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Nutritional Screening of Older Patients

Developing, Testing and Using the Nutritional Form For the Elderly (NUFFE)

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“Every careful observer of the sick will agree in this
that thousands of patients are annually starved
in the midst of plenty…”

Florence Nightingale (1859) in *Notes on Nursing: What It Is, and What It Is Not.*

To Olle,
with all my love

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ABSTRACT

The overall aim of this thesis was to develop, test and use a simple, clinically useful instrument for the nutritional screening of older patients. Four studies were performed, with a quantitative approach, in a geriatric rehabilitation ward in western Sweden. The number of patients who participated was: 56 (I), 114 (II), 147 (III) and 144 (IV) older patients.

A nutritional screening instrument, the Nutritional Form For the Elderly (NUFFE), was constructed (I) and tested regarding reliability and validity (I, II). NUFFE was used in a screening, and the screening results were related to the patients' perceived health and compared to the nurses' nutritional notes in the nursing documentation (III). The screened patients' self-care ability and sense of coherence (SOC) were investigated and the patients' perceived health was related to self-care ability and SOC (IV). The collection of data was done through interviews with the instruments NUFFE (I-IV), the Self-care Ability Scale for the Elderly (SASE) (IV), Antonovsky's SOC scale (IV), a question about perceived health, health-related questions (III, IV) and background variables (I-IV). Weight and height were measured (I-III). The nurses' nutritional notes in the nursing documentation were collected (III).

The screening instrument contains 15 three-point items on ordinal level. The total score ranges between zero and 30 and a higher score indicates higher risk for undernutrition. Evidence of reliability and validity was shown (I, II). The determined cut-off points of NUFFE for identification of patients at low, medium and high risk for undernutrition were set to scores of <6, ≥ 6 and ≥ 13 (III). The screening results showed that 31% of the patients were identified to be at low risk for undernutrition, 55% at medium risk and 14% at high risk. When the screening results were compared to nurses' nutritional notes in the nursing documentation, it was shown that important nutritional issues were absent in many patient records (III). The patients at high risk were more likely to perceive ill health than were those at low risk for undernutrition ($p=0.03$) (III). Those at medium or high risk were more likely to perceive ill health ($p=0.014$) and to have lower self-care ability ($p<0.001$) and weaker SOC ($p=0.007$) than were those at low risk for undernutrition. To perceive good health was associated with higher self-care ability ($p<0.001$) and stronger SOC ($p<0.001$). Lower self-care ability, being single and having been admitted from another hospital ward were three obtained predictors for being at medium or high risk for undernutrition (IV).

In conclusion, NUFFE is a simple, useful screening instrument for identification of older nutritional at-risk patients. The instrument has sufficient evidence of reliability and validity. Using NUFFE in a screening of older patients, the prevalence of patients at medium or high risk for undernutrition was found to be high. Nurses' nutritional notes showed deficiencies, indicating that all medium or high risk patients were not identified. Using NUFFE, associations were found between older patients' nutritional risk and their perceived health, and their self-care ability and SOC, respectively. These associations indicate that being at low risk for undernutrition is concomitant with perceived good health, higher self-care ability and stronger SOC. Conversely, being at medium or high risk for undernutrition is concomitant with perceived ill health, lower self-care ability and weaker SOC.

Key words: ageing, eating, instrument testing, nursing documentation, nutritional risk, health, reliability, self-care ability, sense of coherence, undernutrition, validity

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ABBREVIATIONS

BAPEN	British Association for Parenteral and Enteral Nutrition
BMI	Body Mass Index
CC	Calf circumference
ESPEN	European Society of Parenteral and Enteral Nutrition and, now more broadly, the European Society for Clinical Nutrition and Metabolism
MAC	Mid-arm circumference
MNA	Mini Nutritional Assessment
MNA-SF	Mini Nutritional Assessment - Short Form
MUST	Malnutrition Universal Screening Tool
NRS	Nutritional Risk Screening
NST	Nutritional Screening Tool
NUFFE	Nutritional Form For the Elderly
ROC curve	Receiver operating characteristic curve
SASE	Self-care Ability Scale for the Elderly
SCREEN	Seniors in the Community: Risk Evaluation for Eating and Nutrition
SOC	Sense of Coherence
SGA	Subjective Global Assessment
VIPS	Swedish acronym for well-being, integrity, prevention and security – a widely used structure in nursing documentation in Sweden

ORIGINAL PAPERS

This thesis is based on the following papers, which will be referred to in the text by their Roman numerals:

I Söderhamn, U., Söderhamn, O. Developing and testing the nutritional form for the elderly. *International Journal of Nursing Practice* 2001; 7: 336-341.

II Söderhamn, U., Söderhamn, O. Reliability and validity of the nutritional form for the elderly. *Journal of Advanced Nursing* 2002; 37: 28-34.

III Söderhamn, U., Bachrach-Lindström, M., Ek, A.-C. Nutritional screening and perceived health in a group of geriatric rehabilitation patients. (Accepted 2006 for publication in *Journal of Clinical Nursing*.)

IV Söderhamn, U., Bachrach-Lindström, M., Ek, A.-C. Self-care ability and sense of coherence in older nutritional at-risk patients. (Submitted.)

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CONTENTS

INTRODUCTION

Being at risk for developing undernutrition or to be suffering from undernutrition is a frequent problem among older patients in both hospitals and community resident homes. This is the case in Sweden (Christensson *et al.* 1999, Westergren *et al.* 2002) as well as worldwide (Shum *et al.* 2005, Kagansky *et al.* 2005), and has occurred among older patients for many years (Larsson *et al.* 1990). It is, however, not exclusively older patients who experience this, but also younger adult patients (McWhirter & Pennington 1994, Correia & Waitzberg 2003).

In this thesis nutrition will be seen as a broad all-embracing concept, including different aspects of food and eating, i.e. the foods and the nutrients in the foods and their actions within the body, for example ingestion, digestion, absorption, transport, metabolism and elimination. In nutrition, social, economic, cultural and psychological factors can also be included, because they can contribute to the eating being affected (Rolfes *et al.* 2006). Undernutrition will be defined as a result of insufficient food intake, but it can also appear if nutrients are not absorbed or metabolized adequately or if external losses are excessive (Chen *et al.* 2001). Being at nutritional risk refers here to being at risk for undernutrition. The age group of patients who the studies in this thesis were designed for are those 65 years or older, and this age group is usually defined as the older population (Millen & Nason 2004).

Undernutrition is a potential problem since it is largely unrecognised among older patients in hospitals (Gariballa & Sinclair 2005). It is a serious condition for the patients, because it contributes to poor health, decreased quality of life and increased morbidity and mortality (Chen *et al.* 2001). But it is also a serious problem for the care and the personnel, since many of these patients are not identified. Studies have shown that there is a lack of awareness about signs of undernutrition in hospitals, since all patients are not weighed (Bruun *et al.* 1999, Campbell *et al.* 2002, Rasmussen *et al.* 2004), and weight loss and food intake are seldom registered in the patients' records (Rasmussen *et al.* 2004). Nurses' descriptions about nutritional problems are often vague and unspecific (Kumlien & Axelsson 2002). There seems to be a lack of sufficient knowledge about nutrition among all staff groups (Beck *et al.* 2001) and, according to Elia (2005), poor recognition of undernutrition is also due to inadequate education and training. Hence, it is of considerable importance that caregivers are able to identify patients' nutritional problems before they proceed to undernutrition, and the focus in this thesis is to enhance the possibility to identify older patients at risk for undernutrition.

A nutritional screening instrument can be of help for nurses and other health care professionals in identifying those patients who are in need of more attention and further investigation. But a screening instrument should be able to cover and complete the screening for as many patients as possible. It should also be possible for all caring staff to use such a screening instrument, i.e. it should not require specific training for its administration. When anthropometry is integrated in a screening instrument, it may be hard to perform the screening for all staff in all patients (Weekes *et al.* 2004). Accordingly, there is a need for development of a simple clinical screening instrument for early detection of older patients at nutritional risk during their hospital stay.

Furthermore, such a screening instrument, which should include important risk factors for undernutrition, has to show sufficient evidence of reliability and validity.

Benefits, such as health for the individual, shorter hospital stay, lower hospitalization costs and less demand on home care services, have been found in maintaining a proper nutritional status (Millen & Nason 2004). It has been shown that perceived health problems are important in detecting older persons' risk for undernutrition (Christensson *et al.* 2002, 2003a). Health is also associated with higher self-care ability in older people, since good health has been found to be a predictor for self-care ability (Söderhamn *et al.* 2000). Moreover, according to Antonovsky (1987) the individual's sense of coherence (SOC) is a determining factor for maintaining health. It should therefore be of importance for nurses and other health care professionals in geriatric care to have knowledge about associations between being at risk for undernutrition, perceived health, self-care ability and SOC.

BACKGROUND

Ageing

With increasing age, there are changes in body composition including decrease in lean body mass and total body water, and increase in body fat. These changes lead to reduced muscle mass and a decline in weight. There is also a redistribution of fat, i.e. intra-abdominal fat tends to increase, and subcutaneous fat on the limbs tends to decrease (Eveleth *et al.* 1998, Refai & Seidner 1999, Gariballa & Sinclair 2005). These physiologic changes have influence on the individual's nutritional needs (Rosenberg 1994). Energy requirements diminish, due to the decrease in lean body mass. The loss of muscle mass can contribute to a loss of mobility (Refai & Seidner 1999, Gariballa & Sinclair 2005), and decreased physical activity can also lead to reduced energy requirement (Gariballa & Sinclair 1998). Both smell and taste decline with age and can decrease the appetite, but also affect the choice of food (Refai & Seidner 1999, Gariballa & Sinclair 2005). The decline in smell and taste can be accompanied by early satiation. An early satiation can also be explained by a diminished ability of the stomach to relax with the presence of food (Asai 2004) and the increased time required for emptying the stomach after a large volume of food (Gariballa & Sinclair 2005). With increased age, the ability to sense thirst can also be diminished (Asai 2004).

Nutritional risk

The incidence of disease increases with advanced age (Refai & Seidner 1999, McDonald & Ruhe 2004). Therefore, older patients are at especially high risk for undernutrition due to the fact that physiological changes can lead to eating difficulties in presence of disease (de Groot & van Staveren 2002, Asai 2004, Gariballa & Sinclair 2005). Diseases and the combination of many medications can give several side effects, e.g. change in taste, nausea, constipation, diarrhoea and dysphagia, which affect eating negatively (Asai 2004). Several medications can also decrease salivation, which leads to dry mouth (Bennett & Creamer 1993, Stechmiller

2003) and loss of appetite and thereby risk for undernutrition (Dormenval *et al.* 1998, Holm & Söderhamn 2003, Soini *et al.* 2003).

In order to identify patients at risk for undernutrition, known risk factors have to be taken into account for every older patient. Such important issues that have to be attended to are unintentional weight loss, poor appetite and insufficient food intake (Evans-Stoner 1997, Chen *et al.* 2001, Mowé & Bøhmer 2002). Mouth, dental, chewing and swallowing problems (Andersson *et al.* 2002, Asai 2004, Soini *et al.* 2005) or gastrointestinal problems such as nausea, vomiting, diarrhoea or constipation (Rolfes *et al.* 2006) can make eating difficult. Especially stroke patients have eating difficulties, for example swallowing problems (Jacobsson *et al.* 2000), and are often dependent on help with eating (Westergren *et al.* 2001, Kumlien & Axelsson 2002) and, therefore, are at great risk for developing undernutrition. The reduced ability to eat by oneself is known to lead to a reduction in food and fluid intake (Sidenvall & Ek 1993, Asai 2004).

A low level of activity is also important to attend to, because not being able to perform activities of daily life or being chair- or bed-bound have been found to be risk factors for undernutrition (Shum *et al.* 2005). Being dependent on aids for mobility have been shown to be associated with risk for undernutrition (Wissing & Unosson 1999). Social problems should also be observed, since they can contribute to decreased ability to obtain, prepare and enjoy food (Huffman 2002). Examples of social problems can be isolation, inability to go out to shop, socioeconomic factors and loss of spouse (Gariballa & Sinclair 2005). In older women who live alone, the cooking and eating can, due to lack of psychosocial meaning, be influenced in a negative way (Gustafsson & Sidenvall 2002). Furthermore, an association has been shown between eating alone and being at risk for undernutrition (Wissing *et al.* 2000). Psychological, medical and cognitive conditions, such as depression, dementia and other diseases, can also make eating more difficult (Gariballa & Sinclair 2005).

Health

Health can be characterized by structural and functional soundness or wholeness (Orem 2001). According to the biostatistical theory of Boorse, health is a normal functional ability and disease an internal state that reduces that ability (Boorse 1981, Nordenfelt 1995). Here, health and disease are used as opposites. But according to Nordenfelt's (1995) welfare theory of health, disease in old age does not necessarily mean that the person perceives ill health. Ageing is a normal process that reduces human ability. But this is not the same as reducing health, because in given circumstances health means reaching vital goals (Nordenfelt 1995). Perception of health can also be expressed, according to Pörn's (1993) theory of health, as an equilibrium between repertoires (abilities), environmental circumstances and goals.

Good nutritional status is a factor for healthy ageing of older people (Vetta *et al.* 1999), and is also thought to contribute to the ability to recover from illness (Gariballa & Sinclair 2005). That there is an association between perceived health and nutritional status in older people has

been shown in a study by Margetts *et al.* (2003), whereby older people at high risk for undernutrition were more likely to perceive ill health.

In a study by van Maanen (2006), health was perceived as a 'state of mind' in the context of wholeness among community-living older people who defined themselves as healthy. Older patients in ill health at a geriatric hospital perceived health more as a 'state of absence of disease', due to their dysfunction. For these patients, perceiving health was regaining independence and mobility. In order to maintain health, both groups valued balanced nutrition and exercise, such as walking. Activities such as hobbies were seen as health promotion among the community-living older people, but activities for health maintenance for the patients were regaining skills and self-care abilities (van Maanen 2006). That those patients perceived ill health can be seen as being in agreement with Boorse's theory (1981). But their perceived ill health can also be explained, according to Nordenfelt's (1995) theory, whereby their goals were not reached yet; i.e., they had not yet regained their previous skills and independence.

