to practice guidelines about care processes (Degos *et al*. 2011). Monitoring and transparency about the quality of healthcare are increasingly applied in many countries (Casalino *et al*. 2003, Grol *et al*. 2004, Jamtvedt *et al*. 2006) to improve care and the quality of life. Quality improvement includes evidence-based medicine/nursing, accreditation and (external) accountability. For assessing quality of care integrally, the model of Donabedian (1988) is a useful and proven instrument. This model states that it is essential to focus on structural and process indicators as well as on outcome. A good care structure increases the likelihood of a good process and good process increases the likelihood of good outcome (Donabedian 1988).

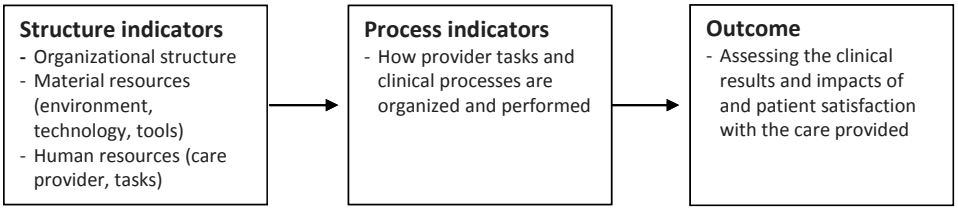


Figure 1.1 Quality model of Donabedian

The focus in the model is on the care providers (healthcare institutions/healthcare workers) on the one hand, and on “clients” like hospital patients and nursing home residents, on the other hand (Donabedian 1985). Structure and process are related to the organisation of healthcare institutions, care processes and the participation of healthcare workers. Donabedian’s (1985) framework of the quality of care offers a good model to develop a relevant measurement instrument for assessing the quality of care and patient safety.

Donabedian’s model (1992) has proved to be valuable for examining the structure and the clinical processes and the outcome of care. However, Donabedian’s model explicitly links structure and process of care to subsequent patient outcomes and therefore fails to take full account of the interaction and independencies between the components of the model (Carayon *et al*. 2006). The sequential progression from structure to process and from process to outcome has been described as too linear of a framework (Mitchel *et al*. 1998) and is therefore of limited use for as to how the three domains influence and interact with eachother (Carayon *et al*. 2006). In addition, as we are interested in

explaining the prevalence of malnutrition, the structure indicators of this model may be directly related to the outcome, i.e. not only via the process of care. The explained variance of the structure indicators via process factors is already incorporated in the explained variance of the process factors.
The model has also been criticized for failing to incorporate antecedent characteristics (e.g. patient characteristics, environmental factors) which are also important in evaluating the quality of care (Coyle & Battles 1999). It is suggested that these factors are in fact essential for fully understanding the true effectiveness of new strategies or modifications within the care process. According to Coyle and Battles (1999), patient factors include genetics, socio-demographics, health habits, beliefs and attitudes, as well as personal preferences. The environmental factors include the patients' cultural, social, political, personal, and physical characteristics, as well as factors related to the health profession itself. In view of this criticism of the uni-trajectory focus of Donabedian's model, we are interested in (a) the direct influence of the structural and process aspects of nutritional care on the outcome (malnutrition prevalence) and (b) the influence of characteristics of nursing home residents on it.

Age, gender, morbidity and care dependency are all related to malnutrition (Lewis&Stacey 1990, Chen *et al*. 2001, Perissinotto *et al*. 2002, Stratton *et al*. 2003, Aliabadi *et al*. 2008, Gaskill *et al*. 2008, Meijers *et al.* 2009, Westergren *et al*. 2009), and also to infections (Vitale 2011), physical disabilities (Oliveira *et al*. 2009) and polypharmacy (Heugerger&Caudell 2011, Jyrkkä *et al*. 2012). Furthermore, the characteristics of healthcare systems in the different countries also affect the way nutritional care is organised and influence the prevalence of malnutrition. The European Society for Clinical Nutrition and Metabolism (ESPEN) published a review (Arvanitakis *et al*. 2008) on the fight against malnutrition and on adequate nutritional care strategies. This deals with: the policy of nutritional screening, the assessment of the nutritional status on admission and the registration of the nutritional status, weight and food intake on a regular basis in care homes and home care together with ways implementing these (Arvanitakis *et al*. 2009). Recommendations to improve the prevention and treatment of malnutrition are the starting point for an organized, multidisciplinary approach to systematic and individual nutritional assessments. Such an approach includes specialized personnel (dieticians), the identification of individual nutritional needs, the correction of physical, psychological and social factors impeding an adequate food intake, as well as the systematic monitoring of food intake, body weight and other relevant parameters (Arvanitakis *et al*. 2009). Furthermore, studies of Meijers *et al*. (2013) and O'Flynn *et al*. (2005) have shown that nutritional screening is the most important process indicator for decreasing malnutrition prevalence rates over time.
Based on the above summary of the literature and findings we have modified Donabedians model and studied the relationship between the different components of the model in this thesis.

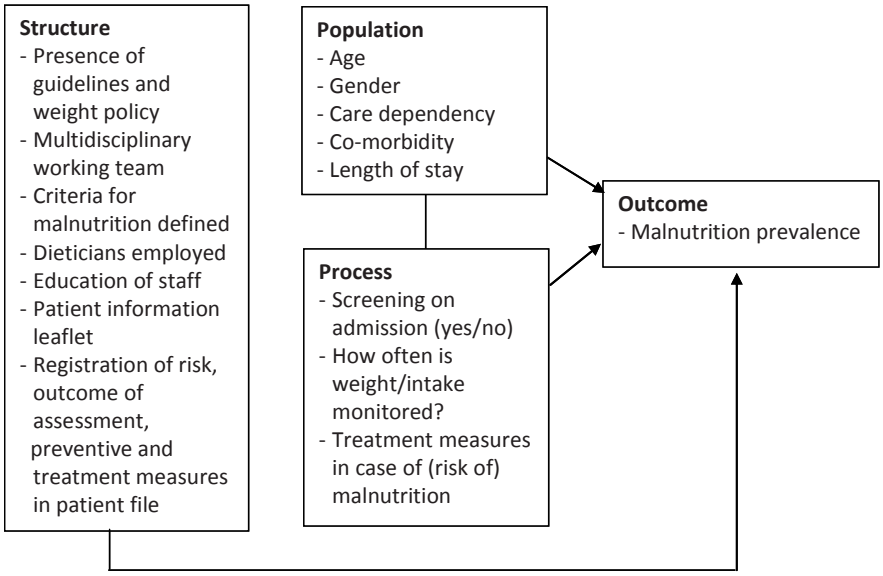


Figure 1.2 Modified quality model of Donabedian used in this thesis

AIM OF THE THESIS

The aim of this thesis is to explore the difference in the prevalence of malnutrition in nursing homes in the Netherlands, Germany and Austria and to answer the question whether structure and process quality indicators of nutritional care and resident characteristics have a direct influence on the prevalence rate of malnutrition in these three countries.

Research questions and outline of thesis

This thesis deals with the relationship between and the influence of patient characteristics and the structure and process indicators of nutritional care on malnutrition prevalence in nursing home residents in the Netherlands, Germany and Austria based on data gathered with the aid of LPZ-International.
First the overall design of the LPZ-International method is described (Chapter 2) aiming at the design of an international multi-country study of the prevalence of care problems in different healthcare sectors (hospitals, care homes and home care) in the Netherlands, Germany, Austria, Switzerland and New Zealand. These care problems include pressure ulcers, malnutrition, falls, restraints and incontinence. It includes prevalence rates as representatives of healthcare outcomes and the study includes structural aspects of care, for example availability of adequate personnel and guidelines

and process factors of care, which preventive measures and treatment interventions are undertaken to deal with these care problems.

Chapter 3 presents the differences in structure, process and outcome of nutritional care between Dutch and German nursing homes, using the following research questions:

- Is there any difference in the prevalence or risk of malnutrition in nursing home residents in Germany and the Netherlands?
- Is there any difference in the process indicators (e.g. screening, prevention and treatment of malnutrition) used in nursing homes in Germany and the Netherlands?
- Is there any difference in the structural indicators of nutritional care used in nursing homes in Germany and the Netherlands?

For this study data were analysed using student t-test, the chi-square test and variance analysis (ANOVA) in order to explore whether there are any significant differences between the two countries in (the risk of) malnutrition, resident characteristics, structure of nutritional care and the prevention and treatment of malnutrition in nursing homes in the Netherlands and Germany.

Chapter 4 deals with the differences in malnutrition prevalence and the resident characteristics in Dutch, German and Austrian nursing homes and with the influence of the resident characteristics on the prevalence of malnutrition, addressing the following research questions:

- What is the prevalence of malnutrition in nursing homes in the Netherlands, Germany and Austria?
- Are the characteristics of malnourished residents different in the three countries?
- Which resident characteristics influence malnutrition?
- Is the prevalence of malnutrition in nursing homes in the Netherlands, Germany and Austria different even when controlling for the resident characteristics that influence the difference in malnutrition prevalence?

In the next chapter (5) the influence of structural quality indicators of nutritional care on malnutrition prevalence in nursing homes in the Netherlands, Germany and Austria was investigated. The research questions that were studied are:

- Are there any differences between these countries in the structural quality indicators of nutritional care?
- Are the structural quality indicators of nutritional care related to malnutrition prevalence?
- Is the prevalence of malnutrition in nursing homes in the Netherlands, Germany and Austria different when controlling for the influencing structural quality indicators of nutritional care?

Chapter 6 deals with the influence of the process indicators of nutritional care on the prevalence of malnutrition in Dutch, German and Austrian nursing homes. The research questions involved are:

- Are there any differences between these countries in the process indicators of nutritional care?
- Are the process indicators of nutritional care related to malnutrition prevalence?
- Is the prevalence of malnutrition in nursing homes in the Netherlands, Germany and Austria different when controlling for the influencing process indicators of nutritional care?
- What is the influence of adding resident characteristics to the model with process indicators of nutritional care?

Chapters 4, 5 and 6 deal with the influence of all the components of the modified quality model of Donabedian on the prevalence of malnutrition and was analysed separately (resident characteristics, structure and process indicators of nutritional care). The influence of the resident characteristics and the structure and process indicators of nutritional care on the prevalence of malnutrition were investigated using univariate logistic Generalized Estimating Equation (GEE) regression analysis in order to build an association model (Twisk 2010).

Chapter 7 of the thesis includes a general discussion reflecting on all the studies described.

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CHAPTER 2

An international prevalence measurement of care problems: study protocol

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ABSTRACT

Aim

The aim of this article is to describe the design of an international audit of the prevalence of care problems in different healthcare sectors using identical methodologies.

Background

Audits, defined as a monitor of quality of healthcare, are increasingly applied in many countries as a strategy to improve professional practice and quality and safety of care. A prerequisite to enable a reliable comparison of quality of care audits is the use of identical instruments and methodology.

Design

Annual cross sectional multi-centre point prevalence survey.

Method

This international prevalence measurement of care problems in hospitals, care homes and home care is performed in the Netherlands, Austria, Switzerland and New Zealand. This study is based on a prevalence measurement of care problems originally performed in the Netherlands. For each care problem (pressure ulcer, incontinence, malnutrition, falls and restraints) at patient level, next to patient characteristics, data are gathered about the prevalence, prevention and treatment of each care problem. Additionally at ward/department and institution level, specific quality indicators are measured related to the care problems. After the measurement, institutions enter their data into a web-based data-entry program. Institutions receive an overview of their own results and results at national level to enable a process of benchmarking.

Discussion

A uniform way of measuring the prevalence of care problems internationally is a significant step forward in gaining insight into the quality of basic care in different healthcare settings in different countries and may lead to more awareness and improvement programs.

INTRODUCTION

Audits, defined as a monitor of quality of healthcare are increasingly applied in many countries as a strategy to improve professional practice and quality as well as safety of care (Electronic Patient Record (EPR), Minimum Data Set-Resident Assessment Instrument (MDS-RAI), Dutch National Prevalence Measurement of Care Problems) (Casalino *et al*. 2003, Grol *et al*. 2004, Jamtvedt *et al*. 2006). These audits express approaches to quality improvement that include evidence based medicine/nursing, accreditation and (external) accountability. Patient safety and more in general quality of care, are considered more and more important with reference to the reduction of preventable adverse events in patients in healthcare organisations and adherence to practice guidelines regarding care processes (Degos *et al.* 2011).

BACKGROUND

It is estimated that in European Union (EU) Member States between 8-12% of the patients admitted to hospitals suffer from adverse events while receiving care (European Commission, Special Eurobarometer 327, 2010). Since patient safety is a serious concern, the Council of the EU recently adopted recommendations on patient safety. These recommendations involve more reporting of patient safety events, education and training of healthcare workers, focusing on patient safety (European Commission, Special Eurobarometer 327, 2010). According to this, fulfilling the basic care needs and adequate tackling of relevant care problems (e.g. malnutrition, falls) are not only fundamental but also important for the quality of life and health of patients and indeed to their safety (Comondore *et al.* 2009).

Quality of care and patient safety can be measured in different ways and can be considered from different perspectives e.g. client's experience (Clearly *et al*. 1997, Weinberger 1999, Attree 2001), perspective of the professionals and also by focusing on outcomes of care (Meadows *et al*. 1997). When focusing on outcomes, the prevalence of care problems such as pressure ulcers, malnutrition, falls and restraints (Bours *et al*. 1999, Green 1999, CBO 2002, Bours 2003, CBO 2004, Neyens *et al*. 2006, Heinze *et al*. 2007, Neyens 2007, EPUAP/NPUAP 2009, EPUAP/NPUAP 2009a, Meijers 2009, Meijers *et al*. 2009a and 2009b) may be used as relevant outcome measures for the quality of care and patient safety.

Measuring quality and safety of care in healthcare takes place at institution level, at country level and at multi-country level. EU policy increasingly focuses on multi-country studies to enable comparison of healthcare outcomes based on country as well as cultural differences (Riedel & Kraus 2011).

Finding reliable and valid instruments to compare data between countries is important in this field of research. Available instruments that provide healthcare institutions with such data are the MDS-RAI (Hutchinton *et al*. 2010), and nutritionDay (prevalence (risk)

for malnutrition) (www.nutritionDay.org). These instruments provide a partial insight into the prevalence of care problems and patient characteristics. To assess quality of care more integrally, Donabedian (1988)—one of the important designers of healthcare quality theories—states it is essential not only to focus on outcome (prevalence of care problems) but also on structural and process indicators. According to Donabedian (1988), an improvement in structure and process may lead to better outcomes. Donabedian's (1985) framework of quality of care offers a good model to develop a relevant measurement instrument to assess the quality of care and patient safety.
The study presented here has been developed according to this framework (Donabedian 1985) and therefore it includes prevalence rates as representatives of healthcare outcomes and structural aspects of care, for example, availability of adequate personnel and guidelines and process factors of care being preventive measures and treatment interventions undertaken to deal with care problems as pressure ulcers, malnutrition, falls, restraints and incontinence.

THE STUDY

This study, LPZ-International, is based on a longer existing prevalence measurement of care problems performed in the Netherlands: National Prevalence Measurement of Care Problems (in Dutch: Landelijke Prevalentiemeting Zorgproblemen (LPZ)) of Maastricht University (UM). The LPZ is an annual, independent prevalence measurement, which has been performed in Dutch healthcare since 1998 (Halfens *et al*. 1997). Initially focusing on pressure ulcers, the measurement extended to other care problems as malnutrition, falls, restraints and incontinence. Yearly over 400 institutions participate in the LPZ with over 40.000 patients, from hospitals, care homes and home care (Halfens *et al*. 2007, Halfens *et al*. 2008, Halfens *et al*. 2009, Halfens *et al*. 2010, www.LPZ-UM.eu).

Aim

The aim of the study is to get insight in the quality of care by collecting data on the prevalence, treatment and quality indicators of care problems in different healthcare sectors (hospitals, care homes and home care) in different countries (the Netherlands, Austria, Switzerland and New Zealand), including pressure ulcers, malnutrition, falls, restraints and incontinence using the same definition, screening instruments and methodology.

Design

LPZ-International is a cross sectional multi-centre point prevalence survey and is conducted annually on one day in different healthcare settings in the Netherlands, Austria, Switzerland and New Zealand. Central coordination of the study is executed by

the LPZ project group at UM. In each country the coordination of LPZ-International is carried out by a national project group led by a national coordinator. In Austria the Institute of Nursing Science at the Medical University of Graz, in Switzerland the Berner Fachhochschule Gesundheit and in New Zealand the Graduate School of Nursing Midwifery and Health at Victoria University Wellington coordinate LPZ-International. The national coordinators meet yearly in an international research group meeting to make appointments concerning the yearly measurement (changes in questionnaires, publications, co-operations). Care problems assessed are: pressure ulcers, malnutrition, falls, restraints and incontinence.

Population

In participating countries, all healthcare organizations are invited by (e)mail including a flyer, through publications in professional journals and by using connections from other projects to participate voluntarily in this international prevalence measurement. Institutions pay for every patient taking part in the measurement. To obtain representative results, institutions are encouraged to measure all departments including all patients present on the day of the measurement. Patients are only included if they or their legal representative give informed consent. No further exclusion criteria where used.

Instrument

The questionnaire of the original Dutch study was developed by consulting experts and based on literature reviews (Bours *et al*. 1999, Bours *et al*. 2000, Hannestad *et al*. 2000, Rohr *et al*. 2005, Neyens *et al.* 2006, Meijers *et al*. 2010, Thüroff *et al*. 2010). Definitions and assessment of the care problems used in this study are presented in Table 2.1.
Since the original questionnaire was in Dutch, for LPZ-International the questionnaires and the instruction material have been translated by professional translators into German, English, French and Italian and back translated and double-checked for nomenclature and cultural differences by the project group in each country and national experts in quality of nursing care. Following this strategy, a situation has been created whereby in every country the same questionnaires are used. The content of the questionnaires is monitored continuously, updated if necessary and also evaluated in the international research group yearly. Changes are made only if they can be substantiated by new knowledge and evidence based research or due to changes in the field (adapting new standards, launching new preventive or treatment strategies).

Table 2.1 Outcome indicators

Definition of care problem	How assessed?	Based on
Pressure Ulcers	Risk assessment by Braden scale	Bours *et al*. 1999, Halfens
Four categories of pressure ulcers (EPUAP/NPUAP, 2009):	Examine every patient at bedside for:	2000a, CBO 2002, Bours *et al.*
Category I: Non-blanchable erythema	Location and grade of wound(s) at the day of the measurement	2003, Bours *et al.* 2003a,
Category II: Partial thickness	Body location of wound(s)	EPUAP 2009, EPUAP 2009a,
Category III: Full thickness skin loss	Development of wound (s): where and when (asking patient or responsible nurse	Meijers *et al.* 2010
Category IV: Full thickness tissue loss	and/or from patient file)	
Malnutrition	Calculation of Body Mass Index (BMI) by recording height and weight	Stratton *et al.* 2003, Konrup
Malnutrition has been operationalised and validated (Meijers et al, 2010):	Undesired weight loss/how much (asking patient or responsible nurse and/or from patient file)	*et al.* 2003, BAPEN 2003, Meijers *et al.* 2010
1. Body Mass Index (BMI)≤18.5 (age 18-65) or BMI≤20 (age>65),	(Reduced) intake over (asking patient or responsible nurse and/or from patient	
2. Unintentional weight loss (more than 6 kg in the previous six month or more than 3 kg in the last month) and	file)	
3. No nutritional intake for three days or reduced intake for more than ten days combined with a BMI between 18.5 and 20 (age 18-65) or between 20 and 23.9 (age>65)	Risk assessment by Malnutrition Universal Screening Tool (MUST)	
Falls	Asking patient or responsible nurse and/or from patient file:	Dijcks & Neyens 2002, CBO
A fall is defined as an unintentional change in position that results in a person coming to rest on the ground or other lower level. In this study the prevalence of falls is calculated as having fallen one or more times during the last month (Kellogg International Work Group on the Prevention of Falls by the Elderly 1987)	How often fallen in last 30 days	2004, Neyens *et al.* 2006,
	Location and time of fall	Neyens 2007
	Activity during fall	
	Cause of fall	
	Fall related injuries (incl. severity)	
Restraints	How often restraint measure taken last 7 days (from patient file)	Hamers & Huizing 2005
Physical restraints are interventions such as bed rails, bed-straps, nursing blankets, deep chairs and chair tables which are used to prevent dangerous or risky situations. Healthcare workers often use physical restraints to prevent falls	Kind of restraint measure (from patient file)	
	Initiator of restraint measure (from patient file or by asking patient)	
	Reason for restraint measure (from patient file)	
	Injuries related to restraint measure (incl. severity)	
Incontinence	Urine incontinent yes/no (observation of patient)	Brandeis *et al.* 1997,
Urinary incontinence is defined as any form of involuntary urine loss (Abrams et al, 2003)	Using a catheter, since when (from patient file)	Hannestad *et al.* 2000,
	Was the incontinence diagnosed yes/no and by whom (from patient file)	Teunissen *et al.* 2004, Rohr *et*
Faecal incontinence is defined as involuntary loss of the bowels for 3 to 4 times a month	When and where developed (from patient file or by asking patient)	*al.* 2005, Moulin du 2008
	Frequency and amount of urine loss (from patient file or by asking patient)	
Double incontinence: is defined as involuntary loss of urine and feces	Cause of incontinence	
Distinction is made between the different kinds of urine incontinence	Incontinence skin lesion (yes/no, location, duration, where developed)	

Questionnaires

The standardised and comprehensive questionnaire measures at three levels: institution; and ward/department level for measuring the kind of institution/ward; and structural/organisational indicators. At patient level patient characteristics are collected and the assessment of the prevalence of each care problem is performed. A specific module has been developed measuring characteristics of each care problem and process indicators (preventive and treatment measures).

Structural indicators

At institution and ward/department level structural indicators for each care problem are assessed with dichotomous answer categories (yes/no) such as the use of a protocol/guideline, availability of educational activities, availability of information brochures for patients/family, having a policy on screening for care problems at admission, and the presence or involvement of professionals (dieticians and tissue viability nurses).
In Figures 2.1 and 2.2, structural indicators on institution and ward/department level regarding malnutrition are listed as an example. For each care problem about ten structural indicators are included both on institution and ward/department level.

Process indicators

Each specific module for each care problem involves questions about the process of care at patient level including preventive and treatment interventions like the use of screening instruments and consultation of experts (Table 2.2). Per care problem about 4 questions are formulated for both preventive and treatment measures. Most questions have multiple answer possibilities. Table 2.2 gives an overview of how preventive and treatment measures are measured.

Outcome indicators

At patient level data concerning the prevalence of each care problem are registered, including some characteristics of the care problems: when and where the care problem started, by whom care problems are diagnosed, whether patients are at risk or not etc (Table 2.1).

General patient characteristics

At patient level, demographic data such as gender, age, body mass index (BMI), operation (yes/no), number and type(s) of disease (co-morbidity), Activities of Daily Living (ADL), Housekeeping Daily Life-Activities (HDL) and length of stay are registered. Furthermore care dependency of the patient is assessed by the Care Dependency Scale (CDS) (Dijkstra 1998, Lohrmann 2003). This scale consists of 15 care dependency items:

eating/drinking, incontinence, body posture, mobility, day/night pattern, getting dressed/undressed, body temperature, hygiene, avoiding of danger, communication, contact with others, sense of rule/values, daily activities, recreational activities and learning ability. Scores are registered with a 5-point Likert scale. Psychometric testing as content, construct and criteria validity was performed and reliability (interrater, homogeneity and internal consistency) was tested (Dijkstra 1998, Dijkstra *et al*.1999, Dijkstra *et al*. 2000, Dijkstra *et al*. 2003, Dijkstra *et al*. 2005). The CDS is validated for different settings and countries (Dijstra 1998, Dijkstra *et al.* 1999, Dijkstra *et al*. 2003, Lohrmann 2003, Dijkstra *et al*. 2005).

