AWARENESS OF MALNUTRITION IN HEALTHCARE:
THE DUTCH PERSPECTIVE

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AWARENESS OF MALNUTRITION IN HEALTHCARE:
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JUDITH MARIA MATHEA MEIJERS

Promotores

- Prof. dr. Jos M.G.A. Schols
- Prof. dr. Theo Dassen

Co-promotores

- Prof. dr. Ruud J.G. Halfens
- Dr. Marian A.E. van Bokhorst-de van der Schueren

Beoordelingscommissie

- Prof. dr. R. de Wit (voorzitter)
- Prof. dr. M.P.F. Berger
- Prof. dr. M. Elia (University of Southampton)
- Prof. dr. P.B. Soeters (Maastricht University hospital)
- Prof. dr. R. Watson (The University of Sheffield)

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GENERAL INTRODUCTION

General introduction

An old English medical cookbook from 1390 ends `Explicit de coquina quae est optima medicina', translated as `Food is the best medicine'. Despite this long-held awareness of the importance of the right and sufficient food in treating illness, Florence Nightingale (1859) later wrote `Thousands of patients are annually starved in the midst of plenty' [1]. The existence of malnutrition among patients in European healthcare organisations has been a well-established fact for many years [2]. The rapid development of medical sciences, technical methods and newly designed protocols and regulations means that we sometimes forget the ordinary but fundamental role of basic care as part of total medical care. Malnutrition is an important, under-recognised, and undertreated health problem related to this basic care [2-14].

Malnutrition prevalence rates are high (10-60%), with massive overall cost to society. In the UK alone it has been demonstrated that malnutrition costs over £7.3 billion per year (10% of public expenditure on health) [15]. It leads to prolonged recovery, increases the need for high-dependency nursing care and the risk of serious complications of illness, and at worst, can result in death from either a preventable complication or depletion [2,4,6,10,16-27]. To all this we can add the patients' reduced quality of life, which is inherent in malnutrition [2,15].
Increasing awareness for malnutrition and paying more attention to adequate nutritional care should positively affect the prevalence of malnutrition in healthcare, as well as its consequences and costs. Therefore, a first step in improving the quality of nutritional care is to increase awareness of malnutrition [28].

Pressure ulcers (PU) are another relevant care problem. Because malnutrition is frequently cited as possibly related to the presence, development, and non-healing of PU [29,30], optimal nutritional treatment might also lead to the prevention and healing of PU. Nutritional guidelines for PU prevention and treatment have been developed to increase attention for and support professional practice to improve nutritional care in patients with (or who are prone to) PU.

First, this thesis studies relevant aspects of the healthcare problem of malnutrition, particularly the effect of increasing awareness of it. Second, it explores the relationship between malnutrition and PU, and examines the use of nutritional guidelines in PU care.

Part one Exploring malnutrition

1.1 Defining malnutrition

Although many studies have reported high malnutrition prevalence rates in healthcare settings, malnutrition is often under-recognised [2-14]. One reason may be the fact that it remains an indistinct concept, and researchers consequently use different definitions, methods and parameters to measure its prevalence [31,32].

Malnutrition literally implies bad or defective nutrition [2]. Elia [33] defined it as a nutritional condition in which insufficient or disproportionate energy, protein, and other nutrients adversely affect tissue/body form (shape, size and composition) and function, and clinical outcomes. Soeters et al. [34] defined it as ''a subacute or chronic state of nutrition in which a combination of varying degrees of undernutrition and inflammatory activity have led to a change in body composition and diminished function''. Not only in disease-related malnutrition but also in endemic malnutrition, loss of body cell and fat mass almost invariably coincides with inflammatory activity, aggravating each other and thus resulting in a vicious circle [34]. Malnutrition may consequently lead to decreased quality of life; delayed wound healing; fatigue and weakness; increased mortality, length of hospital stay, risk of infection and other complications, rate of GP visits, prescription rates, hospital admissions and need for nursing home admission or home healthcare; and lower rates of return to independent living [2,6,10,16,27,35-42].

The lack of a widely accepted definition to detect patients who might benefit from nutritional support is commonly seen as a major restraining factor in effective recognition and treatment [2,31,32,34]. The use of different definitions and operationalisations means that different types and proportions of patients are identified as being at risk. In research, this also hinders comparisons of prevalence and incidence figures across different healthcare settings, age groups, disease groups, disciplines and even countries. A single, undisputed definition of malnutrition is thus eagerly awaited, and research is this area desirable.

1.2 Screening malnutrition

It is obvious that patients at risk of (or with) malnutrition, must first be identified before adequate treatment can begin. Subsequently, in patients considered at risk, a more detailed nutritional assessment is useful. This may yield necessary information about their nutritional state and ability to undergo successful treatment [2,32,34,43,44].

In the absence of formal screening procedures, more than half the patients at risk of malnutrition in various settings are not identified and/or referred for treatment [32,45,46]. Kruizenga et al. [47] pointed out that using a screening instrument at the time of hospital admission may improve the recognition of malnourished patients from 50% to 80%, and that early screening and treatment may reduce the length of the hospital stay. Nutritional screening is now extensively recommended in all healthcare settings. Still, standardised screening is not yet part of everyday care in European hospitals and other care settings [44]. To combat this problem, many national and international organisations have suggested that such screening should be routinely undertaken to identify those likely to benefit from nutritional intervention. Among these organisations are the British Dietetic Association, UK Department of Health, Council of Europe, British Association for Parenteral and Enteral Nutrition (BAPEN), European Society for Clinical Nutrition and Metabolism (ESPEN), American Society for Parenteral and Enteral Nutrition (ASPEN), Royal College of Physicians and NHS Quality Improvement Scotland, World Health Organization, and Dutch government (malnutrition steering group) [44,48-56]. In Europe, screening has become a common standard in Denmark, Norway, Belgium, France, the UK and the Netherlands; it became compulsory in Dutch hospitals in 2007.

To perform adequate nutritional screening, selecting an uniform and validated screening tool is clearly an important issue. At least 70 published tools exist for screening nutritional status, and many more unpublished tools are likely applied in clinical practice [57]. These tools vary significantly in their applicability, usefulness, validity and reliability [57], and there is still no consensus on the best one to use when screening malnutrition in different healthcare settings. Tools used in and recommended for the hospital setting are the Malnutrition Screening Tool (MST) [58] and the Short

Nutritional Assessment Questionnaire (SNAQ) [59]. These have been developed to enable nurses to screen nutritional status quickly and easily. Diagnostic screening tools like the Malnutrition Universal Screening Tool (MUST) [60], Nutritional Risk Screening (NRS-2002) [61] and Mini-Nutritional Assessment Short Form (MNA-SF) [62] (for the elderly) require nurses to have more time and skills because they measure weight, height, BMI, percentage of unintentional weight loss and disease severity. Nevertheless, these tools have the advantage in that they provide more insight into patients' true nutritional status. As yet, however, no consensus has been reached on the best screening tool for assessing nutritional status in all healthcare settings. A study comparing these tools (MNA-SF, MST, MUST, NRS 2002 and SNAQ) in the hospital setting would therefore be a useful start to identify which tool is most valid in this setting.

1.3 Malnutrition prevalence

Malnutrition prevalence depends on age, disease severity (and number), and healthcare setting. Comparing prevalence rates in different European countries and settings reveals that malnutrition in general is common, but there is considerable fluctuation (table 1). Comparing rates across studies, settings, patient groups and countries is difficult, however, because different researchers use different methodologies, definitions and assessment methods.

Table 1 Reported malnutrition prevalence rates [2,5,7-14, 63-66]

Setting	**Malnutrition prevalence**
Hospital	10%-60%
Nursing homes	20%-85%
Home care	15%-25%
Community settings	15%

Prevalence rates of care problems are important in assessing the impact of these problems [36]. In this respect, they are key factors in promoting awareness of malnutrition and initiating a general call for action on both governmental and internal policy decisions in healthcare institutions.

In the Netherlands, little data is available on the prevalence of malnutrition. Before our studies (starting in 2004), only one

national prevalence survey had been performed (in 2001). This study indicated that 25% of the patients were malnourished [66]. The population (n=7606) existed mostly (81%) of hospital patients. To gain more insight in the extent of this problem in total healthcare, a national audit using standardised criteria to assess malnutrition and a standardised methodology to collect prevalence data (figure 1, box 1) among different healthcare settings is a relevant and important activity in promoting nutritional awareness.

1.4 Quality of nutritional care and awareness of malnutrition

The last decennia there is a lot of publicity concerning the measurement of quality of care. Donabedian [67] highlighted three perspectives: the structure, process and outcome of healthcare (figure 1). *Structure* is described as the attributes of the care setting, *process* is what is actually done in prevention and treatment, and *outcome* refers to the effects of care on patients´ health status. Naturally, organisations' outcomes are an essential part of their performance. One can be interested in process and structural indicators of an organization, for example, to make sense of clinical outcomes [67].

1.4.1 Linking structure, process and outcome indicators to nutritional care

Regarding nutritional care, the Council of Europe [50] has suggested to focus on at least the following *structural indicators*: nutritional risk screening policy, adequate nutritional treatment policy, nutritional guidelines, and education. Rasmussen's [45] and Mowe's [46] studies distinctly emphasise that these structural indicators seem necessary in ensuring improved nutritional care for patients, but are lacking in current nutritional practice.

Process indicators reflect what is actually done in daily practice. In nutritional care this involves, for example, nutritional screening at admission, monitoring weight and nutritional intake, consulting a dietician (when necessary), and intervening to prevent and treat malnutrition. Several RCTs show that these nutritional interventions in malnourished patients produce various clinical benefits like improved weight and physical activity scores, and reduced complications and length of hospital stay [32].

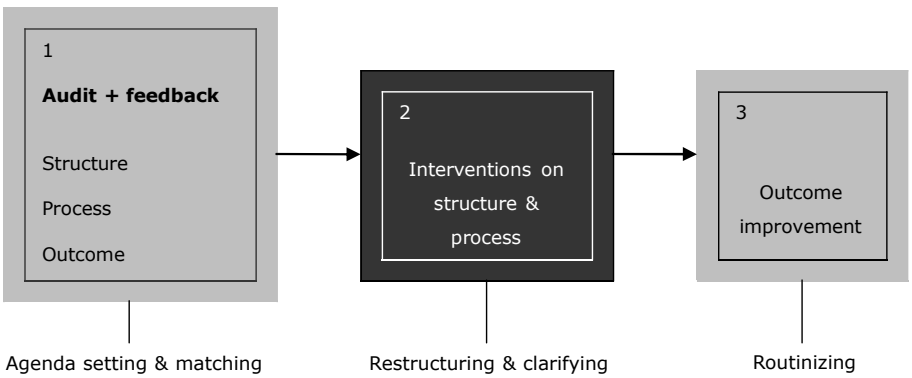
Since *outcome indicators* refer to the effects of care on patients´ health status, malnutrition prevalence could be an example of an

outcome indicator related to the quality of care. In this respect, prevalence rates could be an important start in promoting awareness for malnutrition [28].

Several authors have emphasised the importance of differentiating between *internal* and *external* use of these indicators [68,69]. Internal indicators are used by healthcare providers to monitor and improve the outcomes of their 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 the indicators can subsequently be used to monitor the results of these improvement efforts [70]. External indicators, on the other hand, are used by governments, patient organisations, insurance companies and consumers to compare the quality of healthcare providers' performance.

To date, limited data have been published on the outcome (malnutrition prevalence), process and structural indicators of nutritional care in Dutch hospitals, nursing homes and home care organisations. Measuring these indicators in an internal national audit could yield insight into malnutrition prevalence, and via potential process interventions and structural policy changes necessary to change current practice, lead to increased awareness and eventually improved outcomes (decreased malnutrition prevalence rates) (figure 1). In this audit we focus on these internal indicators.

Figure 1 Audit research model (based on Rogers's organisational innovation theory [28])



Audits, defined as monitors of healthcare quality, are largely used as strategies to improve professional practice [71]. Having an adequate and intensive feedback system is important in translating the audit findings into targets for quality improvement actions and change [67,71-74]. Audit and feedback together can be defined as "any summary of clinical performance of healthcare over a specified period of time", given in written, electronic or verbal format [71]. It appears logical that healthcare professionals should be encouraged to change their nutritional clinical practice when feedback indicates that practice to be incompatible with that of their peers or accepted guidelines. Jamtveld et al. [71] indicated in a Cochrane review that audit and feedback can be valuable in improving professional practice. To date, few large-scale studies have examined the effect of annual audits and feedback on care problems longitudinally (figure 1, box 3) [72]; this has only been undertaken in the area of pressure ulcers. Bours et al. [75] showed small improvements and declining prevalence in pressure ulcer rates in hospitals after five years of monitoring (i.e. auditing) with accompanying feedback. It therefore remains to be seen whether continued auditing of malnutrition prevalence and the nutritional actions undertaken, as well as continued feedback, will reduce prevalence rates of malnutrition over the years.

1.4.2 Rogers's organisational innovation theory [28]

The process from audit to potential care improvement is complex. To structure it, we can link the process to Rogers's organisational innovation theory, which has five stages: agenda setting, matching, redefining/restructuring, clarifying, and routinising. The first two stages constitute the initiation phase, when information gathering and planning occurs; the latter three form the implementation phase, or the actions and decisions involved in putting the innovation/intervention into practice within the organisation. Because the audit mainly focuses on creating awareness and gaining insight into the problem and possible solutions, we focus on the first two stages (figure 1, box 1). Agenda setting is the stage in which an organisation recognises a healthcare problem as relevant (for example, by measuring malnutrition prevalence), and prioritises its improvement. In the matching stage, an organisation gains insight into which interventions (both process and structural) need more emphasis and must be implemented to change practice

and reduce malnutrition prevalence (i.e. the outcome indicator for care quality). In this study we do not focus on the implementation phase of restructuring and clarifying. As every organisation participating in the audit will have different prevalence rates and needs, different process and structural interventions must be planned. We therefore consider this box the 'black box' of implementation. This study mainly focuses on whether awareness in the first box will eventually lead to decreased prevalence rates in the third box (figure 1). In Rogers's organisational innovation model, the last box in figure 1 (related to the outcome) is the routinizing stage. In this stage new behaviour becomes routine, which can lead to lower malnutrition prevalence.
Based on present knowledge, it is currently unclear whether auditing and providing feedback on malnutrition (structure, process and outcome) will actually increase awareness and lead to an improved outcome (i.e. reduced malnutrition prevalence). The effect over the course of years will be of most interest.

Part two Malnutrition and pressure ulcers

2.1 Relationship between malnutrition and pressure ulcers

There is some evidence that malnutrition influences the development and non-healing of pressure ulcers (PU) [29,30]. PU are widespread, with prevalence rates ranging from 3 to 66% in hospitals, nursing homes and home care [76-78]. Also known as decubitus ulcers or pressure sores, PU are defined as "localized damage to the skin and underlying tissue caused by pressure, shear, friction or a mixture of these" [79]. The development of PU depends on extrinsic and intrinsic risk factors. The extrinsic risk factors pressure, shear and friction lead to mechanical loading by decreasing or obliterating tissue circulation, resulting in insufficient blood flow to the skin and underlying tissues, and thus causing tissue ischemia [80]. Relevant intrinsic factors such as limited activity, age, bowel and bladder incontinence, anaemia, infection and nutritional status affect patients' tissue viability and, consequently, the pathophysiologic response to mechanical loading [81-87]. Preventing and managing pressure ulcers involves several strategies intended to tackle both extrinsic factors (e.g. decreasing the pressure duration or magnitude on the skin surface by repositioning the patient or using pressure-relieving cushions or

mattresses) and intrinsic factors (e.g. the capability of the patient's skin to stay intact and resist pressure damage by optimising hydration, circulation and nutrition).
More than half the newly admitted hospitalised patients with stage 3 and 4 PU [88], and half those with PU living at home [90], are indicated to be malnourished. Furthermore, it appears that many acute and chronically ill and elderly patients, at risk of or with PU, experience undesired weight loss [81,87,90-92]. Multivariate analyses indicate that low body mass index, low body weight and reduced food intake are independent risk factors for pressure ulcer development [90,92-95]. Furthermore, malnutrition both increases the risk of PU and impairs its healing. This is due to the diminished nutrient accessibility for tissue maintenance and repair, which causes loss of the cushioning effect of fat mass, declining skin resistance, physical weakness and condition, reduced mobility, and oedema [2,96,97]. Several studies have focused on the effect of nutritional support on the development of PU [99-101] and for patients who already have PU [102,103]. There is some evidence that nutritional supplements are associated with a significantly lower incidence of PU development, and PU in patients who receive high-protein nutritional supplements tends to heal better [94,104]. Still, more evidence is needed on the relationship between malnutrition and PU.

2.2 Nutritional guidelines in pressure ulcer management

In daily practice many patients who have or are prone to PU also have poor nutritional status; thus, nutrition may play an important role in PU prevention and treatment. Guidelines related to care for PU (prone) patients may facilitate the implementation of adequate nutritional care for PU (prone) patients [105-107]; with guidelines being structural indicators of quality of care [67]. An international study by Schols et al. [108] on PU guidelines showed that the attention paid to nutritional prevention and treatment in PU patients varied considerably across different PU-specific guidelines. The authors concluded that recommendations for nutritional management should be incorporated more transparently into PU guidelines, and cover the entire nutritional cycle.
In 2004 the nutritional working group of the European Pressure Ulcer Advisory Panel (EPUAP) launched a specifically European clinical nutritional guideline for PU prevention and treatment in

eight languages covering the whole nutritional cycle (screening, assessment, intervention, evaluation and follow-up) [109]. Because research on guidelines and their implementation indicates that the guidelines are not always reflected in the actual care that patients receive [106-109], insight is necessary into how far this EPUAP guideline is actually disseminated and implemented in clinical practice. It would subsequently be worthwhile exploring whether the availability of nutritional guidelines on PU care actually leads to better (or more intense) nutritional care in patients with or prone to PU in daily practice.

3 Thesis aims and outline

The aim of this thesis is twofold. First, it aims to investigate whether increasing awareness improves the quality of nutritional care by annually auditing malnutrition prevalence and the activities related to nutritional care in hospitals, nursing homes and home care. The second aim is to increase evidence on the relationship between malnutrition and pressure ulcers, and to create insight into the extent and effect of implementing nutritional guidelines in PU care. To address these aims, this thesis examines the following research questions.

Part one Exploring malnutrition

1. Which elements are most important in defining and operationalising malnutrition in healthcare?
2. Which nutritional screening instrument scores highest on criterion validity?
3. What is the prevalence of malnutrition in hospitals, nursing homes and home care, and what activities do healthcare workers undertake to prevent and treat it?
4. Does annual auditing of malnutrition prevalence and actual nutritional care, including the provision of feedback, decrease malnutrition prevalence in hospitals, nursing homes and home care over the years?

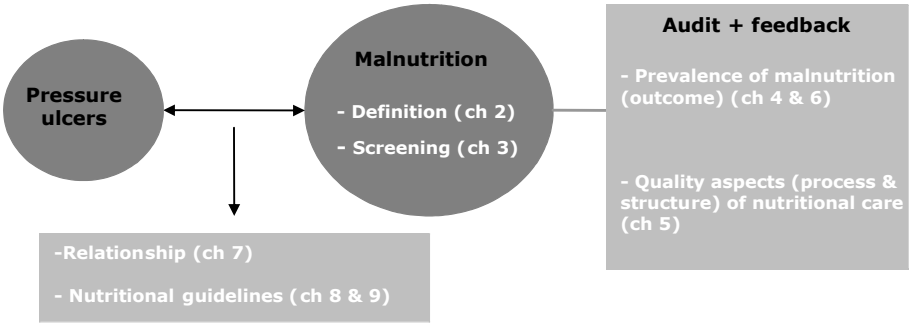
Part two Malnutrition and pressure ulcers

5. Is there a relationship between malnutrition parameters and pressure ulcers?
6. To what extent is the EPUAP nutritional guideline on pressure

ulcer prevention and treatment implemented in clinical practice in Germany, the Netherlands and the UK?

7. Are there differences in nutritional care for pressure ulcer patients regardless of whether nutritional guidelines are used?

Outline



Part one Auditing malnutrition

To answer the first research question, on the important elements in defining and operationalising malnutrition, we undertook a Delphi study. This study is described in chapter 2, where we attempt to find agreement between nutritional experts on important elements in this definition and operationalisation. Chapter 3 reports our study comparing malnutrition screening tools in one hospital adult inpatient population. Criterion validity of quick-and-easy (MST and SNAQ) and diagnostic malnutrition screening tools (MNA-SF, MUST and NRS 2002) are estimated and compared with a 'commonly used' definition of malnutrition.

To answer the third research question, we undertook an annual national prevalence audit with a cross-sectional design; chapter 4 describes the results of the second audit (2005). It provides an overview of the malnutrition prevalence rates in Dutch hospitals, nursing homes and home care organisations. Chapter 5 reports on the results of the fourth audit (2007) and briefly describes the nutritional screening and malnutrition-related treatment interventions performed in Dutch hospitals, nursing homes and home care organisations. It also discusses quality aspects of nutritional care at ward and institutional level.

Finally, to answer the last research question of part 1, we analysed data from the national audit for trends over a four-year period (2004 to 2007), and performed a logistic multilevel analysis to

assess the effects of previous LPZ audits and feedback on malnutrition prevalence in hospitals, nursing homes and home care. These procedures are described in chapter 6.

Part two Malnutrition and pressure ulcers

For the first research question of this second part, we used German cross-sectional audit data from 2007 to analyse the relationship between malnutrition parameters (BMI, undesired weight loss and intake) and pressure ulcers using univariate and multivariate logistic analysis. The results are shown in chapter 7.

To examine the last two questions (chapters 8 and 9), we performed a cross-sectional study in 2005 in the Netherlands, Germany and the UK using a questionnaire including items on the dissemination and implementation of the EPUAP guideline, using Rogers's innovation-decision process model [88]. To answer the last question, the analysis identifies and compares two groups: healthcare organisations with and without a nutritional guideline on pressure ulcer prevention and treatment.

Finally, chapter 10 presents a general discussion of the main findings as well as the strengths and limitations of our studies. It also highlights the implications for practice, policy and future research.

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DEFINING MALNUTRITION

Judith MM Meijers, Marian AE van Bokhorst-de van der Schueren, Jos MGA Schols, Peter B Soeters, Ruud JG Halfens. Defining malnutrition: Mission or mission impossible. Accepted Nutrition

SUMMARY

While screening on malnutrition in healthcare has expanded enormously, a gold standard for the optimal definition and operationalisation of malnutrition is still lacking.
This paper reflects expert opinions on the elements of the definition and operationalisation of malnutrition and is meant to trigger further debate within the nutritional societies.
A Delphi study was performed consisting of three phases. After a literature review (phase 1), questions for a semi-structured interviews were formulated (phase 2). Subsequently, the results of these semi-structured interviews were used to develop the final list of elements (for defining and operationalizing malnutrition). In phase 3 (final phase) experts were asked to provide written feedback regarding ranking the elements concerning the importance of these elements.
22 experts (response 73.3 %) were included in the final phase of this Delphi study. No overall agreement could be reached. The elements 'deficiencies of energy or protein' and 'decrease in fat-free mass' were most often mentioned to be particularly important in defining malnutrition. Elements mentioned to be important in operationalising malnutrition were 'involuntary weight loss', Body Mass Index (BMI)', and 'no nutritional intake'. Opinions on cut-off points regarding these elements differed strongly between experts.
This study shows that there is no full agreement between experts on the elements defining and operationalising malnutrition. The results of this study may fuel the discussion within the nutritional societies, which will most ideally lead to international consensus on a definition and operationalisation of malnutrition.

INTRODUCTION

The pathophysiology of malnutrition consists of the combined influence of over- or undernutrition and inflammatory activity on body composition and biological function. Overnutrition (obesity) implies a positive nutrient balance and undernutrition a negative nutrient balance [1]. Although the term malnutrition encompasses both under- and overnutrition in combination with inflammatory activity, this article focuses on the combined "undernutrition and inflammation part of malnutrition" only.

Screening on disease related malnutrition has expanded enormously during recent years, a gold standard for the optimal definition of malnutrition is still lacking [1-14]. The lack of a widely accepted definition that adequately reflects the pathophysiology of malnutrition and its consequences prevents adequate diagnosis of malnutrition and adequate interventions. As a consequence individuals at risk suffer from post-treatment complications, decreased quality of life and decreased longevity due to malnutrition, and expanding the costs of this serious burden to billions of Euros every year [15]. The lack of consensus how to define and operationalise malnutrition in healthcare is also evident when comparing malnutrition across different healthcare settings, different age groups, disease groups, disciplines, and even between different countries. Therefore, a single, undisputed definition of malnutrition, is eagerly awaited. This should then be followed by an operationalisation yielding to a set of measures that allows to assess nutritional status easily. Donini et al. [16] already concluded in their systematic review, in 2007, that one univocal definition for nutritional status does not (yet) exist, nor does a set of generally accepted standards for assessing the nutritional status exist, either. This study is a first step into reaching such consensus by investigating the current opinions of acknowledged experts in the field of malnutrition on the optimal elements to define malnutrition on the one hand and to operationalise the definition on the other hand. This paper reflects these expert opinions and is meant to provide a basis for further debate.

METHODS

Design and sample

The study design was a Delphi design that consisted of three phases. Phase one included a literature review. Phase two included semi-structured interviews. The results of these semi-structured interviews were used to develop the final list of elements for defining and operationalising malnutrition. In the last phase, experts were asked to provide written feedback by ranking these elements (phase 3) and by indicating missing elements.
After the third phase, it became clear that getting consensus was an utopia. We did not continue narrowing down elements to consensus, but decided it was more interesting to describe the discussion going on in the field

A mixed group of well-known experts in the field of clinical nutrition were randomly selected: they had to have had board functions within the nutritional societies (e.g. ESPEN, ASPEN, BAPEN), professional experience, and had to have published at least 30 publications within the (mal)nutrition field. Furthermore, names were suggested by interviewees who participated in phase two of the study.

Process of phase one and two

In phase one a literature review was performed to create a general overview of important elements used to define malnutrition and its operationalisation. An on-line search of the electronic bibliographic databases CINAHL, Pubmed, Medline, Healthstar, and Cochrane library was performed as well as a manual search of nutritional journals. The keywords which guided the search were undernutrition, micronutrient deficiencies, cachexia, sarcopenia, wasting, protein energy malnutrition, malnutrition, depletion. These keywords were combined with screening (screen), operationalising, assessment, defining (definition), measurement, parameters, classification, elements and criteria. Eventually, 72 articles [5-15, 17-77] were explored by the authors, resulting in a list of 10 clustered elements most often mentioned in defining malnutrition (figure 1) and 13 clustered elements most often mentioned in operationalising the definition of malnutrition into a set of measures to assess nutritional state (figure 2).

Phase two was meant to narrow down the list of elements (figure 1 and 2). The elements were presented by semi-structured interviews with six well known experts from three different countries in the field of malnutrition. They were asked to rank the elements identified for the definition (from 1-10, clustering 1-3 as most important, 4-7 as moderately important, 8-10 least important) and for the operationalisation of the definition (from 1-13, clustering 1-4 as most important, 5-9 as moderately important, 10-13 least important).
If at least two of the six experts mentioned an element to be most important it was included for the final round three (figures 1 and 2).

Figure 1 The main definition elements resulting from the literature review and the semi-structured interviews with 6 experts

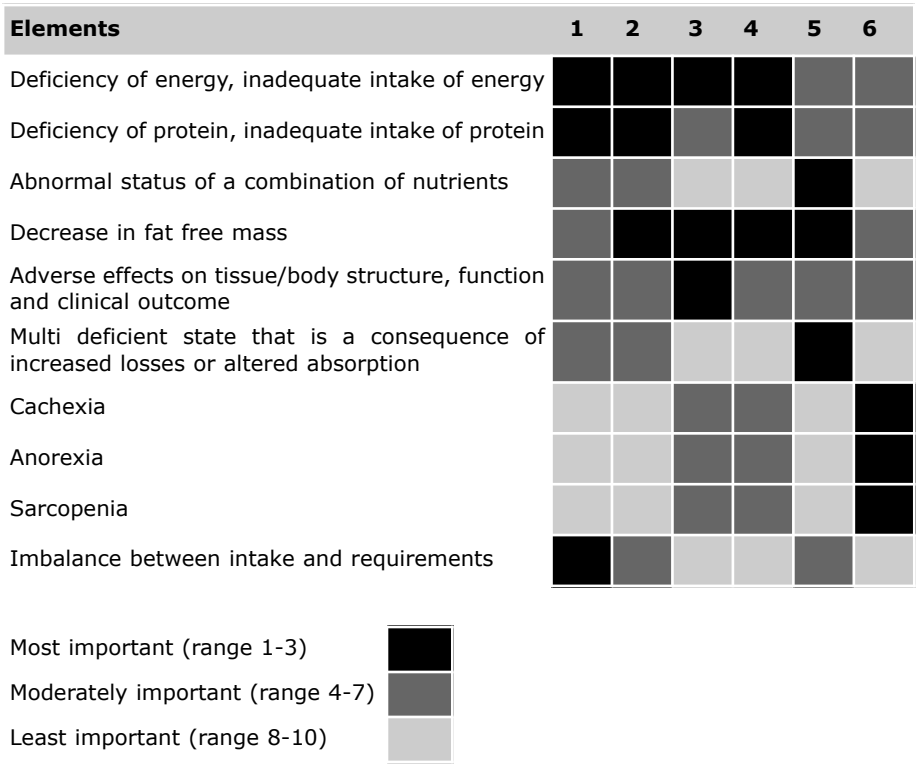
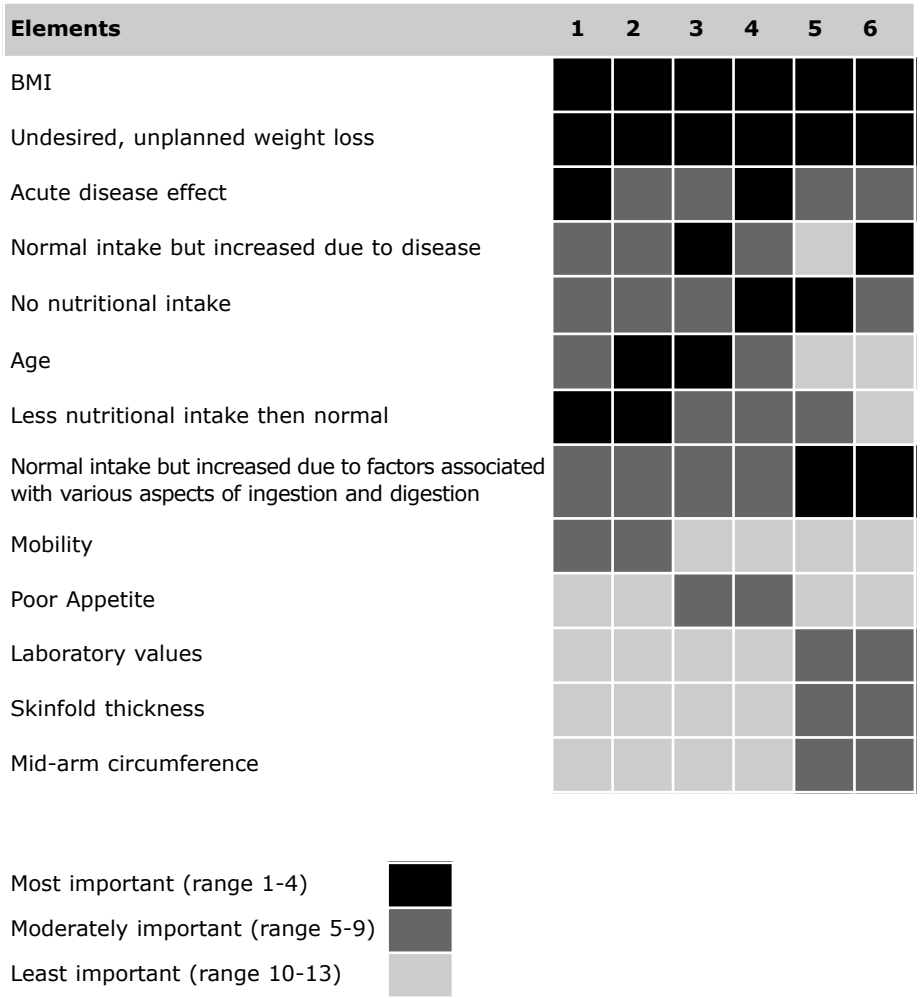


Figure 2 The main operationalisation elements resulting from the literature review and the semi-structured interviews with 6 experts



Process of phase three:

The final list of elements (for defining and operationalizing) was sent to the 30 nutritional experts (from 9 different countries). The experts were asked to provide feedback by ranking these elements. In phase two, 3 elements (deficiency of energy, deficiency of protein, decreased fat free mass) were selected for the definition of malnutrition. The experts were first asked to rank these three elements (1= most important, 2= moderately important, 3= least important).