Self-care ability

Adult persons have developed power and capabilities to meet their own requirements in regulating their own functioning and development. This is self-care, according to Orem (2001), and self-care is the practice of activities for maintaining life, health and well-being. Self-care requisites are expressions of the purposes of an individual's self-care, i.e. insights necessary in the individuals' regulation of their own functioning, development and well-being. One important universal self-care requisite is to maintain an adequate intake of food in order to live and maintain health. This self-care requisite has to be met and, therefore, specific actions are required. Such self-care actions have to be known for the individual, but must also be within the capabilities of that person (Orem 2001). In order to perform self-care activities, motivation as well as a certain level of self-care ability are required (Söderhamn 2000, Orem 2001). Therefore, an individual's self-care ability is the capacity to care for oneself. However, a person can chose to use this self-care ability or not, i.e. it can be exercised or not. When self-care actions are realized, the self-care ability has been exercised (Söderhamn *et al.* 1996a, 1996b).

Human ability decreases with the ageing process (Nordenfelt 1995) and, accordingly, self-care ability will decrease with advanced age (Söderhamn *et al.* 2000). In line with this Haveman-Nies *et al.* (2003) found, in a study among older people, a decline in self-care ability over a ten-year period. Besides age, receiving help and perceived helplessness have also been found to be risk factors for lower self-care ability among older people (Söderhamn *et al.* 2000). The association between receiving help and lower self-care ability are assumed to also exist in older patients at risk for undernutrition or suffering from undernutrition. This is in line with Bachrach-Lindström *et al.* (2000), who found that more dependency on help in activities of daily life was seen in older patients with low weight, and with Brantervik *et al.* (2005), who found that older undernourished patients received more help with personal care. That good nutritional status can contribute to higher self-care ability can also be assumed, since people in a nursing home who were served energy-dense meals not only improved their ener-

gy intake but also maintained their activities of daily life, which include self-care. A control group who were served a standard diet were found to decrease in their activities of daily life (Ödlund Olin *et al.* 2003).

Factors that have been found to contribute to higher self-care ability are perceived good health, being active, feeling satisfied and having close contacts with others (Söderhamn *et al.* 2000). An association between self-care ability and perceived health in older people has been seen by Haveman-Nies *et al.* (2003), and since self-care ability decreases over time, the level of perceived health also decreased.

Sense of coherence

An individual's sense of coherence (SOC) is regarded as a major determinant for maintaining one's position on the health ease/dis-ease continuum. The concept of SOC is built on factors that are, in all cultures, a basis for successful coping with stressors. Comprehensibility, manageability and meaningfulness are the core components of SOC (Antonovsky 1987, 1993).

Comprehensibility refers to the extent to which one perceives the stimuli that confront one and can make sense of them. A person with high comprehensibility expects that stimuli will be predictable or orderable and explicable. Manageability is the extent to which one perceives which resources one has for meeting the demands from the stimuli. These resources can be one's own or can originate from others, for example spouses, friends, colleagues, God or a physician. Having a high sense of manageability means being able to cope when things happen in life and not feeling victimized by these events. Meaningfulness refers to the extent to which one feels that life is worth investing energy in. A person with high meaningfulness will seek the meaning when things happen in life, even after an unhappy experience, and do the best to overcome it (Antonovsky 1987).

According to Antonovsky (1987), the individual's location on the SOC continuum is more or less fixed from early adulthood, though studies on SOC have shown that it is not as stable as Antonovsky assumed. However, in people with initial high SOC it seems to have been most stable over time. Studies have shown that SOC tends to increase with age, i.e. older people tend to have higher SOC than younger people (Eriksson & Lindström 2005).

That SOC and health are related has been seen in studies among older people in hospital (Schneider *et al.* 2004) as well as among home-dwelling older people (Holmgren & Söderhamn 2005). Associations between SOC and functional ability have been found in young, middle aged and older people, since the stronger the SOC is the less pronounced the dysfunction is (Langius & Björvell 1993). But in a study by Ekman *et al.* (2002), such an association could not be seen between functional ability and SOC among older patients with severe heart failure. The heart failure patients had limited functional abilities compared to healthy individuals, but their SOC did not differ. No studies have been found, however, in which SOC in older nutritional at-risk patients has been investigated.

Assumption about associations between central concepts

An assumption in this thesis is that there are associations between nutritional risk, perceived health, self-care ability and SOC in older patients. This assumption is based on results from studies showing associations between nutritional risk and perceived health (Margetts *et al.* 2003), between nutritional risk and functional ability (Pearson *et al.* 2001), between self-care ability and perceived health (Söderhamn *et al.* 2000, Haveman-Nies *et al.* 2003), between SOC and perceived health (Schneider *et al.* 2004), and, finally, between SOC and functional ability (Langius & Björvell 1993). Functional ability is assumed here to be related to self-care ability. The hypothesized associations are, therefore, assumed to exist between nutritional risk and perceived health, self-care ability and SOC, respectively, between self-care ability and SOC and, finally, between perceived health and self-care ability and SOC, respectively.

Nutritional screening or nutritional assessment

There is no gold standard for evaluating nutritional status (Jeejeebhoy 2000), and it is difficult to determine undernutrition or being at risk for undernutrition, because there is a lack of consensus on how to define undernutrition (Wright 2002, Elia *et al.* 2005). This has led to, for example, a variety of different diagnostic criteria as well as the use of different reference values (Joosten *et al.* 1999). There is also a lack of consistency in the definitions of the terms nutritional screening, nutritional assessment and nutritional status and how they should be used. Nutritional screening has often been used interchangeably with nutritional assessment (Lyne & Prowse 1999).

One definition that is also in agreement with the view in this thesis is that nutritional screening serves to identify predisposing factors and the degree of exposure, i.e. being at low, medium or high risk for undernutrition (Lyne & Prowse 1999). The aim of screening is to predict the probability of a better or worse outcome due to nutritional factors (Kondrup *et al.* 2003), and, thus, identify nutritional at-risk patients (McMahon & Brown 2000) in need of an extensive assessment (Rolfes *et al.* 2006). A screening should be simple (Green & Watson 2005) and rapid, and should be undertaken as soon as possible after the patient's admission to hospital (Kondrup *et al.* 2003, Elia *et al.* 2005). According to Weekes *et al.* (2004), screening instruments are not designed for assessing nutritional status but should indicate that nutritional problems are actual or potential. The screening has to be seen as the first step in the process for assessing nutritional status (Lyne & Prowse 1999). The following assessment, which is a more comprehensive process than screening, should be based on a full history, examination and investigation (Kondrup *et al.* 2003) and should lead to a defined nutritional status. A screening is not a diagnostic test (Fletcher & Fletcher 2005). In order to perform a diagnosis of undernutrition, an assessment process has to be performed. But, according to Lyne and Prowse (1999), an assessment process is also necessary in order to plan and provide patients' nutritional care.

A comprehensive geriatric nutritional admission assessment ought to contain an admission history, including surgical, medical and psychosocial conditions, medications, functional his-

tory, nutrition and dietary history and further physical examination. Anthropometric measures and biochemical analyses can also be included in this admission assessment (Omran & Morley 2000, Huffman 2002, Asai 2004). Such a comprehensive assessment process is hard and time-consuming to perform for each patient and requires the involvement of several health professionals, e.g. nurses, physicians and dieticians. Therefore, such an assessment process can also be seen as not being cost-effective. Accordingly, there is a need for a screening instrument in order to distinguish between patients who need further attention and investigation and those who do not.

However, there is often a lack of defined responsibilities (Elia 2005) and cooperation between different staff groups concerning nutritional care, a consequence of which can be that a nutritional screening and assessment are not performed (Beck *et al.* 2001). Physicians have usually regarded nutritional problems as a nursing problem (Teo & Wynne 2001), and nurses have also often considered nutritional assessment one of their responsibilities (Perry 1997). According to Elia *et al.* (2005), nutritional screening should be undertaken in groups at risk for undernutrition, and older patients constitute such a group. Nurses are in an ideal position that makes them especially suitable to perform this screening, because they are near the patient and are also one of those who have an initial meeting and dialogue with the patient after admission to the hospital ward.

The issue is not whether nutritional screening or nutritional assessment has to be performed. Rather, it is about both nutritional screening and nutritional assessment. Screening can not replace an assessment. A nutritional screening, in order to identify at-risk patients, has to be followed by a nutritional assessment of these patients, which is in line with the guidelines from the Council of Europe (Beck *et al.* 2001).

Objective nutritional measurements

Objective nutritional measurements, as parts of a nutritional assessment, include anthropometric measures and biochemical analyses. Examples of anthropometry are weight, height, limb circumferences and skinfold thickness. Triceps and sub-scapular skinfold thickness and mid-arm (MAC) and calf circumferences (CC) are used for assessment of fat stores and muscle mass (Omran & Morley 2000). Serum albumin has been the most used biochemical marker in nutritional studies for many years (Jeejeebhoy 2000). In detection of undernutrition, prealbumin has also been shown to be useful (Robinson *et al.* 2003). Anthropometry and biochemical analyses have been used in nutritional research studies for establishing the prevalence of undernutrition (cf. Larsson *et al.* 1990, Christensson *et al.* 1999, Gariballa 2001). However, serum albumin can not be used as a single indicator of undernutrition, because many conditions such as severe stress, renal and liver diseases and catabolic conditions reduce the serum albumin level (Gariballa & Sinclair 1998). Therefore, undernutrition is usually defined if two, i.e. one anthropometric measure and one biochemical analysis, or more of the variables are subnormal (Ek *et al.* 1996, Christensson *et al.* 2002).

For nutritional screening, anthropometric measurements are less valuable in detecting older patients at nutritional risk because, according to Jeejeebhoy (2000), persons who are starting in the upper end of a normal range can be in a negative nutritional state before the measures show subnormal values. Attention should also be given to ensure that reference data are not too old and are derived from individuals within the same age group. Another reason that anthropometric measurements are complicated to use in screening is that the measurements should be performed carefully by trained persons and with instruments and techniques that minimise errors. Furthermore, skinfold thickness measurements are less accurate in older people due to the fact that intra-abdominal fat tends to increase and subcutaneous fat on limbs tends to decrease. Moreover, it can be difficult to perform anthropometric measurements on non-ambulatory and disabled older people (Eveleth *et al.* 1998, Omran & Morley 2000). Considering these aspects together, anthropometry is useful for the detection of undernourished patients but is clinically less useful for an initial nutritional screening in order to detect patients at nutritional risk.

However, body weight is the most important of the anthropometric measurements, and every patient should be weighed at admission, and then weekly if nutritional problems are found. But it can be difficult to weight every patient, as some are sick and bed-bound. Attention must also be paid to oedema and ascites, because these changes in hydration status can confound changes in body weight (Eveleth *et al.* 1998, Jeejeebhoy 2000, Omran & Morley 2000).

Measuring accurate height in an older patient can be complicated, due to back deformities or inability to stand erect (Omran & Morley 2000). Therefore, other methods to measure height can be used, for example demi-span, half arm-span and knee height (Chumlea *et al.* 1985, Hickson & Frost 2003). But these alternative methods do not seem practical in an early screening of older patients, because these methods increase the screen time and are difficult to use in patients with joint problems and with difficulties to fully extend the arms (Kirk *et al.* 2003, Cook *et al.* 2005).

Body Mass Index (BMI) has been widely used as a measure of body mass, in most cases together with other variables, in nutritional research studies (cf. McWhirter & Pennington 1994, Bachrach-Lindström *et al.* 2001, Rasmussen *et al.* 2004) and is considered to be a simple measure for predicting risk for undernutrition (Thomas *et al.* 2002). But BMI is not able to distinguish overweight patients who involuntary lose their weight (Jeejeebhoy 2000), and it is not sensitive enough to recognise small weight losses (Cook *et al.* 2005). BMI may be less useful in older people because of their decrease in stature (Eveleth *et al.* 1998). This loss of height may lead to an increased BMI, which is why the most ideal solution is to use obtained height in younger years (Omran & Morley 2000). However, both weight and height decrease with advanced age, which leads to BMI being less affected (Dey *et al.* 1999). BMI can not be calculated for all patients due to the fact that weight and height are not always possible to measure in sick and non-ambulatory patients. Therefore, it can be hard to use BMI as an initial screening for detection of all older patients at risk for undernutrition. Ac-

cording to Cook *et al.* (2005), BMI can not be recommended for screening older people, because it is likely to be inaccurate.

Another difficulty with using BMI is that different cut-off values have been used for indicating underweight and overweight. A BMI of 24–29 kg/m^2 is a recommended reference interval for individuals over 65 years (Beck & Ovesen 1998). Ranhoff *et al.* (2005) have found that BMI <23 kg/m^2 can be used for screening of older undernourished or at-risk patients. Older persons ought to have a higher BMI than younger persons, because studies among older people, e.g. over a period of one year (Flodin *et al*. 2000), five years (Breeze *et al.* 2006), nine years (Janssen *et al*. 2005) and 15 years (Dey *et al.* 2001) have shown that a higher BMI is associated with lower mortality rates.

As an alternative to BMI, weight index can be used as a measure of body mass and as an indicator of undernutrition. Weight index has been used in nutritional research studies (cf. Ek *et al.* 1996, Christensson *et al.* 2002). A value of 80% or more is regarded as a normal value (Warnold & Lundholm 1984).

Some nutritional instruments

Instruments for nutritional screening of older patients need to be simple, i.e. tolerable for the patients, easy to handle for the nursing staff (Green & Watson 2005) and simple enough to complete a screening within 5–15 minutes (Rolfes *et al.* 2006). They also have to demonstrate evidence of reliability and validity, including sensitivity and specificity (Green & Watson 2005). Furthermore, the instruments have to be adapted or adjusted for screening of older patients.

According to Elia *et al.* (2005), instruments used for detection of undernutrition differ in ease of use and in their reliability and validity. This situation is complicated due to lack of a general definition of undernutrition, but also because of the fact that there is no generally accepted screening instrument that serves as a gold standard for identifying undernutrition (Elia *et al*. 2005). Various nutritional instruments seem to differ in their purposes, i.e. if they identify patients at risk for undernutrition or undernourished patients. This can be assumed because of different cut-off values of BMI. There also seems to be some indistinctness regarding characteristics of a screening instrument compared to an assessment instrument, i.e. what the difference is between them.