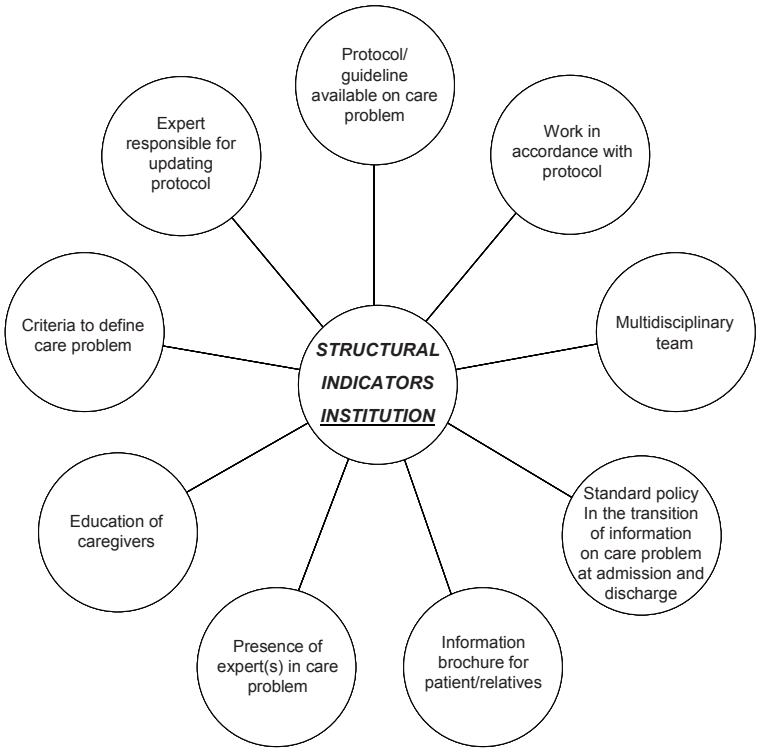

Figure 2.1 Structural indicators at institution level

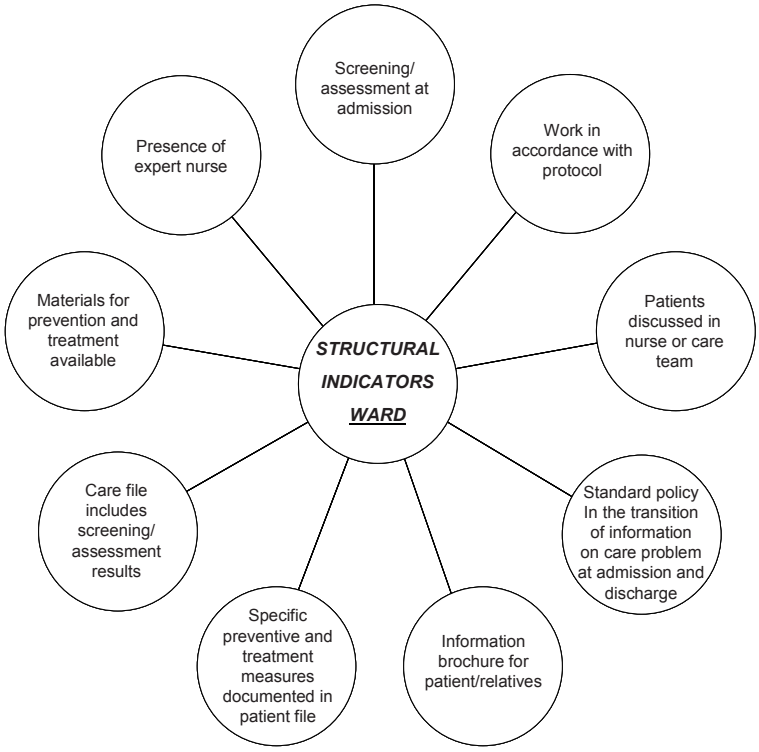

Figure 2.2 Structural indicators at ward level

Data source

Data at institution level are collected by the institutional coordinator who is pointed out in every participating institution. Data at ward/department level are collected by the head of the ward/department. Data at patient level are obtained either by observation and inspection of the patients, from the patient files or by using an assessment instrument like Braden-scale (pressure ulcer risk) (Bergstrom *et al*. 1987) and the Malnutrition Universal Screening Tool (MUST) (malnutrition) (Stratton *et al*. 2003).

Table 2.2 Process Indicators

Care problem	Preventive/treatment measures	Validity of prevalence
Pressure Ulcers	Preventive measures (like use of mattresses, cushions and other aids and the application of repositioning) Treatment per wound (type of dressing)	CBO 2002, EPUAP 2009, EPUAP 2009a
Malnutrition	Nutritional status screened at admission (content and result of screening) Nutritional screening (when, how, how often, by whom) Monitoring intake/weight Treatment measures like providing energy/protein-enriched diet, providing energy-enriched snacks between meals, oral nutritional support and tube feeding Effectiveness of measures evaluated	Stratton *et al*. 2003, Konrup *et al*. 2003, BAPEN 2003, Kruizenga *et al*. 2005, Meijers 2009
Falls	Fall preventive measures like evaluation of medicine prescriptions, therapeutic exercises, evaluate aid devices, alarms, supervision, accommodate surroundings, collaborative agreement, evaluation of eyesight, evaluation of day program/activities Fall injuries preventive measures like head protection, brace/splint, soft and hard hip protection device and bone strengtheners	Dijcks & Neyens 2002, CBO 2004, Neyens *et al*. 2006, Heinze *et al*. 2007
(urine) Incontinence	Different urinary incontinence actions like environmental adjustments, clothing adjustments, medication, bladder training, pelvic floor muscle training, individual and/or department schedule for fixed time bathroom visits, use of disposable incontinence materials Prevention/treatment of incontinence skin lesion (yes/no)	Brandeis *et al*. 1997, Hannestad *et al*. 2000, Minassian *et al*. 2003, Teunissen *et al*. 2004, Rohr *et al*. 2005, Moulin du 2008

Validity and reliability

The original Dutch LPZ questionnaire is based on literature search and definitely established after consulting national and international experts (face validity) (Bours *et al*. 2003, Moulin du 2008, Meijers *et al*. 2009c). Furthermore, national and international guidelines have been taken into account developing the questionnaire. The included instruments (BRADEN, MUST, CDS) have been tested before for reliability and validity for different settings and countries (Table 2.2) (Dijkstra *et al*. 1999, Halfens *et al*. 2000, Stratton *et al*. 2004).
To enhance reliability, each patient is assessed by two healthcare professionals (nurses, dieticians, or doctors). Of these two, one works at the patient's ward/department and one is a professional from another ward/department. Interrater reliability has been tested for hospitals, nursing homes and home care, and found to be good (Cohen's k of 0.87) (Kottner *et al*. 2009, Meijers *et al*. 2009b, Meijers *et al*. 2009c).

Ethical considerations

To conduct the study, ethical approval has been received from the medical ethical committee of a university in the Netherlands (20 December 2007), Austria (9 March 2012) and New Zealand (Summer 2009). In Switzerland for each participating canton ethical approval has been received from the specific cantonal ethical committee as well as from a central Swiss Medical Ethical Committee (4 October 2011).
According to the decisions of the medical ethical committees, in the Netherlands patients had to give their oral informed consent, whereas the patients from Austria, Switzerland and New Zealand had to give a written consent. Each patient is informed about the course of the measurement. After giving informed consent patients can stop participating at any time without giving any reason; patients have no obligations whatsoever.
On the day of the measurement the patient will be examined in order to register whether the patient has one or more pressure ulcers. The skin will be examined at several places. At the same time, the nutritional status will be checked and whether the patient is incontinent, or has recently suffered a fall. These are basic nursing interventions that in fact occur during the daily nursing care. Therefore, the patient runs no risk. The whole examination will take only a few minutes. The nurses will also note several particulars such as age, the reason for admission and particulars on the physical condition. All the characteristics will be noted anonymously and will be treated as strictly confidential.
Each participating institution registers for the measurement voluntarily and by signing the registration form and is obliged to pay for each patient participating in the measurement.
For this study no specific funding has been received to enable the execution of the measurement in the different countries.

Data collection

The Dutch LPZ project group facilitates each national coordinator of every participating country with all documents and a website (www.LPZ-um.eu) in their own language to enable them to carry out the measurement. In each participating healthcare organization of each country an institutional coordinator is responsible for organising the measurement within the organization. All institutional coordinators are trained collectively by the national research group of each country on how to manage the measurement and how to use the printed standardised questionnaires and the specially designed web-based data-entry program. The institutional coordinators train the healthcare professionals, who perform the measurement within the institutions on how to collect data at patient level. The institutional coordinators receive a study protocol and training package with questionnaires, (instruction) manuals and guidelines.
For practical reasons, in home care organizations a representative sample of all clients is drawn and the measurement is spread over four days. The healthcare professional primarily responsible for the patient's care fills out the questionnaire during a home visit. To ensure reliability another independent healthcare professional revisits a random sample of 20 patients per home care organization (Bours *et al*. 2003, Kottner *et al*. 2009).

Data analyses

After data gathering is complete, data are entered into a specially designed web-based data-entry program. The results at institution and national level are generated and published in tables on a private part of the website only accessible by personal log-on data by each individual institution. Tables are provided in percentages, in numbers and kind of ward/department.
Furthermore all data are available as an SPSS-data file for scientific statistical calculations. Each national coordinator receives an SPSS-file with their own country specific data. Each project group writes an annual report describing country specific data. The project group at MU publishes an international report comparing data from different countries. Statistical analyses are performed and data are checked for outliers and normality. The analyses include descriptive frequency distributions for all variables; differences between groups are tested using chi-square test, student's t-test or variance analyses. Logistic regression analyses and multilevel analyses are used to examine trends in prevalence rates, preventive and treatment measures over the years and to correct for differences between patient groups, sectors and countries.

DISCUSSION

Although, currently, some data are available about the prevalence, prevention and treatment of care problems in several countries, reliable comparisons are not always possible due to differences in used definitions, instruments, methodology, and samples. The study presented here provides the opportunity to compare data between countries in a valid and reliable way, due to the use of a standardised methodology (same measurement procedure, instrument, study protocol). Therefore, it provides insight into differences in the quality of basic care in different healthcare sectors, between different countries and into changes over time, since it involves an annual measurement.

According to Donabedian (1992), differences in outcomes can be explained by differences in structure and process factors. However, differences between organizations and countries do not necessarily involve differences in quality of care. They can also be caused by differences in patient characteristics. Therefore outcomes of different countries must be standardized or controlled for patient characteristics. Comparisons between countries may be influenced as well by structural factors. Besides individual organizational characteristics as size and care policy, differences in results can be influenced by country specific organizational, political and cultural differences. Therefore comparisons between countries may give much information about the influence of the healthcare system, and all factors related to this. For instance Tannen *et al.* (2006, 2008) have shown that the prevalence of pressure ulcers are spectacularly lower in German than in Dutch nursing homes, also when adjusting for patient characteristics and preventive measures.

Performing an (inter)national study, it is always difficult to control whether the measurement is performed totally in a uniform way. Therefore, to improve the collection of reliable and valid data, we train all coordinators of each organisation, we provide them with the study protocol and training material to train their own personnel. We ask them to measure on one and the same day in all healthcare organizations and on all wards/departments at all patients present on the day of the measurement. Furthermore, although the questionnaires used in the different countries are uniform, questionnaires are filled out by the measurers (two per patient) from the perspective of country specific standards and habits. For example when no national guideline is available, institutions may refer to their own standards.

However, while institutions have to fill in the data into a routed web-based data-entry program, wrong or impossible data-entry is not possible. For example false length, weight and birth date are refused by the data-entry program. Furthermore, if it is filled out that a patient does not suffer from a care problem; it is not possible to fill out more patient related questions concerning this care problem.

Another aspect which may influence the reliability and validity of the measurements is the difference between internal and external use of data (Freeman 2002). Internal indicators are used by healthcare providers to monitor and improve the outcomes of

their own care processes. Professionals and managers can use this information to explore where potential problems exist, and how they can be approached. Care processes and structures may be redesigned, and indicators can subsequently be used to monitor results of these improvement efforts (Solberg *et al.* 1997). External indicators are for external use to report to healthcare insurers, healthcare inspectorates, etc. External indicators are more prone to reliability and validity errors, while institutions might have a tendency to influence results in a more positive way. LPZ-International is in principle an internal monitor and intends to enhance the quality of care in healthcare organizations. Therefore, while institutions have to invest a lot of manpower in the measurement, in addition to the fee they have to pay for participation, it seems not logical to influence data for a more positive result.

LPZ-International is a cross-sectional annual study; therefore, nothing can be said about the causality of relations. Since prevalence is expressed as a product of incidence and average duration (Rothman & Greenland 1998, Freemen 2002), it is a more relevant measure than incidence when assessing the impact of a problem and to assess subsequent needs within a population. Furthermore incidence measurements are too costly and labour intensive to measure on such a broad scale as the LPZ-International, since it requires daily observation and registration.

Another issue, in this regard, is that not all care problems detected in patients have developed in organizations themselves, and therefore cannot be regarded as a direct result of the quality of care of the institution. Therefore, for each care problem a question is included whether the care problem has been developed in the institution itself or elsewhere. In this way the nosocomial prevalence can be calculated, which gives a more valid indication.

Participation in the audit is voluntary and organizations have to pay to participate in the audit annually as mentioned above. This may influence the generalizability, while only institutions may participate who are really interested in looking to their quality of care (selection bias). Also non-response can influence the prevalence rates (Lahmann *et al*. 2006). Therefore we will include only wards/departments with a response of at least 90% in national calculations.

Although several factors can influence the generalizability, we find each year in the Netherlands, with varying institutions, rather stable but declining prevalence rates, comparable to international prevalence rates, which indicates that the results are a good indication of the quality of care in the Netherlands.

In the Netherlands the study has proven its value: it has led to more awareness of care problems among healthcare workers in individual institutions but also on managerial and political level. As a result several institutions have started to improve their quality of care. Also on national level (www.zorgvoorbeter.nl) improvement programs have been introduced, ‘Care for Better’ for long term care and ‘Cure Faster’ for hospitals, to help institutions to improve their quality of care. Participation in the LPZ and involvement in national improvement programs appear to positively influence the quality of care (Halfens *et al*. 2001, Bours *et al*. 2003, Meijers 2009).

Conclusion

Measuring the prevalence of care problems internationally in a uniformly way is a huge step forward to get insight in the quality of basic care in different healthcare settings in different western countries. LPZ-International seems to be a reliable, valid and generalizable method for this.

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CHAPTER 3

Comparing quality of nutritional care in Dutch and German nursing homes

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ABSTRACT

Aims and objectives
This comparative study investigates possible differences in malnutrition prevalence rates in Dutch and German nursing home residents. It seeks to give insight into the screening, prevention and treatment of malnutrition and the indicators for nutritional care policy.

Background
For decades, malnutrition has been an important ongoing problem, under-recognised in healthcare settings worldwide. A considerable percentage of frail and disabled elderly people suffer from malnutrition. In European nursing homes, the prevalence rates range widely, from 2% to 85%.

Method
This is a multicentre, cross-sectional prevalence study of Dutch and German nursing homes, with the participation of respectively 4,923 and 5,848 residents (age 65+).

Results
Resident characteristics differed significantly between the two countries. Dutch residents were more often male, younger, more care-dependent and significantly more at risk of malnutrition (31.7%). However, actual malnutrition prevalence rates did not differ significantly (Netherlands 26.8% and Germany 26.5%). All German residents were screened at admission, whereas only 73.1% of the Dutch residents were. As part of the screening, nutritional screening tools were used on 38.0% of the Dutch residents and 42.1% of the German residents. A dietician was consulted for 36.7% of the Dutch and 9.3% of the German malnourished residents. The proportion of malnourished residents receiving nutritional intervention was larger in Germany than in the Netherlands. Structural indicators for nutritional policy were fulfilled more often in the Netherlands at institutional level whereas in Germany they were fulfilled more often at ward level.

Conclusion
In this study, German residents had a somewhat better nutritional status than Dutch residents had and more is done to enhance German's nutritional status. The slight differences would perhaps be somewhat larger if both populations were more comparable.

Relevance to clinical practice
Comparing malnutrition prevalence rates, prevention and interventions in healthcare institutions and between countries gives insight into international differences in quality of care.

INTRODUCTION

For decades, malnutrition has continued to be an important and under-recognised problem in all healthcare settings (Bistrain *et al.* 1976*,* Isabel *et al.* 2003*,* Stratton *et al.* 2003*,* Meijers *et al.* 2009, 2009a, 2009b). A considerable percentage of the frail and disabled elderly (10–85%) suffers from malnutrition (Silver *et al.* 1988*,* Lewis *et al.* 1990*,* Sullivan, 1995*,* Donini *et al.* 2007*,* Gaskill *et al.* 2008). In European nursing homes, the prevalence rates range between 2% and 85% (Griep *et al.* 2000, Volkert, 2004*,* Pauly *et al.* 2007*,* Tannen *et al.* 2008). This huge variation can be explained by differences in actual prevalence rates, but also by differences in study population, setting, instruments used and measuring methods (Volkert, 2004, Meijers *et al.* 2009a). Definitions can partly explain the differences in prevalence. For instance, Soeters *et al.* (2008) defined malnutrition as a sub-acute or chronic state of nutrition in which a combination of varying degrees of over- or under-nutrition and inflammatory activity led to a change in body composition and diminished function. Elia (2000) defined it as a nutritional condition in which an insufficient or disproportionate intake of energy, protein, and other nutrients adversely affects tissue/body form (shape, size and composition) and function, and clinical outcomes.

The recently published Delphi study by Meijers *et al.* (2009c) confirmed the non-consensus between experts while pointing out that low BMI (Body Mass Index), undesired weight loss and low nutritional intake were important parameters in operationalising malnutrition. An earlier study by Tannen *et al.* (2006) found that given the same definition, method and instruments the prevalence of pressure ulcers was much higher in Dutch nursing homes than in German nursing homes. The aim of this study is to investigate whether this also applies to the prevalence of malnutrition.

Besides looking at the prevalence figures, it is also important to look at the factors contributing to these figures. Besides 'outcome' (prevalence rate), Donabedian (1988) also distinguished 'structure' and 'process of care' as important parameters for quality of care. Structure denotes the attribution of the settings in which care occurs, such as the use of guidelines in institutions, the presence of a multidisciplinary advisory committee for malnutrition in the institution and the type of healthcare professionals working there. Process denotes what is actually done in performing nutritional care, for example, screening at admission, monitoring weight and nutritional intake, as well as providing energy-enriched diet or snacks between meals to treat malnutrition. Outcome refers to the effects of care on the health status of patients and populations shown in incidence and prevalence rates.

This study addresses the following research questions:

- Is there any difference in the prevalence of (at risk of) malnutrition in nursing home residents in Germany and the Netherlands?
- Is there any difference in the process indicators (e.g. screening, prevention and treatment of malnutrition) used on nursing home residents in Germany and the Netherlands?
- Is there any difference in the structural indicators for nutritional care used in nursing homes in Germany and the Netherlands?

METHODS

Since 2004, Dutch healthcare settings have measured nutritional care annually in terms of outcome (prevalence), process (prevention, treatment) and structural indicators (organisation of care) using the national Prevalence Measurement of Care Problems (in Dutch, *Landelijke Prevalentiemeting Zorgproblemen* (LPZ)) (Halfens *et al.* 2004*,* Meijers, *et al.* 2008). Participation of institutions in the LPZ is voluntary. In 2008, the LPZ was introduced to German-speaking countries. The German LPZ measurements were organised and conducted by researchers in the participating countries under the supervision of an international research team (Bartholomeyczik *et al.* 2010).

Design

The LPZ uses a multicentre, cross-sectional design. The LPZ questionnaire was developed in 2004 and ever since has been continuously improved by the LPZ project team, after consultations with an expert panel (face validity) (Meijers *et al*. 2010), incorporating national and international guidelines and testing for interrater reliability (Meijers *et al*. 2008). Data from two independent measurements in 2008 and 2009 were analyzed for this study.

Instrument

The LPZ is a standardised and comprehensive questionnaire consisting of three measurement levels: the institution, the ward and the patient. At patient level, demographic data such as sex, age, morbidity, care dependency, weight, height, nutritional intake, BMI and undesired weight loss were measured. Care dependency was assessed with the Care Dependency Scale (Dijkstra 1998, Lohrmann 2003). This scale consists of 15 care dependency items: eating and drinking, incontinence, body posture, mobility, day/night pattern, getting dressed and undressed, body temperature, hygiene, danger avoidance, communication, contact with others, sense of rules and values, daily activities, recreational activities and learning ability. Scores were registered on a 5-point Likert scale. Psychometric testing (e.g. for content, construct and criteria validity) was also performed and reliability (interrater, homogeneity and

internal consistency) was tested according to Dijkstra *et al.* (1999, 2000, 2003, 2005). The Care Dependency Scale has been validated for various settings in several countries, including Germany and the Netherlands (Dijkstra 1998, Lohrmann 2003).
Malnutrition was operationalised and validated according to Meijers *et al.* (2008, 2009b): (1) BMI≤18.5 (age 18-65) or BMI≤20 (age>65), (2) unintentional weight loss (more than 6 kg in the previous six month or more than 3 kg in the last month) and (3) no nutritional intake for three days or reduced intake for more than ten days combined with a BMI between 18.5 and 20 (age 18-65) or between 20 and 23.9 (age>65).
At risk of malnutrition is defined as meeting one or more of the following criteria: (1) BMI 21–23.9, (2) not eaten or hardly eaten anything for three days or not eaten normally for more than a week.
At patient level the LPZ poses questions on the process of care, including nutritional screening (when, how, how often, content and by whom) as well as dieticians (consulted or not). Finally, the LPZ registers treatment for malnutrition (providing energy/protein-enriched diet, providing energy-enriched snacks between meals, oral nutritional support and tube feeding). If malnourished residents are not treated because of a palliative policy, this is also registered.
At institutional and ward level, the LPZ assesses structural indicators for nutritional care of malnourished patients, such as the use of a malnutrition/nutritional protocol/guideline, educational activities, availability of an information brochure about malnutrition for residents and their families, whether the institution has a policy on monitoring weight and screening for malnutrition, and the presence or involvement of professionals like dieticians. Since the original text was in Dutch, the questionnaires and instruction material were translated professionally and then double-checked for cultural differences by the project leader in Germany. The nomenclature for departments and professions in German nursing homes was adjusted to reflect the current context.

Sample

All nursing homes were invited to take part voluntarily in the LPZ measurements of November 2008 and/or April 2009 by e-mail or letter (including a flyer), through notices appearing in several professional journals and through connections from other projects. Patients were included only if they gave informed consent, if their weight, height, and weight loss were recorded, and if they were at least 65 years old.
The LPZ team received the approval of the Maastricht University Medical Centre (*MUMC)* medical ethical committee for this study in the Netherlands. The ethical committee associated with the Institute of Nursing Science at Witten/Herdecke University approved the measurement in Germany.

Data collection

In each participating nursing home, one coordinator was responsible for organising the measurement. All coordinators were trained collectively by the research group on how to manage the survey and how to use the printed standardised questionnaire and the specially designed internet data-entry program (www.LPZ-UM.eu). The coordinator completed the questionnaire at institutional level. At ward level, the head of the ward completed the section on structural indicators for the care of malnourished patients and nutritional care policy. The coordinators also received a protocol/training package to support them in training the healthcare professionals who would actually collect the data at patient level. To ensure impartial assessment, each patient was assessed jointly by two healthcare professionals (nurses, dieticians, or doctors), one from the patient's ward and the other an independent observer from another ward.

Analyses

Statistical analyses were performed with SPSS version 16 (SPSS Inc, Chicago, IL). Differences between groups were tested using chi-square tests, student's t-test or variance analyses (ANOVA). P-values were based on two-sided tests, and the cut-off point for statistical significance was <0.05.

RESULTS

Patient characteristics

In the Netherlands 80 nursing homes and in Germany 71 nursing homes participated in both prevalence measurements of malnutrition. In both the Netherlands and Germany, respectively 5,848 and 4,923 residents of 260 and 272 wards met the inclusion criteria.

Table 3.1 shows the general characteristics of the participating nursing home residents. Comparing both populations, all measured characteristics differed significantly between both countries: Dutch residents were more often male, are slightly younger (83.3 years), and more care-dependent (38.7) than German residents. At the time of the measurement, Dutch residents had shorter stays in the nursing home, and they had fewer diseases.

Prevalence of malnutrition (outcome)

Table 3.2 shows the residents' prevalence rates of malnutrition and risk of malnutrition. Although there are no big differences, significantly more Dutch residents are at risk of malnutrition.
Looking separately at the indicators for (the risk of) malnutrition, some small differences are found. The BMI of Dutch residents was significantly lower than in the

German population (p=0.012). However, fewer Dutch residents had undesirable weight loss. No differences were found in nutritional intake.

Table 3.1 Patient characteristics (n=10771)

	Netherlands	Germany	p-value
Number of patients (%)	5848	4923	
Female %	72.7	79.4	<0.001
Mean age in years (± SD)	83.3 (7.0)	83.6 (7.9)	0.04
Care Dependency Scale-sum	38.7	42.1	<0.001
Care Dependency per category %			<0.001
Completely dependent	28.3	26.6	
To a great extent dependent	34.7	27.5	
Partially dependent	20.7	21.0	
To a great extent independent	10.3	15.0	
Completely independent	6.1	9.9	
Length of stay	930 days	1366 days	<0.001
Number of diseases	2.9	4.0	<0.001
BMI	24.8	25.1	<0.001

p-value significance level: 0.05; Categories CDS-sum: <25 completely dependent, 25-44 to a great extent dependent, 45-59 partially dependent, 60-96 to a great extent independent, >96 completely independent

Table 3.2 Prevalence (risk) malnutrition and screening policy (n=10771)

	Netherlands	Germany	p-value
At risk for malnutrition %	31.7	29.1	0.03
Malnourished %	26.8	26.5	0.757
BMI categories %			0.012
>20	84.0	85.7	
18.5–20	8.0	7.7	
<18.5	8.0	6.5	
Undesired weight loss %			
>6 kg over the last 6 months	4.3	6.4	<0.001
>3 kg over the last month	4.8	5.8	0.002
Nutritional intake %			
(Hardly) no intake for >3 days	3.0	2.9	0.655
Reduced intake for >1 week	4.8	4.8	0.977

p-value significance level: 0.05

Screening and treatment of malnutrition (process)

In Germany, almost all residents were screened on nutritional status at admission. In the Netherlands residents are screened significantly less often at admission (see Table 3.3).