In addition, eight elements (involuntary weight loss, BMI, no nutritional intake, acute disease effect, less nutritional intake than normal, normal intake but increased demands, normal intake but increased losses, and age) were selected in phase 2 for the operationalisation of malnutrition. The experts were asked to rank these 8 elements. They were also asked to indicate cut off points for the elements. The ranking ranged from 1-3= most important, 4-6= moderately important, and 7-8= least important.

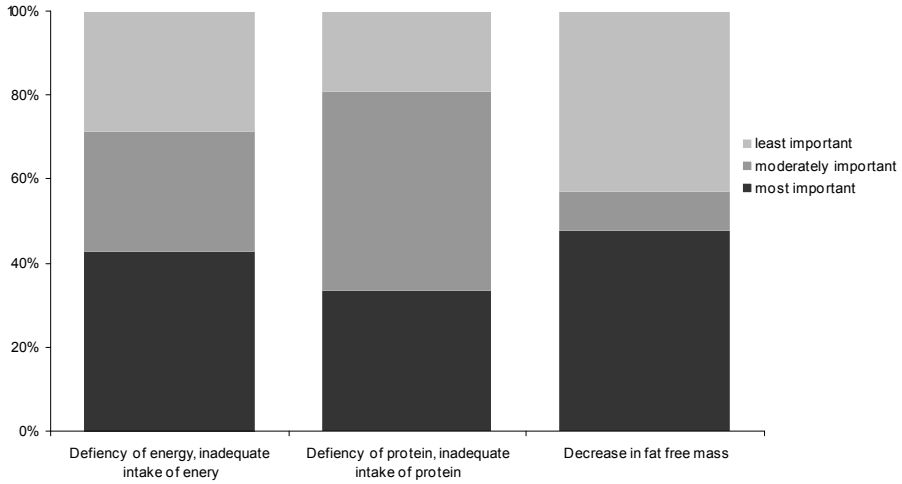
In phase three, two open questions were added as well, which asked for elements that the experts would liked to have seen included in the definition and in the operationalisation of malnutrition. Eye-catching answers related to these questions are literally cited and presented in boxes in the result section of the manuscript.

RESULTS

In this result section, we present the results of phase three, the final round of the study.
After several reminders, eventually twenty-two out of 30 invited experts responded (response 73.3%). Two of the non-respondents answered that they could not answer the questionnaire because of political reasons, without further explanation. The reason of non-response of the remaining 6 non-respondents remained unclear. Of the 22 participating experts, 14 respondents were working as physicians or scientists and 8 were nutritionists or research dieticians in the malnutrition field.

Definition of malnutrition
Respondents ranked all three elements (deficiency of energy, deficiency of protein, decreased fat free mass) as relevant.
They disagreed, however, on the level of importance of the elements, (figure 3). Ten respondents (45.5%) indicated that they found deficiency of energy the most important element in defining malnutrition whereas 6 respondents (27.3%) indicated this to be least important. A decrease in fat free mass was considered to be most important by 50% (N=11) of the experts, while 40.9% (N=9) judged a decrease in fat free mass to be least important.

Figure 3 Elements in defining malnutrition (n=22 experts)



Box 1 presents examples of eye-catching citations of elements that were considered to be missing by the experts, in the list of elements presented in the final round to define malnutrition.

Box 1 Missing elements in the definition of malnutrition (citations n=12)

- Rather than deficiency of energy, I would speak about a negative energy balance
- I suggest that the definition should also encompass other nutrients apart from protein
- I miss micronutrients deficiencies. Malnutrition should be defined as a multi-deficient state that is a consequence of either inadequate intake, increased losses or altered absorption
- Deficiency in micronutrients by an insufficient diet, mostly because the diet is focused upon energy intake
- I miss deficiency of specific micronutrients (e.g zinc, vitamins, Iron, trace elements) (mentioned twice)
- I think that there should be some reference to functional and clinical consequences, which may or may not arise as a result of changes in anthropometry. I suggest that the definition should also encompass other nutrients apart from protein
- Function, inflammation, inadequate intake of energy etc. able

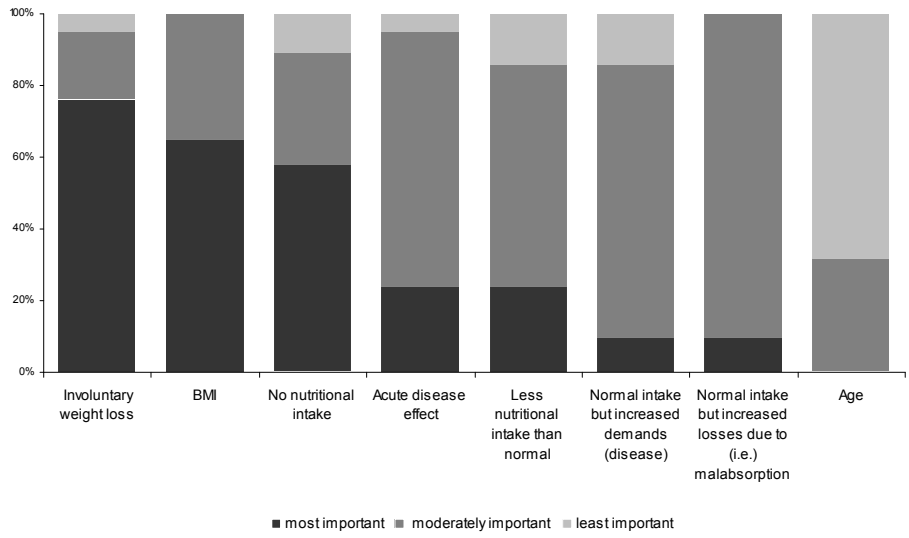
to influence body function
- Functional capacity, immune status, care need, quality of life, disease impact. Malnutrition is complex, first you can see it on decreasing FFM (shortness of energy and protein and changes in metabolism). Defining malnutrition: decreasing of FFM
- I miss lack of muscular strength, hand strength for instance
- Functional quality of muscle and presence of inflammation (which influences muscle strength independent of nutrition)
- I cannot separate the above into rankings as I believe the definition of malnutrition to include all of the above

Overall experts remarked that they would liked to have seen function, and lack of other nutrients (like micro nutrients) and inflammatory activity in the presented list (box 1).

Operationalisation of the definition of malnutrition

The second part of the list included elements important in the operationalisation of the definition of malnutrition. This includes the development of a set of measures, which are a logic consequence of the definition of malnutrition, and which should allow the assessment of nutritional state to be performed in a practical manner. The results are presented in figure 4.

Figure 4 Elements mentioned in the operationalisation of the definition of malnutrition (n=22 experts)



Most experts replied that the elements involuntary weight loss (N=17, 77.3%), BMI (N=14, 63.6%) and no nutritional intake (N=13, 59.1%) were most important to be included in the operationalisation of the definition of malnutrition.
However, the experts' opinions varied considerably regarding the best cut-off points of these elements, when applied in practice (table 1). For example BMI cut of point ranged from <18 to 21 for adults. The time span for no nutritional intake ranged from 3 days to > 10 days.

Table 1 0pinions of experts on cut off points for the elements: involuntary weight loss, no nutritional intake and BMI

Elements	**Cut off points**
Involuntary weight loss	10% overall (N=2), > 10% in 6 months (N=3), 5 % in 1 month (N=2), 5% in 3 months (N=1), 10% loss over 3/12 months (N=1), 5 kg or 10% in 4 weeks (N=1), 3 kg in last month or 6kg in 6 months (N=3), any weight loss (N=4).
No nutritional intake	Time span of >2 days (N=2), ? 5days (N=5), 1 week (N=2), 7-10 days (N=1), last 3 days (N=1), More than 1 week (N=1), > 10 days (N=1).
BMI	BMI < 18 (N=1), < 18,5 (N=5) , 20 (N=4) , 21 (N=3), ? 23 for the elderly above 65 or 85 (N=3).

Another important (23,8% most important, 71,4 % moderately important) element mentioned in the operationalisation of the definition of malnutrition was the 'acute disease effect'. Nevertheless, experts' views varied greatly as to how this disease effect should be defined (table 2). They mentioned measurements of inflammatory activity like elevated CRP, hypoalbuminia, physical immobilization and disease categories following the Nutritional Risk Scale [70].

Table 2 Objectivation of the acute disease effect (all separate views N=1 except CRP N=3)

Elements	Defined as
Acute disease effect	o Acute disease (without further explanation) o Burns > 50% extra energy and protein needs, neurotrauma: extra energy needs o Elevated CRP o Hypoalbuminia (<30g/L) o Define specific high risk diagnoses o Disease categories following Nutritional Risk Scale (NRS 2002) 71 o List of diseases epidemiologically associated with malnutrition; difficult to classify patients according to disease types in screening (as so many different diseases and stages of the same disease) - impact of disease should be seen in weight loss, either on presentation or rescreening although there may be cases where it needs specifically identifying (? role for assessment) o Level of stress in acute conditions (N=1), metabolic stress (N=1), systemic inflammation (N=1), o Level of physical immobilization in chronic conditions

Box 2 presents examples of eye-catching citations of elements that were considered missing by the experts in the list of elements presented in the final round in the operationalisation of the definition of malnutrition.

Box 2 Missed elements on 'operationalisation of the definition of malnutrition' (citations n=11)

- Appetite changes and current appetite
- I believe that our operational definition of malnutrition should be used everywhere in the world. Therefore, I privileged those elements that can be made objective with minimal technical equipment
- I consider involuntary weight loss as the only relevant parameter for the diagnosis of malnutrition. The rest of the variables may contribute but are not part of diagnosis
- BMI is less important than loss of body mass
- I miss an indication for loss of lean body mass e.g. in a circumference measure (calf, midarm or waist)

- Functional capacity
- I miss a Loss of body mass, which will lead to reduced functioning of patients
- In my view, changes in body form may partly but not fully explain the functional and clinical consequences of malnutrition. Especially in the early stages of malnutrition, weight change may be more a marker of an impaired balance of energy rather than a cause of adverse consequences.
- Hand strength, quality of life, blood samples, disease scores, length, social analysis, functional capacity, inflammatory activity (CRP), Low anabolic activity (IGF-I)
- Primary malnutrition, due to poverty should be diagnosed at the nutritional screening
- Change in physical activity can be related to impaired nutrition status, especially if connected with muscle loss. As I suggest loss of FFM as most important element of malnutrition, the decrease (or change) in physical activity should be somehow included in nutrition measurement (I know that this is very difficult but some scale / like Mini Nutrition Assessment (MNA) should be useful)

Experts remarked that they would liked to have seen loss of body mass, and physical activity/function in the presented list (box 2).

DISCUSSION

There is no doubt that malnutrition has serious implications for health and healthcare costs. National and international consensus on the definition of malnutrition and its operationalisation is still lacking. The goal of this study was to investigate the opinions of experts in the field of malnutrition on the optimal elements to define malnutrition and subsequently to operationalise the definition by devising a practical set of measures to assess nutritional state.

Definition of malnutrition

In this study most of the participating experts identified 'deficiency of energy', 'deficiency of protein' and 'decrease in fat-free mass' as the most relevant elements in the definition of malnutrition. Nevertheless, the opinions differed on the priority of importance to

these elements. The ranking (1 to 3, from most to least important) in defining malnutrition could have limited the experts. One of the experts for example stated in box 1 'all were important and it was not possible to rank it from most to least important'.

The elements deficiency of energy and protein and decrease in fat free mass are in part causally related as deficiency of energy and protein and a change in metabolism due to the catabolic influence of trauma and disease (inflammatory activity) may both result in a decrease of fat free mass. It is remarkable that only about 50% of the experts emphasized fat free mass or a comparable measure of body composition to be most important, since low FFM remains a significant predictor of mortality [67,70].
On the other hand, five experts remarked that they would liked to have seen (a decrease of) function (muscle, cognitive, immune function) in the questionnaire (box 1). Apparently they considered functional status to be a crucial element of malnutrition and did not consider fat free mass to correlate sufficiently with function to allow function to be left out of the definition.
In the present study, experts also mentioned that they would liked to have seen inflammatory activity in the definition of malnutrition (box 1). Not only in disease related malnutrition but also in endemic malnutrition and in malnutrition in the elderly, loss of body cell mass and fat mass almost invariably coincide with inflammatory activity, aggravating each other and thus leading to a vicious circle. In view of the fact that deficient uptake or intake of nutrition as well as disease or inflammation related changes in metabolism may lead to altered body composition (decreased fat free mass, body cell mass) it might be a rational approach to rank changes in body composition as the most important element in the definition of malnutrition. We have considered this aspect in a separate publication [15].

Operationalisation of the definition of malnutrition
The elements considered most important in the operationalisation of the definition of malnutrition were involuntary weight loss, BMI and no nutritional intake. Low BMI was proposed as the only measure of body composition. However the cut off points of 'low BMI' are still under discussion as experts mentioned low BMI ranging from <18 to 21 for adults. Moreover, BMI is not always a

reliable indicator of fat free mass. Only when BMI is very low it is likely that fat free mass is low as well.
The proposed elements (involuntary weight loss, BMI, intake and disease effect) are also part of many existing screening and diagnostic instruments for malnutrition [1,37]. Whereas the BMI as an indicator of malnutrition may only be meaningful when it is very low, undesired weight loss and insufficient intake indicate aggravation of malnutrition.
The disease effect was also mentioned to be an important element. Acute (and chronic) disease(s) cause(s) fat free mass but specifically body cell mass to decrease due to increased nutritional requirements, but very important also due to the inescapable catabolic effect of disease on body cell mass and consequently fat free mass [15].

Whereas decrease in functional status did not survive the first and second round of this study, it is remarkable that it was missed in the final round, for both defining and operationalising malnutrition. In operationalising function more measurements of function would be expected like measurements of muscle functions, handgrip strength, immune function, and cognitive functions would be more appropriated [15].

It is also of interest that the elements considered important in the operationalisation of the definition are largely descriptive screening elements (insufficient intake, undesired weight loss), rather than measures indicating a true impairment of physical condition (decreased body cell mass, diminished function, increased inflammatory activity).
A clear distinction between describing risk and measuring impairment of physical condition is important. In clinical practice, screening is often performed first (with mostly quick and easy questionnaires), to identify patients at risk to be malnourished or to develop malnutrition. In patients considered to be at risk, it is advisable to perform a more detailed nutritional assessment after the screening. This may add necessary information regarding the severity and the nature of malnutrition and patients' ability to undergo successful treatment [37].

Design of the study

The design of the study was a Delphi study. From earlier Delphi (expert) studies [73,74] it is known that getting experts to actively contribute is difficult. We experienced this as well; some of the experts had to be sent more than 5 reminder emails before they responded and it acquired more than one year including several reminders to organize the second phase (semi-structured interviews) of the Delphi study. Still, our efforts led to a final response of 73,3%, which is a good response rate.

After the third phase of this study, we realized that narrowing down the elements to reach consensus at the end would be an utopia. We then decided it was more interesting to describe the presently going on discussion in the field than to put more time and efforts into a mission impossible.

We are not aware of any earlier paper structurally describing and publishing the (lack of) agreement between experts like we eventually tried to do in this study. Donini [16], in his systematic review, showed that parameters and diagnosis protocols to assess nutritions status (in elderly) were not homogeneous.

With this study we were able to illustrate some of the discussion that is going on. Hopefully our findings will fuel the discussion in the nutritional field.We realize also that the overall limitation of trying to define a concept is that opinions are coloured by the special professional focus and background of the experts interviewed. In this study a mixed group of experts (physicians, scientists nutritionists, and dieticians) were asked to participate. In this way we hoped to be able to acquire a broad view on the definition of malnutrition and its operationalisation.

We also tried to divide a theoretical part (definition of malnutrition) and a practical part (operationalisation of malnutrition). This proved to be very difficult as the results, to our surprise, show that the operationalisation of the definition does not logically follow the definition.

If we want medical and nursing professionals to consider the nutritional status of patients seriously, elements in defining and operationalising malnutrition must logically reflect the (patho-) physiogical status of malnutrition to allow practice to be evidence

based. Only if we use the same definition and consequently use the same methodology to assess nutritional status we can learn from each other, compare studies internationally, and evaluate for example 'the effect of policy changes or nutritional interventions' in a greater context. This would enable the nutritional societies to establish prevalence rates of malnutrition in a meaningful way, i.e. to indicate the risk of developing complications, or the risk to have diminished quality of life or decreased longevity in different populations and individuals.
We would suggest that nutritional societies use our study results to call a consensus conference and establish an initial consensus to diagnose and operationalise malnutrition, as suggested by Donini et al. [16] as well in 2007.
To fuel the discussion within nutritional societies we would suggest to use the proposed elements that were mentioned to be important in defining and operationalisation malnutrition and build further on these. The operationalisation of the definition should follow and yield a set of measures that allows to assess nutritional state and to diagnose malnutrition.

Based on this study we can conclude that a definition of malnutrition should at least exist of the elements 'deficiency of energy', 'deficiency of protein' and 'decrease in fat free mass'. Also, function and inflammation are suggested to be important for defining malnutrition.
The operationalisation of the definition should follow the definition and yield a set of measures that allows to assess nutritional state and to diagnose malnutrition. Most experts indicated that the operationalisation should at least include the elements involuntary weight loss, BMI and nutritional intake. However, no consensus was reached on the cut-off points for these measures. For this purpose, methods and measures need to be further developed, tested and validated.
We would suggest that nutritional societies use our study results in the debate to try to reach consensus on elements to diagnose malnutrition, to operationalise malnutrition and to establish best cut-off points for these elements. For this purpose, studies to develop, test and validate methods and measures are desirable.

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COMPARISON OF MALNUTRITION SCREENING TOOLS

Floor Neelemaat , Judith MM Meijers, Hinke M Kruizenga, Hanne van Ballegooijen, Marian AE van Bokhorst - de van der Schueren. Comparison of malnutrition screening tools in one hospital population. Submitted for publication

ABSTRACT

Background
Effective recognition and treatment of malnutrition of hospital patients is important. Several screening tools have reported their diagnostic accuracy but these tools have never been estimated for criterion validity in one hospital population. In this study we compared five commonly used malnutrition screening tools against a commonly used definition of malnutrition.

Methods
We estimated the prevalence of malnutrition and compared quick and easy (MST and SNAQ) and diagnostic malnutrition screening tools (MNA-SF, MUST and NRS 2002) to a commonly used definition of malnutrition (low BMI and unintentional weight loss) in 275 adult hospital inpatients. Sensitivity, specificity, positive predictive value and negative predictive value were determined.

Results
Out of all patients 5% was moderately and 25% severely malnourished. The malnutrition screening tools MST and NRS-2002 showed sensitivities over 70%. MUST and SNAQ also showed sensitivities over 70% when comparing both malnutrition categories with the well nourished patients. The MUST questionnaire showed 47% missing values. The MNA-SF showed excellent sensitivity, but poor specificity for the elderly subpopulation.

Discussion and conclusion
In this first study comparing the quick-and-easy malnutrition screening tools (MST and SNAQ) and the diagnostic malnutrition screening tools (MUST, NRS-2002 and MNA-SF) we showed that criterion validity of MST, MUST, NRS-2002 and SNAQ all seem to be equal for screening malnutrition in hospital inpatients. We consider MNA-SF not suitable for elderly hospital inpatients because of its low specificity and low positive predictive value.

INTRODUCTION

Prevalence of disease-related malnutrition in hospital inpatients varies from 25 to 40% [1-4]. Many studies have demonstrated the negative consequences of malnutrition on morbidity and mortality [5-10]. However, the recognition and treatment of malnutrition in inpatients often still fails [11,12]. The lack of a widely accepted malnutrition screening tool for detecting patients at risk of malnutrition is frequently seen as a factor that hinders both effective recognition and treatment.

The diagnosis of disease-related malnutrition can be based on measuring nutritional status. This includes anthropometric data, assessing dietary intake and appetite. Even though no gold standard exists, BMI (kg/m^2) and unintentional weight loss are the most commonly used criteria of malnutrition. The BMI mortality curves suggest that for the general adult population, a cut-off point of BMI 18,5 kg/m^2 is associated with increased mortality [13-19]. For elderly patients a cut-off point of BMI 20 kg/m^2 is considered to be more appropriate given their changes in body composition [16,20-23]. A low BMI indicates chronic malnutrition, whereas unintentional weight loss indicates a more acute deterioration of the nutritional status.
Many nutritional screening tools have been developed over the past years. Composite malnutrition scores, identifying patients at risk of malnutrition, are more accurate than applying a single nutritional parameter [24]. These malnutrition screening tools can be characterised as diagnostic or quick-and-easy tools.

Malnutrition Screening Tool (MST) [25] and Short Nutritional Assessment Questionnaire (SNAQ) [13] are quick-and-easy screening tools: developed for nurses to screen the nutritional status in a quick and easy way. These tools consist of questions that are most predictive of malnutrition. After positive screening, further diagnosis of nutritional status by a dietician or physician is necessary.
The MST and the SNAQ are considered two most accurate and applicable tools readily available for employing in the general hospital inpatient population [26].
Diagnostic screening tools - like Malnutrition Universal Screening

Tool (MUST) [27], Nutritional Risk Screening (NRS-2002) [28] and Mini-Nutritional Assessment Short Form (MNA-SF) [29] - require more time and skills from nurses because of measuring weight and height, calculating BMI and percentage unintentional weight loss and evaluating disease severity. The MUST is commonly used in European hospitals, whereas the NRS-2002 is recommended by the European society for clinical nutrition and metabolism (ESPEN) for the hospital setting [30,31]. The MNA-SF is recommended by ESPEN for elderly patients.

Until now no consensus has been reached on the best malnutrition screening tool for assessing the nutritional status of hospitalised patients. Various studies have pointed out different proportions of patients as being at risk of malnutrition. The use of different screening tools can be an explanation for the different findings. Furthermore it may hamper the comparison of malnutrition prevalences between different settings, patients groups and countries.
This is the first study comparing diagnostic and quick-and-easy malnutrition screening tools (MNA-SF, MST, MUST, NRS 2002 and SNAQ) to a commonly used definition of malnutrition [13-23] (low BMI and unintentional weight loss) in the same hospital population.

PATIENTS AND METHODS

Research design and patients
All adult patients (≥ eighteen years of age) admitted to the VU University Medical Center, during the Dutch annual National Prevalence Measurement of Care Problems [32] on the 4th of April 2006 were asked to participate in a cross sectional screening on malnutrition. Patients were excluded from participation if it was impossible to weigh them, if they were pregnant, demented, unconscious, clinically instable or if they had insufficient knowledge of the Dutch language. Patients suffering from oedema or dehydration were also excluded since anthropometric measurements were necessary for the definition of malnutrition used in this study. We defined patients of 60 years or older as being elderly. A trained nurse and a trained dietician assessed each patient using quick-and-easy malnutrition screening tools (MST and SNAQ) and diagnostic malnutrition screening tools (MNA-SF, MUST and NRS 2002).

The study design was in accordance with the Declaration of Helsinki and was approved by the institutional review board of VU University Medical Center.

Nutritional status

Nutritional status was assessed similar to daily practice: we weighed all patients (wearing light indoor clothes and no shoes) on a calibrated scale (SECA 880, in kilograms to the nearest decimal). Patients were also asked to report their usual weight (one month, three months and six months ago) and height. If patients did not know their height it was measured (SECA 220, in centimetres to the nearest decimal). If patients had a lower body weight than one, three or six months ago we asked whether the weight loss was unintentional.

The investigator determined the nutritional status using measured weight, height and unintentional weight loss. Patients were defined as severely malnourished when one or more of the following conditions were present: BMI <18.5 kg/m^2, unintentional weight loss of more than 5% during the last month or unintentional weight loss of more than 10% during the last six months. Patients were defined as moderately malnourished with 5-10% unintentional weight loss during the last six months, independent of BMI. For elderly patients (≥ 60) a cut-off point for BMI < 20.0 kg/m^2 was applied [14-17].

Criterion validity

The study population was categorized into three groups, based on the objective definition of malnutrition as described above: well nourished, moderately malnourished and severely malnourished.

The criterion validity of the screening tools was determined by comparing the score of each of the five tools with the mentioned definition of malnutrition. As MST, NRS-2002 and MNA-SF consist of only two categories (well nourished and malnourished) and MUST and SNAQ of three categories, - for comparison reasons - both 1) well nourished patients and moderately malnourished patients versus severely malnourished patients 2) well nourished patients versus moderately and severely malnourished patients were assessed.

The MNA-SF was performed only in the subgroup of elderly (≥60 y) patients, because the tool has been developed for this population only.

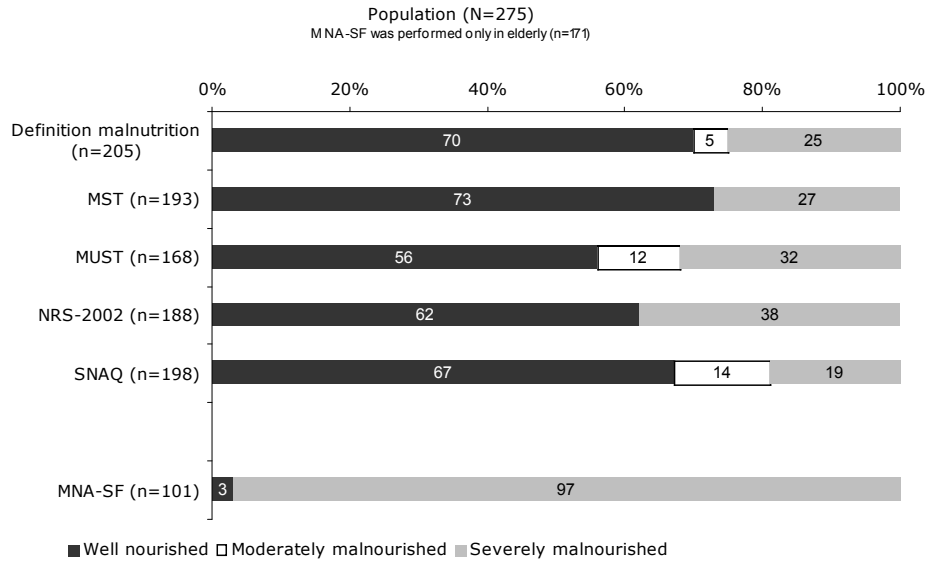
The sensitivity, specificity, positive predictive value and negative predictive value were determined. Sensitivity represents the probability (0-100%) that the screening tool correctly identifies moderately and severely malnourished patients. Specificity represents the probability (0-100%) that the screening tool score correctly identifies well nourished patients. Positive predictive value (0-100%) represents the probability that a patient with a screening tool score for moderate or severe malnutrition is indeed malnourished according to the mentioned definition of malnutrition. Negative predictive value (0-100%) represents the probability that a patient with a screening tool score for well nutrition is indeed well nourished according to the mentioned definition of malnutrition.
The cut-off points of the diagnostic values were: 0.9-1.0 excellent; 0.8-0.9 good; 0.7-0.8 fair; 0.6-0.7 insufficient and 0.5-0.6 poor [33].

Statistics
Data were checked for the presence of possible outliers, but these were absent in this database.
Standard descriptive statistical methods were used to express means, standard deviations, percentages, frequencies and minimum and maximum values. Differences in patient characteristics between the three groups were tested by the Kruskal-Wallis test for continuous variables and by ANOVA with post hoc analysis using the Tukey method for binary variables. P-values were based on two-sided tests, a $p < 0.05$ being considered to indicate statistical significance.
Cross-tabulations were used to present sensitivity, specificity and positive and negative predictive values, as described in the previous section. A 95% confidence interval was assessed. All analyses were performed for the group as a total and for the subpopulation of elderly separately. Statistical analyses were performed using the SPSS-system for Windows, version 16.0 (SPSS Inc, Chicago, IL, USA) and StatXAct4 for Windows, version 4.0.1 (Cytel Software Corporation, Cambridge, USA).

RESULTS

In this study 275 patients participated, of whom 171 (62%) were 60 years and older.
Nutritional status could be determined for 205 patients. 70 patients had incomplete data: on weight (n=24), height (n=27), weight loss during the last month (n=62) and/or weight loss during the last six months (n=66). Screening tools were complete for minimum 168 (MUST) to maximum 198 (SNAQ) patients (figure 1).
In the elderly subpopulation data for MNA-SF were missing for 70 out of 171 patients (41%).

Figure 1 prevalence of malnutrition (%)



According to our definition of malnutrition 70% of the study population was well nourished, 5% moderately malnourished and 25% severely malnourished. There was no difference in the prevalence of malnutrition in the elderly subgroup (≥ 60 years of age). Figure 1 shows the malnutrition scores of the five malnutrition screening tools. The MNA-SF score was only determined in the subgroup of elderly (n=171). The MUST demonstrates the highest percentage of malnourished patients and the MST the lowest percentage of malnourished patients. For all tools the prevalence of malnutrition in the total group was not different from the

prevalence of malnutrition in the elderly subgroup (data not shown).
There were no differences in age between the well nourished, moderately malnourished and severely malnourished patients. BMI was significantly lower in the severely malnourished group versus the well nourished and moderately malnourished group (table 1).

Table 1 Characteristics of well nourished, moderately malnourished and severely malnourished patients applying the commonly used definition

	Well nourished	**Moderately malnourished**	**Severely malnourished**	**P-value**
All patients n (%) n=205	144(70%)	10 (5%)	51 (25%)	-
Sex, % woman	47%	60%	53%	0.613‡
Age in years (± SD)	63(±15)	62 (±15)	62 (±20)	0.822†
BMI in kg/m^2 (± SD)	26.0(±4.0)	26.8 (±5.8)	20.7 (±4.7)	<0.001†
Elderly n (%) n=129	91(70%)	6 (5%)	32 (25%)	-
Sex, % woman	38%	50	56%	0.201‡
Age in years (± SD)	73(±8)	71 (±9)	75 (±11)	0.392†
BMI in kg/m^2 (± SD)	26.5(±3.9)	26.5 (±2.6)	20.8 (±4.6)	<0.001†

‡ Kruskal-Wallis

† ANOVA

P-value and Tukey significance level: 0.05

Table 2 shows the accuracies of the malnutrition screening tools. For SNAQ and MUST these results are split up in 1) well nourished patients and moderately malnourished patients versus severely malnourished patients, 2) well nourished patients versus moderately and severely malnourished patients. The overall results reveal that the malnutrition screening tools MST, MUST, NRS-2002 and SNAQ all show sensitivities and specificities of at least 60% for comparing the well nourished and moderately malnourished with the severely malnourished. When comparing the well nourished with the combination of moderately and severely malnourished patients the sensitivities and specificities were all 70% and higher. The MNA-SF had a sensitivity of 100%, but specificity was low.