The Mini Nutritional Assessment (MNA) was specifically developed to be a rapid and simple tool for assessing the risk of undernutrition in older people (Guigoz *et al.* 1996). It has also been seen as a combined screening and assessment tool (Kondrup *et al.* 2003). Several validation studies, including cross-cultural validations, have been performed. The MNA has been found to be a practical and rapid instrument for the evaluation of nutritional status and is proposed to be integrated in geriatric assessment programs (Guigoz *et al.* 1996). In identifying

older persons at risk for undernutrition, the MNA has been shown to be useful (Christensson *et al.* 2002, Kyle *et al.* 2005).

Recently, a short form of the MNA, the MNA-SF, has been used for quick screening of older persons' risk for undernutrition, using some of the items in the MNA. The MNA-SF has been found to be equal to the complete MNA for nutritional screening (Guigoz *et al.* 2002), and is recommended by the European Society for Clinical Nutrition and Metabolism (ESPEN) as an initial screening for older people (Kondrup *et al.* 2003).

The Subjective Global Assessment (SGA) is an instrument that was initially developed to assess nutritional status in hospitalized surgical patients. The SGA is considered a reliable and valid method for assessing nutritional status in hospitalized surgical patients (Detsky *et al.* 1987, Jeejeebhoy 2000). It has also been shown to be useful in detecting older persons suffering from undernutrition (Christensson *et al.* 2002, Kyle *et al.* 2005). However, the SGA has to be conducted by trained personnel (Ek *et al.* 1996) in order to be regarded as a reliable assessment tool (Omran & Morley 2000) due to the extent of physical examinations, including anthropometric measurements. Therefore, it is very hard to use as a clinical screening instrument and, according to Guigoz *et al.* (1996), was not developed to be a screening instrument.

The Malnutrition Universal Screening Tool (MUST) is a screening instrument for detection of undernutrition (Elia 2003, Kondrup *et al.* 2003) and is recommend by ESPEN. It was primarily developed for use among adults in the community, but has recently been extended for use, for example, in hospitals (Kondrup *et al.* 2003). It can be applied to adult patients of different ages (Elia & Stratton 2004) and has been found to be a reliable and valid instrument (Kondrup *et al.* 2003).

The Nutritional Risk Screening-2002 (NRS-2002) is also recommended by ESPEN and is developed for detection of patients with undernutrition or at risk for developing undernutrition in hospitals. NRS-2002 was shown in a study in Denmark to be practical, because almost all patients could be screened, and it is regarded as a reliable and valid tool (Kondrup *et al.* 2003).

The Nutritional Screening Tool (NST) is developed for use in hospitals and is recommended by the British Association for Parenteral and Enteral Nutrition (BAPEN). It has been shown that NST is a reliable and valid instrument for identifying patients at risk for undernutrition. NST has also been used among older patients (Weekes *et al.* 2004).

The Short Nutritional Assessment Questionnaire (SNAQ) was developed in the Netherlands for early detection of undernourished hospital patients at their admission. It has been tested regarding validity and reproducibility (Kruizenga *et al.* 2005).

In Table 1, some characteristics of five recommended nutritional screening instruments are displayed. These instruments contain anthropometry. The feasibility may be impaired due to the fact that measurements and calculations must be done. This may also contribute to difficulties in using them as self-report instruments. Some of them are not found to be available in the Swedish language. But here, the question can also be raised regarding whether MNA is a screening or an assessment instrument.

Table 1. Some characteristics in five nutritional screening instruments

	MNA	***MNA-SF***	***MUST***	***NRS-2002***	***NST***
Body Mass Index (BMI)	x	x	x [a]	x	x [a]
Cut-off point of BMI	<23.0	<23.0	20.0	<20.5	20.0
Demand on measured weight	x	x		x	
Demand on height measure	x	x		x	
Mid-arm circumference (MAC)	x		x [b]		x [b]
Calf circumference (CC)	x				
Calculation of weight loss in percent			x	x	
Calculation of food intake in percent				x	
Developed in country	France	France	UK	Denmark	UK
Available in the Swedish language	x	x	– [c]	– [c]	
Self- administration					

[a] if possible, not compulsory, [b] alternative to BMI, [c] not found in Swedish

Nursing documentation

Nursing documentation is the legal evidence of nursing activities performed, i.e. that, for example, nutritional observations are done and nutritional nursing assessments, nutritional care plans, activities and evaluations are performed. Nurses are obliged to document these activities in the patients' records, according to Swedish legalisation (SFS 1985:562, SOSFS 1993:17). But studies have shown that the nursing documentation often has deficiencies, for example that all patients' weights are not always documented (Kumlien & Axelsson 2002), that systematic assessments of determining the patients' care needs can be absent (Ehrenberg & Ehnfors 1999) and that the nursing process is not always used (Ehrenberg & Birgersson 2003), e.g. regarding nutrition and nutritional care plans (Soini *et al.* 2005). The deficiencies in the nursing docu-

mentation have also shown incongruence between nurses' oral reports about the patients and what they have documented in the records (Ehrenberg & Ehnfors 2001). However, nurses have positive attitudes towards nutritional nursing care (Christensson *et al.* 2003, Poulsen 2005), but these positive attitudes have not always been reflected in the records (Perry 1997, Poulsen 2005). Such a discrepancy was also seen by Mowé *et al.* (2006) among nurses' and physicians' nutritional attitudes and their reported practice regarding, for example, nutritional assessment, body weight measurement and calculation of energy intake. However, the quality of nursing documentation has improved in Sweden as a result of education and implementation of the VIPS model by Ehnfors *et al.* (1991), which has been designed for structuring the documentation (Björvell *et al.* 2002). In a study by Jordan *et al.* (2003), nursing documentation regarding nutritional issues has also been seen to improve after the introduction of a nutritional screening instrument.

Summary of risk factors for undernutrition

Nursing staff needs to be more aware of risk factors for undernutrition and early signs of undernutrition in older patients. However, early signs of undernutrition are non-specific, for example fatigue, apathy and decline in muscle strength (Asai 2004), and the fact that physiological change is a part of normal ageing can lead to difficulties in identifying undernourished patients and particularly those at risk for developing undernutrition (Gariballa & Sinclair 2005).

Being old with the presence of disease(s) puts the older patient especially at risk for undernutrition (de Groot & van Staveren 2002, Asai 2004, Gariballa & Sinclair 2005). Therefore, risk factors for undernutrition have to be taken into account for older patients, e.g. poor appetite, unintentional weight loss and insufficient food and fluid intake (Evans-Stoner 1997, Chen *et al.* 2001, Mowé & Bøhmer 2002). Furthermore, eating can be affected negatively by problems with the mouth, teeth, chewing or swallowing (Andersson *et al.* 2002, Asai 2004, Soini *et al.* 2005) or nausea, vomiting, diarrhoea or constipation, which thereby become risk factors (Rolfes *et al.* 2006). The same applies to dependency in eating (Westergren *et al.* 2001), low level of activity (Shum *et al.* 2005), social, socioeconomic (Huffman 2002, Gariballa & Sinclair 2005) and psychosocial problems (Gustafsson & Sidenvall 2002), psychological or cognitive conditions (Gariballa & Sinclair 2005) and using several medications (Bennett & Creamer 1993, Asai 2004). Including important risk factors for undernutrition in a nutritional screening instrument ought to be a way to emphasize older patients at risk for undernutrition and thereby those who are in need of further assessment.

AIMS

The overall aim of this thesis was to develop, test and use a simple, clinically useful instrument for the nutritional screening of older patients. The intention was to develop an instrument that is easy to use for nurses and does not require anthropometrical measurements.

The specific aims were to:

- develop an instrument for identification of older nutritional at-risk patients (I)
- test reliability and validity of the new developed instrument, the Nutritional Form For the Elderly (NUFFE) (I, II)
- perform a nutritional screening using NUFFE among a group of geriatric rehabilitation patients (III)
- compare the nutritional screening results and nurses' nutritional notes in the nursing documentation (III)
- relate the nutritional screening results to perceived health (III)
- investigate self-care ability and SOC in the screened patients (IV)
- relate the screened patients' perceived health to self-care ability and SOC (IV)

METHODS

Design and setting

This thesis has an observational descriptive cross-sectional design with a quantitative approach (I, II, III, and IV). The study design is also prospective in Study I and Study II and comparative in Study III. The studies have been carried out in a geriatric rehabilitation ward in a hospital in western Sweden. The ward contained 24 beds and the average length of stay of all admitted patients during the study periods was 35 (I), 34 (II) and 35 (III, IV) days, respectively. These patients were principally admitted from the departments of orthopaedics, medicine and geriatrics, but some were also admitted from the departments of surgery and infection and from their own homes. Common categories of patients were, for example, patients with fractures, hip and knee replacements, osteoporosis, heart and lung diseases and stroke. The ward has had a stable staff composed of nurses and enrolled nurses the entire day and night.

Samples

The inclusion criteria were being newly admitted to the ward, being 65+ years old and having the ability to communicate and co-operate. Exclusion criteria were being an amputee, having bandages or plaster casts that could not be removed, having received enteral and parenteral nutrition (I-IV), suffering from loss of vision (not being able to read) (III, IV) or hearing, being unable to provide details about one's current situation and, finally, being readmitted and having previously been included (I-IV). In Study III, those being cared for by the author were also excluded. The exclusion of amputees and patients with bandages or plaster casts were done due to difficulties in measuring their real body weight. In Study I, however, five amputee patients

participated (BMI and weight index were not calculated for these patients). The number of patients included in the studies is presented in Figure 1 and Figure 2.

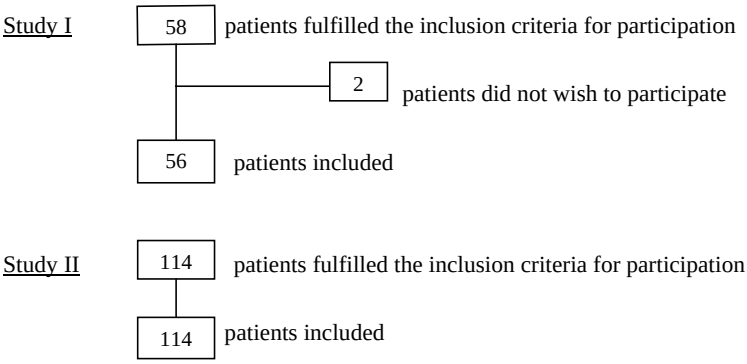

Figure 1. Overview of recruited patients in Study I and Study II

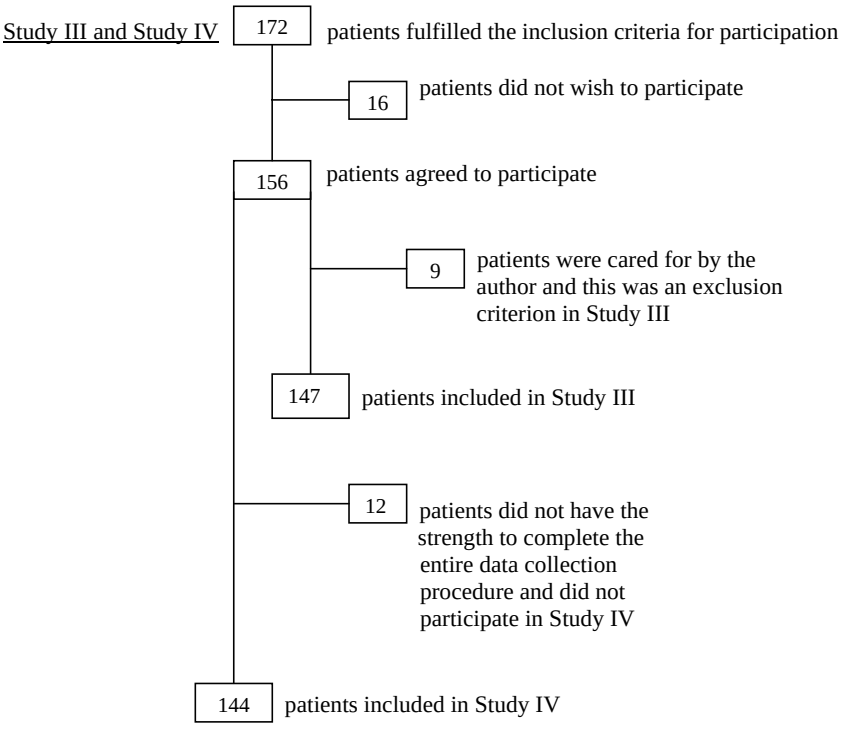

Figure 2. Overview of recruited patients in Study III and Study IV

Development of a new screening instrument

In order to obtain a simple, clinically useful instrument without anthropometric measurements for use in nutritional screening of older patients, a new screening instrument, the Nutritional Form For the Elderly (NUFFE), was constructed after studies about important nutritional issues in the scientific literature (I). Table 2 displays nutritional issues that were found to be of importance for nutritional screening and were therefore included as items in NUFFE. Supportive references, from the instrument development and some more recently found references are also displayed.