Table 3.3 Screening at admission (n=10771)

	Netherlands	Germany	p-value
At admission %	73.1	98.5	<0.001
Content of screening %			
Weight	91.6	98.8	<0.001
Screening instrument	38.0	42.1	<0.001
Weight history	57.2	87.5	<0.001
Clinical view	48.3	82.1	<0.001
Biochemical parameters	2.2	3.1	0.012
Other	15.0	15.9	0.255

p-value significance level: 0.05

Weight (history) and clinical view are most often incorporated in admission screenings and indeed in both countries, almost all the residents who were screened at admission were weighed. Other nutritional screening tools, for example SNAQ (Short Nutritional Assessment Questionnaire) (Kruizenga *et al.* 2005) or MUST (Malnutrition Universal Screening Tool) (Stratton *et al.* 2003), were incorporated in the screening of 38.0% Dutch and 42.1% German residents. Biochemical parameters are seldom used in either country as part of the screening for malnutrition.

In the Netherlands 36.7% of the malnourished residents were seen by a dietician whereas in Germany this was 9.3% (p<0.001). Proportionally more German than Dutch malnourished residents received energy-enriched snacks between meals (p<0.001), tube feeding (p<0.001), parenteral feeding (p<0.001) and drinking 1-1.5 l of fluid (p<0.001) per day (see Table 3.4).

Table 3.4 Treatment for malnutrition (n=10725)

	Netherlands	Germany	p-value
Energy/protein-enriched diet %	9.8	10.9	p=0.074
Energy-enriched snacks between meals %	16.1	25.4	p<0.001
Oral nutritional support %	14.0	13.4	p=0.357
Tube feeding %	1.5	5.1	p<0.001
Parenteral feeding %	0.4	1.4	p<0.001
1-1.5 litres fluid per day %	73.4	88.8	p<0.001
No intervention %	2.1	2.6	p=0.116
Palliative policy %	12.0	1.7	p<0.001

p-value significance level: 0.05

There was no significant difference between Dutch and German residents regarding treatment with oral nutritional support (p=0.357), energy/protein-enriched diet (p=0.074) and the proportion of residents that received no intervention (p=0.116). A palliative care policy, deliberately no nutritional action, was followed in a significantly (p<0.001) larger proportion of Dutch nursing home residents (12.0%) compared to the German nursing home population (1.7%).

Structural indicators for nutritional care at institutional level (structure)

Figure 3.1 presents the structural indicators for nutritional care at institutional level. All structural indicators for nutritional care were fulfilled more often in the Netherlands except for 'education on malnutrition prevention and treatment'.
Only the aspects 'multidisciplinary malnutrition advisory team', 'dietician employed' and 'education on malnutrition prevention and treatment' were fulfilled significantly more often in the Netherlands than in Germany.

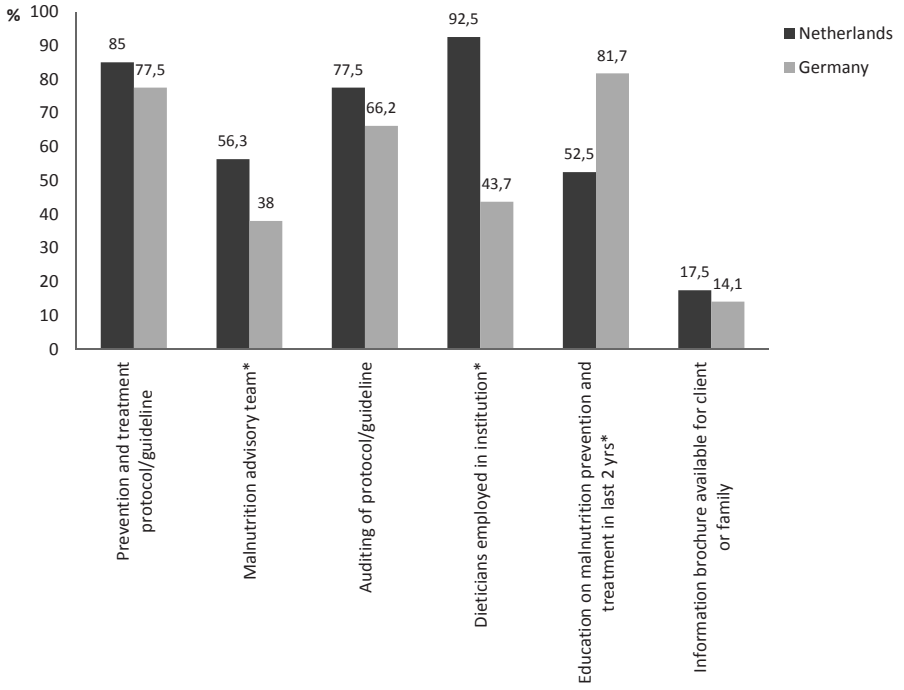

Figure 3.1 Structural indicators for malnutrition policy at institutional level

Structural indicators for nutritional care at ward level (structure)

At ward level, there are some differences between Germany and the Netherlands in the structural indicators for nutritional care. Twice as many Dutch wards as German wards have a staff member focusing specifically on malnutrition.
In Germany, significantly more nutritional interventions are noted in the patient file. Also, weighing residents on admission is included more often and nutritional guidelines are controlled more frequently. No difference between countries was found in providing optimal mealtime ambiance at dinner (see Figure 3.2).

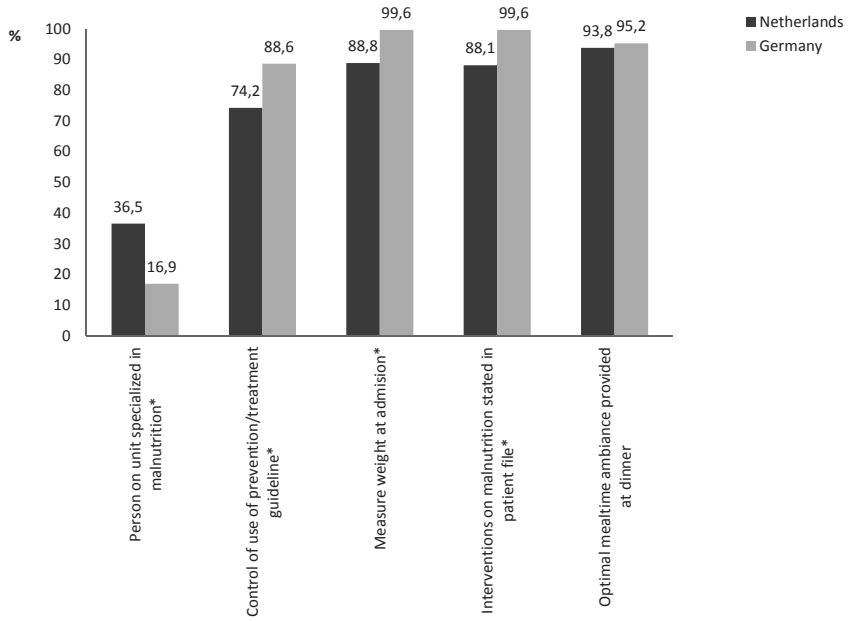

Figure 3.2 Structural indicators for malnutrition policy at ward level

DISCUSSION AND CONCLUSION

No large differences were found in prevalence rates (of aspects) of malnutrition between German and Dutch nursing homes. Although Dutch residents had significantly more risk of malnutrition and more often a BMI under 20, they had slightly less undesired weight loss. However, no difference was found in the actual prevalence of malnutrition between both countries. Almost all German residents were screened at admission, while this was done only for three-quarters of the Dutch residents. The German screenings used more diagnostic sources. If a resident was malnourished, dieticians were consulted four times more often in the Netherlands than in Germany, while nutritional interventions, such as energy-enriched snacks between meals and tube or parenteral feeding were undertaken more often in Germany.

At both institutional and ward level, two indicators for nutritional care differed especially between the countries. More Dutch institutions employ a dietician, but they provide less education to the healthcare workers than in Germany.

Summarizing these results, we can conclude that German residents have a somewhat better nutritional status, and more is done to enhance their nutritional status. Perhaps these slight differences would be somewhat larger if both populations were more

comparable. German residents have more co-morbidity and a longer length of stay, although they are less care-dependent.

The results concerning the prevention and treatment of malnutrition and the structural indicators for malnutrition policy show that in Germany more attention is paid to the process of nutritional care in daily practice, while in the Netherlands, according to the structural indicators, more attention is paid to nutritional care at the institutional and ward levels. For example, although all structural indicators on the institutional level were fulfilled more often in Dutch institutions, educating healthcare professionals on the prevention and treatment of malnutrition occurred far more often in the German institutions.

Although the Dutch and German healthcare systems do not show many differences (Tannen *et al.* 2006), it seems that in Germany more attention is paid to the primary care process than in the Netherlands. The findings of the Tannen *et al.* (2006) study on pressure ulcers are in line with this conclusion. Almost all Dutch residents received a pressure-reducing mattress (structural organisational decision) to prevent the development of pressure ulcers, and less preventive action was undertaken, such as changing position (a primary process decision). In Germany, the opposite applied. The differences in patient characteristics as well as cultural and organisational variations between both countries may explain the difference in prevalence rates we found in our study. Therefore, besides needing to take a closer look at the individual population characteristics, we need more information about the culture of healthcare organisations in both countries.

This study is the first international, uniformly conducted multicentre study of the prevalence of malnutrition focusing on structure, process and outcome indicators for nutritional care in Dutch and German nursing homes. There is one other international study on the subject, by Valentini *et al.* (2009) (Nutrition Day), but it focuses mainly on screening and prevalence of malnutrition and does not address structural and process indicators as this study does. Our study measured all the wards of participating nursing homes, not just those interested in participating, to avoid any risk of selection bias.

An annual, large-scale, multicentre study focusing on malnutrition is unusual in Europe. This study shows that malnutrition is still a considerable problem in nursing home residents in the Netherlands and Germany. Although attention for the problem is growing, ongoing alertness is needed. Therefore, the international measurement of malnutrition prevalence, started in 2004 in the Netherlands, is continuing its annual measurements in the ongoing effort to create structural awareness of the problem in nursing homes in several countries.

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CHAPTER 4

Which characteristics of nursing home residents influence differences in malnutrition prevalence? An international comparison of the Netherlands, Germany and Austria

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ABSTRACT

Introduction
Prevalence rates of malnutrition vary internationally considerably, partly due to differences in measurement methodology and instruments. In this study the same methodology and instruments were used in the Netherlands, Germany and Austria.

Aim
The aim of this study was to investigate whether resident characteristics influence possible differences in malnutrition prevalence between countries.

Design
The study followed a cross-sectional, multi-centre design measuring malnutrition in nursing home residents from the Netherlands, Germany and Austria.

Method
Resident data were gathered using a standardised questionnaire. Malnutrition was operationalized using BMI, unintentional weight loss and nutritional intake. Data were analysed using an association model.

Results
The prevalence of malnutrition in the Netherlands, Germany and Austria was respectively 18.0%, 20.0% and 22.7%. The multivariate GEE logistic regression analysis showed that gender, age, care dependency, the mean number of diseases and some specific diseases are influencing factors for whether the resident is malnourished or not. The odds ratio of malnutrition in the three countries declined after including the influencing factors resulting from the multivariate GEE analysis.

Conclusion
Our study reveals that differences in malnutrition prevalence rates in nursing homes in the Netherlands, Germany and Austria are influenced by different resident characteristics. Since other country related factors could also play an important role in influencing differences in malnutrition prevalence rates between the countries (structure and process factors of malnutrition care policy), we recommend investigating these factors in future studies.

INTRODUCTION

Malnutrition is an important and still rather under-recognised problem in healthcare (Waitzberg *et al.* 2001, Correia & Campos 2003, Kruizenga *et al.* 2003, Stratton *et al.* 2003, Pirlich *et al.* 2006, Valentini *et al.* 2009, Meijers *et al.* 2009b, Vanderwee *et al.* 2010). Malnutrition refers to negative deviations from a normal nutritional status and has been defined as inadequate nutritional status, undernourishment due to poor dietary intake, poor appetite, muscle wasting and weight loss (Chen *et al.* 2001). Elia (2000) defined it as a nutritional condition in which an insufficient or disproportionate intake of energy, protein, and other nutrients adversely affects tissue/body form (shape, size and composition) and function, and clinical outcomes.

Malnutrition increases the chance of complications. It worsens the immune function, leading to a higher risk of infections and impairs wound healing. Moreover, malnutrition impairs quality of life, increases length of hospital stay and costs of healthcare (Green 1999, Elia *et al.* 2005, Russel 2007, Arvanitakis *et al.* 2008, Norman *et al.* 2008, Banks *et al.* 2010, Meijers *et al.* 2012).

Prevalence rates of malnutrition vary internationally enormously (Donini *et al.* 2007, Gaskill *et al.* 2008, Westergren *et al.* 2008, Meijers *et al.* 2009b, Bartholomeyczik *et al.* 2010, Kaiser *et al.* 2010), since in European nursing homes malnutrition prevalence rates are found between 2 to 74% (Volkert *et al.* 2004, Pauly *et al.* 2007, Meijers *et al*. 2009a). Partly these variations can be explained by differences in methodology and instruments used to measure malnutrition, but also population's characteristics can have an influence (Westergren *et al*. 2009) since age, gender, morbidity and care dependency are related to malnutrition (Lewis & Stacey 1990, Chen *et al*. 2001, Perissinotto *et al*. 2002, Stratton *et al*. 2003, Aliabadi *et al*. 2008, Gaskill *et al*. 2008, Meijers *et al*. 2009a, Westergren *et al*. 2009) as well as infections (Vitale 2012), physical disabilities (Oiliveira *et al*. 2009) and polypharmacy (Heuberger & Claudell 2011, Jyrkkä *et al*. 2012).

The aim of this study is to investigate whether resident characteristics influence possible differences in malnutrition prevalence between countries, when using the same methodology and instruments. Our hypothesis is that various resident characteristics influence differences in malnutrition prevalence rates between the Netherlands, Germany and Austria.

The following research questions will be investigated: (1) What is the prevalence of malnutrition in nursing homes in the Netherlands, Germany and Austria? (2) Are characteristics of malnourished residents different in the three countries? (3) Which resident characteristics influence malnutrition? (4) Is the prevalence of malnutrition in nursing homes in the Netherlands, Germany and Austria different when controlling for the resident characteristics that influence the difference in malnutrition prevalence?

METHODS

For this study, data are used from the National Prevalence Measurement of Care Problems (in Dutch: Landelijke Prevalentiemeting Zorgproblemen (LPZ)), which is executed yearly. Since 2004 LPZ measures the prevalence, prevention and treatment of malnutrition and quality indicators of nutritional care. It involves an annually conducted measurement in different healthcare settings (hospitals, long-term care and home care) (Halfens *et al*. 2011). In 2008 the LPZ measurement expanded internationally to Germany and Austria (LPZ-International). In each country data are gathered with the same instruments according to the same procedure. These countries conduct the same standardized measurement, supported by the project group of LPZ (Van Nie *et al*. 2013). In each country the coordination of the LPZ is carried out by a national project group led by a national coordinator. The Dutch LPZ project group facilitates each participating country with all documents and a website in their own language to enable them to promote, support and carry out the measurement. Each year the national coordinators have an international research group meeting to discuss relevant issues and updates concerning possible changes in questionnaires, measurement procedures and co-operations (Bartholomeyczik *et al*. 2010, Nie van *et al*. 2011, Schönherr *et al*. 2012).

Design

The LPZ uses a cross-sectional, multi-center design. For this study the data of LPZ-International collected in April 2009 and April 2010 in Dutch, German and Austrian nursing homes are analyzed.

Instrument

Data were gathered using a standardised questionnaire at patient level. Demographic data as age, gender, date of admission, comorbidity, care dependency, weight, height and unintentional weight loss were measured. Malnutrition was operationalized and validated according to Meijers (2009) and Meijers *et al*. (2010). A resident was qualified as malnourished if they met one of the following criteria: (1) Body mass index (BMI) ≤20 (age>65), (2) unintentional weight loss (more than 6 kg in the previous six month or more than 3 kg in the last month) and (3) no nutritional intake for three days or reduced intake for more than ten days combined with a BMI between 20 and 23.9 (age>65).

Care dependency was measured with the Care Dependency Scale (CDS) (Dijkstra 1998, Lohrmann 2003). This scale consists of 15 items, with a 5 point Likert scale and is validated for different settings in several countries (Dijkstra *et al*. 1999, 2000, 2003, 2005).

Since the original questionnaire and instruction material were in Dutch, these were translated by a professional translator into German. This translation was discussed by

the Dutch project group (who speak German also) with the project group in Germany and Austria until consensus was reached about the translation. The questionnaires were adapted to cultural differences. For instance the nomenclature for departments and professions that are present in German and Austrian nursing homes were adjusted to the local situation.

Sample

All Dutch, German and Austrian nursing homes were invited by (e)mail (including a flyer) and through publications in several professional journals to take part voluntarily in the LPZ measurement.
All residents of the participating nursing homes were invited to participate and included if they (or their legal representatives) gave informed consent. To get a more homogeneous sample, residents were included if they were at least 65 years old. Only those residents that were present at the day of the measurement and who were able to participate in the study were included. Residents were excluded when refusing to participate, not being available at the ward, being comatose or too ill and/or being terminal. In addition data from 2009 of residents who participated both in 2009 and 2010 were excluded.
This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by different ethical committees in the different countries. The LPZ-team received ethical approval from the medical ethical committee of the Maastricht University Medical Centre (MUMC^{+}) for this study in the Netherlands (oral informed consent). The ethical committee related to the Institute of Nursing Science at Witten/Herdecke University gave its approval for the measurement in Germany and the medical ethical committee of the Medical University Graz approved to carry out the study in Austria (written informed consent both in Germany and Austria).

Data collection

Nursing homes, that participated, had to point out a coordinator who was responsible for the measurement within the institution. The coordinators were trained collectively by each national LPZ project group on how to organize data collection, and how to use the questionnaire and the specially designed internet data-entry program. Subsequently, all coordinators trained the healthcare professionals who would perform the data collection. For this the coordinators received a protocol and training package from the Dutch project group to support them in training the healthcare professionals.
Assessment of residents always took place by pairs of healthcare professionals (nurses, dietitians, or doctors); one working on the resident's ward and one independent observer from another ward to enhance reliability.

Data analyses

Statistical analyses were performed with SPSS version 19 (SPSS Inc, Chicago, IL). Chi-square tests, student's t-test or ANOVA (with post hoc analyses using Bonferroni method) and odds ratios were used to describe the differences in (malnourished) resident characteristics between the Netherlands, Germany and Austria. Resident characteristics involved variables such as age, gender, length of stay, kind and number of diseases and care dependency. Univariate logistic regression analyses were performed to describe the relation of each baseline independent variable with the prevalence of malnutrition. Independent variables were: country (0=Netherlands, 1=Germany, 2=Austria) and resident characteristics such as age, gender, length of stay, kind and number of diseases and care dependency. For identifying differences in malnutrition prevalence between the countries, p-values were based on two-sided tests, and the cut-off point for statistical significance was <0.05.

A univariate logistic Generalized Estimating Equation (GEE) regression analysis was performed to estimate the odds ratio of country regarding the prevalence of malnutrition. The dependent variable was malnourished/not malnourished; the independent variables were two dummy variables indicating country (with the Netherlands as reference category). GEE analysis corrects for the dependency of observations of individuals within institutions by adding a 'within subject correlation structure' to the regression model. An exchangeable correlation structure was used, which means that correlations between individuals within the institutions are assumed to be the same. For building the association model all variables which were significantly different between the three countries and related to malnutrition (both with a p-value smaller than 0.10) were seen as possible influencing variables (or confounders) in the GEE analyses. For that, in the multivariate logistic regression analysis, all factors that were related to country and malnutrition difference (with a p-value smaller than 0.10), were added to the univariate model step-by-step so that the mean of both regression coefficients of the dummy variables for country changed. Only covariates that led to a significant change (more than 10% of the regression coefficients) were included (Twisk 2010).

In the final multivariate model (corrected model) the Odds Ratio (OR) of malnutrition in nursing homes in the Netherlands, Germany and Austria was estimated, controlling for the influencing resident characteristics. In this analysis we focused on the change of the odds ratio of malnutrition between the countries in the uncorrected model (univariate, without controlling for influencing residents characteristics) compared to the corrected model (multivariate controlling for the found influencing residents characteristics, see Table 4.5). Prior to multivariate analysis, data were assessed for congruence with regression assumptions.

RESULTS

Response

In this study 214 nursing homes with 19,876 residents were included in the analyses, respectively 133 nursing homes from the Netherlands (n=14,123), 61 nursing homes from Germany (n=3,973) and 20 nursing homes from Austria (n=1,780). The response rate was significantly higher in the Netherlands (92.9%) than in Germany (82.9%) and Austria (80.8%). The reasons for not taking part in the measurement were refusing to participate (64.3%), not being available at the ward (27%), being comatose or too ill (5.7%) and being terminal (3.0%).

Resident characteristics

In Table 4.1 the characteristics of the included residents are shown separately for the Netherlands, Germany and Austria. Dutch residents are more often male, have a shorter mean length of stay, are less dependent of care and have fewer diseases than residents in Germany and Austria.
Most prevalent diseases in all three countries were dementia (42.1% in the Netherlands, 55.2% in Germany and 60.8% in Austria), cardiovascular diseases (41.2% in the Netherlands, 70.0% in Germany and 59.0% in Austria) and motor disorders (27.0% in the Netherlands, 41.9% in Germany and 41.7% in Austria).

Malnutrition prevalence

The prevalence of malnutrition differs also significantly between the countries ($p<0.05$) (Table 4.2). In Germany and Austria the prevalence is somewhat higher than in the Netherlands (respectively 20.0% and 22.7% versus 18.0%).

Relation between resident characteristics and malnutrition

Table 4.3 shows the prevalence of the different characteristics for malnourished and not malnourished residents. Malnourished residents have more diseases, are older, more care dependent and more often female than those not malnourished. Furthermore a significant difference is found between malnourished and not malnourished residents concerning kind of prevalent diseases, for example infectious diseases, cancer, diabetes mellitus, blood diseases, dementia, diseases of the digestive tract, injury resulting from accidents and total hip replacement. No significant difference is found in the length of stay.
To calculate which resident characteristics influence the differences found in malnutrition prevalence rates between the countries, factors that showed a significant difference between the countries and between the malnourished and not malnourished residents ($p<0.1$), were incorporated in a multivariate GEE analyses.