Table 2 Accuracies (95% CI) of the five malnutrition screening tools

Characteristics of all patients
(Well nourished and moderately malnourished patients) versus (severely malnourished patients)

	MST n = 193	**MUST** n = 168	**NRS-2002** n = 188	**SNAQ** n = 198
Sensitivity	76 (66-84)	73 (63-81)	94 (87-98)	68 (58-77)
Specificity	90 (82-95)	82 (73-89)	80 (71-87)	97 (91-99)
Positive predictive value	71 (61-80)	58 (48-68)	62 (52-72)	87 (79-93)
Negative predictive value	92 (85-96)	89 (81-94)	98 (93-100)	91 (84-96)

Characteristics of all patients
(Well nourished patients) versus (moderately malnourished and severely malnourished patients)

	MST n = 193	**MUST** n = 168	**NRS-2002** n = 188	**SNAQ** n = 198
Sensitivity	78 (69-86)	96 (90-99)	92 (85-96)	75 (65-83)
Specificity	96 (90-99)	80 (71-87)	85 (76-91)	84 (75-91)
Positive predictive value	89 (81-94)	69 (59-78)	72 (62-81)	66 (56-75)
Negative predictive value	91 (84-96)	98 (93-100)	96 (90-99)	90 (82-95)

Characteristics of elderly (≥ 60)
(Well nourished and moderately malnourished patients) versus (severely malnourished patients)

	MST n = 123	**MUST** n = 103	**NRS-2002** n = 126	**SNAQ** n = 125	**MNA-SF** n = 91
Sensitivity	74(64-82)	67(57-76)	94(87-98)	63(53-72)	100(96-100)
Specificity	88(80-94)	82(73-89)	79(70-87)	96(90-99)	39 (29-49)
Positive predictive value	68(58-77)	56(46-66)	60(50-70)	83(74-90)	37 (28-47)
Negative predictive value	91(84-96)	87(79-93)	97(91-99)	89(81-94)	100(96-100)

Characteristics of elderly (≥ 60)
(Well nourished patients) versus (moderately malnourished and severely malnourished patients)

	MST n = 123	**MUST** n = 103	**NRS-2002** n = 126	**SNAQ** n = 125	**MNA-SF** n = 91
Sensitivity	78(69-86)	97(91-99)	92(85-96)	72(62-81)	100(96-100)
Specificity	94(87-98)	79(70-87)	83(74-90)	83(74-90)	41(31-51)
Positive predictive value	85(76-91)	68(58-77)	70(60-79)	63(53-72)	42(32-52)
Negative predictive value	91(84-96)	98(93-100)	96(90-99)	88(80-94)	100(96-100)

DISCUSSION

In this first study comparing the malnutrition screening tools MST, MUST, NRS-2002, SNAQ and MNA-SF in one population we have shown that criterion validity of MST, MUST, NRS-2002 and SNAQ all seem to be equal for screening malnutrition in hospital inpatients. In contrast, we consider MNA-SF, developed for the elderly population, not suitable for elderly hospital inpatients because of its very low specificity (39%) and positive predictive value (37%), resulting in referring many false positive malnourished patients to the dietician. A possible explanation for the poor specificity could be that the study population in which this tool was developed consisted not only hospitalized geriatric patients, but also of healthy community-dwelling elderly persons.

This study compared five screening tools in one study population. According to the commonly used of malnutrition 70% of all admitted patients was well nourished, 5% moderately malnourished and 25% severely malnourished. This is in line with previous studies [1-4]. We therefore assume that this hospital inpatient population is representative for other hospital populations.

The definition of risk categories of malnutrition may have influenced the results. We defined risk categories to enable comparison between all the five tools. MNA-SF, MST and NRS-2002 categorise patients into two risk categories: well nourished and malnourished. However, MUST and SNAQ categorise patients into three

malnutrition risk categories: well nourished, moderately and severely malnourished. For comparison, the three risk categories of MUST and SNAQ were combined into two risk categories. We realise this does not do justice to the original intention of these tools. This may partly explain why MUST and SNAQ show poorer results when the well nourished group was combined with the moderately malnourished. The accuracies of MUST and SNAQ were all >70% when the moderately nourished group was combined with the severely malnourished.

The absence of a gold standard can be a point of discussion in every study on disease-related malnutrition [15]. Therefore, in this study, we applied a commonly used and accepted definition of disease-related malnutrition by using both percentage unintentional weight loss and low BMI. Percentage weight loss was used to indicate acute malnutrition whereas a low BMI was used to indicate chronic malnutrition.

Unfortunately this definition of nutritional status could not be determined in all patients. Even though each patient was assessed by a trained nurse and a trained dietician, still 26% of the patients had incomplete data on weight, height and/or weight loss. For these patients no definition of nutritional status could be determined. For both quick-and-easy tools (MST and SNAQ) more complete data were available. This could support the idea that these quick-and-easy screening tools may be easier to fill-out than obtaining the questions of both BMI and involuntary weight loss.

Based on individual hospital preferences, each hospital should implement the most appropriate screening tool for its setting, either a diagnostic or a quick-and-easy tool.
Diagnostic screening tools - like MUST and NRS-2002 - have the advantage that nutritional status can be monitored in time but require more time and skills from nurses because of measuring height and weight, calculating BMI and percentage unintentional weight loss and evaluating disease severity. Implementing MUST or NRS-2002 in an electronical medical chart solves the problem of calculating BMI and percentage unintentional weight loss. In this study, MUST questionnaires were complete for only 53% of patients. This was mainly due to many missing values on the

question about acute disease and expected intake. None of the other tools had so many values missing.
MST and SNAQ are quick-and-easy screening tools, not developed for diagnostic purposes, and not suitable for monitoring the patients' nutritional status in time. They feature easy questions that are most indicative of risk of malnutrition. These questions can be pre-printed in the nurses' charts. For patients with screening score "severely malnourished" a dietician or physician will have to perform further nutritional assessment. Since the applicability of these quick-and-easy tools is high, nutritional status will be screened more easily by the nurse, and, in case of malnutrition, diagnosed by the physician or dietician on the day of admission.

CONCLUSION

This study reveals that the criterion validity of the four malnutrition screening tools MST, MUST, NRS-2002 and SNAQ all seem to be equal for malnutrition risk screening of adult hospital inpatients. Due to its poor specificity, the MNA-SF should not be applied to elderly hospital inpatients. Our advice is to introduce screening of all hospital inpatients on malnutrition with either MST, MUST, NRS-2002 or SNAQ instead of discussing which tool is best to use and at the same time doing nothing.

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MALNUTRITION PREVALENCE

Judith MM Meijers, Jos MGA Schols, Marian AE Van Bokhorst - de van der Schueren, Theo Dassen, Maaike AP Janssen, Ruud JG Halfens. Malnutrition prevalence in the Netherlands: Results of the annual Dutch National Prevalence Measurement of Care Problems British Journal of Nutrition. 2009;101:417-423.

ABSTRACT

The objective of this study was to provide data on malnutrition prevalence in hospitals, nursing homes and home care organisations in the Netherlands in a nationally representative sample and to assess the factors of age, gender, time since admission, ward type and disease, to identify patients at high risk of malnutrition.

A cross-sectional, multi-centre design with a standardised questionnaire was used to measure the prevalence of malnutrition. Nutritional status was assessed by BMI, undesired weight loss and nutritional intake.

12.883 patients were included in this study. The prevalence of malnutrition was highest in hospitals (23.8%), followed by home care organisations (21.7%) and nursing homes (19.2%). Logistic regression analysis revealed no association with age, time since admission and ward type. Being female was associated with malnutrition only in nursing homes. Blood diseases, gastrointestinal tract diseases, infection, COPD, dementia and cancer were factors associated with malnutrition in hospitals. Dementia was associated with malnutrition in nursing homes, while gastrointestinal tract diseases, diabetes mellitus and cancer were the associated factors in home care.

This study shows that malnutrition is still a substantial problem in hospitals, nursing homes and home care in the Netherlands. Malnutrition is a problem for more than one in five patients. Despite growing attention to the problem, more continued alertness is required.

INTRODUCTION

Malnutrition continues to be an important and under-recognised problem in all healthcare settings. Malnutrition can encompass both over- and undernutrition as well as deficiencies or imbalances of specific nutrients [1]. In this study, malnutrition is described as a state of undernutrition.

The first national survey of malnutrition conducted in 2001 by dieticians in the Netherlands included 7606 patients and indicated that approximately 25% appeared to be malnourished [2]. Since then, no other large-scale studies of malnutrition prevalence have been performed in the Netherlands.

Comparisons of malnutrition prevalence in hospitalised patients in different European countries reveals that this fluctuates from 10% to 60% [3]. European studies specifically related to the elderly report prevalence ranging from 22% in Germany up to 84% in Ireland [4,5]. Stratton et al. [6] showed that disease-related malnutrition occurs in hospitals (10-60%), nursing homes (50% or more) and among individuals living independently (>10%). These prevalence rates for malnutrition fluctuate extensively, as they depend on how malnutrition is operationalised [7-9]. As no worldwide consensus on the elements of malnutrition operationalisation has yet been reached, it is very difficult to find a uniform operationalisation covering different patient groups, diseases and settings. It is thus difficult to compare the prevalence rates of malnutrition across different studies, settings, patient groups and countries [6].

Despite these operationalisation differences, research shows that malnourished individuals consult their general practitioners and are admitted to hospitals or nursing homes more often, and have higher postoperative morbidity and mortality, slower wound-healing processes, longer hospital stay and poorer quality of life [10-14].

Obtaining insight into factors for malnutrition should make it possible to identify subgroups of patients at risk. This may have a positive effect on preventing malnutrition and its consequences [6]. The main risk factor, especially in hospitals, home care and nursing homes, is having a disease [15]. There are numerous reasons for this; Stratton et al. [6], for example, highlighted a diversity of disease-related aspects that decrease food intake even when food is available, including loss of appetite, anorexia, nausea,

psychological problems, and difficulties in chewing, tasting, swallowing and digestion. Furthermore, they demonstrated that nutrient requirements are increased by disease, which indicates that even normal intake could be insufficient for such patients.
Another factor influencing malnutrition is age. Higher age is associated with increased risk of Malnutrition, as disease prevalence in this group increases and body composition changes [4,17,21-23]. Gender, too, is another possible factor that could influence malnutrition, as body composition changes occur differently in men and women in the various ageing phases, thus influencing the assessment and screening of malnutrition [24]. Perissinotto et al.[22] found an adjusted malnutrition prevalence rate that was higher for women than for men in the elderly. Pirlich et al. [23], however, found no such gender influence.
Due to increasing awareness in developed countries of the importance of recognising malnutrition in healthcare and the fact that only one extensive study on malnutrition prevalence has been performed in the Netherlands, this study aimed to investigate malnutrition prevalence in Dutch hospitals, nursing homes, and home care organisations on a large representative scale, and to draw more attention from healthcare professionals to the problem of malnutrition. Additionally, the association of factors such as age, gender, disease, ward type and time since admission was assessed to identify patients at risk of malnutrition.

METHODS

Design
This study forms part of the annual National Prevalence Measurement of Care Problems of Maastricht University (*Landelijke Prevalentiemeting Zorgproblemen*; LPZ), which started measuring malnutrition in 2004. The design involves a cross-sectional, multi-centre point prevalence measurement.

Instrument
A standardised questionnaire was used to register data on the organisation itself, wards included and individual patients, including demographic data, reason for admission (registered in the medical records) and nutritional items such as amount of undesirable weight loss (6kg in the previous 6 months or 3kg in the previous month)

and nutritional intake (none for 3 days or reduced for more than 10 days). These items were obtained by having trained professionals measure the patients' height and weight. When being weighed the patients wore light indoor clothes and no shoes, and sat or stood on a calibrated scale. BMI was afterwards calculated by the research group. The nutritional item "undesired weight loss" was measured in kg, as this is faster and simpler for the nurses than calculating the weight loss percentage. Weight loss was assessed form earlier recorded weights in the charts, or, if missing, from recalled weight. The large LPZ population is heterogeneous and incorporates patients from different age groups (range: 18-104 years) and settings, further complicating the operationalisation of malnutrition. Based on literature and consultation with Dutch experts in the field, malnutrition was defined according to one of the three following criteria: 1) Body Mass Index (BMI) less than 18.5; 2) unintentional weight loss (6kg in the previous 6 months or 3kg in the previous month); or 3) BMI between 18.5 and 20 in combination with no nutritional intake for 3 days or reduced intake for more than 10 days [6,9,24-27].

Sample

For the LPZ study, all healthcare organisations in the Netherlands were invited by mail to participate voluntarily. Fifty-seven university and general hospitals (60.6% of the Dutch total of 94), 39 nursing homes (11.3% of the Dutch total of 345) and 19 home care organisations (12.6% of the Dutch total of 150) were included. Only patients of 18 years and older were included, as the criteria for defining malnutrition in patients younger than 18 are complex and vary from the adult population. The LPZ received ethical approval from the University Hospital Maastricht's (azM) medical ethical committee. Likewise, participating organisations were required to obtain approval from their own ethical committees. All patients or their relatives gave informed consent.

Data collection

The annual LPZ study took place on the 4th of April 2005. In each participating organisation one coordinator was responsible for the measurement. The coordinators were trained collectively by the research group on how to manage the survey within the organisation, and how to use the printed standardised

questionnaire and the specially designed Internet data-entry program. The coordinators also received a protocol and training package to support them in training the healthcare professionals who would perform the measurement within the organisations.
To achieve an objective judgment for every patient, two healthcare professionals (nurses, dieticians or doctors; one of whom worked in the patient's ward and the other independent) assessed each patient in the hospitals and nursing homes. For practical reasons, the measurements in home care organisations were spread over four days, and the healthcare professional primarily responsible for the patient's care filled out the questionnaire during a home visit. To ensure that these measurements were consistent, another independent healthcare professional revisited a random sample of 20 patients per home care organisation (Cohens kappa of 0.87).
LPZ participants could find all the information needed for the measurements and data entry on a purpose-built website.

Data analysis
Statistical analyses were performed using SPSS version 13.0 (SPSS Inc, Chicago, IL, USA) including descriptive frequency distributions for all variables. Differences between groups were tested using Student's t-tests, chi-square tests or variance analysis (ANOVA with post-hoc analysis using the Bonferroni method). Additionally, odds ratios (OR) with 95% confidence intervals (95% CI) were calculated.
To confirm associations found in the univariate analysis, a logistic regression analysis was performed separately for hospitals, nursing homes and home care organisations, where ORs with 95% CIs were calculated once again. The dependent variable was malnourished/ well nourished. Prior to analysis, data were assessed for congruence with regression assumption. The independent variables were checked for possible interaction, confounding and multicollinearity. Variables that remained significant at the 0.01 level were presented. This level was seen as significant due to the large sample size. When a group was analysed separately it had to consist of more than 100 patients for the findings to be of statistical value.

RESULTS

As we were rigid in requiring complete nutritional datasets (BMI weight and height), weight loss and data on intake), patients with partial datasets and those younger than 18 (N=394) were excluded from the analysis. This resulted in the total exclusion of 12.459 patients due to missing data on BMI (N=7516) and weight loss (N=4.549) of the original 25.342 participants. The remaining 12.883 (8028 hospital patients, 2061 nursing home patients and 2794 home care patients) were analysed in this study.
Excluded patient characteristics (time since admission, gender, age, disease type and comorbidity), stratified by setting and the ward types, were not significantly different from those of the included patients.
In table 1 the included patients' characteristics are shown separately for hospitals, nursing homes and home care organisations. Compared to those in hospitals, patients in nursing homes and home care were significantly older, and more often female. In hospitals, gender was more equally divided. In hospitals and home care, most patients had heart and coronary diseases and significantly higher BMIs, while more patients in nursing homes had dementia.

Malnutrition prevalence
Table 2 shows the malnutrition prevalence and malnourished patients' characteristics in hospitals, nursing homes and home care organisations. It reveals significant differences in prevalence rates between the three. Hospitals had the highest malnutrition prevalence rate (23.8%), followed by home care organisations (21.7%) and nursing homes (19.2%). In figure 1, malnutrition prevalence is presented per ward type for hospitals and nursing homes. Home care was omitted as it has no identifiable wards.

Table 1 Patient characteristics

	Hospital	**Nursing home**	**Home care**
Organisations N (%)	57 (49.5%)	39 (34.0%)	19 (16.5%)
Patients N (%)	8028 (62.3%)	2061 (16.0%)	2794 (21.7%)
Gender %			
Women N (%)	4199 (52.3%)	1407 (68.3%)	1754 (62.8%)
Men N (%)	3829 (47.7%)	654 (31.7%)*	1040 (37.2%)*
Age in years (±.SD)	65.2 (16)[a,b]	80.3 (10)[c]	76.2 (12)
BMI (±.SD)	25.8 (4.9)[a]	24.1 (5.1)[c]	25.9 (5.3)
Time since admission in days ± Diseases	11.4	829.9	879.2
Infection	682 (8.5%)[a,b]	44 (2.1%)	60 (2.1%)
Cancer	1087 (13.5%)[a,b]	88 (4.3%)[c]	366 (13.1%)
Diabetes mellitus	1009 (12.6%)[b]	285 (13.8%)[c]	585 (20.9%)
Blood diseases	303 (3.8%)	48 (2.3%)	66 (2.4%)
Dementia	301 (3.7%)[a,b]	1262 (61.3%)[c]	339 (12.1%)
Heart and coronary diseases	2606 (32.5)[a,b]	425 (20.6%)[c]	743 (26.6)
Stroke (CVA)	512 (6.4%)[a]	512 (24.9%)[c]	338 (8.5%)
COPD	1554 (19.4%)[a,b]	147 (7.1%)[c]	377 (13.5%)
Diseases of the gastrointestinal tract	1554 (18.4%)[a,b]	133 (6.5%)	262 (9.4%)
Musculoskeletal disorders	1478 (18.4%)	280 (13.6%)[c]	606 (21.7%)
N diseases pp ±	1.64[a,b]	2.96	2.13

COPD = Chronic Obstructive Pulmonary Disease
p <0.01 is significant
* significant difference between women and men
a: significant difference between hospitals and nursing homes
b: significant difference between hospitals and home care
c: significant difference between nursing homes and home care

Table 2 Prevalence rates of malnutrition and characteristics of malnourished and well nourished patients

	Hospital (N=8028)			Nursing home (N=2061)			Home care (N=2794)		
	M+	M-	P value / ORr / 95% CI	M+	M-	P value / OR / 95% CI	M+	M-	P value / OR / 95% CI
Prevalence %	23.8%	76.2%	<.001*a.b	19.2%	80. 8%	<.001*c	21.7%	78.3%	<.001*
Gender %									
Women	23.2 %			21.2%			21.7%		
Men	24.5%		.088. / 93. / 84-1.03	15.0%		<.001 / 1.52 / 1.18- 1.95	21.7%		.507 / 1.00. / .83-1.20
Age in years (± SD)	66.2 (16)	64.8 (16)	<.06	81.2 (10)	80.0 (11)	<.07	75.4 (13)	77.0 (11)	<.06
Time since admission in days ±	10.3	15.6	.01	843.6	826.6	<.001	696.3	930.5	<.001
Diseases									
Infection	33.1%	66.9 %	<.001	-	-	-	-	-	-
Cancer	40.7%	59.3%	.004	-	-	-	51.1%	48.9%	.009
Diabetes Mellitus	21.9%	78.1%	<.001	10.9%	89.1%	<.001	15.4%	84.6%	<.001
Blood diseases	37.6%	62.4%	<.001	-	-	-	-	-	-
Dementia	29.2%	70.8%	<.001	22.1%	77.9%	<.001	20.4%	79.6%	<.001
Heart and coronary	20.9%	79.1%	<.001	17.9%	82.1%	<.001	20.1%	79.9%	<.001
Stroke (CVA)	19.7%	80.3%	<.001	15.4%	84.6%	<.001	12.6%	87.4%	<.001
COPD	29.6%	70.4%	<.001	23.1%	76.9%	<.001	22.8%	77.2%	<.001
Gastr. Tract	37.3%	62.7%	<.001	20.3%	79.6%	<.001	32.4%	67.6%	<.001
Musculoskeletal disorders	15.3%	84.7%	<.001	20.4%	79.6%	<.001	18.8%	81.2%	<.001
diseases pp ±	1.89	1.56	.157	3.09	2.93	.268	2.27	2.10	.271

M+ = malnourished M - = well nourished - = < 100 participants no further analysis performed, OR= Odds Ratio 95% CI= Confidence interval p <0.01 is significant Gastr. Tract= Diseases of the gastrointestinal tract COPD= Chronic Obstructive Pulmonary Disease *= analysis of variance between type of organisations a: difference between hospitals and nursing homes b: difference between hospitals and home care c: difference between nursing homes and home care

Figure 1 Malnutrition prevalence in different hospital and nursing home wards

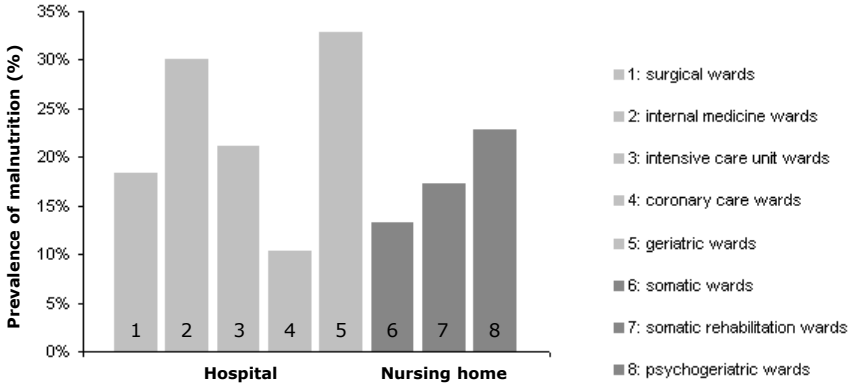
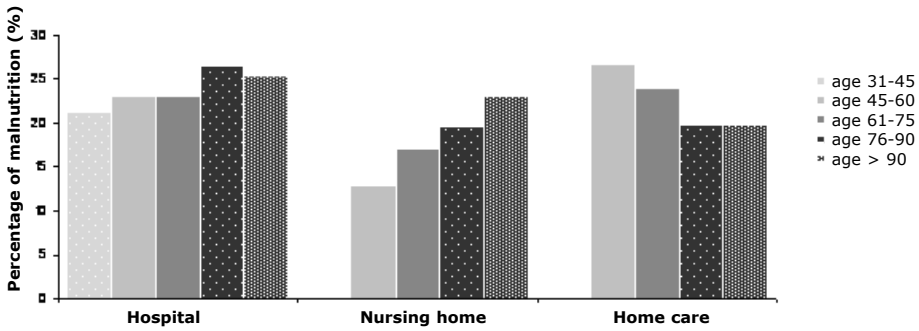


Figure 1 shows that the highest malnutrition prevalence rates occur in psychogeriatric wards in nursing homes, and in geriatric wards in hospitals. In nursing homes the prevalence rate varied from 13.3 % in somatic wards to 22.8% in psychogeriatric wards (with $p<0.001$ difference between them), and in hospitals from 10.3% in coronary care wards to 32.9% in the geriatric wards (with $p<0.001$ difference).

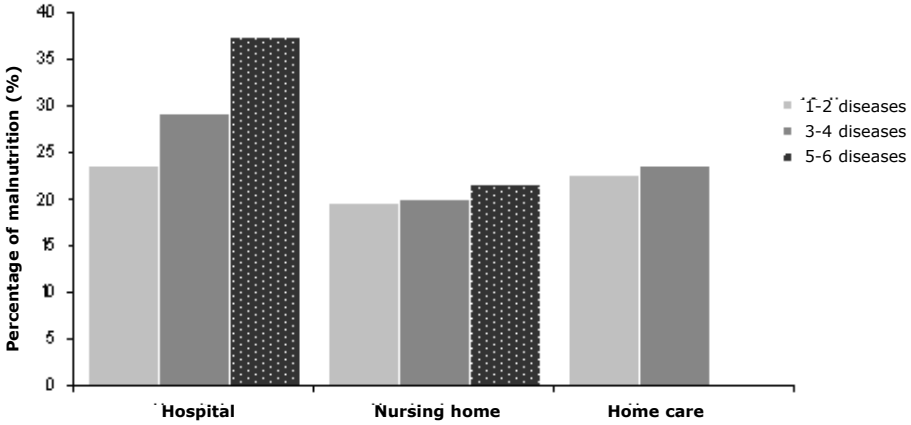
Characteristics of malnourished patients (univariate analysis)
As illustrated in table 2, a significant difference regarding gender was found only in nursing homes. Malnourished patients in hospitals and nursing homes were older than well nourished patients, unlike in home care. Similarly, time since admission was significantly higher for malnourished than well nourished patients in hospitals and nursing homes, while in home care this trend was the opposite. In hospitals, blood diseases, gastrointestinal tract diseases and cancer correlated more often with malnutrition. In nursing homes, dementia and COPD were more often associated with malnutrition, while in home care organisations patients with cancer and gastrointestinal tract diseases were more often malnourished.
Figure 2 shows that malnutrition is associated with increasing age, especially in nursing homes. In figure 3, increasing malnutrition prevalence in hospitals is shown with increasing comorbidity.

Figure 2 Malnutrition prevalence in different age groups



Chi-square for trend: p=0.06 for hospitals, p<0.01 for nursing homes, p=0.02 for home care,

Figure 3 Malnutrition prevalence with increasing comorbidity



Chi-square for trend: p=0.01 for hospitals, p=0.06 for nursing homes, p=0.08 for home care. Home care: group 5-6 diseases to small n<100.

Factors associated with malnutrition (multivariate analysis)

To confirm associations found in univariate analysis, a logistic regression analysis was performed for hospitals, nursing homes and home care organisations separately. The factors gender, age, ward type, disease and time since admission were analysed as

independent variables, with malnourished/well nourished as the dependent variable. Table 3 shows the analysis results per institution type (hospitals, nursing homes or home care organisations). Only factors significantly related to malnutrition are shown.

Table 3 Factors related to malnutrition, assessed by multivariate logistic regression analysis per kind of healthcare organisation

	Hospitals		
Variables in the model	*P* value	OR	95%CI
Infection	<.001	1.70	1.43-2.03
Cancer	<.001	2.74	2.39-3.15
Dementia	<.001	1.53	1.17-2.85
Blood diseases	<.001	2.22	1.73-2.85
COPD	<.001	1.58	1.40-1.80
Diseases of the gastrointestinal tract	<.001	2.46	2.16-2.78

	Nursing home		
Variables in the model	*P* value	OR	95%CI
Gender: female/ male referent	.004	1.45	1.13-1.87
Dementia	<.001	1.55	1.21-1.97

	Home care		
Variables in the model	*P* value	OR	95%CI
Cancer	<.001	4.19	3.32-5.29
Diabetes mellitus	<.001	0.67	0.52-0.87
Diseases of the gastrointestinal tract	.003	1.58	1.18-2.11

Only significant variables (p <0.01) are presented OR= Odds Ratio 95% CI= 95% Confidence interval COPD= Chronic Obstructive Pulmonary Disease

In the multivariate analysis no association with age, age group, ward type or time since admission was found in hospitals, nursing homes or home care organisations. An association with gender (female) was found only in nursing homes. In hospitals, particularly blood diseases, gastrointestinal tract diseases, cancer, dementia, infection and COPD were associated with malnutrition. In nursing homes, patients with dementia were more often malnourished, while in home care cancer, gastrointestinal tract diseases and diabetes mellitus were again most often associated with malnutrition. Patients in home care with diabetes mellitus had a significantly reduced chance of malnutrition. Interactions were tested but found not significant.

DISCUSSION

LPZ is one of the first large-scale, multi-centre prevalence studies focusing on healthcare problems carried out annually in the Netherlands. The purpose of the study was to investigate the prevalence of malnutrition and to assess the association between relevant influencing factors in Dutch hospitals, nursing homes and home care organisations and the prevalence of malnutrition.

Malnutrition prevalence

Our study showed a malnutrition prevalence rate ranging from 19.2% in nursing homes to 23.8% in hospitals. Comparing these rates to other studies in the field is a real challenge as they are largely dependent on the operationalisation of malnutrition (most studies use different screening tools and elements) as well as the population and setting investigated. Yet, a general comparison of our results with these studies shows that our prevalence rates are within the higher range of Stratton et al.'s (2003) reviews, and higher than that indicated by the first Dutch national survey conducted by dieticians in 2001 [2]. Still, comparing this LPZ prevalence study to the earlier national survey is difficult, as in 2001 malnutrition was operationalised only by weight loss. In this study we included a much larger sample of patients and focused on BMI, weight loss and intake. A recent German study by Pirlich et al.[23], however, showed hospital results comparable to ours, while a large study by Waitzberg et al.[17] of 4000 hospital patients in Brazil showed a much larger percentage (48.1%) of malnourished patients.

Geriatric wards in hospitals and psychogeriatric wards in nursing homes exhibited the highest malnutrition prevalence rates, a finding which is again comparable to other studies [2,14,21]. These other studies, however, explained their high prevalence rates by the higher age and vulnerability of the patient groups; in this study no influence of or interaction with age was found in the logistic regression analysis or additional analysis for the different wards.

Factors associated with the prevalence of malnutrition

As mentioned, the literature shows that higher age is a risk factor for developing malnutrition [4,17,21-23]. In this study, an age effect was found in the univariate analysis within nursing homes and home care (figure 1), but this effect disappeared in the multivariate analysis (table 3). The age effect revealed in other studies as well as in our univariate analysis may be due to the fact that higher age is associated with an overall increase in disease prevalence [4,17].

In figure 2, a trend of increasing age with increasing malnutrition prevalence in the univariate analysis of nursing homes was found. In home care, this trend was opposite; with increasing age, malnutrition prevalence decreased. This contradiction could be explained by the fact that sicker older persons are probably more often admitted to nursing homes, thus leaving a healthier population in the home care setting. This would also fit with the time since admission (receiving care) for home care in Table 2; in home care well nourished patients had a longer mean 'time since admission' than malnourished patients.

Perissinotto et al. [22] found that body composition changes occurred differently in men and women in the various phases of ageing, and thus influenced the assessment and screening of malnutrition. Their study indicated that in nursing homes women had a higher chance of becoming malnourished than men. However, like Pirlich et al. [21], we found no relationship between gender and malnutrition in hospitals.

Disease and malnutrition are related. table 2 shows that malnourished patients have a higher mean number of diseases per patient then those who are well nourished. Furthermore, patients with cancer showed a very high risk of being malnourished both in hospitals and home care organisations, a result also identified in other studies [2,6,18-29].

In nursing homes, patients with dementia had a higher risk of malnutrition; this finding is consistent with other studies in nursing homes [28,29]. However, patients with diabetes mellitus in home care had a significantly reduced chance of malnutrition - a finding not supported by other studies. A possible reason for this could be that diabetes mellitus patients are expected to be overweight rather than underweight, which could support our findings. Furthermore the BMI rates of these patients showed that their mean BMI was significantly higher ($p<0.001$).