Table 2. Nutritional issues important for nutritional screening of older patients, included as items in NUFFE, supported by references found before development of the instrument and some more recent references

Important areas	*Nutritional issues*	*References*
Dietary history	Weight loss	Scanlan *et al.* (1994), Evans-Stoner (1997), Chen *et al.* (2001)
	Changes in dietary intake	Detsky *et al.* (1987), Guigoz *et al.* (1996), Wissing *et al.* (2000)
Dietary assessment	Appetite	Cotton *et al.* (1996), Chen *et al.* (2001), Mowé and Bøhmer (2002)
	Intake of cooked food	Guigoz *et al.* (1996), Margetts *et al.* (2003)
	Portion size	Detsky *et al.* (1987)
	Intake of fruits or vegetables	Guigoz *et al.* (1996), Margetts *et al.* (2003), Zulkowski and Coon (2004)
	Tooth, mouth or swallowing difficulties	Scanlan *et al.* (1994), Wipke-Tevis and Stotts (1996), Soini *et al.* (2003), Andersson *et al.* (2002), Asai (2004)
	Fluid intake	Guigoz *et al.* (1996), Thomas *et al.* (2002)
	Problems with eating due to gastro-intestinal problems	Scanlan *et al.* (1994), Cotton *et al.* (1996), Rolfes *et al.* (2006)
	Help with eating	Sidenvall and Ek (1993), Guigoz *et al.* (1996), Asai (2004)
	Health status affecting eating	Wipke-Tevis and Stotts (1996), Margetts *et al.* (2003)
General assessment	Possibility of obtaining food products	Wipke-Tevis and Stotts (1996), Visvanathan *et al.* (2004a), Gariballa and Sinclair (2005)
	Company at meals	Wipke-Tevis and Stotts (1996), Wissing *et al.* (2000), Wikby and Fägerskiöld (2004)
	Activity	Guigoz *et al.* (1996), Gariballa and Sinclair (1998), Shum *et al.* (2005)
	Number of medications	Bennett and Creamer (1993), Guigoz *et al.* (1996), Asai (2004)

The screening instrument was designed as a summated ordinal scale containing 15 three-point items. The items reflect nutritional, social, functional and health-related aspects of the nutritional intake. The instrument involves dietary history, dietary assessment and a general assessment. For each item there are three options. The most unfavourable option gives a score of two, the intermediate option a score of one and the most favourable option a score of zero. The score total ranges from zero to 30 and a higher score indicates higher risk for undernutrition (I).

Data collection

Study I and Study II

The patients were interviewed during their first week at the geriatric rehabilitation ward using NUFFE (I, II) and MNA (II). The succession of the instruments used in the interview in Study II was first NUFFE and then MNA. Body weight and height were measured in all patients after admission to the ward. Weight was also measured after three weeks (I) and at discharge (I, II). MAC and CC were measured as a part of MNA (II). Presence of pressure sores and skin ulcers was noted (I, II). Serum albumin levels at admission (I, II), after three weeks (I) and at discharge (I, II) were noted if the results were available in the patient records. Questions about background variables were included in the interviews (cf. page 24). The patients in Study I were also asked for their own assessment of their nutritional status; if it was bad, lower to some degree or good. They were further asked if they thought that NUFFE had the capability to give a meaningful estimate of their own nutritional status, with four levels possible: to a very high degree, to some degree, to a low degree or not at all.

The Mini Nutritional Assessment (MNA)

The MNA is composed of 18 items and anthropometric measurements on ordinal level. The items comprise general assessment (lifestyle, medication and mobility), dietary assessment (number of meals, food and fluid intake and autonomy of feeding) and subjective assessment (self-perception of health and nutrition). The anthropometric measurements included are weight, height, BMI, MAC, CC and weight loss. Depending on scores obtained, a categorization is done into well nourished, at risk for undernutrition or undernourished. Maximum score is 30, and a score ≥24 indicates good nutritional status. Scores 17–23.5 indicate risk for undernutrition and <17 undernutrition (Guigoz *et al.* 1996).

Study III and Study IV

The patients were interviewed during their first two weeks at the geriatric rehabilitation ward, with one question about perceived health and some health-related questions – receiving help regularly from another person in order to manage daily life, perceived helplessness, being active and feeling satisfied with life – that could be answered with yes or no, background variables (cf. page 24) and the instruments the NUFFE (III, IV), the Self-care Ability Scale for the Elderly (SASE) (Söderhamn *et al.* 1996a, 1996b) (IV) and the original 29-items SOC scale (Antonovsky 1991) (IV) in that succession. The patients' body weight and height were mea-

sured after admission to the ward (III). Existing nursing documentation regarding nutritional issues, which was recorded by the nurses in the patient records from the time of admission until the interviews took place, was printed out and coded with the same number as the interviews. The patients' and nurses' names could not be identified (III).

The Self-care Ability Scale for the Elderly (SASE)
SASE, a summated ordinal Likert scale with 17 five-point items, is based on Orem's (1995) view that self-care agency consists of self-care activity and self-care ability and Pörn's (1984, 1993) theory of health and adaptedness with the three components repertoire, environment and goal. A person's repertoire comprises his or her abilities, i.e. knowledge of how to perform actions or having the technique for performing them. The items reflect areas of concern for older people such as activities of daily living, mastery, well-being, volition, determination, loneliness and dressing. Each item score ranges from 1 to 5 scores, i.e. totally disagree to totally agree. A score of 3 is neutral. Four items are negatively stated and must be reversed in the summation of the scores. The total score can range between 17 and 85. A higher score indicates a higher perceived self-care ability (Söderhamn *et al.* 1996a, 1996b). A cut-point was set to <69 for low scores and ≥69 for high scores, indicating lower and higher self-care ability, respectively, according to the results from a study among home-dwelling older people (Söderhamn et al. 1996b). SASE was developed and tested in Sweden, and evidence has been shown that it is a reliable and valid instrument (Söderhamn *et al.* 1996a, 1996b).

The Sense of coherence (SOC) scale
The SOC scale is a semantic differential scale with two anchoring phrases on ordinal level, with each item having a possible score range of 1-7. The scale consists of 29 items, distributed as follows: eleven addressing comprehensibility, ten addressing manageability and eight addressing meaningfulness. Thirteen of the items are formulated negatively and must be reversed before summation. The total score ranges from 29 to 203, with a high score expressing a strong SOC. The SOC scale was initially developed and tested in Israel and has been translated into many languages, including Swedish, and has been used in several studies in various countries. The scale has been shown to be a reliable and valid instrument (Antonovsky 1987, Antonovsky 1993). The Swedish version of the original 29-item SOC scale has been tested regarding reliability and validity in adults (Langius *et al.* 1992, Langius & Björvell 1993), but also in physically active older people (Söderhamn & Holmgren 2004).

Procedures, analyses and statistics

All interviews were performed by the author, who read the items of the instruments and the other questions aloud for the patients and marked the answers when the patients reported. The remainder of the data was also collected by the author, with the exception of weight and height, which was collected by the staff at the ward as well as the author.

A digital electronic wheelchair balance (Tanita BWB-620, Umedico AB, Rosersberg, Sweden) was used, and the weights were measured in the morning, before breakfast and with only light

clothes on and without shoes, to the nearest 0.01 kg. Height was measured using equipment attached to the wall, to the nearest 0.5 cm. Patients who could not stand upright were measured in bed using equipment with adjustable foot and head parts.

All data were computer analysed using the Statistical Package of the Social Sciences (SPSS®, version 11 and 13). Interval data were presented with means and standard deviations (SD), ordinal data with medians and inter-quartile ranges and nominal data with numbers (n) and percentages (%). Statistical significance was defined as a p-value <0.05.

Testing reliability and validity of NUFFE

BMI (weight (kg)/squared height (m^2)) was calculated at admission (I, II), after three weeks (I) and at discharge (I, II). Weight index (body weight/reference weight x 100) was estimated on these three occasions (I) in the following two ways: a) according to Hessov and Ovesen (1988) with mean weight for actual height derived from middle-aged and older men and women (Björkelund *et al.* 1997) as reference weight and b) according to Warnold and Lundholm (1984) with a formula as reference weight (for women 0.65 x height – 40.4 and for men 0.80 x height – 62.0).

MAC and CC (II) were performed on the non-dominant arm and leg unless this arm or leg was paralysed. A tape-measure was used for the circumferences. MAC was measured at the midpoint of the arm between the tip of the acromion process and the olecranon process. CC was measured at that the point on the calf where it was thickest.

Homogeneity or internal consistency was computed, as a measure of reliability of NUFFE, using the Cronbach's alpha coefficient and Spearman's rank correlation coefficients between each item of NUFFE and the total score (I, II). The correlation of the individual item was calculated when that particular item had been omitted from the total instrument (Streiner & Norman 2003, Polit & Beck 2004). The item-total correlation should be between 0.20 and 0.80 (Streiner & Norman 2003), and the Cronbach's alpha coefficient should be between 0.70 and 0.90. For group-level comparisons a value of 0.70 is usually adequate (Streiner & Norman 2003, Polit & Beck 2004).

In order to test the validity of NUFFE, face validity (I), criterion-related validity, concurrent validity, predictive validity and construct validity (I, II) were assessed. Face validity is based on subjective judgements (Streiner & Norman 2003) and was assessed by asking the participants if NUFFE could give a meaningful estimate of their own nutritional status (I).

Criterion-related validity is obtained when the instrument correlates highly with another criterion in the same area (Streiner & Norman 2003). To assess criterion-related validity the Spearman's rank correlations between obtained total scores of NUFFE and the criteria BMI, weight index and serum albumin levels (I) and BMI, MAC and CC (II), respectively, were calculated.

Concurrent validity is a type of criterion-related validity and can be used when the instrument and another measure are compared, i.e. correlated, at the same time (Streiner & Norman 2003). Spearman's rank correlations were used for assessing this validity by comparing the patients' own assessments of their nutritional status and obtained total scores of NUFFE (I) and by comparing total scores of NUFFE and MNA (II). The correlation coefficient between NUFFE and MNA will be negative due to the fact that a higher score of NUFFE indicates higher risk for undernutrition and a lower score of MNA indicates risk for undernutrition or undernutrition.

Predictive validity is also a type of criterion-related validity when the instrument measure is performed alone at a time before the criterion used, which is performed some time later and then compared (Streiner & Norman 2003). Predictive validity of NUFFE was addressed by calculating differences in total scores of NUFFE at admission between patients who, at discharge, had BMI $\geq$24 kg/m^2 and serum albumin $\geq$36 g/L (i.e. indicating normal nutritional status) and those who had BMI <24 kg/m^2 and serum albumin <36 g/L (i.e. indicating lower nutritional status) (I, II). The choice of cut-off value <24 kg/m^2 for BMI was according to Beck and Ovesen (1998). The differences between these groups were tested with Mann-Whitney *U*-test (two-tailed significance).

Construct validity can be assessed when the instrument is linked to some other measure by a hypothesis or construct. This hypothesis will explore the difference between two populations who would be expected to differ in answers when using the instrument. If this expected relationship is found, the hypothesis and the measure are sound (Streiner & Norman 2003). For assessing construct validity, total scores of NUFFE were compared between three risk groups with expected high scores (A: patients subjectively assessed as suffering from cachexia or decubital ulcers, B: patients objectively assessed with BMI <24 kg/m^2 and serum albumin <36 g/L and C: patients with cancer diagnoses) and three groups with expected low scores assessed as low risk groups. These low risk groups were, A: patients subjectively assessed as not suffering from cachexia or decubital ulcers, B: patients objectively assessed with BMI $\geq$24 kg/m^2 and serum albumin $\geq$36 g/L and C: patients with no cancer diagnoses (I). Total scores of NUFFE were further compared between patients with BMI <24 kg/m^2 and BMI $\geq$24 kg/m^2 and between patients with pressure sores or other skin ulcers and those without pressure sores or other skin ulcers (II). Differences between the groups were tested using the Mann-Whitney *U*-test (two-tailed significance).

Estimating sensitivity, specificity and predictive values of NUFFE

An instrument's sensitivity is its ability to identify cases correctly, i.e. the true positives. Specificity of an instrument is the ability to identify non-cases correctly, i.e. the true negatives. In order to assess sensitivity and specificity of an instrument it is important to have a reliable and valid criterion to assess it against. To determine the cut-off point, i.e. the score for distinguishing between cases and non-cases, a receiver operating characteristic curve (ROC curve) can be used (Polit & Beck 2004).

To develop the appropriate cut-off points of NUFFE for identifying patients at medium or high risk for undernutrition, the MNA scores ≤23.5 (indicating risk for undernutrition) and <17 (indicating undernutrition), respectively, (data from Study II) were used in a secondary analysis in Study III. Cross tables (cf. Table 3) were made over a range of different cut-off points of NUFFE, i.e. each score of NUFFE, and the number of non-risk patients and identified risk patients and non-undernourished patients and undernourished patients, respectively, according to the criterion used, i.e. the MNA scores. The sensitivity (A/(A+C)) and specificity (D/(B+D)) were estimated for each cut-off point of NUFFE. ROC curves were then constructed when true positive cases (the sensitivity value for each cut-off point of NUFFE as Y-axis) were plotted against false positive cases (1 minus the specificity value for each cut-off point of NUFFE as X-axis) over the range of different cut-off points. The optimum cut-off point was found near a "shoulder" of the ROC curve (Streiner & Norman 2003, Polit & Beck 2004).

Table 3. Cross table for calculating sensitivity, specificity and predictive values

		Gold standard=MNA	
		Case	Non case
New test=NUFFE	Case	A	B
	Non case	C	D

The predictive value of an instrument is determined by its sensitivity and specificity. Both positive (A/(A+B)) and negative predictive (D/(C+D)) values were estimated for each cut-off point of NUFFE (cf. Table 3). Positive predictive value here is the probability that a patient is at medium or high risk for undernutrition, e.g. with a positive screening result. Negative predictive value is the probability that a patient is not at medium or high risk for undernutrition, e.g. with a negative screening result (Fletcher & Fletcher 2005).

In Table 4 and Table 5, the sensitivity, specificity and predictive values for a range of different cut-off points of NUFFE for medium and high risk for undernutrition, respectively, are displayed according to the criterion MNA used.

Table 4. Calculated sensitivity, specificity and predictive values for determining the optimal cut-off point for NUFFE, according to the criterion MNA used, in order to measure medium risk for undernutrition

Cut-off points NUFFE (scores)	*Sensitivity (%)*	*Specificity (%)*	*Positive predictive value (%)*	*Negative predictive value (%)*
0	100	0	88	--
1	100	7	88	100
2	99	21	90	75
3	97	36	92	63
4	91	50	93	44
5	82	64	94	33
6	71	86	97	29
7	59	100	100	25
8	46	100	100	21
9	39	100	100	17
10	25	100	100	16
11	20	100	100	15
12	17	100	100	14
13	16	100	100	14

Table 5. Calculated sensitivity, specificity and predictive values for determining the optimal cut-off point for NUFFE, according to the criterion MNA used, in order to measure high risk for undernutrition

Cut-off points NUFFE (scores)	*Sensitivity (%)*	*Specificity (%)*	*Positive predictive value (%)*	*Negative predictive value (%)*
7	100	59	39	100
8	95	71	41	99
9	90	78	46	97
10	80	86	64	96
11	70	94	70	94
12	70	97	82	94
13	70	98	88	94
14	50	99	91	90
15	40	100	100	87

Nutritional screening using NUFFE

For identifying patients at low, medium or high risk for undernutrition, the cut-off points for NUFFE scores were set to <6, ≥ 6 and ≥ 13, respectively. These values were chosen according to an interpretation of estimated sensitivity, specificity and predictive values and performed ROC curves, when MNA was used as a standard.