Table 4.1 Resident characteristics and prevalence of malnutrition

	the Netherlands	Germany	Austria	p-value
Nursing homes, n (%)	133 (62.2)	61 (28.5)	20 (9.3)	
Residents, n (%)	14123 (71.0)	3973 (20.0)	1780 (9.0)	
Gender n (%)				<0.0001 [abc]
Male	3717 (26.3)	868 (21.8)	255 (14.3)	
Female	10409 (73.7)	3105 (78.2)	1525 (85.7)	
Mean age in years (sd)	84 (7)	83 (8)	85 (8)	<0.0001 [abc]
Age categories n (%)				<0.0001
65-74 years	1311 (9.3)	634 (16.0)	187 (10.5)	
75-84 years	5432 (38.5)	1396 (35.1)	557 (31.30)	
≥85 years	7383 (52.3)	1943 (48.9)	1036 (58.2)	
Length of stay, median in days (mean, sd)	631 (1017,	767 (1407, 2129)	694 (1195, 1953)	<0.0001[abc]
Care dependency n (%)	1463)			<0.0001[abc]
Dependent		2927 (73.7)	1431 (80.4)	
Independent	8341 (59.1)	1045 (26.3)	349 (19.6)	
	5783 (40.9)			
Diseases (%)				
Infectious diseases	173 (1.2)	72 (1.8)	58 (3.3)	<0.0001[abc]
Cancer	996 (7.1)	325 (8.2)	148 (8.3)	0.016[a]
Endocrine/nutritional/metabolic diseases	645 (4.6)	497 (12.5)	230 (12.9)	<0.0001[ab]
Diabetes mellitus	2554 (18.1)	1103 (27.8)	329 (18.5)	<0.0001[ac]
Blood diseases	416 (2.9)	176 (4.4)	87 (4.9)	<0.0001[ab]
Psychological disorder	1734 (12.3)	1269 (31.9)	372 (20.9)	<0.0001[abc]
Dementia	5943 (42.1)	2192 (55.2)	1082 (60.8)	<0.0001[abc]
Nervous system disorder	1262 (8.9)	617 (15.5)	264 (14.8)	<0.0001[ab]
Eye/ear disorder	2728 (19.3)	552 (13.9)	330 (18.5)	<0.0001[ac]
Spinal cord lesion/paraplegia	29 (0.2)	10 (0.3)	8 (0.4)	0.132
Cardiovascular disease	5819 (41.2)	2782 (70.0)	1051 (59.0)	<0.0001[abc]
CVA*/hemiparesis	2677 (19.0)	714 (18.0)	319 (17.9)	0.265
Respiratory disorder/disease	1966 (13.9)	402 (10.1)	173 (9.7)	<0.0001[ab]
Diseases of the digestive tract	1610 (11.4)	1101 (27.7)	367 (20.6)	<0.0001[abc]
Disorder/disease of kidney/urinary tract	1658 (11.7)	1029 (25.9)	379 (21.3)	<0.0001[abc]
Skin disorder	903 (6.4)	249 (6.3)	133 (7.5)	0.187
Motor disorders	3814 (27.0)	1663 (41.9)	742 (41.7)	<0.0001[ab]
Congenital disorders	162 (1.1)	101 (2.5)	49 (2.8)	<0.0001[ab]
Injury resulting from accidents	493 (3.5)	202 (5.1)	153 (8.6)	<0.0001[abc]
Total hip replacement	769 (5.4)	222 (5.6)	128 (7.2)	0.011[bc]
Other not specified diseases	1116 (7.9)	452 (11.4)	208 (11.6)	<0.0001[ab]
Mean number of prevalent diseases (sd)	2.6 (1.57)	3.87 (1.68)	3.64 (1.98)	<0.0001**[abc]**

* CVA: cerebrovascular accident; [a]Significant difference between the Netherlands and Germany; [b]Significant difference between the Netherlands and Austria; [c]Significant difference between Germany and Austria

Table 4.2 Prevalence of malnutrition

	Malnutrition prevalence %	p-value	OR*	95% CI**
Total (n=19771)	18.9 (n=3729)			
The Netherlands (n=14021)***	18.0 (n=2530)			
Germany (n=3972)	20.0 (n=795)	0.05	1.137	1.040–1.242
Austria (n=1778)	22.7 (n=404)	0.0001	1.335	1.186–1.504

* OR = Odds Ratio; ** CI = Confidence Interval; *** Reference group

Table 4.3 Patients with malnutrition/without malnutrition and patient characteristics

	M+ [1](n= 3729)	M- [2](n=16042)	p-value	OR**	95% CI***
Gender n (%)			<0.0001	1.420	1.306–1.543
Male	19.4	25.5			
Female	80.6	74.5			
Age in years (mean)	85.1	84.0	<0.0001	1.026	1.021–1.031
Age categories n (%)			<0.0001	1.221	1.156–1.289
65-74 years	8.6	11.2			
75-84 years	34.1	37.8			
≥85 years	57.2	51.0			
Mean length of stay, in days	1143	1184	0.101	1.000	1.000–1.000
Care dependency n (%)			<0.0001	2.190	2.016–2.379
Dependent	22.8	11.9			
Independent	77.2	88.1			
Diseases (%)					
Infectious diseases	1.9	1.4	0.026	1.354	1.036–1.768
Cancer	8.5	7.1	0.003	1.214	1.066–1.382
Endocrine/nutritional/metabolic diseases	7.5	6.8	0.136	1.109	0.968–1.272
Diabetes mellitus	14.7	21.4	<0.0001	0.633	0.574–0.699
Blood diseases	4.0	3.3	0.027	1.231	1.024–1.482
Psychological disorder	16.3	17.1	0.253	0.946	0.859–1.041
Dementia	56.3	44.1	<0.0001	1.632	1.519–1.754
Nervous system disorder	11.2	10.7	0.402	1.050	0.935–1.176
Eye/ear disorder	17.8	18.3	0.491	0.968	0.882–1.062
Cardiovascular disease	44.9	49.6	<0.0001	0.830	0.773–0.892
CVA*/hemiparesis	17.9	18.8	0.176	0.938	0.855–1.029
Respiratory disorder/diseases	14.1	12.5	0.011	1.145	1.032–1.269
Diseases of the digestive tract	18.5	14.8	<0.0001	1.303	1.187–1.431
Diseases of kindney/urinary tract	15.6	15.4	0.747	1.016	0.921–1.121
Skin disorder	6.3	6.5	0.574	0.959	0.828–1.110
Motor disorders	33.0	30.9	0.015	1.099	1.019–1.186
Congenital disorders	1.4	1.6	0.323	0.858	0.634–1.162
Injury resulting from accidents	5.7	4.0	<0.0001	1.458	1.242–1.711
Total hip replacement	6.5	5.4	0.012	1.207	1.042–1.399
Other not specified diseases	10.4	8.6	0.001	1.207	1.042–1.399
Mean number of prevalent diseases	3.02	2.90	<0.0001	1.031	1.011–1.051

* CVA: cerebrovascular accident; ** OR = Odds Ratio; *** CI = Confidence Interval; [1]Patients malnourished [2]Patients not malnourished

Possible influencing variables (GEE Analyses, association model)

Table 4.1 and 4.3 show that gender, age, age categories, mean number of diseases and care dependency, as well as having infectious diseases, cancer, diabetes mellitus, blood diseases, dementia, cardio vascular disease, respiratory diseases, diseases of the digestive tract, motor disorder, injury resulting from accidents, total hip replacement or other not specified diseases were possible confounders or influencing variables. After entering these variables step-by-step in the univariate model, in the final multivariate model (corrected model) (Table 4.4) the variables care dependency, cardiovascular disease, diseases of the digestive tract, age, dementia, diabetes mellitus, gender, mean number of diseases, respiratory diseases and other not specified diseases were included as influencing variables for the difference in malnutrition prevalence in the three countries. The two most influencing resident characteristics (confounders) were care dependency and cardiovascular disease.

Table 4.4 GEE Analyses (association model)

	B1*	B2**	CI 95% B1***	CI 95% B2****	p-value B1	p-value B2
Uncorrected model[1]	1.137	1.335	1.040 – 1.242	1.186 – 1.504	0.05	<0.0001
Corrected model[2]	1.065	1.083	0.967 – 1.174	0.955 – 1.227	0.201	0.214

[1] Variables in model: country (the Netherlands as reference group and Germany and Austria) and malnutrition prevalence; [2] Corrected for variables: care dependency, age, gender, mean number of diseases and specific diseases: cardiovascular disease, diseases of the; digestive tract, dementia, diabetes mellitus, respiratory disorders, and other non-specified diseases; * B1 = Comparing Germany to the Netherlands; ** B2 = Comparing Austria to the Netherlands; *** CI 95% B1 = Confidence Interval B1; **** CI 95% B2 = Confidence Interval B2

The confounders resulting from the analyses influence the odds ratios of countries. Some odds ratios increase when added to the corrected model e.g. diabetes mellitus, cardiovascular disease and respiratory disorder and other decrease or stay stable.
After controlling for these variables in the final multivariate model (corrected model), the odds ratios of malnutrition difference between the three countries declined. The odds ratio for malnutrition prevalence declined when comparing the univariate model (without controlling for predictive residents characteristics) with the multivariate model (controlling for influencing residents characteristics) (see Table 4.4) in the countries (see Table 4.5). The OR of malnutrition between the Netherlands and Germany declined from 1.137 to 1.065 (p-value). The OR of malnutrition between the Netherlands and Austria declined from 1.335 to 1.085 (p-value). After controlling for the influencing patient characteristics (confounders) there were no differences anymore; the OR declined to 1, implying that the differences in prevalence rates declined.
The difference is not significant any more between the Netherlands and Germany and the Netherlands and Austria when controlling for these influencing resident characteristics.

Table 4.5 Odds ratio of malnutrition in the Netherlands, Germany and Austria controlling for influencing resident characteristics

	p-value	OR***	CI 95%****
Univariate			
The Netherlands*			
Germany	0.05	1.137	1.040-1.242
Austria	0.001	1.335	1.186-1.504
Multivariate**			
The Netherlands			
Germany	0.201	1.065	0.967-1.174
Austria	0.213	1.083	0.955-1.227

* Reference group; ** Model includes variables: care dependency, age, gender, mean number of diseases; and specific diseases (cardiovascular disease, diseases of the digestive tract, dementia, diabetes mellitus, respiratory disorders, and other non-specified diseases); *** OR = Odds Ratio; **** CI 95% = Confidence Interval

DISCUSSION

This unique large scale study explored whether resident characteristics influence possible differences in malnutrition prevalence between the Netherlands, Germany and Austria, when using the same methodology and measurement instrument.

The prevalence of malnutrition differed significantly between the countries. The highest prevalence was found in Austria (22.7%, the Netherlands 18.0%, Germany 20.0%). These prevalence findings are within the range of earlier internationally reported malnutrition prevalence rates. Data collected by the Nutrition Day survey showed a malnutrition prevalence of 16.7% in nursing home residents in Germany (Valentine *et al*. 2009). Furthermore a study by Tannen *et al*. (2008) showed comparable rates (15.1%) collected in German nursing homes and another study showed the same rates (15.7%) in Austrian hospitals (Tannen & Lohrmann 2012). A study in different aged care residents in Australia showed a much higher prevalence rate. The prevalence of malnutrition across these facilities varied from 31.8 to 72.1% (Gaskill *et al*. 2008). In interpreting the differences between these studies, it must be realized that each study uses its own methodology as well as definition and operationalization of malnutrition.

Resident characteristics that were both related to country and to malnutrition were seen as possible influencing variables (or confounders) in the GEE analyses. Being female, being older, having more diseases and having the following diseases: cardiovascular disease, diseases of the digestive tract, dementia, diabetes mellitus, respiratory disorder, and other non-specified diseases influence the chance of becoming malnourished.

Our study revealed that the two largest confounders are being more care dependent and having a cardiovascular disease. This finding has been confirmed in other studies showing that malnourished residents are more care dependent. Other studies confirm

our findings on the relationship between malnutrition and cardiovascular disease (Teh *et al*. 2010, Colin-Ramírez *et al*. 2011). Furthermore the remaining confounders found in the GEE analyses are also indicated by other studies. More often residents have several diseases e.g. diseases of the digestive tract and respiratory disorder (Oliveira *et al*. 2009, Hickson 2006). Other studies show that women are more at risk of becoming malnourished (Suominen *et al*. 2005). Gaskill *et al*. (2008) found a relation between malnutrition and an increased age and high level of care needs. Suominen *et al*. (2005) describe similar patient related factors that explain malnutrition in nursing home residents in Finland. Their logistic regression analyses show that impaired functioning, swallowing difficulties, dementia and constipation are associated with being malnourished (Suominen *et al*. 2005). This is also in line with our findings. Although our study is able to show that resident characteristics influence differences in malnutrition prevalence rates between countries, it has never been studied this way before: using the same method and definition on a large scale in different countries.

There was no significant difference between the Netherlands, Germany and Austria after controlling for these influencing variables. Besides resident characteristics other influencing variables could also play a role in the difference in malnutrition prevalence between the countries. Possible influencing variables could be differences in healthcare structure as nutritional care policy (e.g. nutritional screening policy, implementation of a nutritional care protocol/guideline, the policy of discussing malnourished residents in a multi-disciplinary team) and care processes (e.g. preventive and treatment measures used). A study by Meesterberends *et al*. (2013) revealed that six factors, including resident-related, nursing-related and structure-related factors, explain the differences in pressure ulcer incidence rates between nursing homes in the Netherlands and Germany. Future studies must be performed to assess the specific contribution of these structures and process factors to differences in malnutrition prevalence rates in different countries.

Limitations

In this study data from three countries were analyzed with different sample sizes. While institutions participate voluntarily, no information is available about the degree of representativeness of the samples. However, until now there are no other studies with such large numbers of patients.

Since there is no globally accepted golden standard for malnutrition we based our study on a definition that meets those factors about which consensus exists (Meijers *et al*. 2010).

Finally it might be possible that more and other resident characteristics that were not taken into account in our study are of influence at becoming malnourished. Therefore we assume that also structural and process factors could play a role.

Conclusion

Malnutrition is still a considerable problem; about 20% of all nursing home residents in this study were malnourished. There are differences between countries, which can be explained by resident characteristics. Since other country related factors like structure and process factors of malnutrition could also play an important role in influencing differences in malnutrition prevalence rates between the countries, we recommend to investigate these factors in future studies.

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CHAPTER 5

Do structural quality indicators of nutritional care influence malnutrition prevalence in Dutch, German and Austrian nursing homes?

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ABSTRACT

Objective

The aim of this study is to explore whether structural quality indicators for nutritional care influence malnutrition prevalence in the Netherlands, Germany and Austria. Furthermore differences in malnutrition prevalence and structural quality indicators for nutritional care in nursing homes in the three countries are examined.

Research methods and procedures

A cross-sectional, multi-centre study was performed, using a standardised questionnaire at patient, ward and institution level. Malnutrition was assessed by low Body Mass Index, undesired weight loss and reduced intake. Structural quality indicators of nutritional care were measured at ward and institutional level.

Results

The prevalence of malnutrition differed significantly between the three countries (Netherlands 18.0%, Germany 20.0%, Austria 22.7%). Structural quality indicators related to nutritional care as having a guideline regarding prevention and treatment of malnutrition were related to malnutrition and explained malnutrition prevalence variance between the Netherlands and Germany. Differences between the Netherlands and Austria in malnutrition prevalence still existed after controlling for these quality structural indicators.

Conclusion

Structural quality indicators of nutritional care are important in explaining malnutrition variance between the Netherlands and Germany. However they did not explain the difference in malnutrition prevalence between the Netherlands and Austria. Investigating the role of process indicators may provide more insight in the role of structural quality indicators of nutritional care in explaining the malnutrition prevalence differences between the Netherlands and Austria.

INTRODUCTION

Malnutrition is a problem in healthcare settings all over the world (Waitzberg *et al*. 2001, Correia & Campos 2003, Kruizenga *et al*. 2003, Stratton *et al*. 2003, Pirlich *et al*. 2006, Valentini *et al*. 2008, Meijers 2009, Vanderwee *et al*. 2010). Malnutrition has been defined as a condition in which an insufficient or disproportionate intake of energy, protein, and other nutrients adversely affects tissue/body form (shape, size and composition) and function, and clinical outcomes (Elia 2000). Many negative consequences may result from malnutrition even after adjusting for disease type and severity (Green 1999, Elia *et al*. 2005, Arvanitakis *et al*. 2007, Russel 2007, Norman 2008, Banks *et al*. 2010, Meijers *et al*. 2012, Agerwal *et al*. 2013). Due to these negative effects of malnutrition it is important to optimize nutritional care as far as possible.

Donabedian's (1985) model of quality of care can be used as a framework to investigate the quality of nutritional care. This model describes that the outcome (e.g. malnutrition prevalence) is dependent not only on the process of care (e.g. screening at admission, registering height, weight and intake), but also on structural aspects of the care (e.g. employment of dieticians, having a weight measurement policy and the policy to perform nutritional screening, assessment and treatment according to a guideline) (Donabedian 1988).

Both in 2007 and 2009 the European Society for Clinical Nutrition and Metabolism (ESPEN) published a review (Arvanitakis *et al.* 2008, Arvanitakis *et al.* 2009) on the fight against malnutrition on adequate nutritional care strategies concerning for example the policy to perform nutritional screening and assessment of nutritional status at admission, registration of nutritional status, weight and intake on a regular basis for care homes and home care and how to implement these (Arvanitakis *et al.* 2009).

Despite the recommendations and actions undertaken in different countries, still high prevalence rates varying from 2 to 74% are found in European care homes (Valentini *et al*. 2008, Meijers *et al*. 2009a, Meijers *et al*. 2009b, Vanderwee *et al*. 2010, Nie van *et al.* 2011, Tannen & Lohrmann 2012). The differences found in these studies are hard to compare due to a lack of a gold standard and differences in used methodology and definition.

The aim of this study is to explore which structural quality indicators of nutritional care influence the outcome of quality of care in terms of prevalence of malnutrition and impact of possible differences between malnutrition prevalence in Dutch, German and Austrian nursing homes. In this study outcome is defined as malnutrition prevalence and structural indicators of nutritional care are defined as the attributes settings where nutritional care is given defining professional responsibilities, guidelines, availability of nutritional advisory teams, education of both healthcare professionals and patients, screening and monitoring policy.

The following research questions will be addressed: (1) What is the prevalence of malnutrition in nursing homes in the Netherlands, Germany and Austria? (2) Are there differences between the countries in structural quality indicators of nutritional care? (3)

Are structural quality indicators of nutritional care related to malnutrition prevalence? (4) Is the prevalence of malnutrition in nursing homes in the Netherlands, Germany and Austria different when controlling for these influencing structural quality indicators of nutritional care?

MATERIALS AND METHODS

In 2004 the Dutch National Prevalence Measurement of Care Problems (in Dutch: Landelijke Prevalentiemeting Zorgproblemen (LPZ)) from Maastricht University included the annual measurement of malnutrition prevalence and relevant structural quality indicators of nutritional care (Halfens *et al*. 2012). All healthcare institutions in the Netherlands were invited to participate. Since 2008 this measurement was also conducted in Germany and Austria (LPZ-International) (Nie van *et al*. 2013). In Germany only the nursing homes were invited and in Austria both hospitals and nursing homes were asked to participate.

Design

A cross-sectional, multi-center design was used (Nie van *et al*. 2013). In this study, data collected in April 2009 and April 2010 in nursing homes in the Netherlands, Germany and Austria were analysed.

Instrument

A standardised questionnaire was used, measuring at three levels: institution, ward and patient. At institution and ward level data were collected on the kind of institution and ward and also on structural quality indicators of nutritional care (8 questions at institutional level, and 13 questions at ward level), with dichotomous answer categories (yes/no). For a description of all structural quality indicators see Table 5.3. These indicators were considered relevant by a panel of national experts as relevant for a high quality of care (Nie van *et al*. 2013).
At patient level resident characteristics (gender, age, length of stay and care dependency) were registered. Furthermore weight, height and unintentional weight loss were registered either from the patient file or measured at the day of/the day before the measurement.
The definition of malnutrition used in this study was according to Meijers *et al*. (2010): (1) Body mass index (BMI) ≤20 (age>65), (2) unintentional weight loss (more than 6 kg in the previous six months or more than 3 kg in the last month) and (3) no nutritional intake for three days or reduced intake for more than ten days combined with a BMI between 20 and 23.9 (age>65). Residents are malnourished if they meet one of these criteria.

Sample

All nursing homes in the Netherlands, Germany and Austria were invited to take part voluntarily in the LPZ measurement. They all received an (e)mail (including a leaflet). Residents who were at least 65 years old and who gave their (or their legal representative) informed consent were included in the study. Only those residents who were present at the day of the measurement and were able to participate were included in the study. Residents were excluded when refusing to participate, not being available at the ward, being comatose or too ill, and/or being terminally ill. Data from 2009 from residents who participated both in 2009 and 2010 were removed from the data set in order to prevent double registration of the same patient.
Ethical approval was given by the responsible ethical committees of the universities that coordinated the study in the three countries.
Data from 214 nursing homes were analysed (the Netherlands N=133, Germany N=61 and Austria N=20). Altogether 19,876 residents from 798 wards took part in the measurement (Table 5.1). The response rate in Austria (80.8%) and Germany (82.9%) was significantly lower than in the Netherlands (93.9%). The reasons for not taking part in the measurement in the three countries were refusal (64.3%), not being available at the ward at the day of the measurement (27.0%), being comatose or too ill (5.7%) and being terminally ill (3.0%).

Table 5.1 Nursing home population characteristics per country

	The Netherlands	Germany	Austria	p-value
Nursing homes, n (%)	133 (62.2)	61 (28.5)	20 (9.3)	
Wards, n (%)	464 (58.2)	248 (31.1)	86 (10.7)	
Residents, n (%)	14123 (71.0)	3973 (20.0)	1780 (9.0)	
Gender n (%)				<0.0001 [abc]
Male	3717 (26.3)	868 (21.8)	255 (14.3)	
Female	10409 (73.7)	3105 (78.2)	1525 (85.7)	
Mean age in years (sd)*	84 (7)	83 (8)	85 (8)	<0.0001 [abc]
Length of stay, median in days (mean, sd)	631 (1017,1463)	767 (1407, 2129)	694 (1195, 1953)	<0.0001 [abc]
Care dependency n (%)				<0.0001 [abc]
Dependent	8341 (59.1)	2927 (73.7)	1431 (80.4)	
Independent	5783 (40.9)	1045 (26.3)	349 (19.6)	

[a]Significant difference between the Netherlands and Germany; [b]Significant difference between the Netherlands and Austria; [c]Significant difference between Germany and Austria; *sd = standard deviation

Data collection

The procedure of collecting data was introduced by the LPZ project group to each national project group (Nie van *et al.* 2013). All residents were assessed by two healthcare professionals: one working at the resident's ward and one from another ward.

Data analyses

For the statistical analyses SPSS version 19 (SPSS Inc, Chicago, IL) was used. To describe differences in (malnourished) residents characteristics and the structural quality indicators of nutritional care policy at institution and ward level in the Netherlands, Germany and Austria, Chi-square tests, student's t-test or ANOVA (with post hoc analyses using Bonferroni method) and odds ratios were used. Univariate logistic regression analyses were performed to describe the relationschip of each baseline independent variable (country: Netherlands (0), Germany (1) and Austria (2)) and all structural quality indicators at institution and ward level with the prevalence of malnutrition. For identifying differences in malnutrition prevalence between the countries, p-values were based on two-sided tests, and the cut-off point for statistical significance was <0.05.

A univariate logistic Genaralized Estimating Equation (GEE) regression analysis was performed to estimate the odds ratio of country regarding the prevalence of malnutrition. The dependent variable was malnourished/not malnourished; the independent variables were two dummy variables indicating country (with the Netherlands as reference category). GEE analysis corrects for the dependency of observations within institutions by adding a 'within subject correlation structure' to the regression model. An exchangeable correlation structure was used, which means that correlations between individuals within the institutions are assumed to be the same. For building the association model all variables which were significantly different between the three countries and related to malnutrition (with a p-value smaller than 0.10) were seen as possible influencing variables (confounders) in the GEE analyses. All structural quality indicators related to country and malnutrition were added to the model step-by-step so that the mean of both regression coefficients of the dummy variables for country changed. Only covariates that led to a significant change (more than 10% of the regression coefficients) were included (corrected model 1) (Twisk 2010).

Prior to multivariate analysis, data were assessed for congruence with regression assumptions. P-values were based on two-sided tests, and the cut-off point for statistical significance was <0.05.

Finally a model was built to show if the prevalence figures of malnutrition in nursing homes in the Netherlands, Germany and Austria were still different when controlling for the influencing structural quality indicators in the final multiple regression model. In this analysis we focused on the change of the odds ratio of malnutrition between the countries in the univariate model (without controlling for influencing structural quality indicators) compared to model 1 (multivariate controlling for the found influencing structural quality indicators, see Table 5.5).

RESULTS

Population

In Austria significantly more female residents participated than in the Netherlands and Germany (respectively 85.7%, 73.7% and 78.2%). Furthermore the residents in Austria were significantly older (85 years) and more care dependent (80.4%) than those in Germany (83 years and 73.7%) and the Netherlands (84 years and 59.1%). The German residents had the longest length of stay; 767 days (median) (see Table 5.1).

Malnutrition prevalence

The prevalence of malnutrition differed significantly between the three countries. In Austria the prevalence was the highest (22.7%), followed by Germany (20.0%) and the Netherlands (18.0%) (see Table 5.2).

Tabel 5.2 Malnutrition prevalence in nursing homes in The Netherlands, Germany and Austria

	Malnutrition prevalence	p-value	OR*	95% CI**
Total (n=19771)	18.9% (n=3729)			
The Netherlands (n=14021)***	18.0% (n=2530)			
Germany (n=3972)	20.0% (n=795)	0.05	1.137	1.040–1.242
Austria (n=1778)	22.7% (n=404)	<0.001	1.335	1.186–1.504

* OR = Odds Ratio; ** CI = Confidence Interval; *** Reference group

Differences between the countries in structural quality indicators

All structural quality indicators at institution level differ significantly between the three countries. An agreed protocol for the prevention and treatment of malnutrition was available in 54.1% of the Austrian institutions whereas this was the case in 85.2% and 80.8% of the institutions in respectively the Netherlands and Germany. The same counts for working in accordance with this protocol (Austria 54.1%, Germany 85.1% and the Netherlands 73.7%) and for keeping this protocol updated (Austria 51.6%, Germany 74.6% and the Netherlands 74.3%). A multi-disciplinary advisory committee for malnutrition was present in 24.9% of the German institutions whereas in the Netherlands and Austria this was 48.3% and 70.1%. Dieticians were employed mostly in the Dutch and Austrian institutions (91.5% and 83.5%) compared to the German institutions (44.7%). Furthermore a significant difference was found between the countries for two other indicators e.g. organizing a refresher course for caregivers over the last two years concerning the prevention and treatment of malnutrition and for defining criteria for determining malnutrition in the institution. The availability of an information brochure for residents and their family also showed a difference. In less than 22% of all institutions such a brochure was available (the Netherlands 15.8%, Germany 20.3% and Austria 22.0%) (see Table 5.3).