Limitations of this national screening

Although our study sample was large (N=25.342), many patients were excluded if their nutritional data were incomplete; we felt it was very important to have complete and reliable data. Datasets for elderly patients in particular were often incomplete as caregivers found it difficult to actually weigh patients and measure their height. Likewise, Stratton et al. [30] indicated that measuring height and weight particularly in elderly patients is difficult: in their study only 56% of the elderly patients could be weighed.

Nevertheless, the group included in our analysis is a representative sample, with no significant differences in patient characteristics (time since admission, age, gender, number and type of disease) and type of ward compared to the excluded group, which makes the results robust and the sample quite unique.

A particular difficulty with cross-sectional studies focusing on correlations is the fact that the progression over time of certain disorders and their possible risk factors cannot be measured by one-time measurement. As the dependent and independent variable are selected at one and the same time, causality cannot be drawn. For example, disease and malnutrition interact such that the disease may cause secondary malnutrition, or malnutrition may adversely influence underlying disease.

The large LPZ population is heterogeneous and incorporates patients from different age groups (18-104) and healthcare settings, making the operationalisation of malnutrition extremely difficult as there is no consensus on a valid and reliable instrument for quick and easy measurement that suits the whole group at once. However, based on the literature and expert consultants in the malnutrition field in the Netherlands, we did achieve consensus on our definition. We realise, though, that the BMI cut-off points and

the further operationalisation used are debatable, may not be totally appropriate for all age groups, and could possibly result in an underestimation of malnutrition prevalence.
In our operationalisation, undesired weight loss in kilograms was used instead of percentage of weight loss. We do believe it would have been preferable to use absolute percentages, yet fixed cut-off points were easier for the nurses who filled out the questionnaires than having to calculate % weight loss. Still, we had to deal with a large number of missing values in the dataset. In addition, obtaining recalled weights from three and six months earlier has its limitations. Patients and/or their families often do not remember previous weights, or might have used different or non-calibrated scales with or without clothes.
As LPZ was measured on a large scale and to make it easier for the nurses to fill out the questionnaire, questions on diseases were clustered per disease group. Thus, our data do not specify the disease type each patient had at the time of measurement. We realise that this limits further analysis on the disease variable.

An annual, large-scale, multi-centre study like LPZ focusing on healthcare problems such as malnutrition is unique in Europe. This study shows that malnutrition is still a substantial problem in hospitals, nursing homes and home care in the Netherlands. Despite growing attention to the problem, more continued alertness is required. Therefore, in the Netherlands the LPZ's prevalence measurement of malnutrition will be repeated annually to achieve structural and ongoing awareness of the problem within healthcare organisations, as well as to raise national awareness of its approach.

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MALNUTRITION PREVALENCE, PREVENTION, TREATMENT AND QUALITY INDICATORS

Judith MM Meijers, Ruud JG Halfens, Marian AE Van Bokhorst - de van der Schueren, Theo Dassen T, Jos MGA Schols. Malnutrition in Dutch healthcare: Prevalence, prevention, treatment, and quality indicators. Nutrition. 2009;25:512-519.

ABSTRACT

Objective

In most healthcare organisations there is still insufficient awareness for recognising and treating malnourished patients. To gain more insight into nutrition care policies in Dutch healthcare organisations, this study investigated screening, treatment and other quality indicators of nutritional care.

Research Methods & Procedures

In 2007 a cross-sectional multicentre study was performed including 20.255 patients (hospitals N=6.021; nursing homes N=11.902; home care N=2.332). A standardised questionnaire was used to study nutritional screening and treatment at patient level and quality indicators at institutional and ward level (e.g. malnutrition guidelines/protocols, nutritional education, and weighing policy).

Results

Nutritional screening was performed more often in nursing homes (60.2%) than in hospitals (40.3%) and home care (13.9%) ($p<0.001$) In general, one in every five patients was malnourished, and nutritional treatment was applied in less than 50% of all malnourished patients in nursing homes, hospitals and home care. At ward level nursing homes focused more on the quality of nutritional care than hospitals and home care, especially with respect to controlling the use of nutritional guidelines (54.6%, $p<0.03$), weighing at admission (82.9%, $p<0.01$) and mealtime ambiance (91.8%, $p<0.01$).

Conclusions

This large-scale study shows that malnutrition is still a considerable problem in one out every five patients in all participating healthcare settings. Furthermore it demonstrates that recognising and treating malnutrition continues to be problematic. To target the problem of malnutrition adequately, more awareness is needed of the importance of nutritional screening, appropriate treatment and other nutritional quality indicators.

INTRODUCTION

Although a large number of studies, some already more than 20 years old, show high prevalence rates (10-60%) of malnutrition in healthcare organisations, malnourished patients still remain frequently unrecognised in these settings [1-7]. Optimising the recognition and treatment of malnutrition is expected to improve patient outcomes, such as faster (wound) healing process, less postoperative morbidity, shorter stay in hospital, lower incidence of pressure ulcers, lower mortality etc. [8-19]. Early recognition and treatment is therefore an advantage for both patients and healthcare systems.

Focusing on this early recognition, a British study from the 1990s showed that two thirds of the nurses in healthcare organisations weighed patients, 11% measured height, and roughly 80% recorded nutritional outcomes. Some, however, neither thought about nutrition nor performed measurements, as they regarded this information as unimportant [20]. In a Danish study by Rasmussen et al. [21] the respondents agreed that nutrition was a low-priority area in their daily care routine. This can be attributed to deficient knowledge about nutrition, low interest, confusion about to their own responsibilities, problems detecting at-risk patients, and lack of time.

A recent Dutch study [22] undertaken 10 years after the studies mentioned above shows that nutritional assessment and intervention are still not sufficiently applied by any healthcare professionals at any stage of the hospitalisation period. Another recent study by Mowe et al. [23] carried out in Denmark, Sweden and Norway pointed out that the common cause of insufficient nutritional practice was lack of nutritional knowledge. Of the participants, 25% found it difficult to identify patients in need of nutritional therapy, 39% lacked techniques for identifying malnourished patients, and 66% lacked national guidelines for clinical nutrition.

Rasmussen's [10], Bavelaar's [22] and Mowe's [23] studies all distinctly emphasise that quality indicators, such as defining patients at risk, nutritional screening, implementing adequate nutritional treatment, defining responsibilities and increasing knowledge, seem obligatory to ensure improvement in patient care.

In terms of nutritional care policy, since 2001 a number of

contributory national campaigns have aimed to increase attention to the problem of malnutrition in Dutch healthcare organisations and optimise its recognition and treatment. In 2001, the first nationwide screening on malnutrition was performed by the Dutch Dietician Association [3]. Since 2004, the annual Dutch National Prevalence Measurement of Care Problems (LPZ) has measured the prevalence, screening, treatment, quality indicators, and attitude towards malnutrition across different healthcare settings [24]. Furthermore, in 2006 a national improvement programme started in nursing homes aiming to optimise nutritional screening, to develop an adequate weighing policy and to improve mealtime ambiance. Another national campaign, 'Eat well to get well', also began in Dutch hospitals in 2006, aiming to implement screening of all hospital patients at admission, and to provide optimal nutritional treatment for malnourished patients.

Until now, no large-scale data have been published on the nutritional care policy actually carried out in Dutch hospitals, nursing home, and home care organisations. The present article describes the results of the fourth Dutch National Prevalence Study on malnutrition in hospitals, nursing homes, and home care (LPZ). Besides indicating the prevalence rate of malnutrition, the goal of this study was to target the following questions related to the different healthcare sectors: (a) how and how often are patients nutritionally screened? (b) how and how often is nutritional treatment applied? (c) are nutritional quality indicators available at ward and institutional level (table 1)?

MATERIALS AND METHODS

Design

The design of the study was a multicentre cross-sectional point-prevalence measurement, as part of the annual Dutch National Prevalence Measurement of Care Problems (LPZ). The study was carried out in April 2007.

Instrument

A standardised printed questionnaire with three levels was used.

(1) The questions at patient level consisted of demographic data (sex, age, mobility, operation), diseases registered in the medical records, and care dependency (as measured using the Care

Table 1 List of nutritional quality indicators

Institutional level o Availability of an up-to-date protocol/guideline on malnutrition prevention and treatment o Auditing of protocol/guideline on malnutrition prevention and treatment o Availability of malnutrition advisory teams o Multiple dieticians available in the institution o Malnutrition education (prevention and treatment) given by malnutrition specialist within the last two years
Ward level o Specifically trained malnutrition specialist working on the ward o Control of use of prevention and treatment guidelines o Policy to measure weight at admission o Malnutrition interventions documented o Correct mealtime ambiance (restaurant, cooking for self, buffet, prefer eating together, table laid with tablecloth, napkins (family style), nurses asked to help with dinner, silent surroundings, no doctors, nurses or other personnel to disturb eating) [25]

Dependency Scale [26]). Questions about nutritional screening (when, how often, by whom, screening content), consulting of dietician, and nutritional treatment (diets, oral nutritional support, tube feeding, parenteral nutrition) were also included. Answers were obtained by asking the patient or, if this was not possible, by consulting a responsible nurse or relative or patient documentation. Additional questions were asked on weight, height and undesired weight loss. All patients were weighed wearing light indoor clothes without shoes, standing or sitting on a calibrated scale. If height could not be measured because patients were not mobile, it was calculated from knee height, length (cm) of forearm (ulna) or demispan. Weight loss over time was assessed from weights recorded earlier in the charts, or, if missing, from recalled weight. For reasons of practicability, weight loss was expressed in kg.
(2) At ward level (or team level in home care) the head of the department filled out a 12-item questionnaire with dichotomous (yes/no) answers about the type of ward and specified malnutrition

quality indicators (table 1). 3) At the institutional level the coordinator filled out an 8-item questionnaire with dichotomous (yes/ no) answers about the type of institution and the specified malnutrition nutritional quality indicators (table 1). All quality indicators included in this study were formulated by a team of Dutch experts in the field of malnutrition, based on the guidelines of Beck et al. the Resolution 2003 and their own experience [1,2]. However, the actual benefit of implementing the indicators in a larger scale, such as among institutions included in the present study, is not known but will be the focus of future studies.

Malnutrition definition

The large population of LPZ is heterogeneous and incorporates patients from different age groups (18-104) and settings, making the operationalisation of malnutrition complicated. Combining knowledge from the literature, ESPEN guidelines and malnutrition experts, malnutrition was defined as: 1) body mass index (BMI) $\leq$ 18.5 (age 18-65) or BMI $\leq$ 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), or 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 (age > 65) [26-31].

This definition was tested positively for face validity by consulting experts in the field. It was also tested for criterion validity in 300 hospital patients by comparing this LPZ definition to four common relevant screening tools: Malnutrition Screening Tool (MST) [32], Malnutrition Universal Screening Tool (MUST) [33], Nutritional Risk Scale (NRS-2002) [34], and Short Nutritional Assessment Questionnaire (SNAQ) [35]. In these comparisons sensitivity (SE) and specificity (SP) were found to be good (Academical point system, Feb 2007) [36].

Data collection

In each participating organisation one coordinator was responsible for organising the measurement. These 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). To achieve objective judgment for every patient, two healthcare

professionals (nurses, dieticians or doctors; one of whom worked on the patient's ward, and one independent) assessed each patient together.

Sample
For the LPZ study, all healthcare organisations in the Netherlands were invited by mail to participate voluntarily. To obtain a reliable, consistent analysis, patients were only included if they gave informed consent, were 18 years or older, and if weight, height and weight loss were all recorded.

Data analysis
Statistical analyses were performed with SPSS version 13.0 (SPSS Inc, Chicago, IL, USA). Data were checked for outliers and normality. The analyses included descriptive frequency distributions for all variables; differences between groups were tested using Student t-tests, chi square tests, or analysis of variance (ANOVA) (with post hoc analysis using the Bonferroni method). Additionally, odds ratios (OR) with 95% confidence intervals (95% CI) were calculated. If a patient group was analysed separately, it had to consist of more than 100 patients to be of statistical value. P-values were based on two-sided tests, and the cut-off point for statistical significance was <0.05.

RESULTS

Patient characteristics
27.467 patients participated. Patients with missing data on weight, height or weight loss (N=6.971) and those younger than 18 (N=241) were also excluded. This resulted in an exclusion of 7.212 patients of the original 27.467. Excluded patient characteristics (sex, age, disease type and comorbidity) stratified by setting were not significantly different from those of the included patients. A complete dataset of 20.255 patients (6.021 hospital patients, 11.902 nursing home patients, and 2.332 home care patients) was analysed. In table 2 the included patients' characteristics are shown separately for hospitals, nursing homes and home care.
Fifty university and general hospitals (35,2 % of the total number of Dutch hospitals (N= 142), 90 nursing homes (27,8% of the total number of Dutch nursing homes (N= 324) and 16 home care

organisations (6.5% of the total number of Dutch homecare organisations (N= 248) were included.

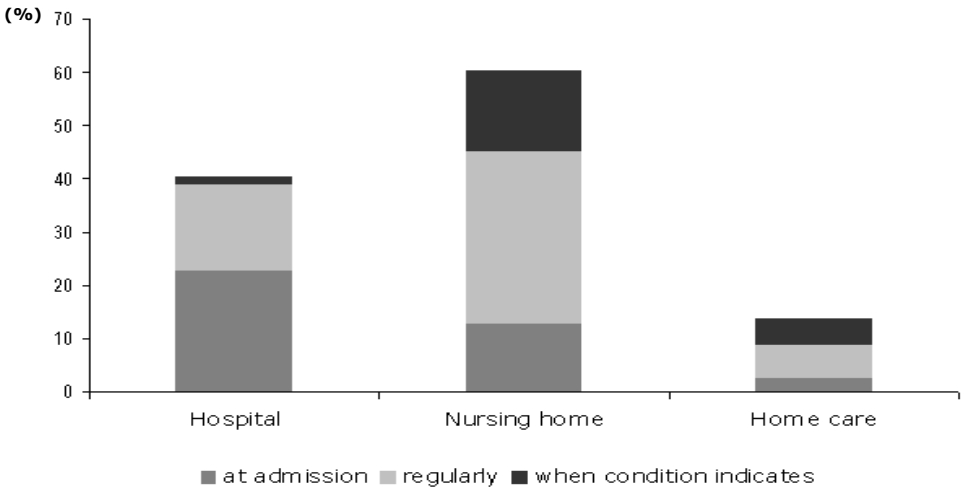
Table 2 Patient characteristics

	Hospital	**Nursing home**	**Home care**
Organisations N	50	90	16
Departments/units N	438	468	98
Patients N	6021	11902	2332
Sex			
Women N (%)	3165 (52.6 %)	8206 (68.9%)	1540 (66.0%)
Men N (%)	2856 (47.4%)	3696 (31.1%)	792 (34.0%)
Age in years (±.SD)	67 (16)*1,2	81 (10) *3	78 (11)
BMI (±.SD)	25.7 (5.2)*1	24.9 (5.1)*3	26.5 (5.7)
Immobility % #	13.1*1,2	5.5	2.3
Care dependent %	4.9	25.1*1,3	1.8
Diseases N (%)			
Infection	575 (9.6%)*1,2	106 (0.9%)*3	59 (2. 6%)
Cancer	721 (12.0%)*1,2	570 (4.8%)*1,3*3	290 (12.6%)
Diseases of the gastrointestinal tract	155 (2.6%)*2	257 (2.2%)*1,3	45 (2.0%)
Blood diseases	139 (2.3%)*2	161 (1. 4%)*3	53 (2.3%)
Dementia	114 (1.9%)	6331 (53.5%)*1,3	143 (6.2%)
Cardio vascular diseases	1596 (26.7%)*2	2458 (20.8%)*1,3	627 (27.2%)
Stroke (CVA)	299 (5.0%)	2715 (22.9%)*1,3	204 (8.9%)
Mean number of prevalent diseases	1.67	3.13	2.56

*p<0.01; 1: between hospitals and nursing homes; 2: between hospitals and home care; 3: between nursing homes and home care; # mobility measured with 4-item Likert scale from immobile to mobile.

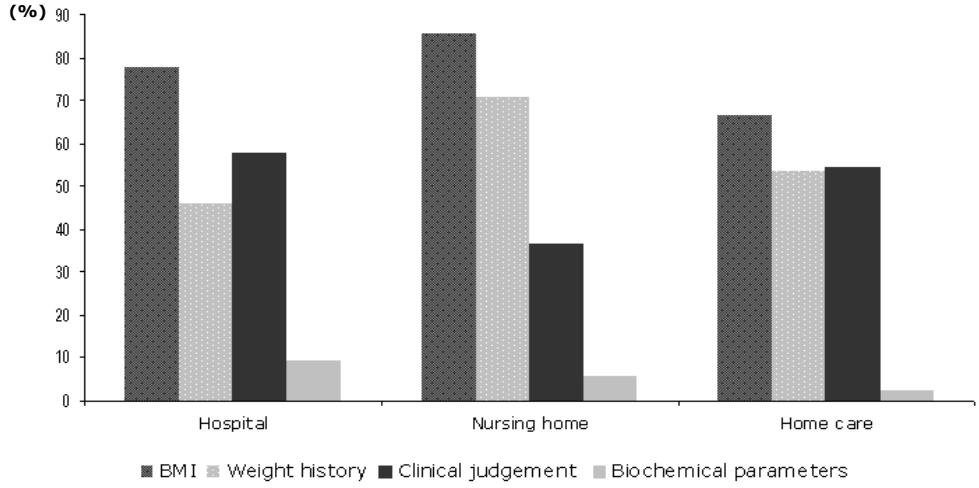
In nursing homes and home care more women than men participated; in hospitals sex was more equally distributed. Compared to hospitals, patients in nursing homes and home care were significantly older. Hospital patients were more immobile and nursing home patients more care dependent than patients in the other settings.
In hospitals and home care, most patients suffered from cardiovascular diseases followed by cancer, while in nursing homes patients mainly suffered from dementia, followed by cardiovascular diseases and stroke. Nursing home patients had the highest number of prevalent diseases, indicating a higher comorbidity.

Figure 1 Screening of patients and time of screening



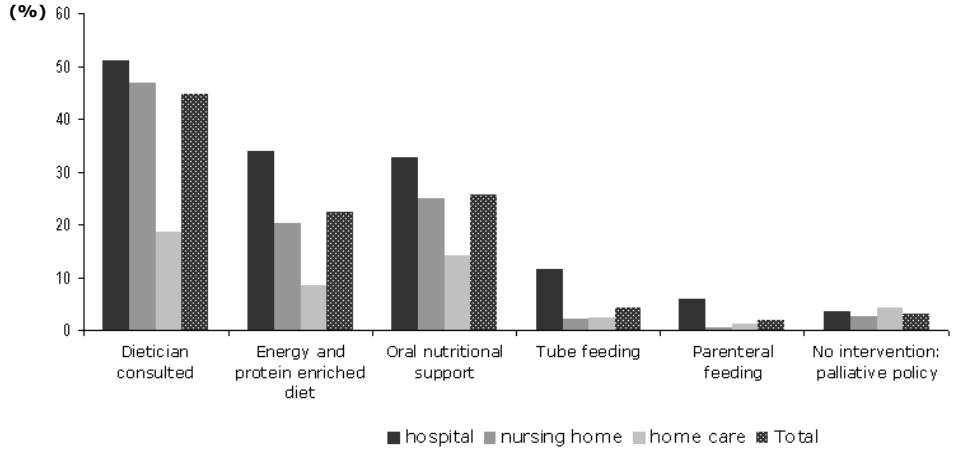
Nutritional screening and prevalence rates of malnutrition
In general, nutritional screening took place in less than 60% of all patients, and was performed significantly more in nursing home patients (60.2%) compared to patients in the other settings (40.3% in hospitals and 13.9.% in home care) (p=0.001) (figure 1). Hospital patients were particularly screened at admission, whereas nursing home patients were particularly screened on a regular (monthly) basis. Nurses tended to carry out the nutritional screening (hospitals 73.9%, nursing homes 55.0%, and home care 51.0%), followed by dieticians (hospitals and nursing homes 25%, and home care 50%).

Figure 2 Content of the screening



Screening predominantly involved measurement of BMI ($p<0.001$ compared to other parameters). Biochemical parameters were used the least. A screening instrument was applied in less than 50% of the screened patients in hospitals and nursing homes, while in home care this was even less (10%). SNAQ (69.3%) and MUST (5.3%) were the most common instruments, though nursing homes did not use an established tool in 91.7% of cases: they mostly used BMI and weight history together as parameters. In home care SNAQ was used in 55% of screened patients.

Figure 3 Nutritional treatment of malnourished patients, and consultation of dietician

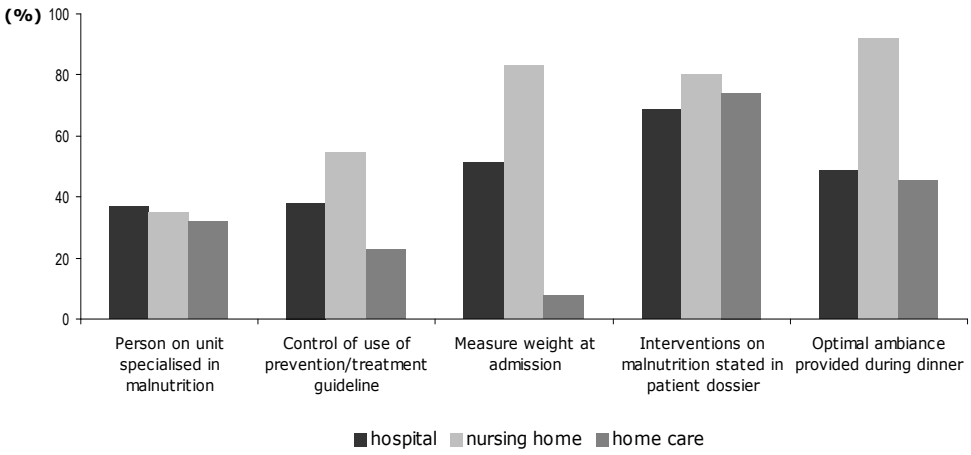


In nursing homes, the prevalence of malnutrition was significantly (p=0.001) higher (24.5%) than in home care (17.9%) and hospitals (22.1%). The highest prevalence of malnutrition in hospitals was in geriatric wards (32%), and in nursing homes in psychogeriatric wards (36%).

Fewer than half of all malnourished patients received nutritional treatment. In hospitals a larger proportion of malnourished patients was treated than in nursing homes, while in home care treatment was provided the least.
A dietician was consulted for less than 50% of all malnourished patients (figure 3). Nutritional treatment most often implied an energy- and protein-enriched diet or oral nutritional supplements.

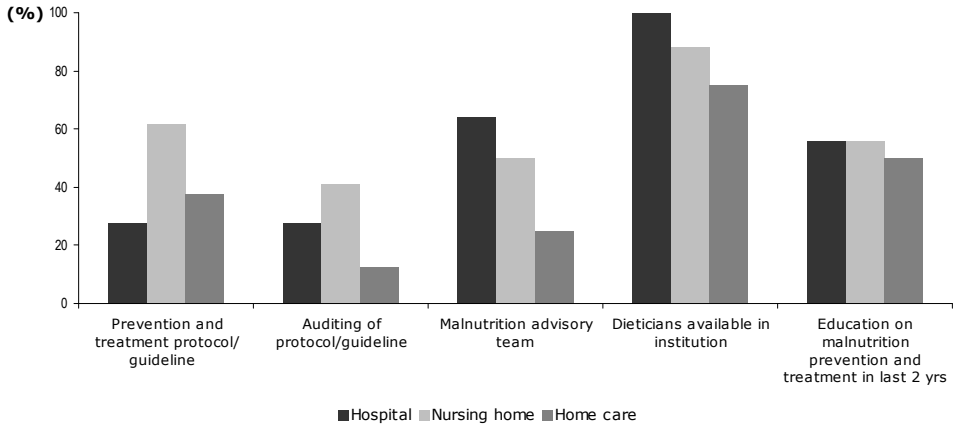
Quality indicators of nutritional care
Figures 4 and 5 show the quality indicators present at ward (team) level and at institutional level respectively.

Figure 4 Quality indicators on malnutrition policy at ward level



Overall, at ward level nursing homes focused more on the quality of nutritional care than hospitals and home care, especially with respect to control of using nutritional guidelines (p<0.03), weighing at admission (p<0.01) and mealtime ambiance during dinner (p<0.01). Of all institutions, 70% stated that if malnutrition interventions were performed they were recorded in the patient dossier.

Figure 5 Quality indicators on malnutrition policy at institutional level.



At institutional level, less than 60% of the participating institutions used prevention and treatment protocols/guidelines. In nursing homes guidelines were used more often than in the other two settings ($p<0.001$). Hospitals had significantly more multidisciplinary nutritional support teams ($p<0.01$). Finally, in half of all the participating institutions educational activities on prevention and treatment of malnutrition had taken place in the last two years.

DISCUSSION

This study is, to our best knowledge, the first that gives detailed insight into the nutritional care policy (screening, treatment and nutritional quality indicators) actually carried out in hospitals, nursing homes and home care. It shows that malnutrition still is a considerable problem in one out every five patients in all participating healthcare settings in the Netherlands. In spite of this, nutritional screening and adequate treatment in malnourished patients are rarely structurally applied. Although nutritional quality indicators are accessible in some participating organisations, much work remains to be done to structurally utilise them in all healthcare organisations.

Screening

Elia et al. [37] recommended that all patients admitted to healthcare organisations be screened on their nutritional status. In this study, nutritional screening took place in less than 60% of the patients. Our findings were based on reported rather than observed practice, and therefore could be an overestimation. In Rasmussen et al.'s [21] study 77% of the nurses pointed out that nutritional screening should be performed, but in only 24% it was stated to be a routine procedure. In the present study, nursing home patients were screened significantly more often compared to the other settings. In 2006, a governmental improvement program in nursing homes focused on improving screening and measuring weight regularly to detect involuntary weight loss over time. This program might have resulted in the greater attention to screening observed in nursing homes in this study compared to the other settings. Screening in nursing homes involved no specific screening tool (91.7%); the most common parameters used together were BMI and weight history, whereas in the other settings specific screening tools like MUST or SNAQ were used more frequently. Remarkably, half of the screened home care patients were screened with the SNAQ [3] although this tool has not been validated for these settings.

Treatment

Nutritional treatment interventions were applied in fewer than half of the malnourished patients; in home care even less so, namely

one out of five patients. Similar results were found in hospital studies by Reilly et al. [38], Rasmussen et al. [21] and Bavelaar et al. [22]. More awareness is needed of the importance of treatment for malnourished patients or patients at risk, and those who are at risk of malnourishment should subsequently be treated adequately. To increase awareness of malnutrition, the Dutch government recently launched quality indicators on screening and treating malnutrition for Dutch hospitals and nursing homes. These indicators are monitored by the healthcare inspectorate, published on the internet and in newspapers, and reflect the quality of care in and between hospitals and nursing homes. They were launched in 2007 (screening) and 2008 (treatment); first results will be available in due course. The quality indicators are meant to lead to quality improvement programs; thus, the data are awaited eagerly to evaluate whether the programme has had the expected effects.
A dietician was consulted for fewer than half of the malnourished patients. This finding fits within the results of an earlier study by Kruizenga et al. (2003) [3] carried out in 2001. O' Flynn et al. [39] pointed out that implementing nutritional care strategies (like screening within 48 hours of hospital admission combined with an educational programme) increased dietetic referrals significantly. It is expected that implementing the aforementioned quality indicators will also lead to an increase in dietetic referrals in the Netherlands as well. Next year's LPZ data will be able to show the changes, if any will be found.

Quality indicators of nutritional care
This study pointed out that nursing homes focused more on the quality of nutritional care than hospitals and home care. However, nutritional care policy was still insufficiently utilised in all healthcare settings. Three out of four wards indicated having a policy to report malnutrition and nutritional interventions in the patient's dossier. Since this was a reported nutritional quality indicator at ward level, it provides no insight into actual practice. Rasmussen et al. [10] indicated that 84% of the nurses in their study felt that interventions should be reported in patient dossiers, but in practice only 18% did register nutrient intake. Another quality indicator was measuring weight upon admission to the ward. This was applied mainly in nursing home wards (82.8%), which was probably influenced by the governmental improvement programmes in

nursing homes focusing on an adequate weighing policy starting at admission.

Remarkably, at patient level it was indicated that in nursing homes screening was mostly performed on a regular (monthly) basis. Thus at ward level there may be an intention to weigh patients at admission, but at patient level this is still mostly done on a regular basis and not necessarily at admission.

Only half of the hospitals wards had a weighing policy at admission. Similar results were found in hospital studies in Norway and Denmark [21,40]. We expect this figure to improve substantially with the recent introduction of the national quality indicator on screening at admission.

Finally, a well-established mealtime ambiance is known to be a cost- and labour efficient intervention that counteracts decreases in quality of life, physical performance, and body weight [25]. Family-style meals stimulate daily energy intake and protect nursing home residents from malnourishment [25]. In this study 90% of the nursing homes wards answered positively questions focusing on a nice mealtime ambiance. This, again, is a positive development.

Although our study included a large sample, many patients (N=7.212) were excluded from the analyses (when nutritional data were incomplete) because of strict inclusion criteria. Nevertheless, the remaining uniquely large group of patients in our analysis is still representative, with no significant differences in patient characteristics (age, sex, number and type of disease) compared to the excluded group. A particular difficulty with cross-sectional studies is that the progression of malnutrition prevalence over time cannot be gauged by this one-time measurement. To clearly measure the influence of the attention (improvement programmes and awareness campaigns) paid to the malnutrition problem, additional longitudinal monitoring with multilevel analyses would be preferable. We aim to publish these longitudinal data soon.

LPZ is, to our knowledge, the first study that comprehensively measures nutritional care policy (screening, treatment and nutritional quality indicators) on different levels in hospitals, nursing homes and home care. Since this study concerns only Dutch data and no other European data are yet available, comparison to other countries is difficult. To create the possibility to compare our results internationally, LPZ is now expanding to the German speaking countries.

CONCLUSION

This study demonstrates that recognising and treating malnutrition is an ongoing problem in all participating healthcare settings. Nutritional policy, screening, and treatment interventions are not sufficiently applied. To target the malnutrition problem adequately, more awareness is needed of the importance of nutritional screening, adequate treatment and other nutritional quality indicators.

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TRENDS AND EFFECTS OF AUDIT AND FEEDBACK ON MALNUTRITION PREVALENCE RATES

Judith MM Meijers, Math JMM Candel, Jos MGA Schols, Marian AE Van Bokhorst - de van der Schueren, Ruud JG Halfens. Trends and effects of audit and feedback on malnutrition prevalence rates. Accepted Journal of Nutrition

ABSTRACT

To date, no studies have analyzed the influence of annual audit and feedback on the prevalence rates of malnutrition. This study analyzes the trend of malnutrition prevalence rates between 2004 and 2007, and the effects of 1) previous audits and feedback from the annual Dutch National Prevalence Measurement of Care Problems (LPZ) and 2) the effect of the participation in Dutch national improvement programs. From 2004 through 2007, an annual multicenter study was performed in Dutch hospitals, nursing homes, and home care organizations using a standardized questionnaire involving measurements at the institutional, ward, and patient level. The data were analyzed by logistic multilevel analysis. Nutritional status was assessed by BMI, undesired weight loss and nutritional intake.