The Mann-Whitney *U*-test (two-tailed significance) was used to test differences between groups with BMI ≥24 kg/m^2 and BMI <24 kg/m^2 regarding NUFFE scores. The chi-square test was used for testing differences between the three groups at low, medium and high risk for undernutrition, regarding nominal data. In order to identify the groups between which the differences were to be found, chi-square test (two-tailed significance) or Fisher's exact test were used. Multiple comparisons were adjusted using the Bonferroni method. One-way ANOVA with the Bonferroni method was used to test differences regarding age and BMI between the three groups (III). In Study IV the Student's *t*-test for unpaired data (two-tailed significance) was used for testing differences between patients at low risk compared to those at medium or high risk for undernutrition regarding age. Differences between participants and non-participants (III, IV) regarding background variables were tested using chi-square test with Yates' continuity correction (two-tailed significance) or Fisher's exact test and Student's *t*-test for unpaired data (two-tailed significance).

Comparison between screening results and nursing documentation

In order to compare the screening results of the interviews with NUFFE and the collected nursing documentation in the electronic patient record for each patient, the nurses' nutritional notes were read and scrutinized. When notes (admission and daily) were identified as corresponding to any of the response alternatives for each NUFFE item, the notes were marked as existent. The comparison between the screening results and the nurses' notes in the nursing records was presented in numbers and percent of the response alternatives for each item from the interview with NUFFE and numbers and percent of similar notes in the nursing records (III).

Screening results related to perceived health

The Mann-Whitney *U*-test (two-tailed significance) was used to test differences regarding NUFFE scores between groups with perceived good and ill health. Chi-square test with Yates' continuity correction (two-tailed significance) was used regarding differences between health-related variables. The chi-square test was used for testing differences between the three groups at low, medium and high risk for undernutrition, regarding perceived health. In order to identify the groups between which the differences were to be found, chi-square test (two-tailed significance) was used. Multiple comparisons were adjusted using the Bonferroni method (III). In Study IV, the chi-square test with Yates' continuity correction (two-tailed significance) was used, regarding differences in perceived health between patients at low risk and those at medium or high risk for undernutrition.

Self-care ability and SOC in the screened patients

The Mann-Whitney *U*-test (two-tailed significance) was used to test differences regarding SASE scores and SOC scores between patients at low risk for undernutrition compared to patients at medium or high risk for undernutrition (IV).

A multiple forward stepwise (conditional) logistic regression analysis was performed in order to investigate possible predictors for being at medium or high risk for undernutrition. The dependent variable was to be screened as being at risk for undernutrition (being at medium or high risk for undernutrition was coded as 1 and being at low risk for undernutrition was coded as 0). Independent variables were age, SASE scores, SOC scores and dummy variables such as civil status (single or widow/-er coded as 1 and married coded as 0), having home care before admission (coded as 1) or not (coded as 0), admission to the rehabilitation ward from another hospital ward (coded as 1) or from home/residential living (coded as 0), perceived good health (coded as 1) or not (coded as 0), receiving help regularly (coded as 1) or not (coded as 0), perceived helplessness (coded as 1) or not (coded as 0), being active (coded as 1) or not (coded as 0) and feeling satisfied (coded as 1) or not (coded as 0). The choice of independent variables was based on variables that in univariate analyses reached a p-value of <0.2 (Altman 1999, p 349) when patients at low risk for undernutrition were compared to patients at medium or high risk for undernutrition (IV).

Perceived health related to self-care ability and SOC

The Mann-Whitney *U*-test (two-tailed significance) was used to test differences regarding SASE and SOC scores between groups with perceived good and ill health (IV).

Ethical considerations

When designing the studies in this thesis important ethical principles were considered, such as the principle of respect for autonomy and human dignity, the principle of beneficence, the principle of nonmaleficence and the principle of justice (Beauchamp & Childress 2001) in compliance with the Declaration of Helsinki (WMA 2004). The patients received oral and written information about the studies. They were informed that their participation or lack thereof had no influence on their care and treatment. The studies have been approved by the Research Ethics Committee of western Sweden (Medical Faculty, Göteborg University, L 214-98 (I), Ö 316-99 (II), Ö 527-01 (III, IV)).

The patients included in the studies had given informed consent to participate and thereby their right to self-determination was ensured. They also had the right to withdraw from the studies without any explanations. They were guaranteed confidentiality, as the data could not be linked to the individual patient. The interviews were also conducted in privacy. Taking this together, the ethical principle regarding respect for autonomy and human dignity was considered.

The principles of beneficence and nonmaleficence were taken into account during the data collection procedure, with the point of time being chosen after consultation with the patients. The intention was that the data collection should not be seen as an encroachment on their care and treatment. The patients were given all the time they needed for answering the interview questions. These questions were considered not to be harmful, however, the patients were given the opportunity afterwards to converse with the interviewer if they had questions about

anything in connection with the interviews. The principle of justice was considered, in that all patients who fulfilled the inclusion criteria were asked about participation in the studies. All patients were also treated in the same way, i.e. they were given the same information about the study at hand.

RESULTS

The age of the participants ranged between 66 and 93 years in Study I, 65 and 92 years in Study II and 65 and 91 years in Study III and Study IV. No differences were seen between participants and non-participants (III, IV), besides the non-participants (n=16 (III), n=28 (IV), cf. Figure 2) being older, with a mean age of 80.9 years (SD 6.1) (p=0.017) and 79.9 years (SD 6.0) (p=0.026) in Study III and Study IV, respectively. Background variables among the participants are displayed in Table 6.

Table 6. Background variables among the participants in Studies I-IV

		Study I n=56	***Study II n=114***	***Study III n=147***	***Study IV n=144***
Age (years)	mean	78.0	78.0	77.0	77.1
	SD	6.7	6.3	6.1	6.0
Sex	males n (%)	15 (27)	42 (37)	71 (48)	67 (47)
	females n (%)	41 (73)	72 (63)	76 (52)	77 (53)
Civil status	married n (%)	23 (41)	43 (38)	64 (44)	63 (44)
	single/widow/er n (%)	33 (59)	71 (62)	83 (56)	81 (56)
Former profession	professionals/white collar workers n (%)	9 (16)	27 (24)	57 (39)	56 (39)
	blue collar workers/house-wives n (%)	47 (84)	87 (76)	90 (61)	88 (61)
Type of dwelling before admission	own home n (%)	52 (93)	109 (96)	142 (97)	139 (97)
	nursing home/residential living n (%)	4 (7)	5 (4)	5 (3)	5 (3)
Admission to geriatric rehabilitation	from home/nursing home/residential living n (%)	10 (18)	20 (18)	19 (13)	18 (13)
	from another hospital ward n (%)	46 (82)	94 (82)	128 (87)	126 (88)
Professional home care before admission	having home care n (%)	26 (46)	47 (41)	39 (27)	40 (28)
	no home care n (%)	30 (54)	67 (59)	108 (73)	104 (72)
Main medical diagnosis	Musculoskeletal diseases/orthopaedic disorders n (%)	43 (77)	61 (54)	60 (41)	60 (42)
	heart and lung diseases n (%)	4 (7)	14 (12)	33 (22)	33 (23)
	stroke n (%)	6 (11)	19 (17)	30 (20)	27 (19)
	other diagnoses n (%)	3 (5)	20 (18)	24 (16)	24 (17)

The new screening instrument NUFFE

The new screening instrument NUFFE, in its English version, is enclosed in the Appendix.

Reliability and validity of NUFFE

The reliability of NUFFE in Study I and Study II was reflected in the item–total score correlations displayed in Table 7. Obtained Cronbach's alpha coefficients were 0.72 and 0.70, respectively, in Study I and Study II.

Table 7. Item–total score correlations (Spearman rank) for NUFFE in Study I and Study II

Item number	*Item content*	*r_s (I)*	*p-value (I) n=56*	*r_s (II)*	*p-value (II) n=114*
1	Weight loss	0.42	0.001	0.31	0.001
2	Changes in dietary intake	0.45	<0.001	0.56	<0.001
3	Appetite	0.64	<0.001	0.51	<0.001
4	Intake of cooked food	0.09	0.5	0.06	0.563
5	Portion size	0.57	<0.001	0.48	<0.001
6	Intake of fruit or vegetables	0.39	0.003	0.26	0.005
7	Possibility of obtaining food products	-	-	0.20	0.032
8	Company at meals	0.27	0.044	0.10	0.309
9	Activity	0.28	0.039	0.12	0.210
10	Tooth/mouth and swallowing difficulties	0.29	0.032	0.25	0.008
11	Fluid intake	0.21	0.127	0.20	0.036
12	Gastrointestinal problems	0.24	0.074	0.40	<0.001
13	Help with eating	0.04	0.746	0.09	0.329
14	Number of drugs	0.10	0.483	0.16	0.098
15	Health state	0.66	<0.001	0.48	<0.001

Face validity was reflected in the fact that 54% of the patients in Study I found that NUFFE to a very high degree gave a meaningful estimate of their own personal nutritional status. Forty-one percent of the patients found that NUFFE to some degree gave such an estimate, while 5% found that NUFFE gave it to a low degree (I).

Criterion-related validity is presented in Table 8, where the obtained correlations between total NUFFE scores and certain criteria (I, II) are displayed.

Table 8. **Spearman rank correlations between total scores of NUFFE and criteria in Study I and Study II**

Criterion	*n (I)*	*r_s (I)*	*p-value (I)*	*n (II)*	*r_s (II)*	*p-value (II)*
BMI at admission	51	-0.37	0.007	114	-0.25	0.008
BMI after 3 weeks	22	-0.47	0.026			
BMI at discharge	50	-0.38	0.006	112	-0.23	0.014
Weight index [a] at admission	51	-0.38	0.006			
Weight index [a] after 3 weeks	22	-0.48	0.026			
Weight index [a] at discharge	50	-0.40	0.004			
Weight index [b] at admission	51	-0.38	0.006			
Weight index [b] after 3 weeks	22	-0.49	0.021			
Weight index [b] at discharge	50	-0.42	0.002			
Serum albumin at admission	56	-0.37	0.005			
Serum albumin after 3 weeks	18	-0.23	0.354			
Serum albumin at discharge	44	-0.55	<0.001			
MAC at admission				114	-0.23	0.014
CC at admission				114	-0.25	0.008

[a] according to Hessov and Ovesen (1988), [b] according to Warnold and Lundholm (1984)

Concurrent validity of the instrument was shown in the correlations between total NUFFE scores and the patients' views of their own nutritional status (I) and between NUFFE and MNA (II), that reached statistically significant values of r_s, –0.72 ($p<0.001$) and –0.74 ($p<0.001$), respectively.

Predictive validity of NUFFE in Study I was reflected in a statistically significant difference between total NUFFE scores at admission for patients who, at discharge, had an assessed normal nutritional status (median 8, inter-quartile range 6-11) and a lower nutritional status (median 14, inter-quartile range 11.5-16.5) (p=0.012), respectively. In Study II, these values were median score 7 (inter-quartile range 5.5-10) for patients who at discharge had an assessed normal nutritional status and median 10 (inter-quartile range 7-14) for patients who at discharge had a lower nutritional status (p=0.019).

Statistically significant differences of NUFFE median scores were found between known groups with expected high and low scores (Table 9), which reflected the construct validity of NUFFE (I, II).

Table 9. Groups with expected high and low NUFFE scores

Groups with expected high NUFFE scores	*n*	*Median (inter-quartile range)*	*Groups with expected low NUFFE scores*	*n*	*Median (inter-quartile range)*	*p-value*
Patients with cachexia or decubital ulcer (group A, Study I)	7	14 (11-15)	Patients without cachexia or decubital ulcer	49	8 (6-11)	0.004
Patients with BMI <24 kg/m^2 and albumin <36 g/L (group B, Study I)	7	14 (10-18)	Patients with BMI ≥24 kg/m^2 and albumin ≥36 g/L	44	8 (6-11.75)	0.003
Patients with cancer diagnosis (group C, Study I)	2	18 (18-18)	Patients without cancer diagnosis	54	9 (6-11.25)	0.017
Patients with BMI <24 kg/m^2 (Study II)	40	9.5 (6-14)	Patients with BMI ≥24 kg/m^2	74	7 (5-10)	0.017
Patients with pressure sores/skin ulcers (Study II)	21	10 (8-12)	Patients without pressure sores/skin ulcers	93	7 (5-10)	0.005

Nutritional screening results using NUFFE

Median NUFFE score in Study III was 7 (inter-quartile range 5–11). In the nutritional screening, 46 patients (31%) were identified with a NUFFE score <6, indicating low risk for undernutrition. Eighty-one patients (55%) scored between 6 and 12, indicating medium risk for un-

dernutrition, and 20 (14%) scored ≥13, indicating high risk for undernutrition. NUFFE scores increased with advanced age, and the patients at high risk for undernutrition were statistically significantly older than those at low risk for undernutrition (p=0.005) (III). In Study IV, the patients at medium or high risk for undernutrition were slightly older than those at low risk for undernutrition (p=0.051). No statistically significant differences were seen between the three groups at low, medium and high risk for undernutrition regarding medical diagnoses. However, no patients with stroke were present in the group at high risk for undernutrition (III).

Sixty-one (41%) patients had a BMI <24 kg/m^2. Median NUFFE score for patients with BMI ≥24 kg/m^2 (n=86, 59%) was 6 (inter-quartile range 5–10) and 8 (inter-quartile range 6–12.5) for those with BMI <24 kg/m^2 (p=0.028). The patients at high risk for undernutrition had statistically significant lower BMI than those who were at medium risk (p=0.003) and those at low risk (p=0.008) (III).