Table 5.3 Prevalence of structural quality indicators for nutritional care at institution and ward level in nursing homes in the Netherlands, Germany and Austria

	The Netherlands	Germany	Austria	p-value
Structural quality indicators at institution level				
1. There is an agreed protocol/guideline for the prevention and/or treatment of malnutrition within the institution.	85.2%	80.8%	54.1%	<0.0001 [abc]
2. Malnutrition-related work within the institution is carried out in a controlled fashion or in accordance with the malnutrition protocol/guideline.	73.7%	85.1%	54.1%	<0.0001 [abc]
3. There is a multi-disciplinary advisory committee for malnutrition at the institution or ward level.	48.3%	24.9%	70.1%	<0.0001 [abc]
4. There is someone within the institution who is responsible for updating and ensuring that the necessary attention is devoted to the malnutrition protocol.	74.3%	74.6%	51.6%	<0.0001 [bc]
5. Within the institution, criteria have been defined for determining malnutrition.	75.4%	95.5%	92.5%	<0.0001 [ab]
6. There are dieticians employed at the institution.	91.5%	44.7%	83.5%	<0.0001 [abc]
7. Over the last two years, a refresher course and/or a meeting was organised for caregivers, which was/were specifically devoted to the prevention and treatment of malnutrition within the institution.	56.6%	79.2%	69.6%	<0.0001 [abc]
8. An information brochure is available at the institution for clients and/or family members about malnutrition.	15.8%	20.3%	22.0%	<0.0001 [ab]
Structural quality indicators at ward level				
1. There is at least one nurse in the ward who is specialized in the area of malnutrition.	42.1%	29.1%	51.7%	<0.0001 [abc]
2. Clients who are at risk and/or malnourished are discussed in the ward in the multi-disciplinary work consultations.	90.4%	85.4%	97.5%	<0.0001 [abc]
3. Work in the ward done in a controlled fashion or in accordance with the malnutrition protocol/guideline.	72.6%	91.0%	58.8%	<0.0001 [abc]
4. Upon admission, every client is weighed as a matter of standard procedure.	81.0%	100%	100%	<0.0001 [ab]
5. Upon admission, the height of each client is determined as a matter of standard procedure.	44.3%	100%	93.5%	<0.0001 [abc]
6. The nutritional status is assessed upon admission.	59.2%	98.3%	100%	<0.0001 [ab]
7. The care file includes an assessment as to the risk of malnutrition for each client.	45.7%	99.9%	97.5%	<0.0001 [ab]
8. The care file/care plan specifies which activities must be implemented for clients who are at risk of malnutrition.	80.9%	98.1%	97.5%	<0.0001 [ab]
9. In case of (expected) malnutrition, a protein- and energy-enriched diet is provided in the ward as a matter of standard procedure.	34.2%	93.3%	95.9%	<0.0001 [abc]
10. Every client who is malnourished (or at risk of becoming so) receives an information brochure for clients and/or family about malnutrition.	14.4%	10.7%	17.4%	<0.0001 [abc]
11. Is the ambience at mealtimes taken into account within the ward (e.g. no interruptions during meal times, setting the table, and choice of meals)?	94.4%	96.6%	99.6%	<0.0001 [abc]
12. The care file includes the intake for each client.	65.2%	100%	100%	<0.0001 [ab]
13. Does the ward have a weight policy?	94.6%	92.5%	46.4%	<0.0001 [bc]

[a] Significant difference between the Netherlands and Germany; [b] Significant difference between the Netherlands and Austria; [c] Significant difference between Germany and Austria

Also all of the thirteen structural quality indicators at department level showed a significant difference between the countries (see Table 5.3). At only a few departments in the three countries there is an information brochure for residents and their families on malnutrition (the Netherlands 14.4%, Germany 10.7% and Austria 17.4%). Furthermore 34.2% of the Dutch nursing home departments had the policy to provide a protein- and energy-enriched diet as a matter of standard care in case of (expected) malnutrition, which is much more common in Germany (93.3%) and Austria (95.9%).
In the Netherlands and Austria in about 45% of the departments at least one nurse is specialized in the area of malnutrition. For Germany, such a nurse was only available in 29.1% of the departments. In about all of the departments in Germany and Austria the height of residents is measured at admission as a standard procedure. In the Netherlands this was the case for almost 50% of all residents. This also counts for the policy of registering the outcome of the assessment of (the risk for) malnutrition in the care file for each resident. Also in the structural quality indicators for nutritional care e.g. work is done in accordance with malnutrition guidelines, policy of registering activities that have to be implemented for patients at risk of malnutrition, patients malnourished or at risk of becoming so receive an information brochure addressing malnutrition and having a weight policy at the department differed significantly between the countries.

Structural quality indicators and malnutrition

Next the relationship between malnutrition and structural quality indicators of nutritional care at both institution and ward level was examined (see Table 5.4). At institution level only the indicator involving whether a refresher course for caregivers had been organized over the last two years on prevention and treatment of malnutrition, showed a significant relationship with the dependent variable malnutrition. At ward level 10 out of 13 structural quality indicators showed a significant relationship with malnutrition.
Indicators as the policy of discussing patients at risk for malnutrition or patients malnourished in a multidisciplinary team, a standard procedure at admission of measuring weight, height and the nutritional status as well as having a specialized nurse at the department did show a relationship with malnutrition. Furthermore a relation was found between malnutrition and indicators as the standard policy to register the outcome of the risk assessment for malnutrition and the intake of each patient as well as the registration in each patient file of the specific activities that have to be undertaken for patients at risk of malnutrition or malnourished patient.
Another significant difference is found in taking mealtime ambiance into account and the provision of protein- and energy-enriched diet in care of (expected) malnutrition. Having a weight policy, working in accordance with a malnutrition guideline and the availability of an information brochure showed no relationship with malnutrition.

Table 5.4 Prevalence of malnourished and non-malnourished residents in institutions fulfilling structural quality indicators at institution and ward level

	M+*	M-**	p-value	OR***	95% CI****
Structural quality indicators institution					
1. There is an agreed protocol/guideline for the prevention and/or treatment of malnutrition within the institution.	81.6%	81.7%	0.847	0.991	0.904–1.086
2. Malnutrition-related work within the institution is carried out in a controlled fashion or in accordance with the malnutrition protocol/guideline.	74.7%	74.3%	0.543	1.026	0.945–1.113
3. There is a multi-disciplinary advisory committee for malnutrition at the institution or ward level.	46.2%	45.7%	0.587	1.020	0.950–1.096
4. There is someone within the institution who is responsible for updating and ensuring that the necessary attention is devoted to the malnutrition protocol	72.0%	72.6.8%	0.440	0.969	0.895–1.049
5. Within the institution, criteria have been defined for determining malnutrition.	82.0%	80.9%	0.100	1.081	0.985–1.185
6. There are dieticians employed at the institution.	80.9%	81.5%	0.395	0.961	0.878–1.053
7. Over the last two years, a refresher course and/or a meeting was organised for caregivers, which was/were specifically devoted to the prevention and treatment of malnutrition within the institution.	64.5%	62.0%	0.006	1.110	1.030–1.195
8. An information brochure is available at the institution for clients and/or family members about malnutrition.	17.9%	17.2%	0.318	1.049	0.955–1.151
Structural quality indicators ward					
1. There is at least one nurse in the ward who is specialised in the area of malnutrition.	42.1%	39.9%	0.012	1.097	1.020–1.179
2. Clients who are at risk and/or malnourished are discussed in the ward in the multi-disciplinary work consultations.	91.3%	89.8%	0.010	1.177	1.039–1.333
3. Work in the ward done in a controlled fashion or in accordance with the malnutrition protocol/guideline.	75.7%	74.8%	0.239	1.051	0.967–1.142
4. Upon admission, every client is weighed as a matter of standard procedure.	88.3%	86.2%	0.001	1.210	1.085–1.350
5. Upon admission, the height of each client is determined as a matter of standard procedure.	62.2%	59.4%	0.002	1.124	1.044–1.209
6. The nutritional status is assessed upon admission.	73.2%	70.0%	<0.0001	1.172	1.082–1.269
7. The care file includes an assessment as to the risk of malnutrition for each client.	64.4%	60.7%	<0.0001	1.173	1.089–1.263
8. The care file/care plan specifies which activities must be implemented for clients who are at risk of malnutrition.	87.7%	85.4%	<0.0001	1.221	1.097–1.360
9. In case of (expected) malnutrition, a protein- and energy-enriched diet is provided in the ward as a matter of standard procedure.	54.6%	51.1%	<0.0001	1.151	1.071–1.236
10. Every client who is malnourished (or at risk of becoming so) receives an information brochure for clients and/or family about malnutrition.	13.6%	14.1%	0.379	0.954	0.860–1.059
11. Is the ambience at mealtimes taken into account within the ward (e.g. no interruptions during meal times, setting the table, and choice of meals)?	94.5%	95.4%	0.025	0.833	0.710–0.977
12. The care file includes the intake for each client.	79.8%	76.7%	0.015	1.200	1.036–1.389
13. Does the ward have a weight policy?	86.1%	86.9%	0.404	0.929	0.782–1.104

* M+ = Residents malnourished; ** M- = Residents not malnourished; *** OR = Odds Ratio; **** CI = Confidence Interval

Structural quality indicators influencing differences in malnutrition prevalence

In the multiple regression analyses structural quality indicators which showed a significant difference between the countries as well as a relationship with malnutrition (see Tables 5.3 and 5.4) were included in the multiple logistic GEE analyses in order to build the association model. After entering the structural quality indicators step-by-step in the model, the final multiple regression model (corrected model 1, see Table 5.5) showed that only structural quality indicators at ward level (5 indicators) (see Table 5.5) were related to the differences in malnutrition prevalence rates in nursing home residents in the Netherlands, Germany and Austria.

Table 5.5 Generalized Estimating Equation Analyses (final association model)

	B1 (95% CI)*	p-value B1	B2 (95% CI)**	p-value B2
Uncorrected model***	-0.289 (-0.408 – -0.170)	0.0001	-0.128 (-0.217 – -0.039)	0.005
Corrected model 1****	-0.281 (-0.476 – -0.086)	0.005	0.095 (-0.096 – 0.288)	0.329

*B1 = Comparing Austria to the Netherlands (Confidence Interval B1); **B2 = Comparing Germany to the Netherlands (Confidence Interval B2); ***Uncorrected model includes country (the Netherlands as reference group and Germany and Austria) and malnutrition prevalence; ****Model 1. includes variables: The care file includes an assessment as to the risk of malnutrition for each client, The care file includes the intake for each client, In case of (expected) malnutrition, a protein-and energy-enriched diet is provided in the ward as a matter of standard procedure, At least one nurse in the ward is specialised in the area of malnutrition, The nutritional status is assessed upon admission

After controlling for the five variables; (1) the care file includes an assessment as to the risk of malnutrition for each client, (2) the care file includes the intake for each client, (3) in case of (expected) malnutrition, a protein- and energy-enriched diet is provided in the ward as a matter of standard procedure, (4) at least one nurse in the ward is specialised in the area of malnutrition and (5) the nutritional status is assessed upon admission (see Table 5.6) in the final multivariate model (corrected model) the odds ratios of malnutrition difference declined comparing the Netherlands to Germany (p=0.329) whereas the odds ratios increased comparing the Netherlands to Austria (p=0.005).

Table 5.6 Prevalence of malnutrition between the Netherlands and Germany and the Netherlands and Austria controlled for influencing structural quality indicators of nutritional care

	p-value	OR**	CI 95%***
Univariate****			
The Netherlands*	<0.0001		
Germany	0.005	1.137	1.040 - 1.242
Austria	<0.0001	1.335	1.186 - 1.504
Model 1. Multivariate*****			
The Netherlands*	<0.0001		
Germany	0.329	0.909	0.757 - 1.100
Austria	0.005	1.325	1.090 - 1.611

* Reference group; ** OR = Odds Ratio; *** CI 95% = Confidence Interval; **** Univariate includes country (the Netherlands as reference group and Germany and Austria) and malnutrition prevalence; ***** Model 1. includes variables: The care file includes an assessment as to the risk of malnutrition for each client. The care file includes the intake for each client, In case of (expected) malnutrition, a protein- and energy-enriched diet is provided in the ward as a matter of standard procedure. At least one nurse in the ward is specialised in the area of malnutrition. The nutritional status is assessed upon admission

DISCUSSION

The primary aim of this study was to explore whether structural quality indicators for nutritional care influenced possible differences between malnutrition prevalence rates in Dutch, German and Austrian nursing homes.

Malnutrition prevalence

Our study showed that the prevalence of malnutrition differed significantly between the three countries ($p \leq 0.05$). In Austria the prevalence was the highest (22.7%), followed by Germany (20.0%) and the Netherlands (18.0%). These prevalence rates are in line with other studies in these countries (Pirlich *et al*. 2006, Tannen *et al*. 2008, Meijers *et al*. 2009a, Tannen & Lohrmann 2012).

Structural quality indicators

Only structural quality indicators at ward level influenced malnutrition prevalence in nursing home residents. No indicators at institutional level seemed to be of great importance in the relationship to malnutrition prevalence comparing the nursing homes of the three participating countries. A plausible and logical explanation could be that the actual ward policy has more influence on the process of preventing or treating malnutrition and therefore a more direct effect on the prevalence of malnutrition.
Research shows that improving the quality of resident care is a complex, difficult and demanding process and does not follow prescribed and linear paths (Roycroft-Malone *et al*. 2004). Therefore more static structural quality indicators at institutional level, such as having protocols at institutional level might be less influential in changing

practice outcomes than structural quality indicators at ward level which probably are more closely linked to actual care process and more concretely in line with daily practice.

Donabedian's model states that "we must begin … with the performance of healthcare providers" (Carayon *et al*. 2006). This reflects the most focus on the providers and their relationship with the processes and outcome(s) meaning that quality is assessed by the way in which care is provided (process) by an individual or care team and less by the structure component of the model (Donabedian 1988). Donabedian (1992) states in his model that structure influences process and that process influences outcome. Due to the criticism on this uni-trajectory model (Carayon *et al*. 2006) we were interested in the direct influence of structural aspects of care on outcome and found that there was an influence of several indicators. Namely in the GEE analyses five structural quality indicators at ward level remain in the corrected model (see indicators in Table 5.5, model 2).

When controlling for these influencing structural quality indicators the significant difference between the Netherlands and Germany in malnutrition prevalence rate is eliminated, meaning that these five structural quality indicators are important in influencing malnutrition prevalence rates in these two countries. Remarkable is that between the Netherlands and Austria the five found structural quality indicators of nutritional care were of no importance in explaining the malnutrition prevalence difference. It is unclear why these indicators were important in the difference in malnutrition prevalence between the Netherlands and Germany and not between the Netherlands and Austria.

Other studies including the review of Arvanitakis *et al*. (2009) implicated these five structural indicators also as important. To be able to prevent and treat malnutrition it is important to use a nutritional screening instrument at admission (Konrup *et al*. 2003, Elia *et al*. 2005, Arvanitakis *et al*. 2009). From other studies we know that it is important to register the result of a malnutrition assessment as well as the food intake of patients (Elia *et al*. 2005, Arvanitakis 2009). Studies show also that providing a protein- and energy-enriched diet as a matter of standard procedure may decrease malnutrition prevalence (Stratton & Elia 2000, Elia *et al*. 2005). Furthermore having a nurse specialist in malnutrition at the department may contribute to a reduction of malnutrition prevalence (Gaskill *et al*. 2009, Rao 2013).

Limitations

All nursing homes in the three countries were invited to participate voluntarily in the measurement. Unfortunately we cannot calculate the actual response rate. From national statistical overviews of healthcare institutions in the three countries it is not clear how many nursing homes there are exactly in the countries, since in some years nursing homes are organized in a different way. Nowadays nursing homes from a certain area are gathered in large corporations. Statistics are not clear in the way they

count the amount of nursing homes (e.g. the small nursing homes one by one or as belonging to large corporations). The included sample is an at random/convenience sample from all nursing homes in the three countries.
In Donabedian's model (1988) the structure of care includes the organizational structure, the material resources (environment, technology, tools), and the human resources (care provider, tasks) (Carayon *et al*. 2006). In our study we focussed on structural quality indicators related to the policy of nutritional care. So the organisational and material resources are not included in the analyses, which may have limited the effect of structure on outcome. For example large nursing homes might have more and better recourses to secure structural quality indicators of nutritional care. On the other hand in small nursing homes functioning on an individual level might benefit from their smaller size due to shorter communication lines and more control (selection bias).
Furthermore the clinical significance of the prevalence rates found is disputable. Although the differences between the countries are statistically significant the actual differences are small (Austria 22.7%, Germany 20.0% and the Netherlands 18.0%).

Conclusion

Our study shows that structural quality indicators of nutritional care were important in explaining malnutrition variance between the Netherlands and Germany. Between the Netherlands and Austria these indicators were of no importance. Investigating the role of process indicators in the model of Donabedian may provide insight in the role of structural quality indicators of nutritional care in explaining the malnutrition prevalence differences between the Netherlands and Austria.

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CHAPTER 6

Influence of process indicators of nutritional care on the prevalence of malnutrition in Dutch, German and Austrian nursing homes

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ABSTRACT

Objectives
This study focuses on process indicators of nutritional care and resident characteristics that explain the difference in malnutrition prevalence in Dutch, German and Austrian nursing home residents.

Design and setting
Cross-sectional multi-centre study.
Nursing homes from the Netherlands (n=133), Germany (n=61) and Austria (n=20) participated.

Participants
In total data from 19,876 nursing home residents aged over 65 years in the Netherlands (n=14,123), Germany (n=3,973) and Austria (n=1,780) were analysed.

Measurements
Process indicators of nutritional care were measured by questions on prevention and treatment of malnutrition. Three questions on prevention were asked: *Was the patient's nutritional status screened at admission, how often is weight monitored and how often is intake monitored.* One question was asked about treatment of malnutrition when residents are malnourished (answer categories e.g. consulting a dietician, providing energy/protein-enriched diet, providing energy-enriched rations between meals, oral nutritional support and tube feeding).

Results
The multiple regression analyses show that the following process indicators were related to malnutrition: *energy-enriched rations provided between meals, consulting a dietician, nutritional status is screened at admission, intravenous feeding, maximum required fluid intake, supplementary oral nutrition and feeding by intubation.* These variables explained the statistically significant difference in malnutrition between the Netherlands and Austria but not completely between the Netherlands and Germany. The difference between the Netherlands and Germany could be explained by resident characteristics (care dependency, age, gender, mean number of diseases and specific diseases).

Conclusion
Process indicators of nutritional care explain the found differences in malnutrition prevalence between the Netherlands and Austria but not completely the found differences between the Netherlands and Germany. Between the Netherlands and Germany also resident characteristics play a role in explaining the found differences in malnutrition prevalence.

INTRODUCTION

Malnutrition is a major problem in nursing home residents in many countries varying between 18-74% (Valentini *et al.* 2008, Meijers 2009, Vanderwee *et al.* 2010, Nie van *et al.* 2011). Malnutrition can be defined as a nutritional condition in which an insufficient or disproportionate intake of energy, protein, and other nutrients adversely affects tissue/body form (shape, size and composition) and function, and clinical outcomes (Elia 2000). Malnutrition leads to negative outcomes such as comorbidity and mortality, a higher chance of complications, worsening of the immune function, a higher risk of infections and impairment of wound healing and also an increase of healthcare costs (Green 1999, Elia *et al.* 2005, Russel 2007, Arvanitakis *et al.* 2008, Norman *et al.* 2008, Banks *et al.* 2010, Meijers *et al.* 2012). Insight in the quality of nutritional care can help to improve prevention and adequate treatment of malnutrition and to decrease its negative effects.

According to Donabedian (1992) quality of care can be described in terms of structure, process and outcome indicators. This conceptual model provides a framework for examining health services and evaluating quality of care (Donabedian 1988). Following Donabedian's model, structural quality indicators of nutritional care involve amongst others having a weight measurement policy, a policy to perform nutritional screening, assessment and treatment according to a guideline and the employment of dieticians. Process indicators of nutritional care include which care is delivered, like for example screening at admission, monitoring height, weight and intake and measures taken to prevent or treat malnutrition (Elia *et al.* 2005a, Soeters *et al.* 2008, Bauer *et al.* 2010). The prevalence of malnutrition is an outcome indicator, which is influenced by structural quality indicators of nutritional care and by process indicators.

Focussing on process indicators there are recommendations approved by the council of Europe, being: there is a need for an organized and multidisciplinary approach towards systematic and individual nutritional assessment and it should include specialized personnel (dietician), the identification of an individual's nutritional needs, the correction of physical, psychological and social factors impeding adequate food intake, as well as the systematic monitoring of food intake, body weight and other relevant parameters (Arvanitakis *et al.* 2009). Studies of Meijers *et al.* (2014) and O'Flynn *et al.* (2005) both showed that nutritional screening is the most important process indicator in decreasing malnutrition prevalence rates over time.

Next to structural and process indicators, the outcome is also influenced by resident characteristics. In analysing the differences in prevalence rates of malnutrition (outcome) between Dutch, German and Austrian nursing homes, Nie van *et al.* (2013a) found that differences in resident characteristics as age, gender, care dependency, number and kind of disease are only partly relevant in explaining differences in malnutrition prevalence.

Since process indicators are related to resident characteristics, in this study we focus on process indicators of nutritional care and resident characteristics that might explain the

differences (p<0.001) in malnutrition prevalence in Dutch (18.0%), German (20.0%) and Austrian (22.7%) nursing home residents (Van Nie *et al.* 2013a).
In order to explain the found differences in malnutrition prevalence between the countries the following research questions will be addressed: (1) Are there differences between the countries in process indicators of nutritional care? (2) Are process indicators of nutritional care related to malnutrition prevalence? (3) Is the prevalence of malnutrition in nursing homes in the Netherlands, Germany and Austria different when controlling for these influencing process indicators of nutritional care? (4) What is the influence of adding resident characteristics found in van Nie *et al.* (2013a) to the model with the remaining process indicators of nutritional care found in research question 3?

METHODS

Data used in this study were collected by the LPZ-International (in Dutch: Landelijke Prevalentiemeting Zorgproblemen (LPZ), in English: Prevalence Measurement of Care Problems) of Maastricht University (UM). This annual, independent prevalence measurement of care problems is performed in different healthcare organisations in different countries (LPZ-International) (Van Nie *et al.* 2013).

Study Design and Ethics

This cross-sectional, multi-centre study was carried out in nursing homes in the Netherlands, Germany and Austria. Data collected on malnutrition and quality of nutritional care in April 2009 and April 2010 were analysed.
Ethical approval was given by the ethical committees of the Maastricht University Medical Centre (MUMC) in the Netherlands, the Witten/Herdecke University in Germany and the Medical University Graz in Austria.

Measurements

Data were collected at three levels: patient, ward and institution. Patient characteristics as age, gender, length of stay, comorbidity and care dependency (Dijkstra *et al.* 2000, 2003) were measured together with prevalence of malnutrition. Malnutrition was defined as: 1) Body mass index (BMI) ≤ 20 (age>65), 2) unintentional weight loss (more than 6 kg in the previous six months or more than 3 kg in the last month) and 3) no nutritional intake for three days or reduced intake for more than ten days combined with a BMI between 20 and 23.9 (age>65) (Meijers *et al.* 2009a, 2010). If residents meet one of these criteria, they are considered to be malnourished.
Process indicators were measured by questions on prevention and treatment of malnutrition. In this study three questions on prevention were asked: Was the patient screened at admission (yes/no), how often is weight monitored and how often is intake

monitored (5 point Likert scale). One question was asked about treatment of malnutrition: in case of (a risk of) malnutrition measures taken (eight answer categories e.g. providing energy/protein-enriched diet, providing energy enriched snacks between meals, oral nutritional support and tube feeding) were registered (Table 6.2).

Sample

Nursing homes in the Netherlands, Germany and Austria were invited to participate in the measurement voluntarily. They received a leaflet by (e)mail with all information about the measurement. The participating nursing homes were asked to include all wards and all residents. Furthermore nursing home residents were included when they (or their legal representative) gave informed consent. Residents present on the day of the measurement and who were able to answer questions, participated. When residents refused to participate, were not available at the ward, or being comatose, too ill or terminally ill, then they were not included.
For this article only residents of 65 years or older participating in 2009 or 2010 were included, while in case of double participation residents' data from 2009 were removed from the dataset.