In total, 80 hospitals, 141 nursing homes, and 48 home care organizations participated. The prevalence of malnutrition showed a decreasing trend in hospitals and home care over the years. In nursing homes, prevalence rates were stable. Furthermore, the more often hospitals and home care organizations participated in the annual LPZ audits, the lower the prevalence rate of malnutrition ($p< 0.001$). Participation in national improvement programs also resulted in lower prevalence rates ($p= 0.027$).

In conclusion, malnutrition prevalence rates have decreased over the last four years in hospitals and home care in the Netherlands . Participation in the LPZ and involvement in national improvement programs positively influenced these malnutrition prevalence rates, possibly indicating that increasing awareness and actively working towards improvement could be important in lowering these rates.

INTRODUCTION

A large number of patients in European healthcare organizations are malnourished; prevalence rates are described to range from 10% to 60% [1-6]. Malnutrition is a serious burden, leading to increased mortality, longer hospital stays, decreased quality of life, and increased complication rates [3,7,8]. It thus costs billions of Euros every year [9]. Resolutions and proposals that could eventually reduce healthcare expenditure already exist, and are expected to enhance the quality of care and clinical outcomes [10-14]. Whether these ultimately translate into effects is not yet widely known.

In Dutch healthcare organizations, malnutrition (defined as undernutrition) frequently still goes unrecognized and undertreated [6,15,16]. In recent years, more attention has been paid to this healthcare problem in the Netherlands by way of contributory national campaigns, and other initiatives. In 2000, a national campaign on disease-related malnutrition was launched, including a one-time nationwide screening of malnutrition performed by the Dutch Dietetic Association [16]. In this study, about 25% of the hospitalized patients appeared to be malnourished. Starting in 2004, the annual Dutch National Prevalence Measurement of Care Problems (LPZ) included an audit of malnutrition prevalence rates, nutritional screening, treatment, monitoring and other relevant nutritional quality indicators in healthcare organizations nationwide [6,16]. The results were fed back to participating healthcare institutions, the government, and the media, creating national awareness of the magnitude of the malnutrition problem. This triggered the initiation of two national government-sponsored improvement programs on malnutrition, one for hospitals and one for nursing homes and residential homes. The program 'Eat well to get well' was launched in 2006 in the hospital setting, aiming to improve attitudes towards structural nutritional screening and, in addition, to provide optimal nutritional treatment. Also in 2006, the program 'Care for better' started in nursing homes and residential homes to optimize structural nutritional screening, develop an adequate weighing policy and improve mealtime ambiance.

In 2007, a compulsory performance indicator for screening and treating nutritional status was introduced, obliging hospitals to report annually on screening at admission and patient intake on the

fourth day of admission. In the nursing and residential homes, a compulsory performance indicator was introduced that focused on the prevalence of malnutrition.
To our knowledge, no studies exist that analyzed the trend in malnutrition prevalence rates over four years, consistently using the same methodology. Whether national initiatives influence these prevalence rates has been described neither. In this study, the following questions are examined: (1) What is the trend in malnutrition prevalence rates between 2004 and 2007 in Dutch hospitals, nursing homes, and home care organizations? (2) What is the effect of previous LPZ audits and feedback on malnutrition prevalence rates in hospitals, nursing homes, and home care? (3) What effect does participation in Dutch national quality improvement programs have on malnutrition prevalence rates?

MATERIALS AND METHODS

Study design
From 2004 to 2007, malnutrition prevalence was audited annually in the multicenter LPZ study, which focused on three types of organizations: hospitals, home care organizations and nursing homes. The study was designed in accordance with the Declaration of Helsinki and approved by the Medical Ethics Committee of the University Hospital Maastricht (azM).

LPZ measurements
For the study, all healthcare organisations in the Netherlands were invited by mail to participate voluntarily. From 2004 to 2007 a standardized printed questionnaire was used, with data gathered at three different levels (institutional, ward and patient level). For this study at patient level, patient demographic data (e.g. age, BMI, sex), nutritional items such as weight and height, amount of undesirable weight loss and whether there was no daily nutritional intake for 3 days or reduced intake for more than 10 days were assessed. The questions about reduced intake were assessed by information from patient documentation/ dossier, and if this was not available, the patients were asked or a responsible nurse/ dietician or relative was consulted.

To obtain an objective assessment of every patient, two healthcare professionals (nurses, dieticians or doctors) evaluated each patient. Of these two, one worked on the patient's ward, and one was an independent professional from another ward. Interrater reliability was found to be good (Cohen's kappa of 0.87) [6].
More detailed information on the audit instruments and data collection methods can be found in previous studies by Meijers et al. [6,15] and on the LPZ website [17].

Definition of malnutrition
The elements body mass index (BMI), undesired weight loss and diminished intake are generally accepted to be important in operationalizing malnutrition [18-22]. Therefore, in this study, malnutrition was operationalized using the three following criteria: 1) BMI $\leq$ 18.5 (age 18-65) or $\leq$ 20 (age > 65), 2) unintentional weight loss ($>$ 6 kg in the last six months or $>$ 3 kg in the last month), or 3) no nutritional intake for three days or reduced intake for more than ten days combined with a BMI of 18.5 to 20 (age 18-65) or 20 to 23 (age > 65). This operationalization tested positively for face validity and criterion validity [15].

LPZ audit feedback 'intervention'
Each year, feedback by means of a report including results at ward and organizational level was fed back to the participating organizations within one week of the LPZ audit. After six weeks, these organizations also received a report with comparable figures on a national (aggregated) level, which could be used as a benchmark. The reports included tables on population characteristics as well as information on malnutrition prevalence, screening, prevention, treatment and policy indicators [15].

Improvement programs 'Care for better' and 'Eat well to get well'
Two national improvement programs were launched in 2006 [23,24]: 'Eat well to get well' in hospitals and 'Care for better' in nursing homes (home care organizations were not involved). Both programs used the breakthrough method [25,26] including Plan Do Check Act cycles [27]. Both also employed an intensive, controlled, active, multifaceted, multidisciplinary and structured implementation plan.

Sample

Hospitals, nursing homes and home care organizations that participated at least once in the LPZ from 2004 to 2007 were included in this study. The following patients were excluded from the analysis: 1) patients for whom complete data on weight, height and weight loss was missing, and 2) patients younger than 18.

Statistics

The statistical analysis included descriptive frequency distributions and tested whether there were significant differences in patient characteristics per setting type (hospital, nursing home or home care) for 2004, 2005, 2006 and 2007. Data were checked for normality and outliers.

To examine the trends of the malnutrition prevalence rates between 2004 and 2007 and the effect of the number of LPZ audits as well as participation in national improvement programs on the malnutrition prevalence rates, logistic multilevel analysis was performed, thereby accommodating for dependencies between observations resulting from organizations being measured repeatedly across time. Although there were four levels in the research design (measurement times nested within patients, patients nested within wards, and wards nested within healthcare organizations), data at each time point had to be aggregated across patients and wards at the organizational level, since the data for a specific patient and ward could not be traced over time. As a result, only two levels were considered in the multilevel analysis: organizations and time points. The benefit of the logistic multilevel approach in the analysis of repeated measures data is that all available data can be included in the analysis, rather than only those cases (i.e. organizations) with complete data [28]. In addition, logistic multilevel analysis presupposes missingness at random (MAR), which means that missing observations (i.e. organization specific prevalence rates missing at a certain time point) may depend on the variables included in the model.

In examining the trend effects the variables "year" and "institution type" were coded as dummy variables, and interaction variables were created to examine whether the trend effects depended on the type of institution. Since introducing interaction variables may lead to collinearity [29] also orthogonal coding was used for these variables. For the institutions that showed a significant trend,

pairwise testing was used to examine which years significantly differed from each other.

To examine the effects of participation in national improvement programs/ campaigns on malnutrition prevalence rates, a dummy variable was included coding whether institutions were involved in Dutch national quality improvement programs. In the analysis model also the variable "number of previous LPZ audits" was included. To correct for differences between institution type and to correct for a possible secular trend, the model was furthermore complemented with "institution type" and "year" as covariates, which both were coded as dummy variables. Since interaction variables were created between "institution type" and the variable "number of previous LPZ audits" and between "institution type" and the variable "participation in national improvement programs", in order to avoid collinearity, also orthogonal coding was used instead of dummy coding and the metric independent variable "number of previous LPZ audits" was centered (i.e. mean score subtracted from each individual score) [29].

Random slopes and random intercepts were tested first, followed by fixed effects according to a top-down procedure. In doing so, first all interactions in the model were examined, deleting step-by-step the least and non-significant effects from the model. When only significant interactions remained, in the next phase main effects, that were not included in one of the remaining interaction effects, were examined. These were also removed step-by-step, each time removing the least and non-significant main effect from the model. In the final analysis model, only significant effects were included or main effects that were part of a significant interaction in the model. In case of significant interaction effects, these were explored further by examining the effects of one of the variables involved in the interaction, for each level of the other variable involved (simple effects analysis). *p*-values were based on two-sided tests. The cut-off point for statistical significance was 0.05. Next to *p*-values, as measures of the effect sizes, odds ratios, their 95% confidence intervals and also the prevalence rates themselves are given.

The descriptive statistical analyses were performed with SPSS version 15.0. The logistic multilevel analysis was performed using MLwiN version 2.02 [30]. Estimates of effects and corresponding statistical tests were obtained through the IGLS (PQL-2) algorithm.

RESULTS

In total 269 different organizations (80 hospitals, 141 nursing homes, 48 home care organizations) were analyzed, yielding 74.496 observations. Six hospitals and 12 nursing homes were involved in the Dutch national quality improvement programs.
Because logistic multilevel analysis was performed, we were able to include all participating institutions from 2004 to 2007; this means that some participated annually while some were measured only once between 2004 and 2007.

Table 1 General overview of the number of participating organizations and patient characteristics per year per kind of setting

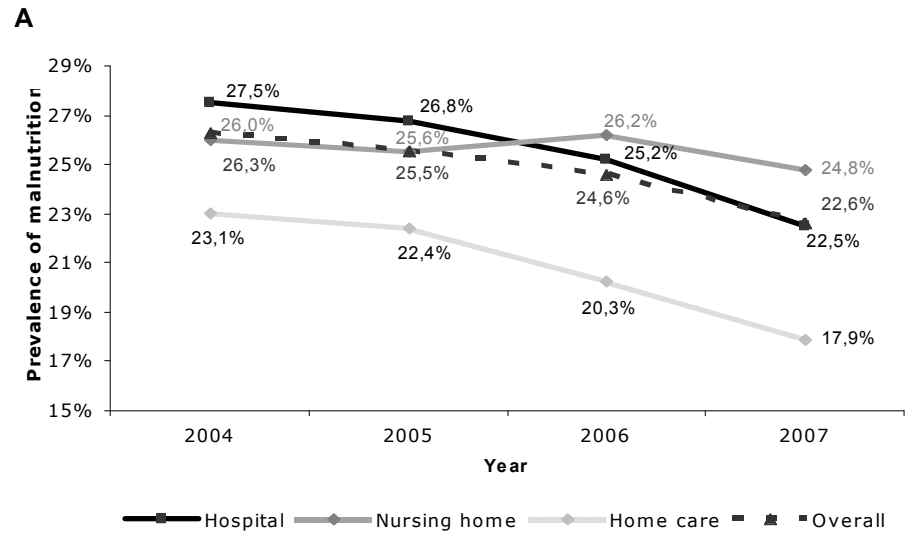
	Hospitals				**Nursing homes**				**Home care**			
Year	04	05	06	07	04	05	06	07	04	05	06	07
Organizations	57	38	39	49	34	48	62	75	15	19	18	23
Patients (N)	11036	7509	6978	8220	4010	4177	7845	9469	3964	3099	3911	4278
Age (± years)	66.1	66.3	67.0	66.8	81.1	81.1	81.2	81.2	77.3	77.1	77.7	77.5
BMI (±)	25.8	25.8	25.9	25.7	24.0	24.2	24.4	24.8	25.9	25.9	26.1	26.5
Sex (female %)	51.4	53.0	52.5	52.4	70.8	69.2	70.2	69.1	61.4	64.5	64.1	65.1

± = mean

Between 2004 and 2007 there were no significant differences in age, BMI, and sex per type of institution. Comparing the different types of institutions, patients in nursing homes and home care were significantly ($p < 0.01$) older than those in hospitals.

The trend analysis
Overall the malnutrition prevalence rates decreased over the years ($\chi^2 = 27.723$, $p < 0.001$) (figure 1a). Since there was a marginally significant interaction ($\chi^2 = 11.897$, $p = 0.064$) between year and type of institution, the trends of the different types of institution were analyzed separately.

Figure 1a Prevalence of malnutrition over the years



There was only a significant trend in hospitals (χ^2 = 43.550, p < 0.001) and home care institutions (χ^2 = 18.562, p < 0.001) (figure 1a). For nursing homes the prevalence did not change over time (χ^2 = 3.893, p > 0. 25) (figure 1a). To further explore the trends, for each institution type that showed a significant trend, we examined which years significantly differed from each other. Table 2 shows the results of this pairwise testing. Only significant differences are shown.

Table 2 Significant results of testing the six differences between years in a pairwise fashion

Hospitals	
2004 with 2007 2005 with 2007 2006 with 2007 Home care	P < 0.001 P < 0.001 P < 0.001
2004 with 2007 2004 with 2006 2005 with 2007	P < 0.001 P = 0.006 P = 0.006

The non-significant results are not shown

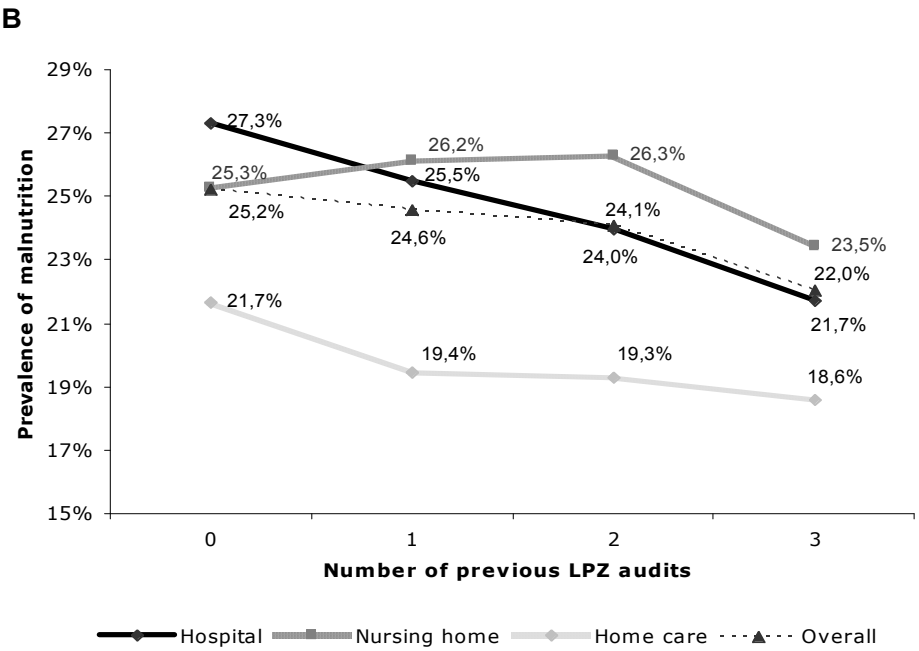
Comparing the different years with each other, table 2 indicates for both hospitals and home care significant differences between 2004 and 2007, and between 2005 and 2007.

Effect of participating in previous LPZ malnutrition audits
The majority of nursing homes and home care institutions participated in only one LPZ measurement during the four years (table 3). Most hospitals however participated more than once, with a substantial percentage (25%) doing so annually.

Table 3 Number of LPZ audits per institution type during the four-year period

Number of LPZ audits	Hospitals (N)	Nursing homes (N)	Home care (N)
1	27	82	29
2	20	33	13
3	13	20	4
4	20	6	2
Total	80	141	48

Figure 1b Effect of number of previous LPZ audits on the prevalence rate of malnutrition



Overall, the more often organizations had participated previously in the annual LPZ measurements, the lower the prevalence rate of malnutrition (*t*= -6.583; p< 0.001) (figure 1b). Analyzing the interaction effect between type of institution and number of LPZ measurements performed (χ^2= 7.471, p= 0.024), we see that, in hospitals (*t*= -6.867, p< 0.001) and home care (*t*= -3.724, p< 0.001), the more often an organization participated the lower the malnutrition prevalence rates (see table 4). This significant relation was not found in the nursing home setting.

Table 4 Results of the logistic multilevel analysis examining the effects of the number of previous LPZ audits and of participating in national improvement programs

Independent variables	**Regression coefficient**	**p-value**	**OR**	**95% CI for OR**
Final logistic regression model:				
Type of institution		< 0.001		
- dummy for home care	-0.276	< 0.001	0.76	(0.66 - 0.87)
- dummy for nursing homes	0.026	0.62	1.03	(0.93 - 1.14)
Participation in national improvement program	-0.108	0.027	0.90	(0.82 - 0.99)
Number of LPZ audits	-0.103	< 0.001	0.90	(0.88 - 0.93)
Type of institution x number of LPZ audits		0.024		
Simple effects of number of LPZ audits				
- for hospitals	-0.103	< 0.001	0.90	(0.88 - 0.99)
- for nursing homes	-0.005	0.83	1.00	(0.95 - 1.04)
- for home care	-0.108	< 0.001	0.90	(0.85 - 0.95)

Effect of participation in national improvements programs

Involvement in one of the national improvement programs had an overall significant effect on the prevalence of malnutrition: involvement led to significantly lower prevalence rates (*t* = -2.250, p = 0.027) (table 4). For hospitals the malnutrition rates were 25% when participating in the improvement program versus 27% when not participating. For participating and non-participating nursing homes these rates were 26% and 28% respectively. There was no significant interaction effect between type of institution and

involvement in a program, which means that the effect of participation in such a program is equal for hospitals and nursing homes. Home care organizations were not included in this analysis as they were not involved in the national improvement programs.

DISCUSSION

This study is one of the first to analyze the trend in prevalence rates of malnutrition over years, consistently using the same methodology, and involving a large number of institutions (and, likewise, a large number of observations) from three different settings. Moreover, it is one of the first that gives detailed insight into the effects of national initiatives such as previous LPZ audits and feedback as well as participation in a national improvement program.

The study indicates that the prevalence rates of malnutrition showed a significant decline over the years for hospitals and the home care setting; for nursing homes, however, the rates remained stable.

This study also indicates, that the number of previous LPZ measurements positively affected prevalence rates in the hospital and home care setting: the more often these organizations participated in the measurements, the lower their malnutrition prevalence rates. In the nursing home setting, on the other hand, no effect was found. This could explain the difference in trends for these three types of organizations.

As one cannot change what one cannot acknowledge, getting attention is a first and important step in changing professional behavior, and confronting healthcare professionals with the results of their own behavior through feedback is likely the strongest key to getting attention. Audits and feedback are common tools to prompt attention that could help improve professional practice, although their effects are usually small to moderate [31]. Generating their own LPZ data via audits and receiving a feedback report (and benchmarking) might have triggered awareness of the malnutrition problem in hospital and nursing homes, and may be important in changing their malnutrition prevalence rates. The same phenomenon was found by Bours et al. [34] using LPZ data on pressure ulcers.

Why LPZ audits and feedback did not affect the nursing home

setting is unclear. From Halfens et al. [35], we know that hospitals and home care organizations are more active in changing their practices to improve the quality of care. In nursing homes, putting the LPZ's relatively 'passive' feedback into action was found to be difficult, as pointed out during the annual evaluation of the LPZ measurements. Since feedback is more effective when given more intensively [31], in the near future we will focus on improving the feedback method in this particular setting. Intensive feedback could consist of, for example, educational meetings/ workshops or include opinion leaders or face-to-face feedback [30].

This study shows that involvement in national improvement programs positively influenced malnutrition prevalence rates. In the governmental improvement programs studied, enabling conditions (e.g. guidelines, education, ambiance, screening policy, weight-monitoring policy, and treatment policy) were implemented in a multifaceted manner. The implementation process followed a structured and coordinated strategy consisting of the breakthrough method (found to be effective in other studies) [36,37]. Rycroft-Malone [38] indicated that improving the quality of patient care is a complex, difficult, multifactorial and demanding process; this makes it hard to analyze which aspects of the programs influenced the outcomes (e.g. the prevalence rates). This was also indicated by O'Flynn et al. [39], who found that malnutrition prevalence significantly decreased over the years 1998-2000-2003 through the implementation of nutritional strategies that also targeted identification and treatment of malnutrition.

In this study we were able to analyze the effect on malnutrition prevalence rates of LPZ auditing and feedback as well as participation in an improvement program. Due to the study design, however, we were not able to point out exactly which determinants within LPZ and the national improvement programs caused the decreasing prevalence rates. A more detailed inventory of the actions taken after the LPZ and testing of these actions in a possible Randomized Controlled Trial (RCT) could further substantiate our conclusions and identify the specific actions that effectively lower prevalence rates. The same could be done for participation in an improvement program.

The effects on malnutrition were examined using an one group longitudinal design, in which institutions participated on a voluntary

basis. This quasi-experimental design does not exclude selection effects: the institutions that have participated in more LPZ audits may be more motivated and more committed, and the effects on malnutrition rates could instead reflect these a priori differences in motivation. The effects could also be due to an ongoing secular trend, since there was no comparison group that did not participate in the LPZ audits. However, note that trend effects were corrected for in the statistical analysis, making this explanation of our results less likely. Furthermore, although it is hard to generalize from other studies, studies like those of Norman et al. [40] indicated that European malnutrition prevalence rates had not changed since 1990.

A third potential threat to the validity of our conclusions is that other events or forces coinciding with the LPZ audits and the national programs could have led to a decrease in prevalence rates. However, we are not aware of any other large scale initiatives in the Netherlands from 2004 to 2007, that might explain the effects as found in the present study.

Statistical issues

The logistic multilevel analysis that was performed has two advantages as compared to other approaches. First, it considers data from all available cases rather than only the complete cases (i.e. those which have measurements at each time point). This lends itself to more power than an analysis only making use of complete cases. Second, working with logistic multilevel analysis on all available data assumes that the unavailable data are missing at random (MAR). This allows the missing observations to depend on other variables (such as the number of previous measurements or the institution type) as long as they are included in the analysis. An analysis of complete cases, by contrast, is more stringent in that it assumes that the missing observations are missing completely at random (MCAR); the prevalence rates of these observations should not depend on any other variable.

CONCLUSION

This study shows a significantly decreasing trend of malnutrition prevalence rates in both hospitals and home care between 2004 and 2007. Participating in the LPZ and involvement in national improvement programs was associated with decreasing prevalence rates, which possibly is due to increased nutritional awareness and improvement of nutritional care.

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THE RELATIONSHIP BETWEEN MALNUTRITION PARAMETERS AND PRESSURE ULCERS

Eman SM Shahin, Judith MM Meijers, Jos MGA Schols, Antje Tannen Ruud JG Halfens, Theo Dassen. The relationship between malnutrition parameters and pressure ulcers in hospitals and nursing homes. Submitted for publication

ABSTRACT

Objective Pressure ulcers (PU) remain a major healthcare problem throughout the world. Although malnutrition is considered to be one of the intrinsic risk factors for PU, more evidence is needed to identify the exact relation between pressure ulcers and malnutrition. This study aims to identify whether there exists a relationship between malnutrition parameters and pressure ulcers in hospitals and nursing homes.

Method A cross sectional study was performed in April 2007 in hospitals and nursing homes in Germany. Pressure Ulcers were assessed according to the grading system of the EPUAP, Malnutrition was made operational by low Body Mass Index (BMI), undesired weight loss and insufficient nutritional intake.

Results 2393 patients from 29 nursing homes and 4067 patients from 22 hospitals participated in the study. Pressure ulcers in both hospital and nursing home patients were significantly ($p < 0.01$) related with undesired weight loss (5-10%). Moreover low nutritional intake was also related to PU in hospitals and nursing homes.

Conclusion There is a significant relationship between malnutrition parameters and pressure ulcers like undesired weight loss and low nutritional intake.

INTRODUCTION

Pressure ulcers (PU) have been described as one of the most costly and physically debilitating complications in the 20th century [1]. Pressure ulcers cause a great deal of discomfort for patients and increase the workload in all healthcare sectors [2]. For patients pressure ulcers cause pain, slow the rehabilitation process, delay hospital discharge and furthermore they increase costs for hospital care, long-term care facilities and the community considerably [3]. A pressure ulcer is an area of localized damage to the skin and underling tissue caused by pressure or shear and/ or a combination of these [4]. According to the European Pressure Ulcer Advisory Panel (1999), pressure ulcers can be classified into four grades. Grade 1 is defined as non-blanchable erthema of the intact skin. Discoloration of the skin, warmth, edema, induration or hardness may also be used as indicators particularly in individuals with a darker skin. Grade 2 is defined as partial-thickness skin loss involving epidermis, dermis or both. The ulcer is superficial and presents clinically as an abrasion or blister. Grade 3 is full-thickness skin loss involving damage to or necrosis of subcutaneous tissue that may extend down to, but through, underlying fascia. Grade 4 is extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures with or without full-thickness skin loss [5].

Whether a patient develops PU depends on both extrinsic and intrinsic factors. Important extrinsic factors (from outside the patient), that play a role in causing pressure ulcers are pressure, friction and shear forces. These factors lead to mechanical loading at skin level and secondary to skin damage and soft tissue breakdown [6]. Intrinsic (patient bound) factors affect tissue viability in the patient and by this the pathophysiologic response to mechanical loading. Several studies using logistic regression analysis indicate that the following intrinsic factors are significantly associated with the presence of pressure ulcers: age, sex, limitation in activity, needing assistance with the activities of daily living, bowel and/ or bladder incontinence, total Braden Scale score, anaemia, infection and nutritional status [7-10]. The relative influence of each of these factors still remains unclear. Nutritional status is one of the intrinsic factors that can be readily influenced.

Both poor nutritional intake and poor nutritional status have been shown to correlate with the development of PU as well as with protracted healing of wounds [11,12].
Notwithstanding methodological shortcomings, cross-sectional and prospective studies also suggest that there is a fairly strong correlation between malnutrition and the development of PU [13-16]. Malnutrition is a status of nutrition in which a deficiency (which is also called undernourishment) or excess, or imbalance of energy, protein and other nutrients causes measurable adverse effects on tissue, body structure, body function and clinical outcome. In this article we mean by malnutrition a status of undernutrition or undernourishment.
Multivariate analysis of epidemiological data indicates that a poor nutritional status and related factors such as low body weight and poor oral food intake are independent risk factors for the development of pressure sores [10,17,18]. Moreover, it appears that many acute and chronically ill as well as elderly patients, at risk of PU or with established PU, suffer from undesired weight loss [11,17-20]. A Cochrane study by Langer et al. (2005) has revealed that up until now there are four clinical trials about the effect of nutritional intervention on pressure ulcer prevention. Three of them did not find a significant relationship between nutritional intervention and pressure ulcer prevention because of the lacking power of these studies, while one study found that intake of high protein mixed nutritional supplements reduced the number of new pressure ulcers.
Four studies about the effect of nutritional intervention on pressure ulcer treatment were found as well. These studies however showed insufficient methodological rigor like a too short study period, in which no healing of pressure ulcer wounds could be detected [21]. The exact causal relationship between malnutrition and PU still remains unclear. Uncertainty also surrounds the precise role of various macronutrients and micronutrients in the prevention and healing of PU [17,18]. In addition to malnutrition, dehydration is also a common and yet under-recognised problem, which makes the skin more frail and susceptible to breakdown; it also may reduce the tissue perfusion at a wound site [22].

Malnutrition may contribute to pressure ulcers in several ways. A combination of loss of lean body mass, which comprises muscle and

skin and challenges the immune system and secondary immobility increase the risk of pressure ulcers by 74% [3]. Hengstermann et al. [23] found that pressure ulcer prevalence in hospitals was 16.7%, whereby 39.5% of PU patients were malnourished. Parameters often used to identify patients at risk of or with malnutrition are anthropometric measurements, food intake, appetite, and severity of disease [24]. Most recommended anthropometric measures are body weight, body mass index and percentage of undesired weight loss [25]. The criteria for malnutrition are a weight loss of more than 5% during the last month or more than 10% during the last 6 months [24,26] and a BMI of less than 18,5 kg/m^2 for adults and a BMI of less than 20 kg/m^2 for patients of ≥ 65 years [27].
Since more evidence is needed whether there exists a relationship between malnutrition parameters and pressure ulcers, this study aims to investigate this relationship in patients admitted to German hospitals and nursing homes on a large scale.

MATERIALS AND METHODS

Design
A cross sectional multi-centre prevalence study was conducted in hospitals and nursing homes throughout Germany in April 2007.

Instrument
A standardised questionnaire was used including questions regarding patient demographics, pressure ulcer characteristics (site, grade, duration) and questions measuring malnutrition. The grading system for PU of the European Pressure Ulcer Advisory Panel was used [28]. Malnutrition was assessed according to the malnutrition indicators in the 2002 ESPEN guidelines, by measuring: percentage undesired weight loss, body mass index with a value of < 18.5 kg/m^2, or a BMI of less than 20 kg/m^2 for patient of ≥ 65 years [27].
In addition nutritional intake was measured with an item of the Braden scale, a validated scale to measure the risk of developing a pressure ulcer. The item includes four levels ´poor´,´probably inadequate´, ´adequate´ and ´excellent´ nutritional intake [29].

Data collection

A coordinator was responsible for the measurement within each institution. The researchers trained the coordinators in all participating hospitals and nursing homes. Secondary each coordinator trained the teams of ward nurses in gathering the data and assessing the four pressure ulcer grades. The trained ward nurses examined all patients in the participating nursing homes and hospitals. To achieve an objective judgment of every patient, two healthcare professionals (nurses, dieticians or doctors) assessed each patient together, one professional working on the ward of the patient, and one independent professional working within the same organisation. The patients were weighed with light clothes and without shoes. The patients' height was taken in centimetres. Body mass index was calculated as follows: body weight/(height in centimetres)^2. The item undesired weight loss was assessed from earlier recorded weights in the charts, or, if missing, from recalled weight.

Nutritional intake (item from the Braden scale) was assessed using earlier recorded nutritional intake and if missing, recalled intake was used [29].

Sample

A total of 8934 patients (6117 from hospitals and 2817 from nursing homes) all over Germany were invited by leaflets to participate voluntarily in the study. Patients included in the study were 18 years and older.

Ethical considerations

Permission to conduct the study was obtained from the Berlin medical ethics committee. Prior to the data collection, informed consent was obtained from the patients, either in person or from one of their legal representatives.

Data analysis

Data were analysed using the statistical package for social science (SPSS) version 15 (SPSS Inc, Chicago, IL, USA).

Descriptive statistics were used to describe the patient's characteristics. Chi-square, odds ratio, and t-test were used to describe the differences regarding nutritional status between patients with pressure ulcers and patients without pressure ulcers.

The same statistical procedures were used to describe the differences between hospital patients and nursing home patients regarding nutritional status. A multivariate logistic regression analysis was performed separately for hospitals, and nursing homes organizations, this analysis was performed to describe the relationship between pressure ulcers and body mass index as well as amount of nutritional intake and undesired weight loss. Prior to analysis, data were assessed for congruence with regression assumption. The independent variables were checked for possible interaction, confounding and multi-collinearity. Variables that remained significant at the 0.05 level were presented.