Comparison between screening results and nursing documentation

The content of NUFFE items 1, 3, 5, 6, 9, 10, 11, 12 and 13 (cf. Appendix) were present in a number of nursing records, with frequencies ranging from 1 to 132. The most frequent notes concerned the activity level (90%) of the patients (item 9). In second place were notes about appetite (55%) (item 3), and then notes about portion size (22%) (item 5). Occurrences of notes concerning weight loss (item 1), tooth/mouth or swallowing difficulties (item 10) and the need of help with eating (item 13), respectively, were found in 14% of the records. Notes about problems with eating due to gastrointestinal problems (item 12) were present in 11%, fluid intake (item 11) in 5% and, finally, intake of fruit or vegetables (item 6) in 1% of the records (III).

No notes were found in the nursing documentation on issues reflecting the content of the remaining NUFFE, i.e. item 2 (changes in dietary intake), item 4 (intake of at least one cooked meal per day), item 7 (possibility to obtain food products), item 8 (company at meals), item 14 (number of medications) and item 15 (health state affects eating) (cf. Appendix) (III).

The nursing records showed that 29 patients had a special nutritional care plan, which indicated that nutritional problems had been identified by the nurses. Of these 29 patients, 11 scored ≥13 in the interview using NUFFE. Thirteen patients scored between 6 and 12, and five scored between 2 and 5 in the interview. Of the 101 (69%) patients identified by NUFFE as being at medium or high risk for undernutrition, 24 had a nutritional care plan. Out of these 101 patients, 48 were not identified as risk patients using the BMI cut-off point <24 kg/m^2 and were not highlighted in the nursing documentation as at-risk patients with a nutritional care plan (III).

Screening results related to perceived health

An association was shown between risk for undernutrition and perceived ill health. Patients who perceived ill health (n=87, 59%) had a median NUFFE score of 8 (inter-quartile range 6–11) and patients who perceived good health (n=60, 41%) had a median NUFFE score of 6 (inter-quartile range 4–9.75) (p=0.011). The patients at high risk for undernutrition were more likely to perceive ill health than were those at low risk for undernutrition (p=0.03) (III). In Study IV the patients at medium or high risk for undernutrition were more likely to perceive ill health than were those at low risk (p=0.014). The patients in perceived ill health were also at greater risk of perceiving helplessness (p<0.001), not being active (p=0.033) and not feeling satisfied with life (p=0.001) than were those in perceived good health (III).

Self-care ability in the screened patients

The obtained SASE median score in the study group was 61 (inter-quartile range 53–69.75). A total of 40 (28%) patients had high SASE scores (≥69) (median score 74, inter-quartile range 72–77), indicating a higher self-care ability, and 104 (72%) had low SASE scores (<69) (median score 57, inter-quartile range 50–62), indicating a lower self-care ability (IV).

The patients at low risk for undernutrition (n=45, 31%) had a SASE median score of 68 (inter-quartile range 58–74) and those at medium or high risk for undernutrition (n=99, 69%) had a SASE median score of 58 (inter-quartile range 51–66) (p<0.001). However, no statistically significant difference in SASE scores was found when the patients at medium risk (n=81, 56%) were compared to those at high risk (n=18, 13%) (p=0.75) (IV).

Lower self-care ability together with being single and having been admitted from another hospital ward were the three predictors for medium or high risk for undernutrition that emerged in the logistic regression analysis (IV).

SOC in the screened patients

The SOC median score in the study group was 152 (inter-quartile range 133–163). The patients at low risk for undernutrition had a SOC median score of 155 (inter-quartile range 143–167.5) and those at medium or high risk for undernutrition had a SOC median score of 146 (inter-quartile range 131–161) (p=0.007). When the medium at-risk patients were compared to the high at-risk patients, no statistically significant difference in SOC scores was found (p=0.28) (IV).

Perceived health related to self-care ability and SOC

Sixty (42%) patients perceived good health and 84 (58%) perceived ill health. The patients who perceived good health had a statistically significant higher SASE median score (median

score 68, inter-quartile range 58–74) than those who perceived ill health (median score 57.50, inter-quartile range 48–66) ($p<0.001$) (IV).

The SOC median score for the patients who perceived good health (median score 158, inter-quartile range 144–173) was also found to be statistically significant higher than for those who perceived ill health (median score 141.50, inter-quartile range 129–157) ($p<0.001$) (IV).

DISCUSSION

The overall aim of this thesis was to develop, test and use a simple, clinically useful instrument for nutritional screening of older patients. The new instrument, NUFFE, was developed to be easy to use for nurses in identifying older nutritional at-risk patients. The development and testing of NUFFE will be discussed below regarding results and methodological considerations. Furthermore, the results of using NUFFE in a screening and the comparison between screening results and the nursing documentation and associations between being at nutritional risk, perceived health, self-care ability and SOC will also be discussed.

Development of the new screening instrument NUFFE

The new instrument was intended to be easy to use for nurses in a clinical setting because it does not require any specific nutritional assessment skills in order to be administered. The ease of using an instrument influences the screening outcome (Elia *et al.* 2005) and, therefore, NUFFE contains a number of items without any anthropometrical measurements. Weekes *et al.* (2004) learned from the development of the screening instrument NST that anthropometry can be hard to perform both for staff and in all patients, because BMI, weight loss in percent and consumed food intake could be not only incorrectly calculated but also not recorded. This led to the questions in NST concerning weight loss and food intake being simplified, i.e. they were not quantified to the amount. MAC replaced BMI, if it was impossible to measure weight and height. Furthermore, the healthcare professionals who would use NST would have to be trained in the measurement of MAC (Weekes *et al.* 2004). According to Green and Watson (2005), it is common to have weight included in instruments, but the result can be that it is not always possible to complete the screening due to the fact that all patients can not be weighed. It is, therefore, important that a screening instrument be capable of identifying nutritional risk in as many patients as possible, even when weight and height can not be easily measured (Elia *et al.* 2005). According to Stratton *et al.* (2006), in patients who could not be weighed the prevalence of undernutrition was higher compared to those who had their weight measured.

Besides being simple to administer, a screening instrument should also be tolerable for the patients (Green & Watson 2005) and the staff. It should be quick to use and not time-consuming, so that a resistance towards nutritional screening does not develop among the staff (Elia *et al.* 2005). Perhaps NUFFE with 15 items could be perceived as too comprehensive, but it should be seen as an advantage to perform a complete screening in one session. However, the patients in Study I found that it was just right with this number of items. As comparison, in

Canada an instrument, the Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN), has been developed in order to be simple to administer. It also contains 15 items with content similar to NUFFE and without anthropometry. However, this screening instrument is intended for older people in community dwellings (Berner 2003). Studies on SCREEN were not found during the period when NUFFE was being developed.

Furthermore, the aim of a screening is to cover as many patients as possible. However, patients with cognitive impairments, for example dementia, can be hard to screen with an instrument like NUFFE. Such patients, however, have to be regarded as risk patients (Weekes *et al.* 2004) who need further attention and investigation, because it is known that this group of patients has difficulties in meeting nutritional needs (Holm & Söderhamn 2003). However, in ambulatory patients with cognitive impairments BMI can give a hint of the risk for undernutrition. The screening results in Study III showed that the patients screened, using NUFFE, as being at high risk for undernutrition had statistically significant lower BMI than those at medium or low risk for undernutrition. This indicates that BMI is not necessary in an early screening using NUFFE, since NUFFE can separate patients with lower and higher BMI. On the other hand, the results in Study III also showed that many patients were not identified as medium or high at-risk patients if BMI <24 kg/m^2 was used as the sole nutritional screening method.

According to Kondrup *et al.* (2003) screening tools, which are developed to detect undernutrition and/or predict undernutrition in hospitals, should include four main areas, i.e. BMI or MAC, recent weight loss, decreased food intake and disease process. NUFFE, as an instrument for screening the risk for undernutrition, contains items that embody weight loss and food intake but not BMI and disease process. However, in the development of NUFFE it was a conscious choice not to include anthropometry, e.g. BMI. Kondrup *et al.* (2003) are also aware that BMI is less useful in older people. Weight loss is found to be a very important indicator in detecting at-risk patients, whereas anthropometrical measurements can underestimate the risk (Kyle *et al.* 2005). The severity of illness and disease process, e.g. major surgery, sepsis and multi trauma, increase the nutritional requirements and can cause nutritional status to worsen rapidly (Kondrup *et al.* 2003). One of the items in NUFFE deals with difficulty to eat due to decreased health. This item can reflect a disease process that influences the patients' perception of health. Furthermore, older patients who, due to illness, are not capable of answering the questions in NUFFE have to be highlighted as nutritionally at-risk patients in need of further attention and investigation. Moreover, if a question about disease process severity had been included in NUFFE, it would have been more difficult to use as a self-report instrument.

In Study I and Study II, NUFFE was assumed to be an instrument for assessing potential and actual undernutrition in older patients. But in Study III and Study IV, NUFFE was considered a screening instrument for identification of older patients at nutritional risk, i.e. with potential undernutrition. These differences in terminology regarding screening and assessment of the risk for undernutrition or undernutrition can be partly explained due to indistinctness in the literature about definitions of nutritional terms, with nutritional assessment being used interchangeably with nutritional screening (Lyne & Prowse 1999). NUFFE is now, more correctly,

regarded as a screening instrument for the risk of undernutrition, because it is composed of variables that can be seen as risk factors for undernutrition. According to Weekes *et al.* (2004), a screening instrument can indicate whether nutritional problems are actual or potential. But to assess, for example undernutrition, further investigation such as anthropometry, biochemical analyses and food intake recording has to be performed. Another reason for regarding NUFFE as a screening instrument for the risk of undernutrition is that no objective parameters are included, e.g. anthropometrical measurements, which are often included in a specific nutritional assessment (Omran & Morley 2000) in order to determine undernutrition.

Reliability and validity of NUFFE

Besides feasibility, reliability and validity are important factors for the screening outcome (Elia *et al.* 2005). In Study I and Study II, the reliability and validity of NUFFE were tested. The Cronbach's alpha reliability coefficients were found to be at levels regarded as sufficient evidence of reliability, according to Streiner and Norman (2003). However, the instrument MNA in Study II showed a lower value than NUFFE, i.e. a Cronbach's alpha coefficient of 0.57. That NUFFE and MNA did not show high alpha coefficients can be explained in the following way, since there is a difference between the homogeneity of an instrument regarding whether the measured variables are effect indicators or causal indicators. An instrument with many effect indicators needs a high Cronbach's alpha coefficient, because each item has to reflect the effect of an underlying construct. The demand for high homogeneity is not as high for an instrument with causal indicators as variables (Streiner & Norman 2003). Both NUFFE and MNA contain items that can be regarded as causal indicators that define the risk for undernutrition and, accordingly, high homogeneity is not crucial.

Item-total correlations were also used for determining the homogeneity of NUFFE (I, II). Some of the items had a low correlation to the total instrument, i.e. below 0.20, but they were not excluded from the instrument because the Cronbach's alpha coefficient did not reach higher values when these items were omitted. Another reason for not excluding these items was that the samples in Study I and Study II were rather homogenous, i.e. the main diagnoses, for example, were musculoskeletal diseases and stroke. This can lead to the patients giving similar answers to a high degree: for example, many were non-ambulatory and most took many medications. A further reason for not excluding these items was that they have relevance in the screening of older patients when taken the discussion of Streiner and Norman (2003) regarding when homogeneity does or does not matter is taken into account.

In instruments that involve summated items, reliability is often tested regarding homogeneity, because it is an economical method requiring only one test administration. There are also other methods for testing reliability, namely the stability by test-retest and the equivalence by inter-rater or intra-rater reliability (Streiner & Norman 2003, Polit & Beck 2004). However, these latter methods were not chosen in testing the reliability of NUFFE. This can be considered a limitation in the testing procedure, because, according to Green and Watson (2005), reliability of a nutritional instrument should be assessed as inter-rater and intra-rater reliability and, ac-

cording to Jones (2004), high inter-rater reliability is a sufficient indication of a reliable nutritional instrument.

Face validity of NUFFE in Study I was reflected by the participants' views regarding the capability of NUFFE to give an estimate of their own nutritional status. To satisfy one's nutritional needs and maintain a sufficient intake of water and food is fundamental for all adult human beings, according to Orem (2001). Every adult ought to possess such knowledge and, therefore, it should be possible for the participants to assess the face validity of NUFFE. To use the patients' views of NUFFE for assessing face validity was also a choice, because NUFFE can be used as a self-report instrument. However, allowing experts to assess content validity had been an alternative for the validation process.

The correlations between total scores of NUFFE and the criteria used for assessing criterion-related validity, BMI, MAC, CC, weight index and serum albumin, showed rather similar correlation coefficients and p-values, which support the criterion-related validity of NUFFE. The criteria, however, have limitations as indicators for the risk of undernutrition. BMI, for example, is not a sensitive indicator for the risk of undernutrition in those persons, who normally weigh less than what is normal for their height (McWhirther & Pennington 1994). The opposite can also exist, i.e. a person with an initially high BMI who has had a weight loss can be at risk for developing undernutrition despite a normal BMI (Jeejeebhoy 2000). Furthermore, a low serum albumin value can often be more an indicator of illness than of undernutrition (Gariballa & Sinclair 1998). Regarding using albumin, it should also be mentioned that it has a long half-life (Tierney 1996), which decreases the information about the current state. Albumin is, therefore, a better marker of chronic undernutrition. Prealbumin is a more sensitive marker than albumin because it has a shorter half-life (Kuszajewski & Clontz 2005), but it can also be abnormal in the presence of illness (Huffman 2002).

The reference weight in weight index was calculated in two ways, i.e. in an established way (Warnold & Lundholm 1984) used in nutritional research studies and according to Hessov and Ovesen (1988). Despite this circumstance both calculations of weight index showed very similar correlation coefficients and p-values.

The concurrent validity of NUFFE was assessed by computing Spearman's rank correlation between NUFFE scores and MNA scores (II). MNA was used because it is a well validated instrument and was developed to determine the risk of undernutrition in older people (Guigoz *et al.* 1996). A difference between NUFFE and MNA is, among other things, that MNA contains items about anthropometrical measurements, independent living, suffering from psychological stress or acute disease, neuropsychological problems and presence of pressure sores or skin ulcers (Guigoz *et al.* 1996). The obtained correlation coefficient was assumed to be high, which supports the assertion that NUFFE is a valid screening instrument.