Data collection

The measurement protocol and procedures were explained to the national project group in each country by the LPZ project group. Participating nursing homes did point out an internal coordinator who was responsible for the measurement. These institutional coordinators were trained collectively by each national project group (the Netherlands, Germany and Austria) in how to perform the data collection. They were trained how to use the questionnaires and the internet data-entry program. The institutional coordinators did receive a protocol and training package to support them in training the healthcare professionals (e.g. nurses, dieticians, doctors). Residents were assessed by two healthcare professionals: one from the ward of the resident and one from another ward (Van Nie *et al.* 2013).

Statistical analyses

To perform the statistical analyses SPSS version 19 (SPSS Inc, Chicago, IL) was used. Differences in (malnourished) residents and the process indicators of nutritional care in the Netherlands, Germany and Austria, Chi-square tests, student's t-test or ANOVA (with post hoc analyses using Bonferroni method) and odds ratios were calculated. To describe the relation of each baseline independent variable (country: Netherlands (0), Germany (1) and Austria (2)) univariate logistic regression analyses were performed to describe the relation of the baseline independent variables and all process indicators of nutritional care with the prevalence of malnutrition. P-values were based on two-sided

tests, and the cut-off point for statistical significance was <0.05 to identify differences in malnutrition prevalence between the countries.

A univariate logistic Generalized Estimating Equation (GEE) regression analysis was performed to estimate the odds ratio of country regarding the prevalence of malnutrition. GEE analysis corrects for the dependency of observations within institutions by adding a 'within subject correlation structure' to the regression model. The dependent variable was malnourished/not malnourished; two dummy variables indicating country (with the Netherlands as reference category) were the independent variables. An exchangeable correlation structure was used (correlations between individuals within the institutions are assumed to be the same). All variables which were significantly different between the three countries and related to malnutrition (with a p-value smaller than 0.10) were seen as possible influencing variables (confounders) in the GEE analyses and therefore included in the association model. All process indicators of nutritional care related to country and malnutrition were added to the model step-by-step so that the mean of both regression coefficients of the dummy variables for country changed. Only covariates that led to a significant change (more than 10% of the regression coefficients) were included (corrected model 1) (Twisk 2010).

Data were assessed for congruence with regression assumptions prior to multivariate analysis. The cut-off point for statistical significance was <0.05 and p-values were based on two-sided tests.

To show if the prevalence rates of malnutrition in nursing homes in the Netherlands, Germany and Austria were still different when controlling for the influencing process indicators of nutritional care, a final multiple regression model was built. The focus was the change of the odds ratio of malnutrition between the countries in the univariate model (without controlling for influencing process indicators of nutritional care) compared to model 1 (multivariate controlling for the found influencing process indicators of nutritional care, see Table 6.5). In a previously published study (Van Nie *et al.* 2013a) some resident characteristics (gender, age and care dependency, having cancer, diabetes mellitus, dementia, cardiovascular disease, respiratory disease, diseases of the digestive tract, injury resulting from accidents or other not specified disease) were found influencing the prevalence of malnutrition in nursing home residents in the Netherlands, Germany and Austria. For the corrected model 2, these factors were added to the corrected model 1 to study what the effect is on the process indicators of nutritional care. Prior to multivariate analysis, data were assessed for congruence with regression assumptions.

RESULTS

Response and population characteristics

Data from 19,876 nursing home residents (the Netherlands 14,123, Germany 3,973 and Austria 1,780) from 214 nursing homes (the Netherlands n= 133, Germany n= 61 and Austria n=20) were analysed for this study. In the Netherlands the response rate was significantly higher (93.9%) than in Germany (82.9%) and Austria (80.8%). Refusal of the resident was the main reason for not taking part in in the measurement (64.3%), followed by not being available at the ward at the day of measurement (27.0%), being comatose or too ill (5.7%) and being terminally ill (3.0%). Residents from Austria were more often female, older and more care dependent compared to those in Dutch and German nursing homes. Furthermore residents from Germany stayed in the nursing home the longest; 767 days (median) (Table 6.1).

Table 6.1 Population characteristics and malnutrition prevalence per country

	The Netherlands	Germany	Austria	p-value
Nursing homes, n (%)	133 (62.2)	61 (28.5)	20 (9.3)	
Wards, n (%)	464 (58.2)	248 (31.1)	86 (10.7)	
Residents, n (%)	14123 (71.0)	3973 (20.0)	1780 (9.0)	
Gender				<0.0001
Male	3717 (26.3)	868 (21.8)	255 (14.3)	
Female	10409 (73.7)	3105 (78.2)	1525 (85.7)	
Mean age in years (sd)	84 (7)	83 (8)	85 (8)	<0.0001
Length of stay, median in days (mean, sd)	631 (1017,1463)	767 (1407, 2129)	694 (1195, 1953)	<0.0001
Care dependency				<0.0001
Dependent, n (%)	8341 (59.1)	2927 (73.7)	1431 (80.4)	
Independent, n (%)	5783 (40.9)	1045 (26.3)	349 (19.6)	
Malnutrition prevalence (total 18.9%)	18.0%	20.0%	22.7%	<0.0001

sd = standard deviation

Malnutrition prevalence

There was a significant difference in malnutrition prevalence in the three countries; in the Netherlands it was the lowest (18.0%) and in Austria the highest (22.7%). In Germany the prevalence of malnutrition was 20.0% (Table 6.1).

Process indicators

In table 6.2 the process indicators of nutritional care are presented. It shows that screening of nutritional status differs significantly between the countries. In Germany and Austria almost all residents were screened at admission (respectively 98.2% and 92.8%) whereas in the Netherlands this was only the case in about half of all residents (48.3%).

No difference was found between the countries in the frequency of monitoring weight and intake. Weight was mostly monitored once a month and in all three countries, intake was monitored when the situation of the resident changed.
Besides adjusting the consistency of food, all preventive and treatment measures differed significantly between the countries. In the Netherlands and Germany the most used preventive or treatment measure was checking if the resident had received the maximum of fluid required (62.1% and 80.9%). Consulting a dietician was mostly used in Austria (61.8%).

Table 6.2 Process indicators nutritional care in the Netherlands, Germany and Austria

	The Netherlands	Germany	Austria	p-value
Has the nutritional status been screened at admission? %	48.3	98.2	92.8	<0.0001
How often is weight monitored? %				0.270
Not monitored	4.7	4.9	4.4	
Every week	4.7	4.2	5.6	
Every month	64.4	65.0	65.5	
When situation of patient changes	23.0	23.1	21.2	
Unknown	3.3	4.9	3.3	
How often is intake monitored? %				0.213
Not monitored	12.0	12.4	12.9	
Every day	18.9	17.7	20.7	
Every week	1.7	1.5	1.5	
When situation of patient changes	63.1	63.6	60.3	
Unknown	4.3	4.7	4.6	
Preventive and treatment measures %				
Dietician consulted	23.8	9.8	61.8	<0.0001
Energy (protein) enriched diet	6.1	11.7	14.6	<0.0001
Energy-enriched rations provided between meals	9.8	30.5	18.4	<0.0001
Supplementary oral nutrition (liquid, nutrition and supplements)	9.8	13.8	19.6	<0.0001
Feeding by intubation	0.9	4.9	4.7	<0.0001
Intravenous feeding	0.2	1.6	1.9	<0.0001
Adjusted consistency	12.4	11.7	11.6	0.476
Maximum required fluid intake	62.1	80.9	48.1	<0.0001

Process indicators and patient characteristics related to malnutrition

Since the process indicators were all related to (a risk of) malnutrition, in the multiple regression analyses all process indicators which showed a significant difference between the countries were included in the multiple logistic GEE analyses in order to build the association model (Table 6.3).

After entering the process indicators step-by-step in the model, the final multiple regression model (corrected model 1, see Table 6.3) showed that the following process indicators were related to malnutrition: (a) *energy-enriched rations provided between meals, (b) dietician consulted, (c) nutritional status is screened at admission, (d)*

intravenous feeding, (e) maximum required fluid intake, (f) supplementary oral nutrition, (g) feeding by intubation.

Table 6.3 GEE Analyses (association model)

	B1*	B2**	CI 95% B1***	CI 95% B2****	p-value B1	p-value B2
Uncorrected model	-0.289	-0.128	-0.408 – -0.170	-0.217 – -0.039	<0.0001	0.005
Corrected model 1[a]	0.042	0.143	-0.106 – 0.190	0.027 – 0.258	0.582	0.016

* B1 = Comparing Austria to the Netherlands; ** B2 = Comparing Germany to the Netherlands; *** CI 95% B1 = Confidence Interval B1; **** CI 95% B2 = Confidence Interval B2; [a] Corrected model 1 includes variables: energy-enriched rations provided between meals, dietician consulted, nutritional status is screened at admission, intravenous feeding, maximum required fluid intake, supplementary oral nutrition, feeding by intubation

For the Netherlands and Austria counts that after controlling for these variables there is no significant difference anymore in prevalence of malnutrition, which means that the variables (a) *enriched rations provided between meals, (b) dietician consulted, (c) nutritional status is screened at admission, (d) intravenous feeding, (e) maximum required fluid intake, (f) supplementary oral nutrition and (g) feeding by intubation* explain the differences in malnutrition prevalence between the Netherlands and Austria.

After controlling for these variables (see Table 6.4) in the final multivariate model (corrected model 1) there is still a significant difference between the Netherlands and Germany which means that these process indicators of nutritional care do not explain completely the difference in malnutrition between the Netherlands and Germany.

After adding the resident characteristics (care dependency, age, gender, mean number of diseases and specific diseases (see Table 6.4)) to the corrected model 1 (model correcting for process indicators), it shows that there is no significant difference anymore in malnutrition prevalence between the Netherlands and Germany. So these resident characteristics together with the found process indicators of nutritional care explain the differences in malnutrition prevalence between the Netherlands and Germany.

The odds ratios in the uncorrected model are 1.137 (NL-G) and 1.335 (NL-A) which means that the risk of getting malnourished is bigger in both Germany and Austria compared to the Netherlands. When adding the process indicators to the model the odds ratios decrease, resulting in respectively 0.867 and 0.959 which means that the risk of getting malnourished is smaller in both Germany and Austria. This is the same when adding the resident characteristics to the corrected model 1 (see Table 6.4) in both countries.

Table 6.4 Odds ratio of malnutrition in the Netherlands, Germany and Austria controlling for influencing process indicators for nutritional care and resident characteristics

	p-value	OR**	CI 95%***
Univariate			
The Netherlands*			
Germany	0.005	1.137	1.040-1.242
Austria	0.0001	1.335	1.186-1.504
Model 1 Multivariate[a]			
The Netherlands			
Germany	0.018	0.867	0.771–0.976
Austria	0.577	0.959	0.829–1.110
Model 2 Multivariate[b]			
The Netherlands			
Germany	0.278	0.933	0.824–1.057
Austria	0.155	0.897	0.772–1.042

* Reference group; ** OR = Odds Ratio; *** CI 95% = Confidence Interval; [a] Model 1 includes variables: energy-enriched rations provided between meals, dietician called in, nutritional status is screened at admission, intravenous feeding, maximum required fluid intake, supplementary oral nutrition, feeding by intubation; [b] Model 2 includes variables: energy-enriched rations provided between meals, dietician called in, nutritional status is screened at admission, intravenous feeding, maximum required fluid intake, supplementary oral nutrition, feeding by intubation and care dependency, age, gender, mean number of diseases and specific diseases: cardiovascular disease, diseases of the digestive tract, dementia, diabetes mellitus, respiratory disorders, and other non-specified diseases

DISCUSSION

In this study we explored which process indicators of nutritional care and resident characteristics possibly explain differences in malnutrition prevalence in Dutch, German and Austrian nursing home residents. There was a significant difference in prevalence of malnutrition between the countries ($p<0.0001$). This is similar to studies done by Volkert *et al.* (2011) and Bartholomeyczik *et al.* (2010) in Germany and Schönherr *et al*. (2012) in Austria.

Our study showed that there was no difference between the countries in preventive measures like monitoring weight and intake, whereas the screening of nutritional status at admission differed significantly. In Germany and Austria almost all residents were screened at admission (respectively 98.2% and 92.8%) whereas in the Netherlands this was only the case in about half of all residents (48.3%). Meijers *et al.* (2014) found similar results in a study in the Netherlands (2009 44% and 2010 45%) and a study of Schönherr *et al.* (2012) revealed the same in Austrian nursing homes (93.4%).

All treatment measures differed significantly between the countries except for adjusting the consistency of food. The treatment measure that was used mostly in Austria was consulting a dietician (61.8%) while in the Netherlands and Germany the most frequently used treatment was checking whether the resident had the maximum of fluid intake required (62.1% and 80.9%).

The multiple regression analyses show that the following process indicators were related to malnutrition: (a) *energy-enriched rations provided between meals, (b) dietician consulted, (c) nutritional status is screened at admission, (d) intravenous feeding, (e) maximum required fluid intake and (f) supplementary oral nutrition and (g) feeding by intubation.* These variables explained the statistical significant difference in malnutrition between the Netherlands and Austria but not between the Netherlands and Germany.

In a study of O'Flynn *et al.* (2005) it is stated that to prevent an increase of malnutrition prevalence the implementation of nutritional care strategies such as altering the catering services and nutritional screening and education have shown their effectiveness. Nutritional screening is crucial to identify malnutrition or the risk for malnutrition. Dieticians play an important role in fighting malnutrition. Dieticians can bridge the gap between nutritional knowledge and nutritional care to improve the nutritional status and quality of life of elderly (Chwang 2012).

The focus in managing malnutrition is offering enough food choices and high calorie food followed by caloric supplements in between meals (Morley 2012). Our findings are in line with this vision.

Providing energy-enriched diet and supplements between meals was associated to malnutrition prevalence and explained the found differences in malnutrition prevalence between the Netherlands and Austria.

The difference between the Netherlands and Germany was additionally explained by resident characteristics. So the process indicators of nutritional care from the association model and resident characteristics (care dependency, age, gender, mean number of diseases and specific diseases) found in Van Nie *et al.* (2013a) explain together the found differences in malnutrition prevalence between the Netherlands and Germany.

Why process indicators of nutritional care mainly explain the differences in malnutrition prevalence between the Netherlands and Austria and why resident characteristics are crucial in eliminating the difference in prevalence of malnutrition between the Netherlands and Germany is hard to explain with our results due to the design of the study (cross-sectional prevalence study). Further research is needed in this field. Probably other factors like the structure of healthcare in the different countries, cultural differences and education and level of nursing staff may play a role as well.

Conclusion

Process indicators of nutritional care as providing energy-enriched rations between meals, calling in a dietician, screening of nutritional status at admission, intravenous feeding, providing the maximum required amount of fluid, supplementary oral nutrition and feeding by intubation explain the differences in malnutrition prevalence between the Netherlands and Austria but not completely the differences between the Netherlands and Germany. Besides process indicators of nutritional care also resident

characteristics explain the differences in malnutrition prevalence between the Netherlands and Germany. The rationale behind this finding has to be investigated more in depth in future studies

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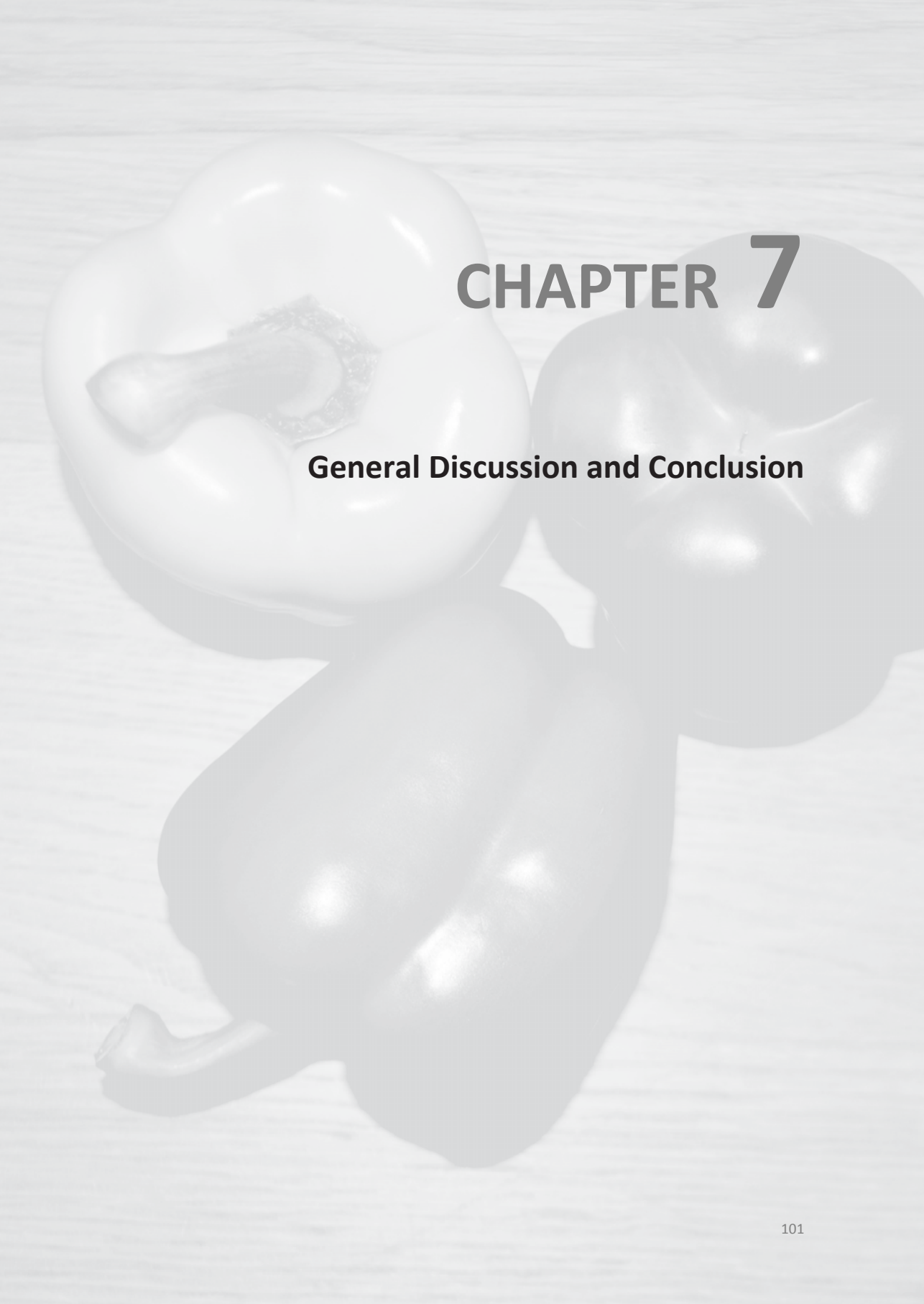

CHAPTER 7

General Discussion and Conclusion

INTRODUCTION

A considerable percentage of frail and disabled older people (10–85%) suffer from malnutrition (Donini *et al*. 2007, Gaskill *et al*. 2008). In European nursing homes, the prevalence rates range between 17% and 85% (Volkert *et al*. 2004, Pauly *et al*. 2007, Tannen *et al*. 2008, Meijers *et al*. 2009, Valentini *et al*. 2009). It is expected that malnutrition will continue to be a serious healthcare problem in Europe since the population is ageing progressively. Therefore insight in influencing factors of malnutrition prevalence is needed.

This thesis focuses on malnutrition in nursing home residents in the Netherlands, Germany and Austria. The relation between resident characteristics, structure and process indicators of nutritional care and malnutrition prevalence in nursing home residents in these three countries has been studied by analysing data from LPZ-international. In the overall study, it has been explored if the outcome of malnutrition prevalence is influenced by differences in structure and process indicators of nutritional care or whether the outcome is the result of differences in characteristics of nursing home residents in the Netherlands, Germany and Austria. The methodology of the LPZ-international study has been described in detail in the first part of the thesis (chapter 2).

This chapter summarises the study results and provides a theoretical reflection as well as a methodological consideration and finally gives implications for future research and practice.

SUMMARY OF RESULTS

Structure, process and outcome indicators of nutritional care in Dutch and German nursing homes

In the first study, described in chapter 3, data from the Netherlands and Germany were analysed in order to get insight in the differences between these two countries in the prevalence of malnutrition and in the structure and process indicators of nutritional care. This study showed the relevance of a study like this and acted as a basis for our further studies. Almost 27% of the residents in both countries were malnourished.

Although Dutch residents were significantly more often at risk of malnutrition, no significant difference was found in the actual prevalence of malnutrition between both countries. However differences were found in process and structure indicators. Almost all German residents underwent a nutritional screening at admission, while in the Netherlands this was done in 75% of the residents. The German nutritional screening involved more diagnostic items. If a resident was malnourished, dieticians were consulted four times more often in the Netherlands than in Germany, while nutritional interventions, such as energy-enriched snacks between meals and tube or parenteral

feeding were undertaken more often in Germany. At institutional level, two indicators for nutritional care differed between both countries. Dutch institutions employ more often a dietician, but they provide lesser education to the healthcare workers than in German institutions.
Summarizing these results, German residents had a somewhat better nutritional status (less risk of malnutrition), and more is done to enhance this status. Yet, both populations were not completely comparable. German residents showed more co-morbidity and a longer length of stay, although they were less care-dependent.
Although the Dutch and German healthcare systems do not show many differences (Tannen *et al*. 2006), our study suggests that in Germany more attention is paid to the primary care process (more often screening and interventions) than in the Netherlands. However, also the differences in resident characteristics as well as cultural and organisational variations between both countries may explain the differences we found in our study.
The study in chapter 3 was the first international, uniformly conducted multi-centre study on the prevalence of malnutrition and related structure and process indicators in Dutch and German nursing homes. There is one other international study on this subject, by Valentini *et al.* (2009) but that study focuses mainly on screening and prevalence of malnutrition and does not address structural and other process indicators as our study did.
Therefore, additional insight is needed in which indicators influence malnutrition prevalence in order to prevent and treat malnutrition and optimise nutritional care in nursing homes in Europe.

Structure, process and outcome indicators in Dutch, German and Austrian nursing homes

In the next three studies (chapter 4 to 6) an adapted model (see figure 7.1) on quality of care by Donabedian (1988) was studied by using data collected by LPZ-International in 2009 and 2010 in the Netherlands, Germany and Austria.
In our model structure indicators of nutritional care are operationalised by: (a) criteria for malnutrition are defined, (b) the presence of a guideline to prevent and treat malnutrition, (c) malnourished residents are structurally discussed in a multidisciplinary team, (d) dieticians are employed in the institution, (e) the presence of an information brochure for residents, (f) staff is trained regularly on the subject of malnutrition prevention and treatment, (g) the wards register residents that are at risk of malnutrition, (h) the outcome of the nutritional assessment, and (i) the used preventive and treatment measures for each resident are registered in their file.
Process indicators of nutritional care in our model are: (a) do institutions screen residents for malnutrition at admission? (b) do wards monitor weight and dietary intake and (c) how frequent do they do that? and, (d) what are the used measures in case of malnutrition?

Furthermore we added resident characteristics to the model (age, gender, care dependency and comorbidity).

Malnutrition prevalence is the outcome indicator in our model and operationalised by the definition of Meijers *et al*. (2010): (1) Body Mass Index (BMI) ≤18.5 (age 18-65) or BMI≤20 (age>65), (2) unintentional weight loss (more than 6 kg in the previous six month or more than 3 kg in the last month) and (3) no nutritional intake for three days or reduced intake for more than ten days combined with a BMI between 18.5 and 20 (age 18-65) or between 20 and 23.9 (age>65). Residents are malnourished if they meet one of these criteria.
In addition, in the subsequent data analyses, an analytic association model was built in order to find influencing factors (structural, process indicators and resident characteristics) of malnutrition prevalence in nursing home residents in the Netherlands, Germany and Austria.