RESULTS

The overall response rate to participate in this study was 72.5% (6473). Concerning the nutritional indicators, missing data were found on body mass index (3.2%) and undesired weight loss (14.2%).

The study was conducted in a total sample of 6460 participants; 2393 participants from 29 nursing homes and 4067 participants from 22 hospitals. The mean age of the patients in the nursing homes was 83.2 and in hospitals 65.2. In the nursing homes 80.7% was female in hospitals this was 55.2%.

The pressure ulcer prevalence in hospitals was 7.1% and in nursing homes 5.8%. Overall, there was a significant difference between patients with pressure ulcers and without pressure ulcers regarding age and body mass index ($p< 0.01$, $p< 0.01$) respectively. The mean age of patients with pressure ulcers was 76.5 ± 13.4 years, while the mean age of participants without pressure ulcers was 71.3 ± 17.6 years. The mean BMI of patients with pressure ulcers was 24.7 ± 6.0 against 25.7± 5.2 in patients without pressure ulcers.

Table 1 Difference between patients with and without pressure ulcers concerning nutritional parameters in hospitals (N = 4067, univariate analysis)

Variables	PU+ (N=290)	PU- (N=3777)	P-Value	OR[1]	CI 95%[2]
Undesired weight loss < 5%	15.9%[#]	9.4%	<0.001	1.797	1.253-2.577
5-10%	14.0%	6.6%	<0.001	2.294	1.557-3.378
>10%	3.7%	3.1%	0.629	-	-
BMI cut off <18.5 kg/m^2	16,0%	5.4%	0.002	3.325	1.514-7.306
BMI cut off <20 kg/m^2	12.7%	8.0%	0.018	1.683	1.090-2.600
Poor nutritional intake	10.5%	2.5%	<0.001	4.617	2.998-7.108
Probably inadequate nutritional intake	25.1%	12.0%	<0.001	2.455	1.846-3.263

1: Odds ratio; 2: Confidence interval 95%; PU+ = with pressure ulcers; PU- =without pressure ulcers;

Table 2 Difference between patients with and without pressure ulcers concerning nutritional parameters in nursing homes (N = 2393, univariate analysis)

Variables	PU+ (N=139)	PU- (N=2254)	P-Value	OR[1]	CI 95%[2]
Undesired weight loss < 5%	12.8%	5.2%	<0.001	2.675	1.532-4.671
5-10%	9.2%	1.5%	<0.001	6.610	3.245-13.466
>10%	3.0%	0.5%	<0.01	5.244	1.442-19.072
BMI cut off <20 kg/m^2	33.3%	15.5%	<0.001	2.824	1.921-4.152
Poor nutritional intake	33.3%	15.0%	<0.001	2.891	1.489-5.611
Probably inadequate nutritional intake	8.1%	3.0%	<0.01	2.340	1.527-3.586

1: Odds ratio; 2: Confidence interval 95%; PU+ = with pressure ulcers; PU- =without pressure ulcers;

As shown in table 1 and 2, a significant difference between patient with and without PU was found regarding undesired weight loss in both settings, with patients with PU having significantly more undesired weight loss. Additionally in both settings low BMI was different and only in nursing homes occurred significantly more

often in patient with PU. Concerning low nutritional intake, in both settings patients with PU had significantly more often an inadequate or poor intake; however there were also differences found between both settings, with in the hospital setting poor nutritional intake showing odds ratio's ranging from 3 to 7.

Table 3 Multiple logistic regression model for malnutrition indicators associated (P < .05) with pressure ulcers in the hospital setting

Variables	**B**	**S.E.[1]**	**Sig.[2]**	**OR [3]**	**95.0% CI**	
Probably inadequate intake	.252	.084	.003	1.287	1.092	1.516
Poor nutritional intake	.934	.261	<.000	2.544	1.525	4.246
Undesired weight loss 5-10%	.554	.217	.011	1.741	1.137	2.666
Bedfast	1.834	.154	<.000	6.261	4.632	8.463

B= Regression coefficient; CI= Confidence Interval; 1 = Standard error; 2 = Significance; 3 = Odds ratio

Table 4 Multiple logistic regression model for malnutrition indicators associated (P < .05) with pressure ulcers in the nursing home

Variables	**B**	**S.E.[1]**	**Sig.[2]**	**OR [3]**	**95.0% CI**	
Probably inadequate intake	.383	.112	.001	1.467	1.177	1.828
Poor nutritional intake	1.002	.358	.005	2.723	1.351	5.489
Undesired weight loss 5-10%	1.525	.377	<.001	4.597	2.196	9.622
Chair fast (wheelchair)	.397	.184	.031	1.487	1.036	2.133

B= Regression coefficient; CI= Confidence Interval; 1 = Standard error; 2 = Significance; 3 = Odds ratio

Table 3 and 4 show a significant relationship between the presence of pressure ulcers in hospitals and undesired weight loss (5-10%). This is even more the case in nursing homes where the odds for getting pressure ulcers was 4.597 (95% CI ranging from 2.196-9.622) times higher when patients lose weight between 5 and 10%. Furthermore poor nutritional intake is related to PU in both settings. Bedfast and chair fast (wheelchair bound) were both confounders.

DISCUSSION

The main objective of this study was to find evidence whether there is a relationship between malnutrition parameters (undesired weight loss, low BMI and low nutritional intake) and pressure ulcers in patients admitted to hospitals and nursing homes. This study was able to explore this on a large scale in two different settings. Based on the logistic regression analysis, there was a significant relationship between the presence of pressure ulcers and undesired weight loss (5-10%). Also in other studies it has been indicated that many acute and chronically ill as well as elderly patients, at risk of PU or with established PU, suffer from undesired weight loss [11,17-20].
Moreover, inadequate and poor nutritional intake was strongly related to the presence of pressure ulcers in hospitals and nursing homes. This is in agreement with other studies using multivariate analysis, that have indicated that poor oral food intake is an independent risk factor for pressure ulcers [10,17,18].

A particular difficulty with cross-sectional studies focusing on correlations is the fact that the progression over time of certain disorders and their possible risk factors cannot be measured by a one-time measurement. As the dependent and independent variable are selected at one and the same time, causality cannot be drawn. For example, disease and malnutrition interact as such that the disease may cause secondary malnutrition, or malnutrition may adversely influence underlying disease.
Furthermore, missing data regarding body mass index and undesired weight loss were present since it is extremely difficult to measure these indicators in such a large group of hospital and nursing home patients. Other studies have indicated this as well in the past [30-32].

PRACTICAL IMPLICATIONS

Nevertheless, the results of this article confirm the relationship between PU and malnutrition and therefore the importance of adequate nutritional care in PU (prone) patients. Since malnutrition in potential is a reversible risk factor for wounds (PU), early identification and management of it is very important.

Therefore all PU (prone) patients should have a nutritional screening to determine whether the patient has any nutritional deficiencies and if nutritional screening identifies patients to be malnourished or at nutritional risk, subsequently this must lead to a more complete nutritional assessment by a registered dietician or if needed by a multidisciplinary nutritional team [11,17-20, 27,33-35]. After the assessment, tailor-made nutritional support has to be provided to each nutritionally compromised individual. To support the implementation of adequate nutritional management in daily pressure ulcer care, more detailed clinical guidelines on nutrition exist and should be available [36-38].

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IMPLEMENTATION OF A NUTRITIONAL GUIDELINE FOR PRESSURE ULCER CARE

Judith MM Meijers, Jos MGA Schols, Pam A Jackson, Gero Langer, Michael Clark, Ruud JG Halfens. Evaluation of the dissemination and implementation of a nutritional guidelines for pressure ulcer care. Journal of Wound Care. 2007;16(5):201-5.

ABSTRACT

Objective
In 2004 the European Pressure Ulcer Advisory Panel (EPUAP) nutritional working group developed a nutritional guideline for pressure ulcer prevention and treatment. This study investigated the degree to which the guideline was disseminated and implemented in clinical practice.

Method
A cross-sectional study was undertaken in healthcare organisations in the Netherlands, Germany and the UK. A printed standardised questionnaire which followed Rogers' model of the innovation-decision process was developed, translated and distributed to 1087 healthcare organisations.

Results
The response rate was 33% (n=363). Sixty-one per cent of respondents knew of the guideline (59% in the Netherlands, 22% in Germany and 75% in the UK). Twenty-five per cent had applied it to their clinical practice (26% in the Netherlands, 9% in Germany and 26% in the UK) and used its recommendations for nutritional screening. The main barrier to the provision of nutritional support appeared to be lack of knowledge and skills.

Conclusion
One year after its dissemination, more than half of respondents knew of the guideline, with one in of four applying it to their practice. The guideline was better disseminated and implemented in the Netherlands and UK than in Germany, where only 4% of participants had used it.

INTRODUCTION

Pressure ulcers are a common, expensive and painful healthcare problem, with prevalence rates ranging from 3% to 66% in health-care organisations [1-4]. The estimated annual treatment costs are 1.07 billion in the UK, 2.4 billion in the USA and 0.6 million in the Netherlands [5,6].

A pressure ulcer is defined as localised damage to the skin and underlying tissue caused by pressure, shear, friction or a combination of these [7]. The development of pressure ulcers depends on extrinsic and intrinsic risk factors. The most important extrinsic risk factors are pressure, shear and friction, which lead to mechanical loading and secondary damage to the skin and soft tissue [8]. Intrinsic factors have an effect on tissue viability and consequently influence the pathophysiological response to mechanical loading. Studies have found significant associations with age, sex, limited activity, incontinence (bowel and bladder), infection and nutritional status. The relative influence of each of these intrinsic risk factors is still unclear [9-14].

A 2003 Cochrane review indicated that there is no strong scientific evidence for a direct relationship between poor nutrition and pressure ulcer development and healing, and a causal relationship has never been established, although the methodological quality of these studies is weak [15]. Nevertheless, individual studies have demonstrated that an adequate nutritional intake may help protect against pressure ulcer development and improve the rate of healing [16-24].

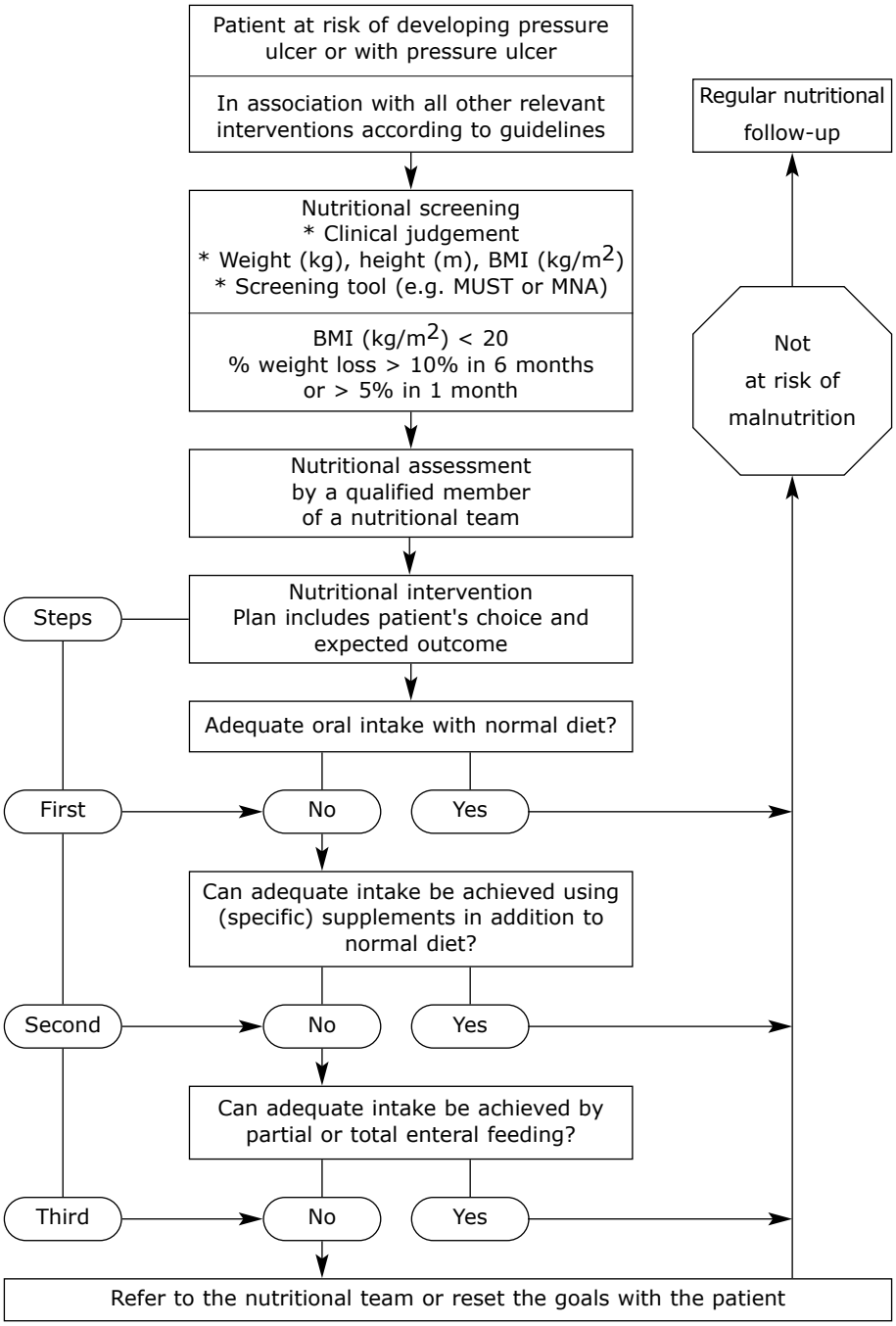
A recent meta-analysis by Stratton et al. [25] on enteral nutritional support in the prevention and treatment of pressure ulcers pointed out that, in four randomised controlled trials (RCTs), oral nutritional supplements (250-500Kcal for two to 26 weeks) were associated with a significantly lower incidence (25%) of pressure ulcer development in 'at-risk' patients compared with routine care. Furthermore, some studies showed a trend towards improved healing with high protein nutritional supplements when compared with studies using standard formulae. However, Stratton et al. [25] indicated that more robust RCT studies are needed to scientifically confirm the latter finding.

As nutritional status can be easily influenced by patient and practitioner interventions, clinical guidelines could set out the

optimum management approach. Such guidelines provide an important bridge between research findings and clinical practice [26], can aid the implementation of evidence-based research and give structural directions on how to provide efficient and adequate care, thereby improving quality of care [27].

A study of previous pressure ulcer prevention and treatment guidelines concluded that most guidelines paid less than adequate attention to nutrition [28]. The European Pressure Ulcer Advisory Panel (EPUAP) therefore set up a nutritional working group comprising practitioners from European countries to develop a clinical nutritional guideline on pressure ulcer prevention and treatment. The guideline was launched in 2004 and translated into eight languages. It covers the whole nutritional cycle (screening, assessment, intervention, evaluation and follow-up) and includes weight recommendations. It emphasises the importance of incorporating nutritional activities structurally into daily pressure ulcer management. The most essential elements of the guideline have been mapped into a decision tree (figure 1) [29].

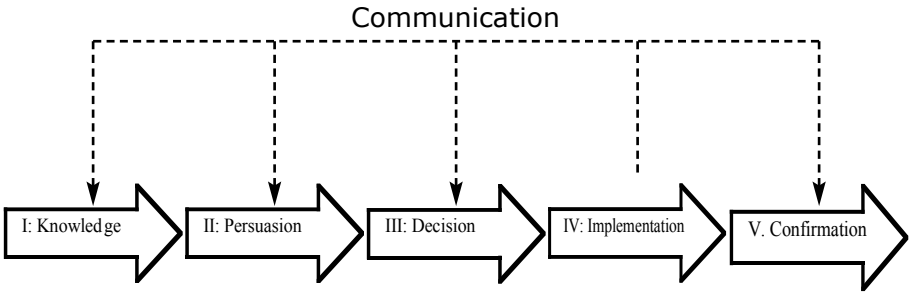
Figure 1 Decision tree on nutrition in pressure ulcer prevention and treatment



The guideline has been disseminated via the EPUAP's network, which comprises its conferences, internet site, members and publication, and through the nutritional industry [29]. However, the availability of clinical guidelines does not automatically lead to their use in daily practice. In 2005 the EPUAP nutrition-working group therefore decided to explore the degree to which the nutritional guideline had been disseminated and implemented in clinical practice in Germany, the Netherlands and UK.
In this study the term 'dissemination' is defined as distribution and does not necessarily include action. 'Implementation' is defined as the actual use of the guideline in daily practice [30].

Rogers' model of innovation-decision process
Rogers' model of the innovation-decision process [31] was chosen as a framework for this study as, unlike other models in this field, it incorporates specific stages of the dissemination and implementation process. The model charts the five stages through which an individual (or another decision-making unit, such as a group, society, economy or country) moves across the innovation-decision process (figure 2).

Figure 2 Rogers' model of innovation-decision process (modified from original, 2003)



These stages typically follow each other in a time-ordered manner. The first three stages of the model are comparable to dissemination of a guideline as the participant is not yet using the guideline actively.
1) In the *knowledge stage* an individual becomes aware of and reads the guideline and learns about the existence of the guideline. "What?," "how?," and "why?" are the critical questions in the knowledge phase.

2) The *persuasion stage* occurs when the individual develops a negative or positive attitude towards the guideline.
3) At the *decision stage*, the individual chooses to adopt or reject the innovation. While adoption refers to "have this guideline present in practice because it is the best course of action available," rejection means, "not to adopt this guideline".
4) In the *implementation stage*, a guideline is actually put into practice. Uncertainty about the outcomes of working with this guideline can still be a problem at this stage
5). At the *confirmation stage* the individual looks for support for his or her decision of using the guideline. This decision can be reversed if the individual is exposed to conflicting messages or barriers to using this guideline.

The study participants were mapped in accordance with Rogers' model, thereby providing an insight into the percentage of participants in the various stages of dissemination and implementation one year after the launch of the guideline.

METHOD

A cross-sectional design was used. In total, 1087 clinical healthcare organisations (300 from the Netherlands, 300 in Germany and 487 in the UK) were invited to participate in the study at the end of 2005. A national coordinator in each country invited the selected healthcare organisations, which comprised hospitals, nursing homes and home care, to participate in the postal survey. The national coordinators were members of EPUAP nutritional working group.
The healthcare organisations' addresses were selected from several relevant databases in all three participating countries. The UK and Netherlands used more targeted databases, and Germany a more general database. The questionnaires were sent to managers of the healthcare organisations, who were asked to allocate them to whoever was primarily involved in nutritional policy for pressure ulcer prevention and treatment.
Ethical approval was not required as the questionnaire focused on organisational aspects and patients were not directly involved.
The standardised questionnaire was developed by the EPUAP nutritional working group, following the Rogers' implementation

stages. It included 24 items: eight questions had a dichotomous outcome; two questions included four-point ordinal scales (always-never), and the remaining questions had a Likert scale ranging from four points to 10. For the knowledge stage, two questions enquired about awareness of the guideline and whether it had been read, and one question asked about the dissemination channel. For the persuasion stage, one question enquired about attitudes towards the guideline. For the decision stage, two questions asked about the presence of this guideline in practice. For the implementation stage, respondents working in areas that had incorporated the EPUAP guideline into practice were asked 11 questions about its actual use in order to ascertain whether it was being followed correctly. Several guideline recommendations, such as screening of nutritional status (when, who, how often, content), assessment, interventions, evaluation and follow-up were explicitly tested. For the confirmation stage, two questions enquired about barriers to nutritional support within pressure ulcer prevention and treatment. In addition, respondents' demographic characteristics were asked in five items (profession, workplace, frequency of involvement in pressure ulcer care, membership of a pressure ulcer committee and involvement in pressure ulcer policy). Members of the EPUAP nutritional working group translated the questionnaires into Dutch, German and English, checking content similarity with each other.

Statistical analysis

Statistical analyses were performed using SPSS version 13.0 (SPSS Inc, Chicago, IL, USA). The statistical analysis included descriptive frequency distributions of all variables. Analyses were performed per country independently and for the total sample. Differences between groups were tested with chi-square test and analysis of variance. Statistical significance was set at $p < 0.05$. In some questions multiple answers were possible therefore the total can be > 100%.

RESULTS

The sample

In total, 363 organisations returned the questionnaires: 146 Dutch, 50 Germany and 167 UK. This yielded a response rate of 33% (49% for the Netherlands, 17% for Germany and 34% for the UK). No

information was available as to why organisations did not respond. Respondents comprised nurses (59%), dietitians (18%), physicians (6%) and other (mostly managers) (17%). Eighty-six per cent were members of a pressure ulcer committee or involved in pressure ulcer policy. Forty-nine per cent worked in a hospital setting, 26% in a long-term care setting and 22% in a home care. Most participants were involved daily or weekly in the care of patients at risk of or with a pressure ulcer.

Table 1 Phase 1, 2, 3 of Rogers' model of innovation-decision process

	NL	**Ger**	**UK**	**Total**
Total sample N	146	50	167	363
Incomplete questionnaires	4	1	9	14
1) Knowledge (N)	142	49	158	349
%	59.4% [1,2]	22.4% [3]	75.3%	61.4%
Dissemination channels (N)	85	11	119	215
EPUAP review	4.1% [2]	0% 3	17.6%	11.2%
EPUAP internet site	3.1%[1,2]	37.5%	27.9%	18.8%
Other Professional journal	17.3%	31.3%	14.7%	16.8%
Industry	27.6%[1,2]	0%	0%	10.8%
EPUAP conference	13.3%[1]	0%	15.4%	13.6%
Other conference	22.4%[1,2]	6.3%	13.2%	16.4%
Colleagues	10.2%[1,2]	0%	5.1%	6.8%
Other	2.0%[1]	25.0%	5.9%	5.6%
2) Persuasion (N) **Consequence of knowing**	85	11	119	215
Positive attitude	89.9%	99.2%	100%	99.1%
Negative attitude	1.1%	0.8%	0%	0.9%
3) Decision (N)	76	11	119	213
%	25.9%[1]	9.1%[3]	26.1%	25.1%

NL= the Netherlands Ger= Germany UK= United Kingdom

1= Significant (p< .005) differences between NL and Ger

2= Significant (p< .005) differences between NL and UK

3= Significant (p< .005) differences between Ger and UK

Knowledge stage
Sixty-one per cent of participants were aware of the EPUAP nutritional guideline. Significantly more were from the UK and the Netherlands than from Germany ($p<0.01$) (table 1).
The most frequently mentioned dissemination channel was the EPUAP internet site (19%), followed by professional journals (17%) and conferences (16%). In the Netherlands the nutritional industry played a significant ($p=0.02$) and major role in dissemination of the guideline, and the EPUAP internet site played a significantly minor role ($p< 0.01$) compared with Germany and the UK.

Persuasion stage
Respondents who had read the guideline stated that it mostly confirmed their views about the importance of nutrition in pressure ulcer prevention and treatment. Only 1% disagreed with the guideline, leaving 99% with a positive attitude towards its content.

Decision stage
Of the respondents who had read the guideline, 25% stated that they were applying its content to their daily practice (the Netherlands 26%, Germany 9%, UK 26%). The guideline was significantly ($p = 0.01$) more evident in daily practice in the UK and in the Netherlands than in Germany. The guideline was mainly used in hospitals (61%), followed by home-care organisations (17%) and long-term institutional care (17%). More dietitians (29%) than nurses (25%) or physicians (11%) used it in practice.

Implementation stage: As the stages typically follow each other in a time-ordered manner, only responses from participants who used this guideline in their daily practice were analysed. As only two used the guideline in Germany, these were not be taken into account in the further stages as this sample was too small for further analysis.

Table 2 Implementation stage

	NL	UK	Total
4) Implementation			
(N)	22	31	54
Should nutritional screening in practice be undertaken for every patient?			
At risk of PU			
Always	19.0%	37.9%	31.4%
Sometimes	66.7%	55.2%	58.8%
Rarely	14.3%	6.9%	9.8%
Never	0%	0%	0%
With PU?			
Always	38.1%	46.7%	44.2%
Sometimes	57.1%	53.3%	53.8%
Rarely	4.8%	0%	1.9%
Never	0%	0%	0%
Screening includes			
Weight	86.4%	61.3%	72.2%
BMI	18.2%*	67.7%	48.1%
Weight history	95.5%*	51.6%	70.4%
Clinical judgment	45.5%	64.5%	57.4%
Nutritional screening tool	22.7%*	80.6%	57.4%
Nutritional interventions			
Normal feeding	31.8%*	71.0%	55.6%
Oral supplements	95.7%	96.8%	96.3%
Tube feeding	36.4%*	51.6%	46.3%
Parenteral feeding	4.5%*	38.7%	25.9%
Evaluation: Outcome measures to record the success or failure of intervention			
No measurement	4.5%	19.4%	13.0%
Weight gain	86.4%	74.2%	76.6%
Development of PU	68.2%	51.6%	59.3%
Improvement in PU healing	81.8%*	64.5%	72.2%
Biochemical parameters	18.2%*	58.1%	42.6%
Follow up: How frequently screened?			
At first contact only	4.8%	10.0%	7.7 %
At regular intervals	57.1%*	33.3%	44.2%
When condition indicates	28.6%	43.3%	36.5%
Never	0.0%	0.0%	0.0%
Don't know	9.5%	13.3%	11.5%

NL= the Netherlands UK= United Kingdom *= Significant ($p < .005$) differences between NL and UK

Screening: Every participant screened patients; screening was most likely to take place 'sometimes', followed by 'always' and then 'rarely', although this percentage was much lower for patients with pressure ulcers. Full results for this and other aspects relating to the implemention stage are given in table 2.

Assessment: Weight and weight history were most frequently mentioned in responses. healthcare organisations in the Netherlands mentioned weight history significantly more often than those in the UK ($p = 0.03$). In the UK, body mass index (BMI) and use of a nutritional screening tool were mentioned significantly more frequently than in the Netherlands ($p = 0.01$).

Intervention: When a nutritional problem was identified, the most commonly identified intervention was oral supplements, followed by normal feeding, particularly in the UK, where this was significantly more frequent than in the Netherlands ($p = 0.01$). Parenteral feeding was also mentioned less frequently in the Netherlands than in the UK ($p = 0.01$).

Evaluation: Weight gain was the outcome measure most frequently used to evaluate the success or failure of nutritional intervention, followed by pressure ulcer healing. Biochemical parameters were mentioned significantly more frequently in the UK than in the Netherlands ($p = 0.01$). Thirteen percent of both countries still used none of these outcome measures.

Follow-up: In the Netherlands and UK patients were most likely to be screened regularly or more often if their condition indicated. Patients were screened at first contact in less than one in 10 organisations. No one stated that they never screened patients.

Confirmation stage: Here, the individual looks for support for his or her decision to use the guideline. The individual could reverse their decision if exposed to barriers to implementation. Figure 3 shows the most important barriers to nutritional support.

Figure 3 Barriers in nutritional support in PU patients (N=61)

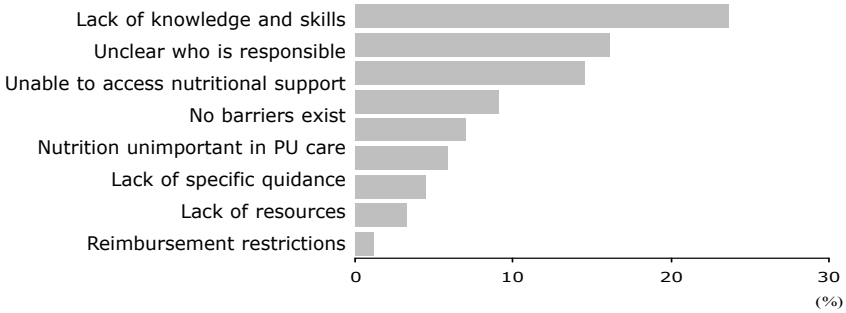


Figure 3 shows that the most important barriers to nutritional support in PU patients, were lack of knowledge and skills, followed by lack of clarity about who is responsible for nutritional support and an inability to access nutritional support. Least mentioned barriers were reimbursement restrictions and lack of resources. Nine percent of the participants said that no barriers exist.

DISCUSSION

The goal of this study was to investigate the degree to which the EPUAP nutritional guideline on pressure ulcer prevention and management had been disseminated and implemented in clinical healthcare organisations in the Netherlands, Germany and UK.
Sixty-one per cent of the study participants were aware of the EPUAP nutritional guideline, and of these 99% had a positive attitude towards it. Moreover, 25% of those who were aware of the guideline had used it in their daily practice. However, it is important to note that, due to the low response rate, the questionnaire might present a skewed view of the current state of implementation across the three countries.
The guideline was launched in 2004 with no specific strategy for its dissemination and implementation. One year later, a relatively large number of the participating organisations already knew of it, especially in the Netherlands (59%) and UK (75%), and a smaller number had actually applied it to practice (26% and 26% respectively). In Germany, only 22% were aware of the guideline and 9% had used it in daily practice. However, these results may be influenced by selection bias as most German participants were not aware of the EPUAP, which has few German members and

communicates mainly in English, which may be a barrier for German-speaking countries. Furthermore, in Germany there is a national expert standard which professionals are expected to use as the guideline for pressure ulcer prevention and treatment. Lastly, the German addresses were randomly selected from a general database, whereas in the UK all NHS trusts were selected and in the Netherlands addresses were taken from a targeted database. Any of these factors could have influenced the results.

Interestingly, of the 61% who were aware of the guideline, 99% had a positive attitude towards it, yet only one in four of the organisations used it. One reason for this could be that implementing guidelines is time consuming [30], and this study took place too soon after the launch. Another reason may be that implementation strategies are not treated as an integral part of the development process of clinical guidelines, then implementation in daily practice may be hampered [30]. While dissemination may increase awareness among the target audience, it is not sufficient to bring behavioural change in the absence of an active implementation strategy [32]. One year, therefore, may be too short a time in which to measure the effects on daily practice of guidelines disseminated without an implementation strategy.

Moreover, practitioners struggle when implementing guidelines, despite their enthusiasm. This seems to be because they experience a number of barriers. Understanding these barriers will enable the development of strategies for increasing the use of guidelines in daily practice [33,34]. This study showed that the most important barrier to implementation was lack of knowledge and skills, followed by lack of clarity about who is responsible for nutritional support, and inability to access nutritional support. These barriers were also identified in previous studies [34-36]. These barriers were not explored further, so no extra information was available on which skills and knowledge were lacking. An insight into why these barriers exist will improve guideline implementation in clinical practice. As discussed, individual studies have indicated that adequate nutritional status has a positive effect on pressure ulcer prevention and healing. It is important that this relationship is made more explicit, and strong scientific evidence from robust RCTs is therefore needed. This will help increase our understanding of the relationship between pressure ulcer and nutrition, and provide a stronger evidence base on which to implement new guidelines.

CONCLUSION

This study demonstrates that the EPUAP guideline on nutrition in pressure ulcer prevention and management was quite well disseminated in the Netherlands and the UK. After only one year, two-thirds of participating healthcare organisations were aware of the guideline and one quarter had it in place. The main barrier to implementing nutritional support in pressure ulcer care was lack of knowledge and skills.

RECOMMENDATIONS

- A larger multi-country controlled study is needed on the dissemination and implementation of this European guideline
- Greater focus on the barriers to implementing nutritional support in pressure ulcer care, with a view to creating an effective implementation strategy
- Learn from best-practice examples of implementation in different countries

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DIFFERENCES IN NUTRITIONAL CARE IN PRESURE ULCER PATIENTS WHETHER OR NOT USING NUTRITIONAL GUIDELINES

Judith MM Meijers, Jos MGA Schols, Pam A Jackson, Gero Langer, Michael Clark, Ruud JG Halfens. Differences in nutritional care in pressure ulcer patients whether or not using nutritional guidelines. Nutrition. 2008;24(2):127-132.