The construct validity and predictive validity of NUFFE were supported when patients at high and low nutritional risk could be separated. For example, construct validity was assessed com-

paring patients with and without cancer and patients with and without pressure sores/skin ulcers (I, II). That these groups were chosen can be explained by the fact that they were available as known groups for the risk of undernutrition. There is a known relationship between undernutrition and pressure sores (Ek *et al.* 1991, Tierney 1996), and patients with cancer are at greater risk for developing undernutrition than are other patients (Kruizenga *et al.* 2003). However, despite a very small group of patients with a cancer diagnosis in Study I, it was a statistically significant difference in NUFFE median scores between them and the patients without a cancer diagnosis.

Sensitivity, specificity and predictive values of NUFFE

Besides reliability and validity, an instrument also has to show sensitivity and specificity (Green & Watson 2005). It is of great importance that a nutritional screening instrument is able to distinguish between, e.g., patients at low risk and those at medium or high risk for undernutrition. To determine these cut-off points for NUFFE, MNA was used as standard because it was available, but also because it is the most well-known instrument in Sweden for detecting nutritional risk in older people. Most desirable is to obtain an instrument that is both highly sensitive and specific. But this is not possible, because when the sensitivity increases the specificity decreases, and vice versa. The positive and negative predictive value is also dependent on the value of sensitivity and specificity, i.e. the higher sensitivity the better the negative predictive value and the higher specificity the better the positive predictive value (Fletcher & Fletcher 2005). Therefore, the cut-off points for NUFFE (<6 indicating low risk, ≥6 indicating medium risk and ≥13 indicating high risk for undernutrition) were determined using an interpretation of the best estimated values, i.e. to find the most optimal values for both sensitivity and specificity, and an interpretation of the performed ROC curves. The determined cut-off point of ≥13 is close to the suggested cut-off point (>13) for identifying patients suffering from undernutrition in Study I. In Study II the suggested cut-off point for undernutrition was >11, which has been shown to give the same calculated sensitivity and negative predictive value as the determined cut-off point of ≥13. However, in Study I and Study II the cut-off points were suggested to indicate undernutrition, but now ≥13 is regarded as indicating high risk for undernutrition, which has been discussed above.

The obtained value of NUFFE for measuring medium risk for undernutrition showed that specificity (86%) and positive predictive value (97%) were higher than sensitivity (71%) and negative predictive value (29%). A high positive predictive value indicates that an identified medium at-risk patient actually is a medium at-risk patient. High specificity leads to a lower frequency of false positives (Fletcher & Fletcher 2005). The sensitivity, specificity and predictive values of MUST and NRS-2002 have been calculated with SGA as a standard, in order to measure the nutritional risk, and it was also found that both MUST and NRS-2002 showed higher specificity than sensitivity. The values of sensitivity, specificity, positive predictive values for MUST and NRS-2002, with SGA as a standard, were lower than these values for NUFFE with MNA as a standard, besides the negative predictive values, which were higher for MUST and NRS-2002 (Kyle *et al.* 2006). According to Fletcher and Fletcher (2005), the negative pre-

dictive value tends to be high if the prevalence of the issue of concern is low. That the prevalence of patients at medium or high risk in Study II was high (76%) can be an explanation of the low negative predictive value (29%) for the cut-off point 6. The negative predictive value for the cut-off point of 13 was high (94%). This may indicate that the prevalence of patients at high risk was relatively low (15%). However, the cut-off point for NUFFE for measuring the medium risk is considered the most important cut-off point, because both patients at medium and high risk are identified. The results in Study IV showed that both medium and high at-risk patients had lower self-care ability and weaker SOC, which supports the importance of the identification of both these groups.

Using MNA <17, indicating undernutrition, as a standard for measuring the high risk for undernutrition using NUFFE can be seen as not comparable. Because NUFFE is considered a screening instrument, it can show that several nutritional problems exist, i.e. high risk for undernutrition, but can not assess undernutrition. On the other hand, after an assessment process undernourished patients are supposed to be found in the group at high risk for undernutrition, i.e. NUFFE scores ≥13.

Nutritional screening using NUFFE

Using NUFFE in a screening among a group of geriatric rehabilitation patients showed that 69% were at medium or high risk for undernutrition (III). This result is rather similar to the results from other studies among older patients. For example, in a Swedish study (Westergren *et al.* 2002) among geriatric rehabilitation patients, almost half of the patients were at risk of developing undernutrition or were suffering from undernutrition assessed by SGA. Furthermore, in a study among geriatric rehabilitation patients using MNA, 75% of the patients were at risk for undernutrition or were undernourished (Visvanathan *et al.* 2004b). Similar results were also found when MNA-SF was used for screening in a group of older acute medical patients, i.e. 74% of the patients were at risk for undernutrition or were undernourished (Ranhoff *et al.* 2005). That the screening results with NUFFE are found to be rather similar to the results from other studies using other nutritional instruments implies that a generalization seems possible regarding the prevalence of older nutritional at-risk patients. However, the limitations in the study must be taken into account regarding such a generalization, i.e. the rather small sample, that the study was performed in only one hospital ward, and the broad exclusion criteria. A geriatric rehabilitation ward was chosen because of the variety of medical diagnoses present among these patients. The broad exclusion criteria imply that nutritional at-risk patients might be missed in the screening, for example those who received enteral and parenteral nutrition (Weekes *et al.* 2004). This patient group, however, was very small and was excluded because of a supposed difficulty in comparing these patients to the other participating patients, who did not have additional nutrition. Another reason for exclusion was also a supposed difficulty for those patients to answer some of the questions. But when NUFFE is used clinically, all patients who can answer the questions can be screened. Using a screening instrument like NUFFE can be justified because 48% of the 101 screened medium or high at-risk patients were missed as at-risk patients in need of further attention and investigation when BMI <24 kg/m^2 was used as

the sole screening method. These patients were also not identified by the nurses, according to the nursing documentation.

No differences in prevalence of diseases and disorders between patients at low, medium or high risk for undernutrition were found, except that no patients with stroke were present in the group at high risk for undernutrition (III). A similar relationship was seen by Covinsky *et al.* (1999), i.e. undernutrition in older hospitalized patients could not be explained by greater illness severity or co-morbidity. However, according to Kondrup *et al.* (2003), severe disease can impair nutritional status, due to decreased appetite and increased nutritional requirements. In line with this, Margetts *et al.* (2003) could show an association between long-standing illness and being at medium or high risk for undernutrition in older females.

Furthermore, in Study III, the screening result using NUFFE showed that age had some importance for being at greater risk, because patients at high risk for undernutrition were statistically significantly older than those at low risk for undernutrition. When the patients at low risk in Study IV were compared to those at medium or high risk for undernutrition, the same tendency was seen, but it was not statistically significant. These results can be compared to a study among older patients by Ek *et al.* (1991) in which female patients with advanced age had a higher frequency of undernutrition than those who were younger. Gazzotti *et al.* (2000), however, could not find differences in age related to MNA scores in older patients with acute illness.

Living alone and being admitted to the ward from another hospital ward were obtained predictors for medium or high risk of undernutrition (IV). An association between living alone and nutritional risk has been shown by Wissing *et al.* (2000), Zulkowski and Coon (2004) and Brantervik *et al.* (2005), but was not found by Pearson *et al.* (2001) and Shum *et al.* (2005). Being admitted from other hospital wards being a predictor for medium or high risk is in line with other studies, because relationships have been found between lengths of hospital stay and weight loss (Gazzotti *et al.* 2003, Rasmussen *et al.* 2004).

Comparison between screening results and nursing documentation

When the screening results were compared to nurses' nutritional notes in the nursing documentation, it was shown that important nutritional issues were absent in many patient records, i.e. all medium and high at-risk patients identified using NUFFE could not be found in the nursing documentation (III). These deficiencies were reflected in the records through, e.g., an important issue like appetite being present in slightly more than half of the records. Notes about weight loss were found in a tenth of the records. That the number of medications used was not present in the nursing records may be explained by the fact that the documentation of medications is recorded elsewhere in the patient records. Nevertheless, number of medications is relevant in the nutritional assessment of the older patient, because a high number influences nutritional status negatively (Gazzotti *et al.* 2000). Shortcomings in the documentation about the patients' nutrition have also been reported in other studies in Sweden as well as other countries

(Kumlien & Axelsson 2002, Rasmussen *et al.* 2004, Soini *et al.* 2005). According to Kondrup *et al.* (2002), the main reasons that nurses did not perform nutritional screening were lack of instructions and lack of guidelines. Therefore, implementation of a screening instrument like NUFFE could be a way to ensure that important questions are asked of the patients and may support and help the nurses in highlighting nutritionally at-risk patients in need of further attention and investigation. Having a screening instrument included in the admission routine ought to be a guarantee that the patients will be screened, and that nutritional issues are also reflected in the nursing documentation.

Only 24% of the patients screened to be at medium or high risk for undernutrition in Study III were found to have nutritional care plans. However, because the data collection was performed during a period of up to two weeks after the patients' admission to the ward, this can imply that a care plan had not yet been created for those patients, whereby the data collection was performed in the beginning of the two-week period. According to Howard *et al.* (2006), all patients at risk for undernutrition or suffering from undernutrition should have a nutritional care plan. That 24% of the medium or high at-risk patients had a nutritional care plan can be compared with a study carried out in Denmark (Rasmussen *et al.* 2004) in which 33% of the identified nutritional at-risk patients had a nutritional care plan. Reasons for nurses not using and documenting in nutritional care plans can include difficulties in identifying at-risk patients and in setting up care plans (Beck *et al.* 2002).

Nutritional risk, perceived health, self-care ability and SOC in older patients

The assumption that there are associations between nutritional risk and perceived health, self-care ability and SOC, respectively, in older patients was confirmed by the results in Study III and Study IV. The patients at high risk for undernutrition were more likely to perceive ill health than were those at low risk (III), which is in line with Margetts *et al.* (2003). Furthermore, the patients at medium or high risk were more likely to perceive ill health than were those at low risk for undernutrition (IV). Similar association, i.e. the worse the general state of health, the worse the nutritional status, has also been shown in other patients groups, for example in HIV-infected younger adult patients when their nutritional status was assessed with SGA (Karlsson & Nordström 2001).

Besides a higher degree of perceived ill health, the patients at medium or high risk for undernutrition were also found to have lower self-care ability and weaker SOC than those at low risk for undernutrition. This was also highlighted in one of the obtained predictors for medium or high risk for undernutrition, which was found to be lower self-care ability (IV). These results are supported by results from other studies, for example Brantervik *et al.* (2005), who found that undernourished older patients received more help with personal care. Undernourished older service flat residents have been found to have diminished functional ability (Ödlund Olin *et al.* 2005), and total dependence in activities of daily living in geriatric rehabilitation patients has been found to be a risk factor for undernutrition (Shum *et al.* 2005). The fact that self-care ability and SOC were synchronized (IV) was also an observed tendency by Ageborg *et al.*

(2005). This synchronization in Study IV was shown through the results that patients at medium or high risk for undernutrition had both lower self-care ability and weaker SOC and, conversely, that low at-risk patients had higher self-care ability and stronger SOC.

An association was also seen between self-care ability and perceived health, since the patients who perceived ill health had lower self-care ability than those who perceived good health (IV), which is in line with Haveman-Nies *et al.* (2003). This is also consistent with the result from a study among older home-dwelling older people by Söderhamn *et al.* (2000), in which perceived good health was obtained as a predictor for higher self-care ability. Furthermore, Lee (2000) found that persons who assessed their health negatively were at higher risk of functional decline. According to Haveman-Nies *et al.* (2003), a decrease in perceived health and self-care ability, seen over a ten-year period, was lower for people who were active compared to those who were inactive. This is in agreement with the results from a study by Lindgren *et al.* (1994), who found that mobility and activity, but also contentment, had great impact on perceived good health among older people. These results can also be compared to those from Study III, in which patients who perceived ill health were at greater risk of perceiving helplessness, not being active and not feeling satisfied with life than those in good health were. According to Söderhamn *et al.* (2000) perceived helplessness has also been found to be a risk factor for low self-care ability.

Furthermore, SOC was found to be associated with perceived health, i.e. the patients who perceived good health had higher SOC than those patients who perceived ill health (IV). This result confirms Antonovsky's (1987) theoretical model that SOC is a factor for maintaining health. The result is also supported by Schneider *et al.* (2004) and by Holmgren and Söderhamn (2005).

Being at low risk for undernutrition and perceiving good health may indicate that good nutritional status contributes to perceived good health, which is also assumed by Gariballa and Sinclair (1998); but also the opposite, i.e. that lower nutritional status contributes to perceived ill health. The obtained association between being at low risk for undernutrition and having higher self-care ability may indicate that good nutritional status has a positive impact on self-care ability (cf. Ödlund Olin *et al.* 2003). This association also points out that being at medium or high risk for undernutrition may contribute to lower self-care ability, which entails that the patients more or less have a low capacity for caring for themselves (Orem 2001). This implies that, according to Orem's (2001) self-care deficit nursing theory, these patients are in need of nursing care due to their self-care deficits. Besides higher self-care ability, the low at-risk patients also had stronger SOC, which may indicate that self-care activities are realized to a greater extent when a certain level of the SOC components comprehensibility, manageability and meaningfulness is present. The self-care ability can be exercised (Söderhamn *et al.* 1996a, 1996b) and self-care actions can be performed in order to meet the universal self-care requisite maintaining an adequate intake of food in order to live and maintain health (Orem 2001).

However, in cross-sectional studies it is impossible to determine the causal connections, i.e. what is causing what, and, accordingly, in this thesis the obtained associations between nutritional risk, perceived health, self-care ability and SOC merely indicate that they are related to each other.