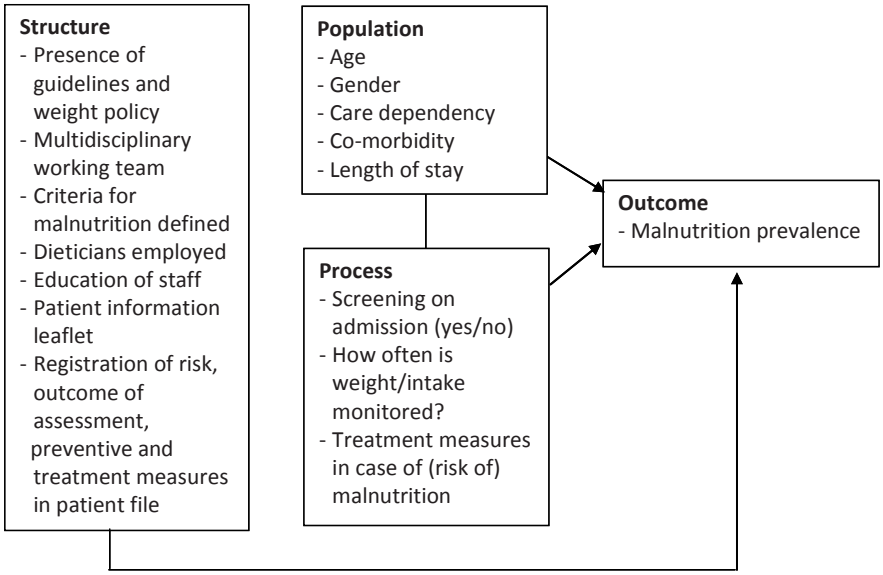

Figure 7.1 Modified quality model of Donabedian used in this thesis

Response

The analyses of the three studies included 214 nursing homes with 19,876 residents; 133 nursing homes from the Netherlands (n=14,123), 61 nursing homes from Germany (n=3,973) and 20 nursing homes from Austria (n=1,780). The response rate was

significantly higher in the Netherlands (92.9%) than in Germany (82.9%) and Austria (80.8%). The reasons for not taking part in the measurement were refusing to participate (64.3%), not being available at the ward (27%), being comatose or too ill (5.7) and/or being terminal (3.0%). Furthermore the population in the Netherlands was substantially larger due to the fact that institutions are used to take part in the measurement of the LPZ. Since 2004 healthcare institutions in the Netherlands have already been invited to take part in the malnutrition measurement of LPZ.

Malnutrition prevalence

The prevalence of malnutrition as measured in the studies described in chapter 4, 5 and 6 differs significantly between the three countries. In Germany and Austria the prevalence is somewhat higher than in the Netherlands (respectively 20.0% and 22.7% versus 18.0%). These prevalence findings are within the range of earlier internationally reported malnutrition prevalence rates. Data collected by the nutritionDay survey showed a malnutrition prevalence of 16.7% in nursing home residents in Germany (Valentini *et al*. 2009). A study by Tannen *et al*. (2008) showed comparable rates (15.1%) collected in German nursing homes. Furthermore a study of Stange *et al*. (2013) revealed that 18.2% of the German nursing home residents ware malnourished whereas a study of Suominen *et al*. (2005) found a prevalence rate of 29% in Finnish nursing homes. A somewhat higher prevalence rate (38.6%) was found by Crogan and Pasvogel (2003). A study in different aged care residents in Australia showed a much higher prevalence rate. The prevalence of malnutrition across these facilities varied from 31.8 to 72.1% (Gaskill *et al*. 2008).
Differences in malnutrition prevalence between countries can be explained by differences in the operationalisation of malnutrition. In our studies we used in all countries the same definition, namely the definition of Meijers *et al*. (2010) operationalised by BMI, intake and weight loss.
In addition, the Health Council of the Netherlands (2011) recently published a report on malnutrition in the elderly concluding that weight loss should be defined by a percentage of weight loss instead of weight loss in kg. Based on this advice, LPZ-International changed the operationalisation of weight loss from kg to percentage in 2013.

Resident characteristics

Our first study (chapter 4) showed that residents of the three countries differed in gender, age, length of stay, care dependency, mean number of disease and in some specific diagnoses.
Dutch residents were more often male, had a shorter mean length of stay, were less dependent of care and had fewer diseases than residents in Germany and Austria.
The most prevalent diseases in all three countries were dementia, cardiovascular diseases and motor disorders.

Chapter 4 showed that some resident characteristics are related to malnutrition. Malnourished residents have more diseases, are older, more care dependent and more often female than those being not malnourished. Furthermore a significant difference was found between malnourished and not malnourished residents concerning the kind of prevalent diseases for example infectious diseases, cancer, diabetes mellitus, blood diseases, dementia, diseases of the digestive tract, injuries resulting from accidents and total hip replacement. The two largest confounders for malnutrition prevalence were being care dependent and having a cardiovascular disease.
Other studies also show that malnourished residents in general are more care dependent and have more often a cardiovascular disease (Colin-Ramirez *et al*. 2011, The *et al*. 2010). Other confounders found in our study on resident characteristics, such as comorbidity and having a disease of the digestive tract and respiratory disorders are also found in other studies (Oliveira *et al*. 2009, Hickson 2006). Some studies also show that female nursing home residents are more at risk of getting malnourished (Suominen *et al*. 2005). Gaskill *et al*. (2008) found a relation between malnutrition and an increased age and high level of care needs. Suominen *et al*. (2005) reported similar resident related factors that may explain malnutrition in nursing home residents in Finland. Impaired functioning, swallowing difficulties, dementia and constipation are associated with being malnourished. From our study we can conclude that resident characteristics as gender, age and comorbidity do influence differences in malnutrition prevalence rates between the Netherlands and Germany and the Netherlands and Austria. After controlling for these resident characteristics (care dependency, cardio vascular disease, diseases of the digestive tract, age, dementia, diabetes mellitus, gender, mean number of diseases, respiratory diseases and other not specified diseases) no significant difference in malnutrition prevalence between the Netherlands and Germany and the Netherlands and Austria was found.

Structural quality indicators

In chapter 5 the influence of structural indicators of nutritional care on malnutrition in nursing homes in the Netherlands, Germany and Austria were analysed. All structural quality indicators at institution and ward level differed significantly between the three countries. However the only indicator at institution level that showed a relation to malnutrition prevalence involved whether a refresher course for caregivers had been organized over the last two years on prevention and treatment of malnutrition. At ward level ten out of thirteen indicators showed a relationship with malnutrition prevalence including: (a) the policy of structurally discussing residents at risk of malnutrition or malnourished residents in a multidisciplinary team, (b) the existence of a standard procedure at admission of measuring weight, (c) height and (d) nutritional status, (e) having a specialized nurse at the ward, (f) having a standard policy to register the outcome of the risk assessment for malnutrition and (g) the intake of each resident, (h) the registration in each resident file of the specific activities that have to be

undertaken for residents at risk of malnutrition or malnourished residents, (i) taking mealtime ambiance into account and (j) the provision of protein- and energy-enriched diet in case of (expected) malnutrition.
A plausible and logical explanation for the fact that hardly any quality indicators at institutional level showed a relationship to malnutrition prevalence could be that static structural quality indicators at institutional level, such as having protocols at institutional level might be less influential in changing practice outcomes than structural quality indicators at ward level, which probably are more closely linked to actual care processes and more in line with daily practice.
Further analyses revealed that the structural quality indicators of nutritional care were of no importance in explaining the difference in malnutrition prevalence between the Netherlands and Austria. However when controlling for these structural quality indicators at ward level the difference between the Netherlands and Germany in malnutrition prevalence rate was eliminated. These structural quality indicators at ward level (a) the care file includes an assessment as to the risk of malnutrition for each resident, (b) the care file includes the intake for each resident, (c) in case of (expected) malnutrition a protein- and energy-enriched diet is provided at the ward as a matter of standard procedure, (d) at least one nurse at the ward is specialised in the area of malnutrition and (e) the nutritional status is assessed upon admission are important in influencing malnutrition prevalence rates in these two countries. It remains unclear why these indicators were important in the difference in malnutrition prevalence between the Netherlands and Germany and not between the Netherlands and Austria.
Studies like the review of Arvanitakis *et al*. (2009) have indicated that the five structural indicators we found in our study are important. To be able to prevent and treat malnutrition it is important to use a nutritional screening instrument at admission (Elia *et al*. 2005, Konrup *et al*. 2003) and to register the result of a malnutrition assessment as well as the food intake of patients. Other studies show that providing a protein- and energy-enriched diet as a matter of standard procedure may decrease malnutrition prevalence as well (Stratton & Elia 2000). Furthermore having a nurse specialist in malnutrition at the ward may contribute to a reduction of malnutrition prevalence (Rao 2013, Gaskill *et al*. 2009).

Process indicators

In Chapter 6 the influence of process indicators was investigated. This study showed that there was no difference between the countries in measures taken to prevent malnutrition, like monitoring weight and intake. Only the frequency of screening of the nutritional status at admission differed significantly. Meijers *et al*. (2013) found similar results in a study in the Netherlands and a study of Schönherr *et al*. (2012) revealed the same in Austrian nursing homes.
All treatment measures undertaken, differed significantly between the countries except for adjusting the consistency of food.

Multiple regression analyses showed that the following process indicators were related to malnutrition prevalence: (a) protein- and energy-enriched rations provided between meals, (b) consulting a dietician, (c) nutritional status screened at admission, (d) intravenous feeding, (e) taking care of maximum required fluid intake, (f) supplementary oral nutrition and (g) tube feeding. In a study of O'Flynn *et al*. (2005) it is stated that to prevent an increase of malnutrition prevalence, the implementation of nutritional care strategies such as altering the catering services and nutritional screening and education have shown their effectiveness. Nutritional screening is crucial to identify malnutrition or to assess the risk of malnutrition. Dieticians play an important role in fighting malnutrition. Dieticians can bridge the gap between knowledge on nutrition and nutritional care, to improve the nutritional status and quality of life of elderly (Chwang 2012).
Our analyses showed that variables as providing enriched rations between meals, consulting a dietician, screening of nutritional status at admission, intravenous feeding, taking care of maximum required fluid intake, supplementary oral nutrition and tube feeding explained the difference in malnutrition prevalence between the Netherlands and Austria but not between the Netherlands and Germany. Further analyses showed that the difference in malnutrition prevalence between the Netherlands and Germany was mainly explained by resident characteristics as found in chapter 4 (care dependency, age, gender, mean number of diseases and specific diseases). Resident characteristics together with the process indicators of nutritional care explain the difference in malnutrition prevalence between the Netherlands and Germany.

METHODOLOGICAL CONSIDERATIONS AND LIMITATIONS

Design

LPZ-International is a cross-sectional annual study; therefore, nothing can be said about the causality of relations. For this incidence studies are necessary. However incidence measurements are costly and labour intensive. To assess the impact of a problem and subsequent needs within a population, prevalence measurements are preferred. Prevalence is in fact the product of incidence and the average duration (Rothman and Greenland 1998, Freemen 2002), and therefore in this case a more relevant measure than incidence. Furthermore prevalence can be measured on a much broader scale than incidence, since this requires daily observation and registration. Therefore a prevalence measurement is much more suitable for investigating the size of a care problem, as measured in the LPZ-International.

Instrument

The instrument used in our study was originally developed in the Netherlands based on a state of the art, literature search and by consulting experts/expert panels (Meijers *et*

al. 2010). It involves structure indicators of nutritional care, preventive and treatment measures and resident characteristics.
Although the questionnaire used in the different countries is identical, the questionnaire is filled out by the measurers from the perspective of country specific standards and habits. For example when no national guideline is available, institutions may refer to their own standards in answering the question if there is a protocol or guideline available in the institution or at the ward. Additionally not all structural indicators are of the same importance to countries. For example in Germany, nursing homes are not used to employ dieticians, but they consult dieticians from private practices. Furthermore in contrast to the Netherlands and Germany, there is no national protocol or guideline in Austria to prevent or treat malnutrition yet and institutions are used to follow their own guideline when available. In interpreting the data we have taken into account these country specific differences.
In our study we focussed on structural quality indicators related to the policy of nutritional care. In the original model of Donabedian (1988) structure indicators are described as organizational structure, material resources (environment, technology, tools) and human resources (number and quality of care givers, education of care giver, care giver tasks). In our measurement organisational and material resources were not included which may play a role in influencing malnutrition prevalence as well as the confounders we found in our analyses.
Furthermore we did not analyse any data on the size of the nursing homes. Large nursing homes might have more and better resourses to secure structural quality indicators of nutritional care. On the other hand small nursing homes might benefit from their smaller size due to shorter communication lines and more control.
Another issue is that not all care problems detected in patients, have been developed in the organisations themselves, and therefore cannot be regarded as a direct result of the quality of care of the institution. Therefore, for each care problem a question was included whether the care problem has been developed in the institution itself or elsewhere. In this way the nosocomial prevalence can be calculated, which gives a more valid indication.

Sample

In all studies, data were analysed with different sample sizes per country. The Dutch sample is the largest because nursing homes are used to take part in this measurement for already a very long time. Since 1998 all Dutch nursing homes are invited to take part in the LPZ measurement.
Unfortunately we are not able to calculate the actual response rate of nursing homes per country. From national statistical overviews of healthcare institutions in the three countries it is not clear how many nursing homes there are exactly in the three participating countries. Since some years nursing homes in many countries are organized in a different way. Nowadays nursing homes from a certain area can be

gathered in large corporations. Statistics are not clear in the way they count the amount of nursing homes (e.g. the small nursing homes one by one or as belonging to large corporations). The included sample, therefore, was an at random/convenience sample from all nursing homes in the three countries.
The response rate of residents differs also between the countries. This can mainly be explained by the way informed consent is collected. According to the decisions of the medical ethical committees, in the Netherlands residents had to give only their oral informed consent, whereas the residents from Germany and Austria had to give a written consent.
While institutions participate voluntary, no information is available about the degree of representativeness of the samples and if results can be generalized per country. However, getting a representative prevalence figure for the three countries was not the goal of our study. The goal was to investigate factors influencing malnutrition prevalence between the countries, and for this representativeness is not necessary. More important is that the organisations represent the wide range of answer possibilities in the measurement.
Participation in LPZ-International is voluntary and organizations have to pay to participate in the audit annually as mentioned above. As a result maybe only institutions participate who have already a higher quality of care, because they are really interested in their quality of care. At the other hand, one could argue that especially those institutions participate which want to improve their quality of care regarding malnutrition.

Data collection

Performing an (inter)national study, it is always difficult to control whether the measurement is performed totally in a 100% uniform way. Therefore, to improve the collection of reliable and valid data, all institutional coordinators were trained collectively and provided with the study protocol and training material to train their own personnel in how to perform the measurement. Institutions were asked to measure on one and the same day and to include all wards and residents that were present at the day of the measurement.
In addition, to enhance reliability, each resident was assessed by two healthcare professionals; one working at the resident's ward and one from another ward. Interrater reliability has been tested for hospitals, nursing homes and home care, and found to be good (Cohen's k of 0.87) (Kottner *et al*. 2009, Meijers *et al.* 2009b, Meijers *et al*. 2009c).

IMPLICATIONS FOR FUTURE RESEARCH

Malnutrition is a serious problem in nursing homes in the Netherlands, Germany and Austria since one out of five nursing home residents is malnourished. Our studies revealed that a lot of factors influence malnutrition prevalence rates. Older and female residents are more at risk of getting malnourished. Comorbidity also influences malnutrition prevalence. Furthermore structural and process factors of nutritional care are of influence whether a resident gets malnourished or not. Based on the results of our studies we recommend further research into the influence of process and structure indicators of nutritional care by performing a longitudinal exploratory study, analogue to for instance Meesterberends *et al*. (2013).

Moreover, in future intervention studies, structure and process indicators can be implemented and followed over time to get insight in the real effects of adapting nutritional care policy and preventive and treatment measures.

Furthermore future research can reveal other structure factors that might influence malnutrition prevalence. Factors like educational level of staff, number of staff, kind and organisational structure of institution, size of institution but also other differences in resident populations may influence malnutrition prevalence rates in institutions and between countries. Population differences and population size are important when comparing countries. To get more insight into possible causes of differences in malnutrition prevalence and its influencing factors, data should be corrected for differences in population size and characteristics. In addition, differences in healthcare systems and cultural differences should be taken into account as well.

IMPLICATIONS FOR PRACTICE

From our studies we can conclude that it is important for nursing homes to explicitly pay attention to meeting relevant structural quality indicators of nutritional care on ward level, close to the primary care process. This may enable healthcare professionals directly in performing adequate nutritional care to residents with malnutrition or at risk of malnutrition. More concrete, this means that to decrease malnutrition prevalence rates in nursing home residents, paying attention to the following structural aspects is relevant: taking care of both the availability and implementation of a nutritional guideline as well as regular staff education on ward level, having a standard procedure of measuring weight, height and nutritional status at admission and during nursing home stay, the organisation of a regular discussion of patients at risk of or with malnutrition in multidisciplinary team meetings, paying attention to mealtime ambiance, availability of relevant nutritional interventions and having a standard policy to register relevant nutritional data in the resident files.

With regard to process indicators of nutritional care it is important to implement the main elements of the total nutritional cycle into daily practice. This includes both

nutritional screening and assessment leading to a nutritional diagnosis as well as application of adequate nutritional interventions with subsequent monitoring of their effect.
Since malnutrition is prevalent in one out of five nursing home residents, executing an annual prevalence measurement, such as LPZ-International, is crucial to keep awareness of malnutrition as a very relevant care problem.

CONCLUSION

Measuring the prevalence of care problems and related quality indicators internationally in the same way is a huge step forward to get insight in the quality of basic care in different healthcare settings in different countries. LPZ-International seems to be a good method for this.
An annual, large-scale, multi-country and multi-centre study focusing on malnutrition up until now is unusual in Europe. Nevertheless such a study is important to ultimately increase the quality of (nutritional) care Europe wide.
Our study has shown that malnutrition overall is still a considerable problem in nursing home residents. It has become clear that there are differences in malnutrition prevalence between countries, which can be partly explained by resident characteristics and structure and process factors of nutritional care.
Further research is necessary on additional country related factors that might have an influence on malnutrition prevalence and also on relevant interventions that may tackle this relevant care problem in European nursing homes.

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Summary

SUMMARY

For decades, malnutrition has continued to be an important and under-recognised problem in all healthcare settings. In European nursing homes, the prevalence rates of malnutrition range between 2% and 74%. This wide range is partly due to differences in actual prevalence rates, but also by differences in the way malnutrition is defined and the way malnutrition is measured. Prevalence studies show differences in study populations, care home settings and measurement instruments used. Malnutrition refers to negative deviations from a normal nutritional status and has been defined as an inadequate nutritional status, undernourishment due to poor dietary intake, poor appetite, muscle wasting and weight loss. It is a nutritional condition in which an insufficient or disproportionate intake of energy, protein, and other nutrients adversely affects tissue/body form (shape, size and composition) and function, and clinical outcomes. Malnutrition increases the risk of medical complications, weakens the immune function, leading to a higher risk of infections and impairs wound healing. Moreover, malnutrition impairs quality of life, increases length of hospital stay and costs of healthcare.

Age, gender, morbidity and care dependency, as well as infections, physical disabilities and polypharmacy are related to malnutrition. Furthermore characteristics of healthcare systems in different countries affect the way nutritional care is organised and therefore also influence malnutrition prevalence.

To assess quality of care integrally, the model of Donabedian is a useful and proven instrument. The model states that it is essential to focus on structural and process indicators and on outcome as well. According to Donabedian, an improvement in structure and process of care may lead to better outcomes. The model offers a good basis to develop a relevant measurement instrument to assess the quality of care.

In this thesis data from the LPZ-International study are used in order to answer the central question: Is there a difference in malnutrition prevalence and in quality indicators related to structure and process of nutritional care in nursing homes between the Netherlands, Germany and Austria? Furthermore we have also examined whether malnutrition prevalence is influenced by differences in structure and process indicators of nutritional care in these countries or if the prevalence rate is the result of differences in characteristics of nursing home residents in the Netherlands, Germany and Austria. The measurement instrument used in LPZ-International has been developed according to the framework of Donabedian.

Chapter 1 of this thesis is a general introduction dealing with malnutrition and the quality of care in nursing homes, but it also describes the aim and outlines of our study, as well as the research questions posed.

In **chapter 2** the overall study design of LPZ-International is described. It involves the design of an international multi-country study on the prevalence of care problems in different healthcare sectors (hospitals, care homes, home care) in different countries (the Netherlands, Austria, Switzerland and New Zealand), including pressure ulcers,

malnutrition, falls, use of restraints and incontinence. The study includes prevalence rates as representatives of *healthcare outcomes* and incorporates both *structural aspects of care*, for example the availability of enough and adequately skilled personnel, equipment and guidelines *and process factors of care*, including the preventive measures and treatment interventions undertaken to deal with the care problems mentioned above.

In the studies described in this thesis we only use data on malnutrition in nursing home residents in the Netherlands, Germany and Austria. At the time Chapter 2 was written, Germany had withdrawn from LPZ-International and therefore is not mentioned in the design article. However the earlier performed measurements in Germany (2008, 2009 and 2010) have been executed following the same methodology as described in the design article (chapter 2).

The first study with data from LPZ-International is presented in **chapter 3**. This comparative study investigates possible differences in malnutrition prevalence rates in Dutch and German nursing home residents. It provides insight into the screening, prevention and treatment of malnutrition and the indicators for nutritional care policy.

Resident characteristics differed significantly between the two countries. Dutch residents were more often male, younger, more care-dependent and significantly more at risk of malnutrition. However, actual malnutrition prevalence rates did not differ significantly. All German residents were screened at admission, whereas this only was the case in 73.1% of the Dutch residents. Nutritional screening tools were used in 38.0% of the Dutch residents and 42.1% of the German residents. A dietician was consulted for 36.7% of the Dutch and 9.3% of the German malnourished residents. The proportion of malnourished residents receiving nutritional intervention was larger in Germany than in the Netherlands. Structural indicators for nutritional policy were fulfilled more often in the Netherlands at institutional level whereas in Germany they were fulfilled more often at ward level. Finally, it was concluded that German residents had a somewhat better nutritional status than Dutch residents and that more efforts are done to enhance the nutritional status of German residents.

In **chapters 4, 5 and 6** the influence of all components of the adapted quality model of Donabedian on the prevalence of malnutrition was analysed separately (resident characteristics, structure and process indicators of nutritional care). The influence of resident characteristics, structure and process indicators of nutritional care on the prevalence of malnutrition were investigated using univariate logistic Generalized Estimating Equation (GEE) regression analysis in order to build an association model.

Chapter 4 describes a cross-sectional, multi-centre study measuring malnutrition in nursing home residents from the Netherlands, Germany and Austria. The aim of this study was to investigate whether resident characteristics influence possible differences in malnutrition prevalence between countries. The prevalence of malnutrition in the Netherlands, Germany and Austria was respectively 18.0%, 20.0% and 22.7%. The multivariate GEE logistic regression analysis showed that gender, age, care dependency, the mean number of diseases and some specific diseases are influencing factors for

whether a resident is malnourished or not. The odds ratio of malnutrition in the three countries declined after including the influencing factors resulting from the multivariate GEE analysis.

The study revealed that differences in malnutrition prevalence rates in nursing homes in the Netherlands, Germany and Austria are influenced by various resident characteristics. Since other country related factors might also play an important role in influencing differences in malnutrition prevalence rates between countries (structure and process factors of malnutrition care policy), we recommend investigating these factors in future studies.

In **chapter 5** the same data were used as in the study presented in chapter 4. However the aim of this study was to explore whether structural quality indicators of nutritional care influence malnutrition prevalence in the Netherlands, Germany and Austria. Five structural quality indicators of nutritional care: (1) the care file includes an assessment as to the risk of malnutrition for each client, (2) the care file includes the intake for each client, (3) in case of (expected) malnutrition, a protein-and energy-enriched diet is provided in the ward as a matter of standard procedure, (4) at least one nurse in the ward is specialised in the area of malnutrition and (5) the nutritional status is assessed upon admission, were related to malnutrition and explain malnutrition prevalence variance between the Netherlands and Germany. However, the differences between the malnutrition prevalence rates of the Netherlands and Austria still existed after controlling for these structural quality indicators.

The study described in **chapter 6** focused on process indicators of nutritional care and resident characteristics, using the same data set as in the studies described in chapter 4 and 5. Process indicators of nutritional care were measured by questions about the prevention and treatment of malnutrition. Three questions on prevention were asked: *Was the patient screened at admission, how often is weight monitored and how often is intake monitored.* Furthermore one multicomponent question was asked about the treatment of malnourished residents (consulting a dietician, providing energy/protein-enriched diet, providing energy-enriched rations between meals, oral nutritional support and tube feeding). The multiple regression analyses showed that the following process indicators were related to malnutrition: *energy-enriched rations provided between meals, consulting a dietician, nutritional status is screened at admission, intravenous feeding, maximum required fluid intake, supplementary oral nutrition and feeding by intubation.* These variables explained the statistically significant difference in malnutrition prevalence between the Netherlands and Austria but not between the Netherlands and Germany. The difference between the Netherlands and Germany could additionally be explained by resident characteristics (care dependency, age, gender, mean number of diseases and specific diseases).

The last chapter **(chapter 7)** of this thesis includes a general discussion reflecting on the main findings of all studies described in the thesis. An annual, large-scale, multi-country and multi-centre study focusing on malnutrition in different health care settings is rather new in Europe. Such a study is important to ultimately increase the quality of

(nutritional) care in health care Europe wide, which is really necessary because this thesis again and clearly reveals that malnutrition is still a considerable problem in nursing home residents, since in all three countries one out of five residents was malnourished. LPZ-International seems to be a good method/instrument for this. The differences in malnutrition prevalence between the countries can be partly explained by differences in both resident characteristics and in structure and process indicators of nutritional care.

Based on the results of our studies we recommend further research into the influence of process and structure indicators of nutritional care by performing a longitudinal exploratory study. In future intervention studies, structure and process indicators can be implemented and followed over time to get insight in the real effects of adapting nutritional care policy and preventive and treatment measures.