ABSTRACT

Objective

Malnutrition, characterised by a loss of lean body mass enhances the risk of pressure ulcers (PU). As the intrinsic risk factor nutritional status in PU development can be influenced by practitioners interventions, the use of clinical guidelines might be a satisfactory management approach. This study investigated the influence of using nutritional guidelines in daily practice on the actual nutritional care pressure ulcer (PU) (prone) patients receive. The barriers with regard to providing nutritional support were also explored.

Method

A cross sectional study was carried out in 1087 hospitals, nursing homes, and home care organizations in the Netherlands, Germany, and the United Kingdom. As this study focused on comparing nutritional care in daily practice in PU (prone) patients respectively using and not using nutritional guidelines, for the analyses two groups (healthcare organisations with and without guideline) were identified. Differences between the groups were tested using chi square test and by analysis of variance (ANOVA).

Results

In total respondents of 363 organizations participated in the study, of which 66.1% organizations used nutritional guidelines for PU care in practice. Significant differences between organizations with nutritional guideline versus organisations without guidelines were mostly on nutritional screening ($p < 0.001$) and the extent of the nutritional screening which included significantly more weight history recalls, weight measurements, and BMI measurements (all $p < 0.05$). The most important barrier to providing nutritional support for PU (prone) patients in both groups was knowledge and skills.

Conclusion

Using a nutritional guideline in PU care contributes to the amount of nutritional screening conducted in daily practice as well as content and extent of this screening.

INTRODUCTION

Undernutrition and protein-energy malnutrition are seen in alarmingly high rates among institutionalized patients. Malnutrition can be defined as a nutritional condition in which an insufficiency, an overload or a disproportion of energy, protein, and other nutrients cause adverse effects on tissue/ body form (body shape, size and composition) and function, and clinical outcomes [1]. Comparing data on the prevalence of malnutrition in institutionalized (hospitals, nursing homes and home care) patients in different European countries shows that prevalence rates vary from 20% to 60% [2]. A combination of loss of lean body mass and immobility enhances the risk of pressure ulcers (PUs) by 74% [3]. The development of PU depends on extrinsic and intrinsic risk factors. The largely examined extrinsic risk factors pressure, shear and friction lead to mechanical loading of the skin and soft tissue [4]. The intrinsic factors have an effect on tissue viability in patients and, consequently influence the pathophysiologic response to mechanical loading. Studies exploring these intrinsic risk factors have found significant effects associated with limited activity, age, bowel and bladder incontinence, anaemia, infection and nutritional status [5-11].

A PU - also known as decubitus ulcer or pressure sore - is defined as "localized damage to the skin and underlying tissue caused by pressure, shear, friction or a mixture of these" [12]. PU's are widespread, expensive and painful healthcare problems, with prevalence rates ranging from 3 to 66% in hospitals, nursing homes and home care [13,14]. The estimated cost of treating PU's in the United Kingdom (UK) is 1.07 billion Euro, in the USA 2.4 billion Euro and in The Netherlands 0.6 million Euro [15,16]. Improving the quality of PU care could influence the estimated annual costs and quality of life [9,13,14,17].

A causal relationship between nutrition and PU has not yet been found because studies performed in this field have been of weak methodological quality [18]. Nevertheless a systematic review by Stratton et al. (2005) pointed out that although more robust randomized controlled trials are required, nutritional supplements were associated with a significantly lower incidence (by 25%) of PU development and that several studies in which patients received high protein nutrition demonstrated a tendency toward enhanced

healing of PU. The intrinsic factor nutritional status, within the development and healing of PUs, can be controlled by patients and practitioners' interventions. Using clinical guidelines in this area could indicate an optimal PU management approach by professionals and could eventually positively influence healthcare costs and quality of life. In daily practice, guidelines have been shown to facilitate the implementation of scientific research outcomes, present structured instructions on how to give efficient and effective care, and thereby lead to improved quality of care [20-21].

The nutritional working group of the European Pressure Ulcer Advisory Panel (EPUAP) launched a specific clinical nutritional guideline in PU prevention and treatment in eight languages in 2004 [22]. Although this guideline was developed at an international level, after one year, the guideline, was disseminated widely. In a follow-up study, more than half of the respondents were aware of the guideline, and one in four were actually using it in daily practice [23]. Research on guidelines and guideline implementation however indicates that the use of guidelines is not always reflected in the actual care that patients receive [24-27]. Estabrooks [28] refers to this dilemma as a gap between what is known and what is done. Therefore after distributing the nutritional guideline and studying its dissemination [23], the nutritional working group of EPUAP was interested in how daily practice where nutritional guidelines (for example the EPUAP nutritional guidelines) were implemented compared with daily practice where nutritional guidelines were not implemented and whether there were any differences in nutritional care that PU (prone) patients received. Furthermore differences in the barriers to implementing nutritional support for PU (prone) patients were explored in these two groups.

MATERIALS AND METHOD

A cross-sectional design was used for this study. A sample of hospitals, nursing homes and home care organizations in the United Kingdom, the Netherlands and Germany were contacted by mail at the end of 2005 by the national coordinator in each country. The national coordinators were members of EPUAP nutritional working group.

In total 1087 healthcare organizations (300 from the Netherlands,

300 in Germany, and 487 in the United Kingdom) were invited to participate. The printed questionnaires were sent to the managers of the healthcare organizations with the kind request to distribute them to the individual in the organization who was principally responsible for nutritional policy in PU prevention and treatment. Ethical approval was not necessary because the questions focused on organizational aspects and did not gather data at a patient level. The standardized questionnaire was constructed by the EPUAP nutrition working group. The questions were translated into English, German and Dutch by the members of the EPUAP nutrition working group, and checked for content similarity.
Questions focused on the implementation of nutritional guidelines for PU prevention and treatment in daily practice and on the actual nutritional care given to PU patients, which included screening of nutritional status (is the patient screened, by whom, how often, content of screening), nutritional interventions (when, kind, and content), evaluation (outcome measures of nutritional intervention) and follow up (policy after evaluation). Two further questions were included on what barriers to implementing nutritional support within PU prevention and treatment were present in daily practice. In addition, demographic characteristics of respondents were collated (profession, workplace, frequency of involvement in PU care, and membership of a PU committee or involvement in PU policy).

Statistical Analysis
Statistical analyses were performed using SPSS version 13.0 (SPSS Inc, Chicago, IL, USA). Because the successive samples of the separate countries were too small for comparison of the countries and groups (with and without guideline) separately (total N=50 in Germany, 28 used guidelines), the sample was combined and therefore the total sample of organizations was used for analysis. The statistical analysis included descriptive frequency distributions of all variables. Because this study focused on comparing nutritional policy in PU patients in daily practice with and without the implementation of a nutritional guideline, two groups were identified for the analysis: with (group 1) and without (group 2) a nutritional guideline in PU care in daily practice. Differences between groups were tested with chi-square test and analysis of variance. Statistical significance was set at $p < 0.05$. In some questions multiple answers were possible therefore the total can be > 100%.

RESULTS

The sample

In total respondents of 363 organizations (146 Dutch, 50 German, and 167 UK) participated in the study, with a response rate of 33% (49% for the Netherlands, 17% for Germany and 34% for the United Kingdom). Of the non-respondents no further information was available about the reason for non-response.

Most respondents were involved daily or weekly in the care of patients with PU and consisted generally of nurses (58.8%), and dieticians (17.8%). Of the respondents 85.5% were members of an internal PU committee or involved in the PU policy of their organisation. The largest group of respondents worked in a hospital setting (46.9%), followed by long term care setting (nursing home, 25.8%) and home care (21.6%).

In 240 (66.1%) organizations nutritional guidelines for PU prevention and treatment were available, which left 123 (33.9%) organizations, where no nutritional guidelines were used.

Most nutritional guidelines mentioned were developed in line with national guidelines (43.8%), or on a local level (35.1%). Table 1 lists the characteristics for the guideline and non-guideline groups.

Table 1 Characteristics of the groups

	Guideline	**No Guideline**
(N)	240	114
Profession		
Physician	5.9%	7.0%
Dietician	21.8% *	10.5%
Nurse	55.2%	64.9%
Other	17.1%	17.6%
Care setting		
Hospital	45.8%	48.2%
Home care	18.1% *	28.9%
Nursing homes	30.3% *	17.5%
Other	5.8%	5.4%
Member of PU committee	83.3%	77.9%

* = Significant ($p < .005$) between guideline and no guideline

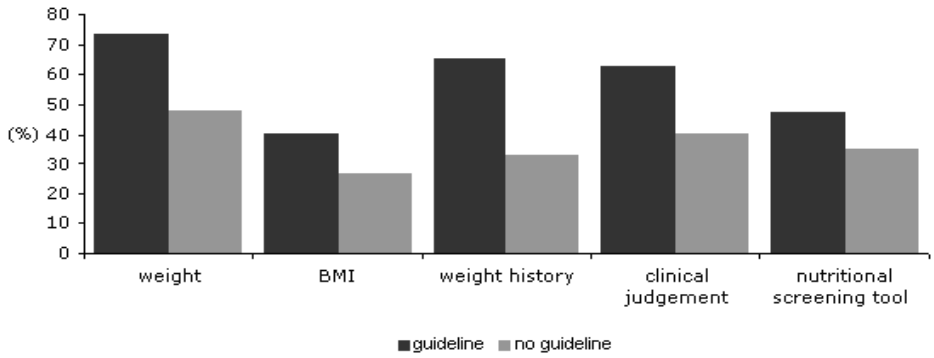
Table 1 shows that in the guideline group there were significantly more dieticians compared to the non nutritional guideline group. Nurses reported more frequently that they did not use nutritional guidelines but the difference was not significant. Table 1 also shows that in home care settings significantly fewer (p = 0.003) nutritional guidelines were used in PU care compared with long term institutional care where the trend (p = 0.003) was the opposite. In both groups the respondents were mostly members of PU committees.

Table 2 Nutritional care in PU patients

(N)	**Guideline** 240	**No Guideline** 114
Nutritional screening for every patient with PU?		
Always	38.8%*	14.4%
Sometimes	56.7%	44.2%
Rarely	5.6%*	23.1%
Never	3.0%*	18.3%
How frequently screened?		
At first contact only	9.8%	5.6%
At regular intervals	43.6%*	21.3%
When condition indicates	31.6%	34.3%
Never	1.3%*	11.1%
Don't know	12.4%	12.4%
Nutritional interventions		
Normal feeding	48.8%	39.5%
Oral supplements	90.4%	80.7%
Tube feeding	37.5%	36.8%
Parenteral feeding	21.7%	26.3%
Outcome measures to record the success or failure of nutritional interventions		
No measurement	17.5%	20.2%
Weight gain	55.0%*	28.9%
Development of PU	44.2%*	27.2%
Improvement in PU healing	56.7%*	33.3%
Biochemical parameters	17.5%	20.2%

* = Significant (p < .005) between guideline and no guideline PU= Pressure Ulcer

Figure 1 Content of nutritional screening



Focusing on the nutritional activities from screening and intervention, nutritional screening in PU care was conducted significantly more frequently in organizations where a nutritional guideline was used compared to the group not using a guideline (table 2). In the group not using a nutritional guideline 18.3% never performed nutritional screening in patients with PU, whereas in the group using a nutritional guideline this was significantly less (3.0%, $p < 0.001$). Furthermore structured nutritional screening at regular intervals was significantly more frequent ($p = 0.01$) in the group using a nutritional guideline. Moreover, in the group using a guideline, the number who 'never' screened was significantly ($p < 0.001$) less than in the group using no nutritional guideline.

The content of nutritional screening in the two groups is indicated in figure 1. The figure shows that in the group using a guideline, the content of nutritional screening consisted more frequently of weight measurements, weight history recalls, body mass index calculation, clinical judgement, and use of nutritional screening tools such as Malnutrition Universal Screening Tool (MUST) or Nutritional Risk Screening (NRS2000) (as part of the screening) compared with the group not using a nutritional guideline. All differences were statistically significant ($p < 0.05$).

Nutritional interventions (table 2) such as normal feeding and oral supplements were used more frequently in the nutritional guideline group, whereas tube feeding was used equally in the two groups and parenteral feeding was given less frequently in the group using guidelines. However no significant differences were found between the two groups concerning the use of nutritional interventions.

Focussing on outcome measures to record success or failure of a

nutritional intervention, table 2 shows that, in the group using a nutritional guideline, weight gain, development of PU, and improvement in PU healing were used significantly ($p < 0.05$) more frequently as outcome indicators than in the group not using a nutritional guideline.

Figure 2 Barriers in nutritional support within pressure ulcer patients

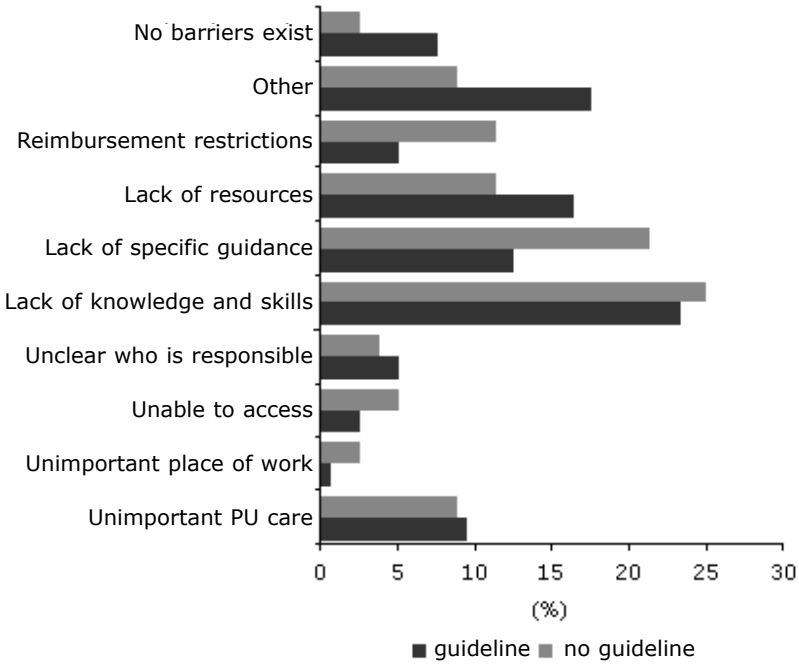


Figure 2 shows that the most important barrier to giving patients nutritional support in both groups was knowledge and skills ($p = 0.06$). Figure 2 also shows that in the group using nutritional guidelines lack of resources ($p < 0.001$) and 'other' ($p < 0.001$) were mentioned more frequently compared with the group not using a guideline. Analyzing the open category other indicated that 'other' barriers identified most frequently were lack of time, staff not understanding screening, and general practitioners reluctancy to prescribe supplements, and to refer patients to a dietician.
In the group not using a nutritional guideline, lack of specific guidance ($p < 0.001$), and reimbursement restrictions ($p < 0.001$) were mentioned most frequently after lack of knowledge and skills. In addition, the category 'no barriers exist' was mentioned more in organizations using a nutritional guideline than in organizations not using a nutritional guideline ($p < 0.001$).

DISCUSSION

The goal of this study was to investigate differences in daily practice regarding nutritional care in PU patients and possible barriers in providing patients nutritional support, between organizations with and without a nutritional guideline implemented in PU care. The results show that screening is done significantly more in daily practice where a nutritional guideline is in place. So having a nutritional guideline in PU care contributes to the amount and frequency of screening performed in daily practice. However what we do not know is whether this screening was already part of the care prior to the actual specific guidelines being implemented as this is a cross-sectional study and therefore this information is not available.
Considering nutritional screening in daily practice where a nutritional guideline is used more extensive nutritional screening activities such as weight measurements, weight history records, body mass index calculations and clinical judgments are recorded. Nutritional interventions such as normal feeding and oral supplements were also used more frequently in the group using a guideline. The rationale for this could be that more diagnostic activities logically may be followed by more therapeutic interventions. However with regard to this aspect no significant differences were found between the two groups. One of the reasons could be that the guideline implementation is still in an early phase in the participating organizations.
The results showed that in home care settings nutritional guidelines in PU care were used significantly less often compared to long-term institutional care setting. This could be because in home care it is perhaps more difficult to implement guidelines as patients live independently, nurses work autonomously and visit the client for only short periods and therefore may have less influence on the total patient care.

Understanding the barriers to implementing nutritional support is important to be able to develop strategies that can be used to increase the use of an adequate nutritional policy in daily practice [29]. The most important barrier to implementing adequate nutritional support in both groups was lack of knowledge and skills. This barrier has already been identified in previous studies

[26,30,31]. In the non-guideline group lack of specific guidance was also mentioned paradoxically. The group using a guideline in daily practice appeared to have more barriers to implementing nutritional support than the group not using a guideline. This might be because this group is more focused on nutritional activities in PU care and therefore they are more often confronted with actual barriers. In this study, these barriers were not further explored and therefore no additional information was available about which skills and knowledge, and resources were lacking.

Limitations

It is important to notice that due to the rather low response rate, it could be possible that the results present a skewed view of the current state of daily nutritional care. Therefore the results have to be interpreted carefully. Furthermore this study focused on daily practice where a nutritional guideline was available versus practice where this was not the case. The availability of a nutritional guideline however does not necessarily mean that professionals use the guideline in the correct way. The findings of our study were based on reported practice and not on observed practice. Also, the sample was analyzed as a whole, rather than comparing the groups in each country, due to the low sample size from each country. Nevertheless, the literature on guideline development in all three countries was examined and no major differences were found, and therefore the decision was made to analyze the data as one sample [32,33].

In addition there was no indication of how long the nutritional guidelines had been implemented in practice and what the exact content of these guidelines were, which also might influenced the results.

Three out of four respondents in both groups were members of a PU committee or involved in PU policy, which could biased the results because the group that replied to the questionnaire were probably more interested in PU care.

As argued in the introduction, individual studies have indicated that adequate nutritional status has a positive effect on pressure ulcer prevention and healing [19]. It is important that this relationship is made more explicit. This will help enlarge our understanding of the relationship between pressure ulcer and nutrition, and offer a stronger evidence base on which to implement new guidelines.

CONCLUSION

The goal of this study was to investigate the influence of having a nutritional guideline in daily practice on actual nutritional care in PU (prone) patients, and the relevant barriers to implementing nutritional support. The results show that having a nutritional guideline in PU care contributes to the amount of nutritional screening in daily practice, to the content as well as the extent of the nutritional screening. The most important barrier to implementing nutritional support in both groups was lack of knowledge and skills, followed by lack of resources.

RECOMMENDATIONS

1. The introduction of nutritional guidelines in PU care should be considered, to increase the frequency of nutritional screening of patients and hence to identify nutritional problems for those at risk of PU development or with PU in time, to start adequate and individualized nutritional interventions
2. The use of nutritional guidelines in PU care is a multidisciplinary challenge because nutrition is not the responsibility of one healthcare profession.
3. Focussing on relevant barriers to implementing nutritional support in PU care is essential to create an adequate and effective nutritional policy.

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GENERAL DISCUSSION

10

Introduction

This thesis consists of two parts. First, it aims to define the healthcare problem malnutrition and to describe its screening and auditing, particularly the effect of increasing awareness. The focus is on prevalence and not on theory of explaining the underlying mechanisms (explaining variance) of malnutrition.
Second, it explores the relationship between malnutrition and pressure ulcers, and investigates the use and benefits of nutritional guidelines on PU care. In doing so, it examines the following research questions.

Part one Exploring malnutrition

1. Which elements are most important in defining and operationalising malnutrition in healthcare?
2. Which nutritional screening instrument scores highest on criterion validity?
3. What is the prevalence of malnutrition in hospitals, nursing homes and home care, and what activities do healthcare workers undertake to prevent and treat it?
4. Does annual auditing of malnutrition prevalence and actual nutritional care, including the provision of feedback, decrease malnutrition prevalence in hospitals, nursing homes and home care over the years?

Part two Malnutrition and pressure ulcers

5. Is there a relationship between malnutrition parameters and pressure ulcers?
6. To what extent is the EPUAP nutritional guideline on pressure ulcer prevention and treatment implemented in clinical practice in Germany, the Netherlands and the UK?
7. Are there differences in nutritional care for pressure ulcer patients regardless of whether nutritional guidelines are used?

The final chapter discusses the main findings, strengths and limitations of our studies, as well as their implications for practice, policy and future research. Because the audit (section 1.3) was our main focus, we describe the related methodological aspects and future research plans in more detail.

Part one Exploring malnutrition

1.1 Defining malnutrition

In exploring the healthcare problem of malnutrition, the first step is to gain insight into how to define and screen it. However, yet no agreement exists on the optimal method for nutritional risk screening and assessing nutritional status [1,2]. Different measures, equipment and formulae lead to different outcomes at both the individual and the population level [3]. This is largely due to disagreement about the basic definition of malnutrition. Therefore, our first study in chapter 2 aimed to investigate the opinions of malnutrition experts on the optimal elements for defining malnutrition, and subsequently to operationalise the definition by devising practical measures to assess nutritional state; the overarching intention was to trigger further debate.

In the literature, the many different definitions hamper comparisons between studies, countries and healthcare settings. This study confirmed the lack of consensus. Still, the elements 'energy or protein deficiencies', 'decrease in fat free mass', and 'function and inflammation' were identified as important in defining malnutrition, while 'involuntary weight loss', 'body mass index (BMI)', and 'no nutritional intake' were seen as important in operationalising it. The proposed elements (involuntary weight loss, BMI, and intake) are also part of many existing screening and diagnostic instruments for malnutrition. Opinions on cut-off points for these elements differed strongly between experts.

The methodological limitations broadly explained in chapter 2 might have partly influenced the results. One possible limitation could be that of the 30 experts invited, 8 decided not to cooperate without clear reason. Still, given the diversity in opinion and extensive discussion we doubt that these experts would have influenced the results. Moreover, we did not completely follow the Delphi methodology to the end of the study, as we realised during its course that agreement would be impossible because of the large diversity of opinions resulting from the complexity of the phenomenon.

Another question that arises is whether achieving consensus between experts is possible at all. The discussion on the optimal definition of malnutrition has spanned many years, and nutritional experts' opinions still differ greatly. Malnutrition is extremely complex given the web of determinants that influence it, including severity of disease, inflammation, appetite, ageing, intake (macronutrients or micronutrients), poverty and social isolation.

Difficulties in agreeing on definitions also exist for other healthcare problems. For example, there has long been discussion between experts on how to define pressure ulcers, an appropriate grading system and the role of fluid. In addition, there is still limited insight into the aetiology of the problem, which possibly enhances the difficulties in defining it.

Only if we define malnutrition consistently and use the same methodology to assess nutritional status study results and incidence/ prevalence rates can be compared internationally. This would enable prevalence rates can to be established meaningfully, i.e. to indicate the risk of complications, diminished quality of life or decreased longevity in different populations and individuals. It would also contribute to better and clearer communication between healthcare settings and disciplines.

The definition of malnutrition should reflect the essence of the malnourished state. If we agree on the pathophysiology, including for example the role of inflammation, the definition will logically follow [3]. Next, fundamental research should test the theoretical concepts to disentangle the proposed concept. Methods and measures for assessing nutritional state should subsequently be developed and tested to operationalise the definition; consensus on which measures are optimal should presumably follow [3].

For now, we want to state clearly that although there is not yet consensus on the best way to define and operationalise malnutrition, potentially malnourished patients and those at risk for malnutrition still need to be identified (via screening) and treated adequately in accordance with the evidence-based ESPEN, ASPEN and BAPEN guidelines.

1.2 Screening malnutrition

Screening is undertaken to identify patients at risk for malnutrition. In the Netherlands, screening at admission to hospital became compulsory 2007. No consensus has yet been reached on the best malnutrition screening tool to apply. Our study in chapter 3 aimed at comparing a commonly used definition of malnutrition (based on involuntary weight loss and BMI) with the screening instruments MNA-SF, MST, MUST, NRS 2002 and SNAQ [4-8] in one adult hospital population; it revealed that the choice of instrument does not matter because the MST, MUST, NRS 2002 and SNAQ all showed good criterion validity.
By depicting sensitivity, specificity, positive and negative predictive value of the instruments, we were also able to indicate overestimation and underestimation of the screening tools.
Due to its low specificity (39%) and positive predictive value (37%), we do not recommend the MNA-SF for screening elderly hospitalised inpatients.

In this study the screening instruments were compared against a commonly used 'objective' definition of malnutrition (including undesired weight loss and low BMI). Even though no gold standard is available yet, BMI (kg/m^2) and unintentional weight loss are the most commonly used criteria of malnutrition. From literature it is known that for the general adult population the BMI mortality curves suggest that, a cut-off point of BMI 18,5 kg/m^2 is associated with increased mortality. For elderly patients a cut-off point of BMI 20 kg/m^2 is considered to be more appropriate given their changes in body composition (chapter 3). Also the Delphi study pointed out that these elements were considered as very important by the experts (chapter 2).

Though each patient was assessed by both a trained nurse and a trained dietician, as many as one in four still had incomplete BMI and/ or undesired weight loss data. For both quick-and-easy screening tools (MST and SNAQ), more complete data were available than for tools like MUST and NRS 2000. This supports the idea that the quick-and-easy tools may be easier to fill out [9]. However, they are not intended for diagnostic purposes, or suitable for monitoring patients' nutritional status over time. They feature simple questions on items that are most indicative of malnutrition

risk; in patients indeed considered at risk, they should be followed by a more detailed nutritional assessment by the doctor or dietician after the screening. This may add necessary information on the severity and nature of malnutrition, and patients' ability to undergo successful treatment [2].

A common limitation in nutritional screening is that it is only one of the increasing number of procedures that health professionals are asked to perform during their busy working programme. Because quick-and-easy tools are readily applicable, they remove obstacles to screening. Nutritional screening should be therefore be performed in every healthcare setting with a tool that is valid from a scientific point of view, quick-and-easy to use in a practical sense, and acceptable for both patients and healthcare workers. For future research, we suggest validating practical screening tools for all healthcare settings.

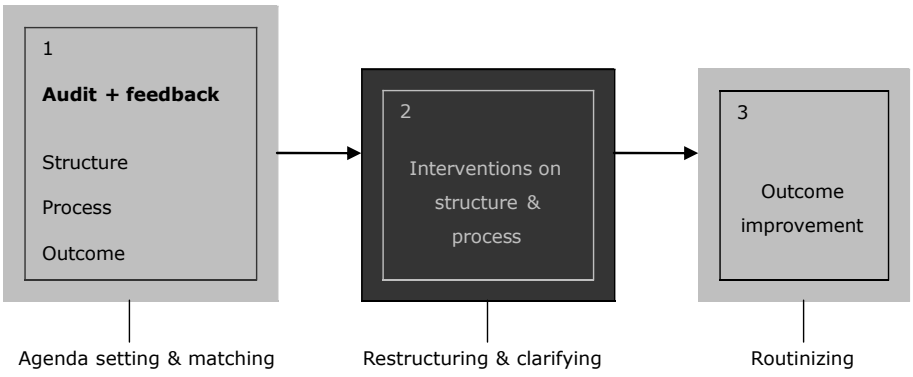
1.3 Quality of nutritional care and awareness of malnutrition

The audits performed in chapters 4, 5 and 6 included indicators of structure, process and outcome to measure all aspects of the quality of nutritional care (figure 1) [10]. The conceptual model we used (figure 1) was first presented and explained in the introduction to this thesis. We hypothesised that measuring the quality of nutritional care (structure, process and outcome, box 1 in figure 1) by way of an annual internal audit would increase awareness of the malnutrition problem and ultimately lead to decreasing malnutrition prevalence rates over the years (box 3 in figure 1). To structure the model, we linked it to Rogers's organisational innovation theory [11].

The audits in chapters 4 and 5 focused on the first box in figure 1; they measured malnutrition prevalence and healthcare workers' activities to prevent and treat malnutrition in hospitals, nursing homes and home care. The results showed that malnutrition is highly prevalent: overall, one in every five patients was malnourished. Moreover, nutritional care in hospitals, nursing home and home care appeared to be suboptimal, as process indicators showed that malnourished patients and those at risk for malnutrition were often unrecognised and undertreated. Fewer than 60% of the patients were screened in hospitals and nursing homes,

and only 13.9% in the home care setting. Likewise, fewer than half of the malnourished patients actually received nutritional treatment, which is clearly insufficient. However, it is worth noting that a small group of patients does not receive nutritional treatment for medical or ethical reasons (i.e. terminally ill patients). Research shows that screening and treatment are important: the use of a screening instrument may improve identification of malnourished patients (from 50% to 80%), and early screening and adequate treatment may reduce the length of hospital stay [12]. Finally, structural quality indicators at ward and institutional level show that further improvement is needed in the areas of guideline implementation, education, mealtime ambiance, documentation and so on. The Council of Europe as well as Rasmussen's [13], Mowe's [14] and Nijs's [15] studies distinctly emphasise that these indicators seem necessary in ensuring improved nutritional care for patients.

Figure 1 Audit research model (based on Rogers's organisational innovation theory [11])



To increase awareness, the audit results were communicated through written feedback reports at institutional and national level (benchmark). The reports included tables on population characteristics as well as information on malnutrition prevalence (outcome), screening, prevention and treatment (process), and policy indicators (structure). Our study (chapter 6) confirmed that auditing and feedback can help reduce prevalence rates over time, because we showed significant decreasing prevalence rates in the hospital and home care setting (box 3, figure 1). Chapter 6 points out that the more often hospitals and home care organisations

participated in the LPZ audits over the years, the lower the malnutrition prevalence rates. Obviously, this change results not just from measuring the healthcare problem each year: action is needed in order to change practice. It is likely that the increasing awareness prompted structural and process interventions (figure 1, box 2) that influenced prevalence rates (figure 1, box 3). In future research, more insight is necessary into the contents of this 'black box' (figure 1, box 2) to gain insight into which structural and process interventions precisely are most effective. Moreover, the results of our annual audit study also created national awareness of the magnitude of the malnutrition problem, in the eyes of policymakers and politicians. This triggered the initiation of two national, government-sponsored improvement programmes on malnutrition. 'Eat well, to get well' was launched in 2006 in hospitals, aiming to improve professional attitudes towards structural nutritional screening combined with optimal nutritional treatment. In the same year, 'Care for better' started in nursing homes and residential homes to enhance structural nutritional screening, develop an adequate weighing policy and improve mealtime ambiance. Our multilevel study in chapter 6 showed that participation in these national programmes resulted in lower malnutrition prevalence rates over time. Because these interventions were multifaceted, it is not possible to point out which of their components were effective. In future research, intervention studies are needed to indicate what the active and effective ingredients are in lowering prevalence rates.

Overall, measuring healthcare problems via our LPZ audit is important in maintaining attention for and increasing awareness of these problems, although improvement programmes and concrete interventions in the structure and process of nutritional care are needed to give concrete direction to actual change.

1.3.1 Methodological reflections on the audits (2004-07)

The audit in this thesis was a large-scale affair including 74.496 patients and a number of settings, including approximately 65% of all Dutch hospitals, 44% of nursing homes and 20% of homecare organisations. Over four years, 269 different organisations (80 hospitals, 141 nursing homes, 48 home care organisations) participated once or several times.