Since we did not focus on all structural indicators of the Donabedian model future research could focus on factors like educational level of staff, number of staff, kind and organisational structure of institutions, size of institutions but also on other relevant differences in resident populations. Population differences and population size are important when comparing countries. To get more insight into possible causes of differences in malnutrition prevalence and its influencing factors, data should be corrected for differences in population size and characteristics like age, length of stay and morbidity. In addition, differences in healthcare systems and cultural differences should be taken into account as well, for example by assessing culturally depended eating habits.

From our studies we can conclude that it is important for nursing homes to explicitly pay attention to meeting relevant structural quality indicators of nutritional care on ward level, close to the primary care process. This may enable healthcare professionals directly in performing adequate nutritional care for residents with malnutrition or at risk of malnutrition. More concrete, this means that to decrease malnutrition prevalence rates in nursing home residents, paying attention to the following structural aspects is relevant: taking care of both the availability and implementation of a nutritional guideline as well as regular staff education on ward level, having a standard procedure of measuring weight, height and nutritional status at admission and during nursing home stay, the organisation of a regular discussion of patients at risk of or with malnutrition in multidisciplinary team meetings, paying attention to mealtime ambiance, availability of relevant nutritional interventions and having a standard policy to register relevant nutritional data in the resident's file.

With regard to process indicators of nutritional care it is important to implement the main elements of the total nutritional cycle into daily practice. This includes both nutritional screening and assessment leading to a nutritional diagnosis as well as application of adequate nutritional interventions with subsequent monitoring of their effects.

Since malnutrition is prevalent in one out of five nursing home residents, executing an annual prevalence measurement, such as LPZ-International, is crucial to keep awareness of malnutrition as a very relevant care problem.

Samenvatting

SAMENVATTING

Ondervoeding is al jaren een onderschat probleem in alle gezondheidzorgsectoren. Vaak wordt ondervoeding niet herkend en blijf behandeling uit. Prevalentiecijfers in Europese verpleeghuizen variëren tussen 2% en 74%. Deze grote spreiding kan zowel verklaard worden door daadwerkelijke verschillen in prevalentiecijfers, maar ook door de verschillende definities van ondervoeding en de verschillende manieren van meten die in studies gehanteerd worden. Verder verschillen onderzoekspopulaties vaak van elkaar en zijn er verschillen tussen verpleeghuizen in de verschillende landen. Ondervoeding kan worden gedefinieerd als een inadequate voedingstoestand door een slecht of ontoereikend dieet, een slechte eetlust en verlies van gewicht. Ondervoeding heeft invloed op de lichaamsomvang en samenstelling, de lichaamsfunctie en ook op de klinische uitkomsten. Ondervoeding heeft een negatieve invloed op het immuunsysteem, verhoogt het risico op infecties en vertraagt de wondgenezing. Verder kan ondervoeding leiden tot een afname van de kwaliteit van leven, tot een langere ziekenhuisopname en daarmee ook evident tot fors hogere kosten van de gezondheidszorg.
Verschillende factoren zijn gerelateerd aan ondervoeding; leeftijd, geslacht, morbiditeit en zorgafhankelijkheid maar ook infecties, immobiliteit en polymedicatie. Ook de wijze waarop de gezondheidszorg in verschillende landen is georganiseerd en het daarmee samenhangende voedingsbeleid in de onderscheiden zorgsectoren hebben een invloed op de prevalentie van ondervoeding.
Het kwaliteitsmodel van Donabedian is een beproefde methode om de kwaliteit van zorg in kaart te brengen. In het model wordt gefocust op structuur- en procesfactoren en op de invloed van deze twee groepen factoren op de uitkomst. Volgens het model van Donabedian leidt een verbetering van structuur en proces tot een betere uitkomst. In dit geval gaat het om structuur- en procesfactoren van de voedingszorg en hun invloed op de uitkomst ‘prevalentie van ondervoeding’.
In dit proefschrift worden gegevens, die verzameld zijn in de internationale LPZ-studie, gebruikt om een antwoord te vinden op de centrale vraag: Is er een verschil in prevalentie van ondervoeding en in structuur- en procesfactoren gerelateerd aan de voedingszorg in verpleeghuizen in Nederland, Duitsland en Oostenrijk? Tevens is onderzocht of de prevalentie van ondervoeding direct beïnvloed wordt door verschillen in structuur- en procesfactoren van voedingszorg in de genoemde landen of dat de prevalentie van ondervoeding voornamelijk wordt beïnvloed door karakteristieken van de verpleeghuisbewoners zelf.
Het model en de theorie achter het model van Donabedian vormen de basis van het meetinstrument dat in de (internationale) LPZ-studie wordt gebruikt.
De algemene inleiding van het proefschrift (**Hoofdstuk 1**) geeft achtergrondinformatie over het zorgprobleem ‘ondervoeding’ enerzijds en (het meten van) de kwaliteit van zorg anderzijds. Verder worden de centrale vraagstelling en de deelvragen per onderzoek weergegeven. Het hoofdstuk besluit met het beschrijven van de opbouw van het proefschrift.

In **hoofdstuk 2** wordt het design van de internationale LPZ-studie beschreven. Het betreft een internationale studie naar zorgproblemen in verschillende sectoren van de gezondheidszorg (ziekenhuizen, verpleeg- en verzorgingshuizen en thuiszorg) in verschillende landen (Nederland, Oostenrijk, Zwitserland en Nieuw Zeeland). Deze zorgproblemen betreffen: decubitus, ondervoeding, vallen, gebruik van vrijheids-beperkende maatregelen en incontinentie. In de LPZ-studie is de uitkomstmaat steeds de prevalentie van deze onderscheiden zorgproblemen. Verder worden zowel structuurfactoren waaronder de aanwezigheid van structureel beleid, voldoende geschoold personeel en equipment en ook procesfactoren zoals de preventieve en behandelingsmaatregelen van de zorgproblemen gemeten.
Voor de onderzoeken in dit proefschrift zijn de data met betrekking tot ondervoeding bij verpleeghuisbewoners in Nederland, Duitsland en Oostenrijk gebruikt. Op het moment dat hoofdstuk 2 werd geschreven had Duitsland zich uit het project teruggetrokken. Echter de metingen die eerder in Duitsland in 2008, 2009 en 2010 waren verricht, zijn uitgevoerd volgens het onderzoeksdesign beschreven in hoofdstuk 2.
In **hoofdstuk 3** worden de eerste analyses van gegevens uit de internationale studie van de LPZ beschreven. In een vergelijkende studie is onderzocht of er verschillen zijn tussen Nederland en Duitsland met betrekking tot de prevalentie van ondervoeding bij verpleeghuisbewoners en ook met betrekking tot de structuur- en procesfactoren van de voedingszorg. Uit deze studie blijkt, dat de populaties uit de twee landen significant van elkaar verschilden. Nederlandse verpleeghuisbewoners waren vaker van het mannelijk geslacht, jonger, meer zorgafhankelijk en hadden een grotere kans op het krijgen van ondervoeding (risico). Tussen de landen was geen verschil in de prevalentie van ondervoeding. Alle Duitse verpleeghuisbewoners werden op ondervoeding gescreend bij opname, terwijl dit het geval was bij 73,1% van de Nederlandse verpleeghuisbewoners. Structurele voedingsscreening werd toegepast bij 38,0% van de Nederlandse verpleeghuisbewoners en bij 42,1% van de bewoners in Duitsland. In Duitsland (9,3%) werd de diëtist minder vaak geraadpleegd dan in Nederland (38%) maar het aantal ondervoede bewoners, dat een voedingsinterventie onderging, was groter. De wijze van organiseren van de voedingszorg wordt gemeten met structuurfactoren op instellings- en afdelingsniveau. Structuurfactoren op instellings-niveau zoals aanwezigheid en het regelmatig actualiseren van een voedingsprotocol en het consulteren van een diëtiste waren in Nederland vaker aanwezig terwijl in Duitsland juist factoren op afdelingsniveau (het wegen van bewoners bij opname en het registreren van voedingsinterventies) vaker aanwezig waren. Uit dit deelonderzoek werd geconcludeerd dat Duitse verpleeghuisbewoners een iets betere voedingsstatus hebben dan Nederlandse verpleeghuisbewoners en ook dat in Duitsland meer gedaan wordt aan voedingszorg om de voedingsstatus van de bewoners te verbeteren.
In de **hoofdstukken 4, 5 and 6** is onderzocht wat de invloed van alle componenten van het model van Donabedian is op de prevalentie van ondervoeding (bewoners-karakteristieken, structuur- en procesfactoren van voedingszorg). Hierbij is gebruik

gemaakt van de analysemethodiek van logistieke regressie analyse (Generalized Estimating Equation (GEE)).

Hoofdstuk 4 beschrijft een cross-sectionele, multi-centre studie waarin de prevalentie van ondervoeding in verpleeghuizen in Nederland, Duitsland en Oostenrijk is gemeten. De doelstelling van het onderzoek was om na te gaan of bewonerskarakteristieken van invloed zijn op eventueel gevonden verschillen in de prevalentie van ondervoeding tussen de landen. De prevalentie van ondervoeding in Nederland, Duitsland en Oostenrijk was respectievelijk 18.0%, 20.0% en 22.7%. Uit de GEE analyse bleek dat geslacht, leeftijd, zorgafhankelijkheid, gemiddeld aantal aandoeningen en ook het hebben van specifieke aandoeningen van invloed zijn op het hebben van ondervoeding. De odds ratio van ondervoeding in de drie landen daalde na de inclusie van deze factoren. Verschillen in prevalentie van ondervoeding tussen de drie landen worden dus deels door deze factoren beïnvloed.

Aangezien ook structuur- en procesfactoren van invloed kunnen zijn op de gevonden verschillen in prevalentie van ondervoeding tussen de landen, is in de volgende twee studies de invloed van deze factoren onderzocht.

In **hoofdstuk 5** zijn dezelfde data gebruikt als in de studie beschreven in hoofdstuk 4. De centrale vraag in deze studie was of structuurfactoren van voedingszorg van invloed zijn op de prevalentie van ondervoeding in Nederland, Duitsland en Oostenrijk. Uit de studie blijkt dat vijf structuurfactoren gerelateerd zijn aan ondervoeding en deels de verschillen in prevalentie tussen de landen verklaren: (1) in het verpleegdossier wordt voor elke cliënt het risico op ondervoeding vastgelegd, (2) in het verpleegdossier/ zorgplan wordt vermeld welke activiteiten ondernomen moeten worden bij cliënten met een risico op ondervoeding, (3) op de afdeling wordt standaard een eiwit- en energieverrijkt dieet verstrekt bij (dreigende) ondervoeding, (4) er is tenminste één persoon op de afdeling die zich gespecialiseerd heeft op het terrein van ondervoeding en (5) de voedingsstatus wordt gescreend bij opname.

Deze factoren verklaren het verschil in prevalentie van ondervoeding tussen Nederland en Duitsland maar niet het gevonden verschil tussen Nederland en Oostenrijk. Tussen deze twee landen lijken dus ook nog andere factoren een rol te spelen.

In **hoofdstuk 6** wordt een studie beschreven naar de invloed van procesfactoren en bewonerskarateristieken op de prevalentie van ondervoeding, opnieuw gebruikmakend van dezelfde dataset als in de studies geschreven in hoofdstuk 4 en 5.In deze studie werden een drietal vragen gesteld over procesfactoren (preventieve en belangdelingsmaatregelen) om de voedingszorg in kaart brengen. Deze drie vragen waren: *wordt de voedingsstatus van bewoners bij opname gescreend, hoe frequent wordt het gewicht van de bewoners gemeten en hoe frequent wordt de daadwerkelijke voedingsopname genoteerd.* Daarnaast werd gevraagd welke behandelingsmaatregelen er worden genomen in geval van ondervoeding (consulteren diëtist, energie (eiwit)verrijkt dieet, energieverrijkte tussentijdse verstrekkingen, orale bijvoeding (drinkvoeding en supplementen), sondevoeding, parenterale voeding, aangepaste

consistentie (gemalen, ingedikt) en cliënt krijgt de voorgeschreven hoeveelheid vocht per dag binnen).
Uit de multiple regressie analyse kon geconcludeerd worden dat de volgende factoren gerelateerd zijn aan ondervoeding: energieverrijkte tussentijdse verstrekkingen, consulteren diëtist, bij alle bewoners wordt de voedingsstatus bij opname gescreend, parenterale voeding, cliënt krijgt de voorgeschreven hoeveelheid vocht per dag binnen, orale bijvoeding (drinkvoeding en supplementen) en sondevoeding.
Deze factoren verklaarden het verschil in prevalentie tussen Nederland en Oostenrijk maar niet het verschil tussen Nederland en Duitsland. Het verschil tussen Nederland en Duitsland wordt daarnaast ook verklaard door de bewonerskarakteristieken gevonden in de studie beschreven in hoofdstuk 4 (zorgafhankelijk, leeftijd, geslacht, gemiddeld aantal aandoeningen en specifieke aandoeningen).
De algemene discussie in **hoofdstuk 7** geeft een overzicht en discussie van de belangrijkste resultaten zoals beschreven in de voorafgaande hoofdstukken. Tevens worden de gehanteerde theoretische en methodologische overwegingen toegelicht. Verder worden aanbevelingen gegeven voor toekomstig onderzoek en de praktijk.
Een grootschalige studie naar ondervoeding, zoals de LPZ-studie, uitgevoerd in verschillende landen en volgens een uniforme methodiek is nieuw in Europa. Een dergelijke studie is belangrijk om de kwaliteit van de voedingszorg te verbeteren in verpleeghuizen in Europa, omdat de studies in dit proefschrift aantonen dat ondervoeding nog steeds een belangrijk en vaak voorkomend probleem is in verpleeghuizen. De LPZ methodiek lijkt een goede methode te zijn om zo' n studie uit te voeren.
Verschillen in prevalentie van ondervoeding in de onderzochte landen kunnen deels worden verklaard door verschillen in bewonerskarakteristieken, en deels door proces- en structuurfactoren van de zorg.
Aanbevolen wordt om verder onderzoek te doen naar de invloed van proces- en structuurfactoren middels een grootschalige longitudinale exploratieve studie. Verder kan in toekomstig uitgevoerd interventie onderzoek inzicht worden verkregen in het effect van geïntegreerde voedingszorg en relevante preventieve en behandelings-maatregelen.
In de studies beschreven in dit proefschrift zijn niet alle structuurfactoren uit het kwaliteitsmodel van Donabedian, zoals opleidingsniveau en aantal medewerkers, organisatiegrootte en structuur en ook niet alle bewonerskarakteristieken, meegenomen. Ook de populatiegrootte is een factor die van invloed kan zijn. Daarom is het van belang dat ook inzicht in deze en wellicht nog andere relevante factoren wordt verkregen, zodat de verschillen in gevonden prevalenties verder verklaard kunnen worden. Ook is het belangrijk om verschillen tussen de gezondheidszorgsystemen zelf en ook culturele verschillen tussen de landen onderling mee te nemen in toekomstig onderzoek (bijvoorbeeld verschillen in voedingsgewoonten).
Algemene conclusie uit deze studies is dat het belangrijk is voor instellingen om vooral te focussen op structuurfactoren op afdelingsniveau; dus dicht bij het zorgproces. Dat

maakt het mogelijk voor zorgverleners om adequate voedingszorg te verlenen en kan uiteindelijk leiden tot verlaging van de prevalentie van ondervoeding bij verpleeghuisbewoners.

Het is belangrijk om op de volgende structuurfactoren te focussen: het implementeren en actualiseren van protocollen en richtlijnen gericht op voedingszorg, het regelmatig scholen van personeel, het invoeren van een beleid gericht op het regelmatig meten van het lichaamsgewicht, de lichaamslengte en de voedingsstatus, bij opname en gedurende het verblijf. Verder moet er aandacht zijn voor een goede registratie van aan de voedingszorg gerelateerde gegevens in het dossier van de bewoner en moetenbewoners met (een risico op) ondervoeding regelmatig in het zorgteam besproken worden. Tenslotte is ook aandacht voor een goede ambiance rondom de maaltijden essentieel.

Met betrekking tot procesfactoren van de voedingszorg is het belangrijk om alle elementen van een goede preventie en behandeling in de praktische voedingszorg te implementeren. Daartoe behoren een goede en structurele screening op ondervoeding, een daarop volgend meer diepgaand assessment van de voedingsstatus, een juiste voedingsbehandeling en het monitoren daarvan.

Aangezien ondervoeding voorkomt bij één op de vijf verpleeghuisbewoners blijft het belangrijk om een jaarlijkse meting, zoals de LPZ-meting, uit te voeren want daarmee houdt men instellingen en medewerkers alert op dit belangrijke zorgprobleem.

Valorisation

VALORISATION

Relevance

Malnutrition is an important and still rather under-recognised problem in healthcare. Malnutrition refers to negative deviations from a normal nutritional status and has been defined as inadequate nutritional status or undernourishment due to poor dietary intake, poor appetite, muscle wasting and weight loss. Malnutrition is defined as a nutritional condition in which an insufficient or disproportionate intake of energy, protein, and other nutrients adversely affects tissue/body form (shape, size and composition) and function, as well as the clinical outcomes. Malnutrition could be either undernutrition or overnutrition. In this thesis, however, malnutrition is defined as undernutrition.

Malnutrition increases the chance of medical complications. It reduces the immune function, leading to a higher risk of infections, and it impairs wound healing. Moreover, malnutrition impairs the quality of life and increases the length of hospital stay and the costs of healthcare.

The prevalence of malnutrition varies greatly from one country to the other. In European nursing homes, malnutrition prevalence rates vary from 2 to 74%. This variation can be explained partly by differences in methodology and instruments used to measure malnutrition, but also by differences in both population characteristics and structural indicators as well as process indicators of nutritional care. Therefore the aim of this thesis was to explore the difference in the prevalence of malnutrition in nursing homes in different countries (the Netherlands, Germany and Austria) and to answer the question whether structural and process quality indicators of nutritional care and resident characteristics have a direct influence on the prevalence rate of malnutrition in these three countries (see Chapter 1).

Target groups

Based on the results of our studies we recommend further research into the influence of process and structure indicators of nutritional care by performing a longitudinal exploratory study in nursing home residents. Moreover, in future intervention studies, relevant structure and process indicators can be implemented and followed over time to get insight in the real effects of adapting nutritional care policy. Population differences and population size are important when comparing countries. To get more insight into possible causes of differences in malnutrition prevalence and its influencing factors, data should be corrected for differences in population size and characteristics. In addition, differences in healthcare systems and cultural differences should be taken into account as well (see Chapter 7).

Activities/Products

Our study has shown that malnutrition overall is still a considerable problem in nursing home residents in the Netherlands, Germany and Austria. It has become clear that the differences in malnutrition prevalence between countries can be explained partly by resident characteristics and also by structure and process factors of nutritional care. Further research is necessary on additional country related factors that might have an influence on malnutrition prevalence and also on relevant interventions that may tackle this relevant care problem in European nursing homes (see Chapter 7).

Innovation

An annual, large-scale, multi-country and multi-centre prevalence study focusing on malnutrition is unusual in Europe up until now. Nevertheless such a study is important to ultimately increase the quality of (nutritional) care Europe wide (see Chapter 7).
Since malnutrition is prevalent in one out of five nursing home residents, executing an annual prevalence measurement, such as LPZ-International, is crucial to raise a wide awareness of malnutrition as a very relevant care problem (see Summary).

Schedule and Implementation

Implications for future research

Malnutrition is a serious problem in nursing homes in the Netherlands, Germany and Austria since one out of five nursing home residents is malnourished. Our studies revealed that a lot of factors influence malnutrition prevalence rates. Older and female residents are more at risk of getting malnourished. Comorbidity also influences malnutrition prevalence. Furthermore structural and process factors of nutritional care are of influence whether a resident gets malnourished or not. Based on the results of our studies we recommend further research into the influence of process and structure indicators of nutritional care by performing a longitudinal exploratory study.
Moreover, in future intervention studies, structure and process indicators can be implemented and followed over time to get insight in the real effects of adapting nutritional care policy and preventive and treatment measures.
Furthermore future research can reveal other structure factors that might influence malnutrition prevalence. Factors like educational level of staff, number of staff, kind and organisational structure of institution, size of institution but also other differences in resident populations may influence malnutrition prevalence rates in institutions and between countries. Population differences and population size are important when comparing countries. To get more insight into possible causes of differences in malnutrition prevalence and its influencing factors, data should be corrected for differences in population size and characteristics. In addition, differences in healthcare systems and cultural differences should be taken into account as well.

Implications for practice

From our studies we can conclude that it is important for nursing homes to explicitly pay attention to meeting relevant structural quality indicators of nutritional care on ward level, close to the primary care process. This may enable healthcare professionals directly in performing adequate nutritional care to residents with malnutrition or at risk of malnutrition. More concrete, this means that to decrease malnutrition prevalence rates in nursing home residents, paying attention to the following structural aspects is relevant: taking care of both the availability and implementation of a nutritional guideline as well as regular staff education on ward level, having a standard procedure of measuring weight, height and nutritional status at admission and during nursing home stay, the organisation of a regular discussion of patients at risk of or with malnutrition in multidisciplinary team meetings, paying attention to mealtime ambiance, availability of relevant nutritional interventions and having a standard policy to register relevant nutritional data in the resident files.

With regard to process indicators of nutritional care it is important to implement the main elements of the total nutritional cycle into daily practice. This includes both nutritional screening and assessment leading to a nutritional diagnosis as well as application of adequate nutritional interventions with subsequent monitoring of their effect.

Since malnutrition is prevalent in one out of five nursing home residents, executing an annual prevalence measurement, such as LPZ-International, is crucial to keep awareness of malnutrition as a very relevant care problem.

Dankwoord

DANKWOORD

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Maastricht, augustus 2014

About the author

ABOUT THE AUTHOR

Noémi van Nie-Visser was born in Amsterdam on March 23rd 1968. After graduating from secondary school (HAVO) at the Hervormd Lyceum West in Amsterdam she moved to Maastricht in 1986 to start at the Sociale Academie her education to become a social worker. After one year she switched to Maastricht University. From 1987 till 1992 she studied at the Faculty of Health Science and graduated in Health Organization, Policy and Economics of health care (Beleid en Beheer) in 1992. Her master thesis was a study on experienced work load by health care workers in a Dutch (verpleeghuis St. Martinus te Weert) and a Belgian (rust- en verzorgings-huis Ter Dreve te Roeselare) nursing home.

In April 1993 she took up a position as a hospital manager at Bethesda Children Hospital in Budapest where she contributed to the reorganisation of the first private hospital in Eastern Europe after the fall of the communistic regime. After coming back to the Netherlands she worked as an interagent (intercedente) at Randstad Uitzendbureau in Sliedrecht, Tilburg, Heerlen and Eijsden (1995-1999).

From 1999 till 2001 she worked as a PR-manager at research centre Good Clinical Practice (GCP) in Heerlen. Responsibilities were, recruiting patients for clinical trials through a network of general practitioners by visiting and informing general practitioners, writing PR publications and functioning as a spokesman for the (local) press.

In 2001 she worked as a consultant at HP Projectpromotie bv in Maastricht. In 2002 she started her own company: Pannon Pontis Consultancy. As an independent consultant she was responsible for the management of different projects for the Chamber of Commerce (Kamer van Koophandel, Maastricht), real estate companies and other companies (desk research, office management, promotion and advertisement). In the meantime she tried to make also a living aiming at her hobby: (Hungarian) gastronomy (catering, wine tasting and cooking classes).

In 2006 there she went back to the field of Health Science. She became a researcher at Maastricht University at the Faculty of Health Science, department of Health Care and Nursing Science. As a researcher she participated in a research project for the Dutch Health Care Inspectorate, part of the project Consumers information and transparency of care in care homes and nursing homes. The aim of the study was to find a methodology and registration format to present the outcome of inspectorate reports about quality of care in care homes and nursing homes for health care consumers, a format for www.kiesbeter.nl (RIVM).

By the end of 2007 she took up a position as a project manager and researcher at the same faculty and department at the Dutch National Prevalence Measurement of Care Problems (in Dutch: Landelijke Prevalentiemeting Zorgproblemen (LPZ)). She was responsible for the expansion of LPZ in Germany, Austria, Switzerland and New Zealand. After a pilot study in 2008 she started a PhD project comparing prevalence, prevention, treatment and management of malnutrition in older nursing home residents in the Netherlands, Germany and Austria under the supervision of Prof. dr Jos Schols, Prof. dr. Christa Lohrmann, Dr. Ruud Halfens and Dr. Judith Meijers.
At the moment she is working as a freelance consultant contributing to various research and educational projects in the field of health care and (mal)nutrition.
Noémi likes reading, cooking and collecting cooking books. She lives in Maastricht together with her husband Ferry van Nie and is a mother of two, Anikó (1995) and Antal (1997).

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