Because we felt it was important to use reliable data, we included only complete nutritional datasets (BMI, weight loss, intake); this meant that a relatively large number of patients had to be excluded (chapter 4). Datasets for elderly patients in particular were often incomplete as caregivers found it difficult to actually perform measurements of weight and height. Other studies have also mentioned the difficulty of weighing patients [16-18]. One might hypothesise that this group of excluded patients was probably at even higher risk of weight loss than the included patients, and, consequently, that our prevalence rates are an underestimation. An additional analysis, however, demonstrated that there were no significant differences in patient characteristics (time since admission, age, sex, disease type and number of diseases and ward type) between the included and excluded groups. Our sample may therefore be considered representative, which makes it unique and the results robust.
In the sample of 2007 (chapter 5) the amount of missing data had decreased to 25%, while this was 49% in the sample of 2005. It seems likely that participation to repeated measurements leads to better data sampling, because participants know in advance what actions they are expected to undertake for this measurement.

We trained the coordinators of each institution on how to manage the audit. Although we implemented an uniform protocol for this study, the actual data collection was done by trained nurses from within the institutions. To increase objectivity, two healthcare professionals (nurses, dieticians or doctors; one who worked at the patient`s ward, and one independent) assessed each patient together.

The data collection questionnaire for the audits (chapters 4, 5 and 6) was developed and updated annually in line with recent literature and guidelines [2,18-21] and consultation with Dutch experts on malnutrition.
The same Dutch experts and results from the Delphi study (chapter 2) were used for the definition of malnutrition in these audits. Moreover, we used this same definition in different care settings, though this was challenging given the overall national and international lack of consensus. Our definition tested positively for face validity and criterion validity in the hospital setting (chapter 5).

In the future we recommend that criterion validity also be tested in the other settings. The structural quality indicators measured at ward and institutional level (chapter 5) were formulated by a team of Dutch experts and based on Beck et al.'s [19] guidelines and the 2003 Resolution on Food and Nutritional Care in Hospitals [21]. Implementing indicators such as nutritional screening, education and ambiance was found to be beneficial in other studies [12,15,22,23]; in future studies we recommend testing the benefit of including these structural indicators as well.

1.3.2 Future research plans

From our study in chapter 6 we know that the audits have led to significantly decreasing prevalence rates over the years, and that the number of previous audits is important in lowering these rates in hospitals and home care. Still, future research should examine the content of this 'black box' (box 2, figure 1), because it remains unclear what specific actions (structural and process interventions) organisations carried out after the LPZ audits, and which of these interventions were effective. Furthermore, each practice environment seems to offer its own specific set of factors that hinder or promote implementation in terms of contextual influences [24].

Because the cross-sectional design of the study does not enable us to identify which interventions (process, structural or combined) might have been the most effective, controlled before-after intervention studies with adequate designs are required in future research. They should preferably be combined with process evaluations and specific measurements of organisational context to increase understanding of the generalisability of specific interventions [25,26]. Furthermore, there is a need for a well-designed process evaluation to explore and provide insight into the complex dynamics underlying the variable benefit of auditing and feedback in our study, given that the benefit did not appear in every setting. This evaluation would be necessary to further validate our conclusions and find out what specific actions are most effective in lowering prevalence rates.

Another important issue is that nursing home prevalence rates were stable; the number of previous audits (and feedback) had no influence. In the evaluations of the annual audits, nursing home

coordinators indicated that they had difficulties interpreting the results and linking the feedback to practical, concrete structural and process improvement interventions. In future research, we must therefore focus on possible problems in the current feedback system, and develop a more tailormade system that allows nursing homes to translate their research findings into relevant structural and process interventions. This will mean first theoretically mapping the essential components of a feedback system, then gaining qualitative insight into the essential components for this specific setting, and finally developing a new system and evaluating its feasibility. The Medical Research Council (MRC) framework for developing and evaluating complex interventions can be used as a theoretical guide for designing this intervention [25]. To evaluate the most effective system, different combinations of feedback systems/strategies should be tested on various intervention groups.

The LPZ audit has provided insight into the healthcare problem of malnutrition in hospitals, nursing homes and home care. To be able to treat malnutrition early, we recommend that general practitioners (GPs) incorporate nutritional care into their general patient care as well. In the community setting, malnutrition is also a relevant healthcare problem (table 2, chapter 1); in the future we must investigate the possibilities for expanding the audit into this area.

1.3.3 Internationalisation of the LPZ audit

Because comparing structural, process and outcome indicators with other studies and countries is complex due to the different definitions and methods used, we started disseminating our LPZ audit in Germany and Austria in 2008 [27]. This international project now enables us to compare prevalence, prevention and treatment interventions between these countries in the same settings, on a large scale, in a uniform manner, and using the same methods and definitions.

Another annual European malnutrition audit is Nutrition Day [28]. Though both measurements seem similar at first glance, they differ in that the LPZ measures different settings and levels (patient, ward and institutional) and includes quality indicators for nutritional care, while Nutrition Day focuses on the hospital setting. Initiatives like

these, however, are important in creating international awareness of the healthcare problem as well as learning from each other from both a care and a research point of view.

Part two Malnutrition and pressure ulcers

2.1 Relationship between malnutrition and pressure ulcers

Pressure ulcers (PU) are another very topical care problem whose development depends on extrinsic and intrinsic risk factors. Malnutrition is considered one of these intrinsic risk factors: it appears to both increase the risk [29] and impair the healing [30,31] of PU. Because few studies had indicated that a relationship might exist between malnutrition and PU [32-35], more evidence was needed. Our study in chapter 7 confirmed the relationship between PU and the malnutrition parameters undesired weight loss (5-10%) and poor nutritional intake. However, because we used a cross-sectional design, we cannot draw conclusions about causality. A causal relationship between nutrition and PU, then, has still not been proven. More evidence is thus needed to increase our understanding of their relationship.

The results of our study in chapter 7 once more confirm the relationship between PU and malnutrition parameters [32-35] and thereby at least support the importance of adequate nutritional care in patients with or prone to PU. Detailed clinical guidelines should support the implementation of adequate nutritional management in daily PU care .

2.2 Nutritional guidelines in pressure ulcer management

Guidelines may help to improve clinical practice since they increase professionals' nutritional alertness and can promote structural nutritional screening, assessment and nutritional intervention (if necessary) in patients with or prone to PU. Over the past decade, increasing emphasis has been placed on the use of guidelines in healthcare. In many countries, national healthcare quality institutes and organisations representing healthcare professionals play important roles in developing and implementing guidelines for various care aspects. Such activities should enhance the integrated quality of care.

Schols et al.'s [35] international study on guidelines in PU care

concluded that recommendations for nutritional management were not transparently incorporated into most of the PU guidelines investigated. This motivated the nutritional working group of the European Pressure Ulcer Advisory Panel (EPUAP) to develop a specific, European clinical nutritional guideline for PU prevention and treatment covering the whole nutritional cycle [36]. The guideline was launched in 2004 in eight languages. Because research indicates that guidelines are not always reflected in actual patient care [35,37,38], insight was needed into what degree this EPUAP guideline was actually disseminated and implemented in clinical practice. Investigations in chapter 8 showed that after a year of its being disseminated (without a specific dissemination strategy), 60% percent of organisations knew of the EPUAP nutritional guideline, and 25% had already applied it in their clinical practice and used its nutritional screening recommendations. However, due to the low response rate, the questionnaire might present a skewed view of the state of implementation across the three countries. Moreover, three out of four respondents from the participating organisations were members of a PU committee or involved in PU policy, which could bias the results as they were probably more interested in PU care. Finally, the findings were based on reported rather than observed practice. Therefore, socially desirable answers might have also influenced our results.
As health professionals are asked to perform an increasing number of procedures during their busy working programmes, we believe it is best not to have separate guidelines for every care problem. We have therefore started to integrate the EPUAP nutritional guideline into the international pressure ulcer prevention and treatment guidelines developed in collaboration with the American NPUAP and European EPUAP. These guidelines will be disseminated through the EPUAP network at the end of 2009. Future studies could cover the dissemination, implementation and benefits of these new guidelines in more countries, including a larger sample of participants.

As mentioned above, research on guideline implementation suggests that guidelines are not always reflected in actual patient care [35-43]. Estabrooks [39] refers to this dilemma as a gap between what is known and what is done. Because we were interested in the benefits of using nutritional guidelines in daily PU management, in chapter 9 we examined actual PU management

(process interventions) in practices with nutritional guidelines available compared to ones without. This revealed that having a nutritional guideline contributed to the amount and frequency of PU screening in daily practice, and to the use of nutritional interventions such as oral supplements. Guidelines, then, seem to increase awareness of the importance of nutritional care in PU patients, and lead to concrete action. Still, these results must be interpreted carefully: the study design was cross sectional, which means we do not know how long the nutritional guidelines had been available in the practices and what their exact content was. A more longitudinal design would be preferable to research this matter. Moreover, the low response rate could result in a skewed view of daily nutritional care, because the participating organisations may already be more interested in nutritional care in patients with or prone to PU.

In our study, we tried to determine whether using nutritional guidelines (a structural indicator) in clinical practice led to enhanced use of process interventions such as screening, treatment and monitoring malnutrition (i.e. what is actually done in prevention and treatment). In future research it would be useful to assess whether using guidelines also leads to better outcomes (i.e. PU prevention and faster wound healing).

3.0 Implications for practice

The annual malnutrition audits (chapters 4 and 5) have shown that malnutrition is still highly prevalent in all healthcare sectors and nutritional care is not yet optimal. This means malnourished patients and patients at risk of malnutrition often remain undiagnosed and undertreated. Optimising the identification and treatment of malnutrition should improve patient outcomes such as faster wound healing, less postoperative morbidity, shorter hospital stays, lower PU incidence, better quality of life, lower mortality, and so on [44-53]. It is therefore important to improve nutritional care in general, and to follow the nutritional cycle (screening, assessment, intervention, evaluation and monitoring) structurally for all patients. This starts with screening to identify patients at risk of malnutrition. We therefore strongly recommend that malnutrition screening be introduced for all patients and in all healthcare

settings using a valid and practical screening tool. It should be part of regular care, just like assessing body temperature and blood pressure, and should start from the moment the patient enters the healthcare setting. Patients at risk require a more detailed nutritional assessment by a nutritional team (or at least by a dietician) to identify necessary information about their nutritional state and ability to undergo successful treatment. We also recommend that more emphasis be placed on adequate nutritional treatment using evidence-based guidelines (e.g. ESPEN and ASPEN) [54,55].
Finally, when treatment begins, we recommend that the outcomes be monitored. The main effort and costs involved in screening may be due to care and follow-up rather than the screening procedure itself. But identifying a problem does not necessarily result in improved outcomes unless there is an effective care plan to deal with it. The effectiveness of this plan should be monitored by defined measurements and observations, such as the recording of dietary intake, body weight and function. This may lead to alterations in treatment during the course of the patient's condition. The results of screening, assessment and nutrition care plans should be communicated to other healthcare professionals, especially when the patient is transferred back into the community or to another institution. Structural indicators like education, guidelines, risk screening policy and adequate treatment policy are necessary to guide the improvement of nutritional care for patients.

This thesis showed that annual auditing and feedback improves malnutrition prevalence rates in hospitals and home care organisations over time. Clearly, then, auditing and feedback seem to increase awareness. Annual internal auditing is important to maintain attention for the care problem; to increase awareness, results must be communicated throughout the institution, from the managers to healthcare workers. Moreover, improvement actions in structure and process must be planned and implemented to further increase the quality of care in the future.

Finally, the results of our study in chapter 7 confirm the relationship between PU and malnutrition parameters, and thereby support the importance of adequate nutritional care in patients with or prone to PU. Because malnutrition potentially is a reversible risk factor for

PU, its early identification and management is very important. All patients with or prone to PU therefore need more complete nutritional assessment, followed by tailormade nutritional support. Detailed clinical guidelines on nutrition do exist to support the implementation of adequate nutritional management in daily PU care; their implementation, however, it is of utmost importance (chapters 8 and 9).

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SUMMARY

SAMENVATTING

DANKWOORD

PUBLICATIONS

ABOUT THE AUTHOR

11

SUMMARY

Malnutrition (i.e. undernutrition) is an important, under-recognised, and undertreated problem in healthcare. Malnutrition prevalence rates in all healthcare settings are high (10-60%), with massive overall cost to society. Malnutrition leads to prolonged recovery, increases the need for high-dependency nursing care and the risk of serious complications, and, at worst, can result in death from either depletion or a preventable complication. Increasing awareness of malnutrition and attention to adequate nutritional care may positively affect both the prevalence of malnutrition in healthcare and its consequences.

Pressure ulcers (PU) are another and also very topical healthcare problem. Their development depends on extrinsic and intrinsic risk factors. Malnutrition as an extrinsic factor seems to increase the risk and impair the healing of PU. This thesis therefore addresses the healthcare problem of malnutrition and its relationship with PU.

The thesis begins with a general introduction (chapter 1) and thereafter consists of two parts. The first part aims to describe the definition and screening of malnutrition and investigate whether increasing awareness (through annual audits of malnutrition prevalence and nutrition-related activities) improves the quality of nutritional care in hospitals, nursing homes and home care. The second part aims to increase evidence on the relationship between malnutrition and PU, and to create insight into the extent and benefits of implementing nutritional guidelines in PU care.

Part 1 Exploring malnutrition

Chapter 2 describes the results of a Delphi study among 22 experts which aimed to trigger further debate on the definition and operationalisation of malnutrition. The study ultimately confirmed the lack of overall agreement, although it showed that experts saw energy deficiency, protein deficiency and decreased fat-free mass as most important in defining malnutrition. They also suggested function and inflammation to be important.
Operationalisation of the definition should subsequently yield a set of measures that allows the assessment of nutritional state and

diagnosis of malnutrition. Most experts indicated that the elements involuntary weight loss, BMI and nutritional intake were important in operationalising malnutrition. However, no consensus was reached on the cut-off points for these measures.

Chapter 3 presents the results of a study in which five malnutrition screening tools (MST, MUST, NRS-2002, SNAQ and MNA-SF) were compared in one adult hospital inpatient population. This study revealed that the MST, MUST, NRS-2002 and SNAQ all seem to be criterion valid for malnutrition screening among this population, but the MNA-SF should not be used with elderly hospitalised inpatients because of its poor specificity.

Chapter 4 presents data from the 2005 Dutch malnutrition audit, which involved 12.883 patients. The results show that malnutrition is still a substantial problem in hospitals, nursing homes and home care. Its prevalence was highest in hospitals (23.8%), followed by home care organisations (21.7%) and nursing homes (19.2%). The highest prevalence rates were found in psychogeriatric wards in nursing homes, and in geriatric wards in hospitals. Being female was only associated with malnutrition in nursing homes. Blood and gastrointestinal tract diseases, infection, COPD, dementia and cancer were associated with malnutrition in hospitals. Dementia was associated with malnutrition in nursing homes, while gastrointestinal tract diseases, diabetes mellitus and cancer were associated factors in home care patients.

Chapter 5 presents data from the 2007 Dutch malnutrition audit, which involved 50 university and general hospitals (N=6021), 90 nursing homes (N=11.902) and 16 home care organisations (N=2332), and focused especially on aspects such as nutritional screening and treatment and nutritional care quality indicators. The study showed that nutritional screening took place in less than 60% of all patients in nursing homes, hospitals and home care. Hospital patients in particular were screened upon admission, whereas nursing home patients were screened more regularly (i.e. monthly). An acknowledged screening instrument was used for under 50% of the screened patients in hospitals and nursing homes, while in home care this was even less (10%). Likewise, a dietician was consulted and nutritional treatment was provided for under 50% of

malnourished patients in all sectors.
'Nutritional treatment' most often entailed an energy- and protein-enriched diet or the provision of oral nutritional supplements. At ward level, nursing homes focused more on the quality of nutritional care than hospitals and home care, especially with respect to the use of nutritional guidelines, weighing at admission and mealtime ambiance.

Chapter 6 presents data from the malnutrition audits from 2004 to 2007, analysed by way of logistic multilevel analysis. In total, 269 different organisations (80 hospitals, 141 nursing homes and 48 home care organisations) were analysed, yielding a total of 74.496 observations. This study indicated that malnutrition prevalence showed a significantly decreasing trend in hospitals and home care over the years, but remained stable in nursing homes. Participation in the annual LPZ audit and involvement in national improvement programmes positively influenced the prevalence rates in hospitals and home care, indicating that increasing awareness and taking active steps towards improvement may be important in lowering these rates.

Part 2 Malnutrition and pressure ulcers

Chapter 7 shows the results of a 2007 German cross-sectional audit (N=6460), and analyses the relationship between malnutrition parameters (BMI, undesired weight loss and intake) and PU using univariate and multivariate logistic analysis. The study confirmed the relationship between PU and the malnutrition parameters 'undesired weight loss (5-10%)' and 'poor nutritional intake', and thus supports the importance of adequate nutritional care in patients with or prone to PU.

Chapter 8 reports the results of a cross-sectional study on the implementation of the EPUAP nutritional guideline for PU prevention and treatment carried out in 363 healthcare organisations in the Netherlands, Germany and the United Kingdom. This study demonstrated that one year after its dissemination, 61% of the respondents knew of the guideline. The most frequently mentioned dissemination channel was the EPUAP internet site (18.8%), followed by professional journals (16.8%) and conferences

(16.4%). Overall, 25% of the respondents had already applied it in their clinical practice and used the guideline's recommendations for nutritional screening. The guideline was better disseminated and implemented in the Netherlands and the UK than in Germany, where only 9% of participants had applied it in practice. The main barrier to the provision of nutritional support appeared to be lack of knowledge and skills, followed by lack of clarity about who is responsible for nutritional support, and an inability to access nutritional support.

Chapter 9 focuses on the differences in nutritional care for patients with or prone to PU between organisations using and not using the guidelines. The data were derived from a cross-sectional study in healthcare organisations in the Netherlands, Germany and the UK. In total, respondents from 363 organisations participated in the study. Nutritional guidelines were used in daily practice in 66.1% of these organisations. There were significant differences in the content and extent of nutritional screening between organisations using nutritional guidelines and those not using them. Moreover, nutritional interventions such as improving normal feeding and providing oral supplements tended occur more frequently in organisations using nutritional guidelines. However, these differences were not statistically significant.

Chapter 10 presents a general discussion of the studies presented in this thesis and summarises the main findings. It also puts forth a number of methodological reflections and implications for research and practice.

SAMENVATTING

Ondervoeding is een belangrijk maar ook onderschat en onderbehandeld probleem binnen de gezondheidszorg. Prevalentiecijfers van ondervoeding zijn hoog in alle sectoren in de gezondheidszorg (10-60%), met als gevolg hoge overheidsuitgaven en collectieve kosten. Ondervoeding heeft ondermeer een tragere genezing tot gevolg, het verhoogt de behoefte aan intensieve zorg en het risico op ernstige complicaties en kan zelfs in het ergste geval zonder effectieve behandeling leiden tot de dood.
Een grotere bewustwording ten aanzien van het voorkomen van ondervoeding en aandacht voor een adequate voeding(szorg) kunnen een positieve invloed hebben op zowel de prevalentie van ondervoeding in de gezondheidszorg als op de negatieve consequenties van ondervoeding.

Decubitus is een ander belangrijk en actueel zorgprobleem in de gezondheidszorg. De ontwikkeling van decubitus is afhankelijk van extrinsieke en intrinsieke risicofactoren. Ondervoeding als extrinsieke factor lijkt het risico op decubitus te vergroten en de genezing ervan te beïnvloeden.

Dit proefschrift richt zich primair op het probleem ondervoeding binnen de Nederlandse gezondheidszorg en secundair op de relatie tussen ondervoeding en decubitus.

Het proefschrift begint met een algemene introductie (hoofdstuk 1) en bevat vervolgens twee delen. In het eerste deel wordt ingegaan op de definitie van en de screening op ondervoeding. Vervolgens wordt onderzocht of het aandacht geven aan ondervoeding (door jaarlijkse audits van de prevalentie van ondervoeding en voedingsgerelateerde activiteiten) de kwaliteit van voedingszorg in ziekenhuizen, verpleeghuizen en thuiszorg verbetert. In het tweede deel wordt aandacht besteed aan de relatie tussen ondervoeding en decubitus enerzijds door cross-sectioneel deze relatie te onderzoeken, en anderzijds door de implementatie van een voedingsrichtlijn voor decubitus te onderzoeken.

Deel 1 Ondervoeding in de gezondheidszorg

Hoofdstuk 2 beschrijft de resultaten van een Delphi-studie onder 22 internationale experts. Het onderzoek bevestigt het ontbreken van een algemene overeenstemming wat betreft de definitie, alhoewel de resultaten laten zien dat de experts energie- en eiwittekort en een verminderde vetvrije massa als belangrijk beschouwen bij het definiëren van ondervoeding. Verder wordt in relatie tot ondervoeding gewezen op de relevantie van functionele stoornissen en inflammatie.
Voor de operationalisatie van ondervoeding moet dit leiden tot een set meetbare variabelen die de beoordeling van de voedingsstatus en de diagnostisering van ondervoeding mogelijk maken. In het onderzoek geven de meeste experts aan dat de aspecten als ongewenst gewichtsverlies, BMI en voedingsintake belangrijk zijn voor de operationalisatie van ondervoeding. Deze aspecten passen ook in de meest gebruikte screeningsinstrumenten. Echter, er werd geen overeenstemming bereikt wat betreft de vastgestelde afkappunten voor deze parameters.

Hoofdstuk 3 geeft de resultaten weer van een onderzoek waarin vijf screeningsinstrumenten voor ondervoeding (MST, MUST, NRS-2002, SNAQ en MNA-SF) zijn vergeleken bij een populatie van volwassen patiënten in een ziekenhuis. Het onderzoek wijst uit dat de MST, MUST, NRS-2002 en SNAQ allemaal criterium valide zijn voor de screening van ondervoeding in deze populatie. Wat betreft de MNASF wordt geadviseerd deze niet te gebruiken bij ouderen die in het ziekenhuis zijn opgenomen, omdat de specificiteit laag blijkt te zijn.

Hoofdstuk 4 beschrijft de resultaten van het onderdeel ondervoeding binnen de Landelijke Prevalentiemeting Zorgproblemen (LPZ) uit 2005, waarbij 12.883 patiënten betrokken waren. De resultaten laten zien dat ondervoeding nog steeds een substantieel probleem is in ziekenhuizen, verpleeghuizen en thuiszorg. De prevalentie was het hoogst in ziekenhuizen (23,8%), gevolgd door thuiszorgorganisaties (21,7%) en verpleeghuizen (19,2%). De hoogste prevalentiecijfers werden gevonden op psychogeriatrische afdelingen van verpleeghuizen en op geriatrische afdelingen van ziekenhuizen. Alleen in verpleeghuizen was er een significante

relatie tussen het vrouwelijke geslacht en het ondervoed zijn. Bloed- en gastro-intestinale -aandoeningen, infecties, COPD, dementie en kanker zijn van invloed op ondervoeding in ziekenhuizen. Dementie wordt geassocieerd met ondervoeding in verpleeghuizen, terwijl gastro-intestinale aandoeningen, diabetes mellitus en kanker relevante risicofactoren zijn bij thuiszorgpatiënten.

Hoofdstuk 5 beschrijft de data van de Nederlandse idem LPZ ondervoedingsaudit van 2007, waarbij 50 academische en algemene ziekenhuizen (N=6021), 90 verpleeghuizen (N=11.902) en 16 thuiszorgorganisaties (N=2332) betrokken waren. De studie richtte zich onder andere op aspecten als screening en behandeling van ondervoeding en op kwaliteitsindicatoren die zich richten op de (onder)voedingszorg. Het onderzoek wijst uit dat minder dan 60% van de patiënten in verpleeghuizen, ziekenhuizen en thuiszorg gescreend werden op hun voedingsstatus. Ziekenhuispatiënten werden met name gescreend bij opname, terwijl patiënten in verpleeghuizen vaker periodiek (bijvoorbeeld maandelijks) werden gescreend. Voor minder dan 50% van de gescreende patiënten in ziekenhuizen en verpleeghuizen werd een erkend en gevalideerd screeningsinstrument gebruikt, terwijl dit voor de thuiszorg nog minder was (10%). Daarbij was voor minder dan 50% van de ondervoede patiënten in alle sectoren een diëtist geconsulteerd en een behandeling voor ondervoeding ingesteld.
Daar waar behandeling wel plaatsvond, bestond deze meestal uit een energie- en eiwit verrijkt dieet of orale voedingssupplementen. Op afdelingsniveau lag de focus in verpleeghuizen meer op de kwaliteit van de voedingszorg dan in ziekenhuizen en thuiszorg, vooral waar het gebruik van voedingsrichtlijnen, het wegen bij opname en aandacht voor de maaltijdambiance betrof.

Hoofdstuk 6 beschrijft de data van de LPZ ondervoedingsaudits van 2004 tot 2007, geanalyseerd met behulp van een logistische multilevelanalyse. In totaal werden 269 verschillende organisaties (80 ziekenhuizen, 141 verpleeghuizen en 48 thuiszorgorganisaties) geanalyseerd, leidend tot een totaal van 74.496 observaties. Dit onderzoek wijst uit dat, door de jaren heen, de prevalentie van ondervoeding een significant dalende trend laat zien in zowel ziekenhuizen als thuiszorgorganisaties, maar dat deze stabiel blijft

in verpleeghuizen. Deelname aan de jaarlijkse LPZ-meting en deelname aan nationale verbeterprogramma's als het "Eten en drinken project" van het Vilans in de care sector en het "Wie beter eet wordt sneller beter" van het Sneller Beter Project (stuurgroep ondervoeding) in de cure sector, beïnvloeden de prevalentiecijfers positief in ziekenhuizen en thuiszorgorganisaties, en wijzen erop dat voedingsbewustzijn en het nemen van actieve stappen voor verbetering belangrijk zijn voor het verlagen van de cijfers.

Deel 2 Ondervoeding en decubitus

Hoofdstuk 7 beschrijft de data van een in 2007 gehouden audit (n=6460) in Duitsland en analyseert de relatie tussen enkele relevante ondervoedingparameters (BMI, ongewenst gewichtsverlies en voedingsinname) en de prevalentie van decubitus, gebruik makend van univariate en multivariate logistische analyses. Het onderzoek bevestigt de relatie tussen de prevalentie van decubitus en de ondervoedingparameters 'ongewenst gewichtsverlies' (5-10%) en 'lage voedingsinname', en ondersteunt daarmee de relevantie van adequate voedingsinname bij de preventie en behandeling van decubitus.

Hoofdstuk 8 beschrijft de resultaten van een cross-sectionele studie naar de implementatie van de EPUAP voedingsrichtlijn voor decubituspreventie en -behandeling, uitgevoerd in 363 organisaties in Nederland, Duitsland en Groot-Brittannië. De studie toont aan dat de richtlijn, één jaar na de verspreiding ervan, bij 61% van de respondenten bekend was. Het meest genoemde verspreidingskanaal was de EPUAP website (18,8%), gevolgd door vakliteratuur (16,8%) en congressen (16,4%). Globaal paste 25% van de respondenten de richtlijn reeds toe. De richtlijn was beter verspreid en geïmplementeerd in Nederland en Groot-Brittannië dan in Duitsland, waar slechts 9% van de deelnemers de richtlijn in de praktijk had gebruikt. De grootste barrière voor adequate voedingsondersteuning bleek een tekort aan kennis en vaardigheden te zijn, gevold door onduidelijkheid over wie er verantwoordelijk is voor de voedingsondersteuning .

Hoofdstuk 9 focust op de verschillen in voedingszorg voor patiënten met of met een risico op decubitus tussen organisaties waarin wel

of niet gebruik gemaakt wordt van richtlijnen. De data werden ontleend aan een cross-sectionele studie in gezondheidszorg-organisaties in Nederland, Duitsland en Groot-Brittannië. In totaal hebben 363 respondenten van verschillende organisaties deelgenomen aan het onderzoek. Voedingsrichtlijnen werden in 66,1% van de organisaties dagelijks gebruikt. Er waren significante verschillen wat betreft inhoud en omvang van de voedingsscreening tussen organisaties die gebruik maakten van voedingsrichtlijnen en organisaties die geen gebruik maakten van voedingsrichtlijnen. Bovendien werden voedingsinterventies zoals het verbeteren van de dagelijkse voeding en het verschaffen van orale supplementen vaker gebruikt in organisaties die gebruik maakten van voedingsrichtlijnen.

Hoofdstuk 10 bevat een algemene discussie met betrekking tot de beschreven studies in dit proefschrift en vat de belangrijkste bevindingen samen. Ook worden een aantal methodologische reflecties en implicaties voor de praktijk en toekomstig onderzoek uiteengezet.

Voor me
'n hoge berg
Soms de moed niet
Om deze te beklimmen
Heb kracht nodig
Voor deze nieuwe weg

Nog twijfelend over mijn keus
Voel ik 'n hand op mijn schouder
Die me naar boven leid
Steeds hoger, en hoger

Boven op de berg
Kijk ik achterom
Het was een lange weg
Soms eenzaam en onbekend
Daar, waar ik ging zitten
Even niet meer verder durfde
Hebben jullie mijn hand gepakt
En mij de weg gewezen

Eenmaal boven
Is het uitzicht bewonderenswaardig!
Geen berg te hoog!

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ABOUT THE AUTHOR

Judith Meijers was born on the 9th of December 1977 in Tegelen, the Netherlands. After finishing secondary school at the Blariacum College in Blerick, she studied nursing from 1995 to 1999. She then worked as a nurse and member of several innovation project teams in various hospital wards in Venlo and Eindhoven until 2004. During this time she also followed an upper management bachelor related to healthcare (1999-2001). In August 2004 she received her master's degree in Health Sciences (Care Sciences specialisation) at Maastricht University, after a six-month internship at the University of Alberta in Canada. During this internship, supervised by Carole Estabrooks within the world-leading Knowledge Utilization Studies Program (KUSP), Meijers studied contextual factors related to research utilisation. In 2007 she began a Master in Epidemiology at the Institute for Research in Extramural Medicine (EMGO Institute) of the VU University Medical Center Amsterdam, which she will complete in 2009.
In November 2004, Meijers took up a research position at Maastricht University working on the Dutch National Prevalence Measurement of Care Problems (LPZ). Her particular focus was the healthcare problem of malnutrition in hospitals, nursing homes and home care which resulted in the development of a Dutch malnutrition module, which, together with the other LPZ modules, was disseminated in November 2008 in Germany and Austria.

Meijers is a member of the European Pressure Ulcer Advisory Panel's (EPUAP) nutrition working group. In this capacity she has researched the implementation and benefits of the EPUAP nutritional guideline on pressure ulcer prevention and treatment, which was launched in 2004. She is also involved in updating this guideline and incorporating it into the EPUAP's PU prevention and treatment guidelines to be launched at the end of 2009. In addition, Meijers has been a member of the LESA national working group since January 2009, which aims to develop first-line collaboration agreements between GPs, dieticians and home care organisations to better identify and treat malnutrition and realise more efficient and effective collaboration. Further, she has participated in the EU Burden of Illness study since 2008, which aims to determine malnutrition's economic implications in terms of resource use in European hospitals, care homes and home care.

Meijers participated in the Nursing Science PhD programme organised jointly by Maastricht University and Berlin's Charité University, and co-organised the European Doctoral Conference in Nursing Science (EDCNS) in Vienna in 2007 and Maastricht in 2008. After her PHD, she will continue working on the healthcare problem malnutrition at Maastricht University as a postdoctoral researcher.