Implications for nursing practice

Using a screening instrument as a routine procedure in a hospital ward is justified when the prevalence of risk patients is high and, especially, when many of these patients are not identified (Elia *et al.* 2005). The screening performed using NUFFE confirmed that the prevalence of older patients at medium or high risk for undernutrition was high. The comparison between screening results and nursing documentation also showed that all screened medium or high at-risk patients were not identified by the nurses (III). Therefore, to include a nutritional screening instrument like NUFFE in the nurses' admission dialogues with older patients ought to be a way to optimize the identification of nutritional at-risk patients in need of further attention and investigation and thereby focus their nutritional care. To use a screening instrument in order to identify patients at risk for undernutrition ought to be justified because undernutrition is a risk factor for higher incidence of complications and increased mortality, length of hospital stay and costs (Correia & Waitzberg 2003).

But, according to Jordan *et al.* (2003), the clinical impact of a screening instrument has to be explained to the staff. Therefore, before the implementation of NUFFE as a clinical screening instrument, information and education about older people's increased risk for being at medium or high risk for undernutrition in hospitals has to be provided. O'Flynn *et al.* (2005) could show that the prevalence of being at risk for undernutrition or being undernourished was reduced after interventions such as nutritional education, higher food quality and implementation of a screening instrument in order to identify nutritional at-risk patients. Furthermore, the advantages of a screening instrument must also be highlighted. The possibility at an early stage to identify and treat nutritionally at-risk patients ought to give benefits like shorter hospital stays because, according to Kyle *et al.* (2006), medium or high at-risk patients are more likely to be hospitalized for a longer time than those at low risk for undernutrition. Moreover, the impact of nutritional status regarding perceived health, self-care ability and SOC should be of importance for the willingness to use a screening instrument (III, IV). Using NUFFE as a self-report instrument should be a way to decrease the burden that a clinical screening instrument can imply.

Nutritional screening has to be performed (Kondrup *et al.* 2003, Howard *et al.* 2006) and ESPEN (Kondrup *et al.* 2003) and BAPEN (Wekes *et al.* 2004) have given recommendations for nutritional screening tools for patients in hospital, for example MUST, NRS 2002 (Kondrup *et al.* 2003) and NST (Weekes *et al.* 2004). But these three instruments have not been found to be available in the Swedish language, and they all contain anthropometrical measures. NUFFE should, therefore, be a reasonable alternative according to the results presented in this thesis.

Guidelines should be available together with NUFFE, because lack of instructions and lack of guidelines are barriers to performing nutritional screening (Beck *et al.* 2002, Kondrup *et al.*

2002). The guidelines should contain cut-off points for NUFFE in order to screen low, medium and high at-risk patients. Attention should be given to patient groups that can not be screened using NUFFE, e.g. those patients with impaired cognitive function and/or severity of illness or disease, so they have to be treated as at-risk patients in need of further attention and investigation. But even patients who are screened to be at low risk for undernutrition but who have, for example, weight loss or decreased appetite should not be neglected. They have to be re-screened with regular intervals, e.g. weekly.

A screening instrument will be most effective if it is followed by a care plan (Elia *et al.* 2005). According to Jordan *et al.* (2003), introduction of a screening instrument improved nursing documentation related to issues specified in the instrument. But it did not improve the outcomes of the screening since, e.g., the patients' food intake was not recorded. A way to ensure that screened patients are given continuous attention with further investigation, assessment, treatment and evaluation can be to give examples of nutritional nursing interventions, which ought to be highlighted in a nutritional nursing care plan. This information should be linked to the guidelines for the screening. But there is also a need for resources for this desirable care in order to improve the outcomes (Elia *et al.* 2005). However, benefits such as health for the individual (Millen & Nason 2004), shorter hospital stay (Kyle *et al.* 2006) and lower hospitalization costs while patients are maintaining a proper nutritional status (Millen & Nason 2004) should be sufficient reasons for prioritising resources for nutritional care. But according to Beck *et al.* (2002), the costs for identifying patients in need of nutritional care are low.

The patient has to be involved in his or her own care, because the care should be performed in collaboration between patient and caregivers (SFS 1982). In a study by Florin *et al.* (2005), it was found that the patients identified more severe nutritional problems than their nurses did. Accordingly, patients not being given the possibility to influence their own nutritional care are a barrier to proper nutritional care (Beck *et al.* 2001). Pedersen (2005) found that care based on older patients being actively involved in their nutritional care was a way to improve their food intake and thereby prevent undernutrition. Therefore, patients' nutritional care should be organized and performed together with the patients. Having an individualized nutritional nursing care plan can be of help to nurses in performing and evaluating the nutritional care. In order to highlight the screening process, it should be an advantage, besides including NUFFE in the nurses' admission dialogue, to also incorporate NUFFE in the electronic patient record together with guidelines and proposals for nutritional nursing care plans. This ought to decrease the risk of not following guidelines, because, according to Kondrup *et al.* (2002), even if guidelines are present, they are not always followed.

In an individualized nutritional nursing care plan attention should be focused on the identified at-risk patients' problems that emerged in the screening using NUFFE. Patients experiencing, e.g., weight loss, decreased appetite and/or difficulty eating should have their nutritional requirements estimated and their food intake recorded (Beck *et al.* 2002, Kondrup 2004) for a number of days and, if possible, BMI and weight loss in percent calculated as the basis for the nurses' nutritional assessments. Patients who are not found to meet their nutritional require-

ments should be offered enriched food and/or protein and energy supplementation. These patients should not be denied the benefits of supplementation (Teo & Wynne 2001), because supplementation may give weight gain and beneficial effects on mortality in older people (Milne *et al.* 2005). Moreover, identified at-risk patients need continuous attention, and if possible issues such as weight should be followed, because many patients' nutritional status usually declines during their hospital stay (Kowanko 1997, Rasmussen *et al.* 2004). Therefore, the patients' nutritional care plans should be used during the hospital stay. The nurses, together with the ward team and the patients, have to continuously co-operate and evaluate regarding the nutritional care as well as document in the nutritional care plans (Kondrup 2004) according to the nursing process. If necessary, a dietician should be counselled. In the discharge planning the nutritional assessment and care must be highlighted and documented in the discharge summary together with a prescribed nutritional care plan (Beck *et al.* 2001), especially when the nutritional care has to be continued, for example, in primary health care or nursing homes (Mowé *et al.* 2006).

CONCLUSIONS

The main conclusions of this thesis are as follows:

- NUFFE is a simple, useful screening instrument for the identification of older nutritional at-risk patients.
- NUFFE has sufficient evidence of reliability and validity for identifying older nutritional at-risk patients.
- Using NUFFE in a screening of older patients, the prevalence of patients at medium or high risk for undernutrition was found to be high.
- Nurses' nutritional notes showed deficiencies in the nursing documentation, indicating that all patients at medium or high risk for undernutrition were not identified.
- Using NUFFE, associations were found between older patients' nutritional risk and their perceived health, and their self-care ability and SOC, respectively.
- Associations were found between older patients' perceived health and self-care ability and SOC, respectively.
- These associations indicate that being at low risk for undernutrition is concomitant with perceived good health, higher self-care ability and stronger SOC. Conversely, being at medium or high risk for undernutrition is concomitant with perceived ill health, lower self-care ability and weaker SOC.
- Using NUFFE as a screening instrument, according to guidelines with an accompanying individualized nutritional nursing care plan ought to be an aid for nurses to identify older nutritional at-risk patients and a way to improve the patients' nutritional care, as well as to improve the nursing documentation.
- Further studies are needed in order to test reliability and validity of NUFFE in different groups of older patients and home-dwelling older people and perform longitudinal experimental studies in order to investigate associations between being at nutritional risk, perceived health, self-care ability and SOC.

SAMMANFATTNING PÅ SVENSKA (SUMMARY IN SWEDISH)

Att vara i riskzonen för att utveckla undernäring eller att vara undernärd är vanligt förekommande bland äldre sjukhusvårdade patienter. Det är ett stort problem att många av dessa patienter inte blir upptäckta. Att använda ett screeninginstrument borde vara en hjälp för sjuksköterskor att identifiera riskpatienter som är i behov av vidare utredning för bedömning av sitt näringstillstånd i syfte att tidigarelägga behandling och därmed förebygga undernäring. Ett sådant instrument ska vara enkelt att använda men också kunna uppvisa en tillfredsställande reliabilitet (att det mäter tillförlitligt) och validitet (att det mäter det som det är avsett att mäta).

Det övergripande syftet i denna avhandling var att utveckla, testa och använda ett enkelt, kliniskt användbart instrument för nutritionsscreening av äldre patienter. Intentionen var att utveckla ett instrument som ska vara lätt att använda för sjuksköterskor och inte kräva antropometriska mätningar. De fyra delstudierna (I-IV) i avhandlingen har en kvantitativ ansats. I dessa delstudier deltog 56 (I), 114 (II), 147, (III) och 144 (IV) äldre patienter (≥65 år) vårdade på en geriatrisk rehabiliteringsavdelning på ett sjukhus i västra Sverige.

Ett nutritionsscreeningsinstrument, ”the Nutritional Form For the Elderly” (NUFFE), konstruerades, innehållande 15 frågor. Instrumentet omfattar funktionella, sociala, nutritionella och hälsorelaterade aspekter på näringsintaget. De specifika frågorna behandlar viktförändring, förändring i matintaget, aptit, intag av lagad mat, portionsstorlek, intag av frukt eller grönsaker, tillgång på matvaror, social samvaro, aktivitet, tand-, mun- och sväljningsproblem, vätskeintag, problem med mag-tarmkanalen, assistans med matintaget, antal läkemedel samt hälsotillstånd. Instrumentet är utformat som en ordinalskala med tre svarsalternativ på varje fråga. För varje fråga ges noll, ett eller två poäng. Poängen för varje fråga summeras. Den totala poängsumman kan variera från noll till 30. Ju högre poäng, ju högre risk för undernäring anses föreligga.

Patienterna intervjuades med instrumenten NUFFE (I-IV), ”Mini Nutritional Assessment” (MNA) (II), ”the Self-care Ability Scale for the Elderly” (SASE) (IV), Antonovskys skala för mätning av känsla av sammanhang (IV), en fråga om upplevd hälsa, ett antal hälsorelaterade frågor (III, IV) och bakgrundsfrågor (I-IV). Vikt och längd mättes (I-III) och serumalbumin användes om det var tillgängligt i patientjournalerna (I, II). Nutritionsanteckningar, förda av sjuksköterskorna i omvårdnadsjournalerna fram till det att intervjuerna utfördes, samlades in, kodades och avidentifierades (III).

Reliabilitet för det nykonstruerade instrumentet (I, II) bedömdes som homogenitet. Validitet bedömdes som ytvaliditet (I), kriterierelaterad validitet, samtidig validitet, prediktiv validitet och begreppsvaliditet (I, II). Instrumentets sensitivitet, specificitet och prediktiva värden bestämdes med MNA som standard. En screening genomfördes med NUFFE. Screeningsresultatet relaterades till patienternas upplevda hälsa. Screeningsresultatet jämfördes också med sjuksköterskornas nutritionsanteckningar i omvårdnadsjournalerna (III). Vidare undersöktes de

screenade patienternas egenvårdsförmåga och känsla av sammanhang. Patienternas upplevda hälsa relaterades också till egenvårdsförmåga och känsla av sammanhang (IV).

NUFFE uppvisade tillfredsställande reliabilitet, med t.ex. Cronbachs alfa-koefficienter på 0.72 (I) och 0.70 (II), och validitet; t.ex. ytvaliditet ansågs föreligga genom att 54% av patienterna ansåg att NUFFE till en mycket hög grad kunde ge en meningsfull uppskattning av deras nutritionsstatus. Kriterierelaterad validitet fastställdes genom statistiskt signifikanta korrelationer mellan NUFFE och Body Mass Index (BMI) (I, II), viktindex och serumalbumin (I). Samtidig validitet ansågs föreligga genom en erhållen korrelationskoefficient på –0.74 ($p<0.001$) mellan NUFFE och MNA (II). Prediktiv validitet visades genom en statistiskt signifikant skillnad i NUFFE-poäng vid ankomsten mellan patienter som vid utskrivningen hade ett sämre näringstillstånd (BMI <24 kg/m^2 och serumalbumin <36g/L) och ett normalt näringstillstånd (BMI ≥24 kg/m^2 och serumalbumin ≥36 g/L) ($p=0.012$ (I), $p=0.019$ (II)). Begreppsvaliditet visades genom statistiskt signifikanta skillnader i NUFFE-poäng mellan grupper av patienter med förväntade höga respektive låga poäng; t.ex. patienter med trycksår eller hudsår hade högre poäng än patienter utan trycksår eller hudsår ($p=0.005$) (II).

Beräkningen av sensitivitet, specificitet och prediktiva värden för NUFFE, med MNA som standard, visade att brytpunkterna för låg, medelhög och hög risk för undernäring var vid <6, ≥6 och ≥13 poäng. Nutritionsscreeningen med NUFFE visade att 31% av patienterna hade låg risk, 55% hade medelhög risk och 14% hade hög risk för undernäring. Jämförelsen mellan screeningsresultatet och sjuksköterskornas nutritionsanteckningar visade att innehållet i nio av instrumentets frågor återfanns i ett antal omvårdnadsjournaler, t.ex. uppgifter om aptit återfanns i 55% av journalerna och uppgifter om viktförlust i 14% av journalerna. När screeningsresultatet relaterades till patienternas upplevda hälsa framkom samband mellan risk för undernäring och upplevd hälsa, dvs patienter som hade hög risk för undernäring upplevde sig ha dålig hälsa i större utsträckning än de som hade låg risk för undernäring ($p=0.03$) (III). Vidare upplevde de patienter som hade medelhög eller hög risk för undernäring dålig hälsa i större utsträckning än de som hade låg risk för undernäring ($p=0.014$). De som hade medelhög eller hög risk för undernäring hade också lägre egenvårdsförmåga ($p<0.001$) och svagare känsla av sammanhang ($p=0.007$) än de som hade låg risk för undernäring. De som upplevde god hälsa hade högre egenvårdsförmåga ($p<0.001$) och starkare känsla av sammanhang ($p<0.001$) än de som upplevde dålig hälsa. Att ha lägre egenvårdsförmåga, att leva ensam och att ha blivit remitterad från en annan sjukhusavdelning var tre erhållna prediktorer för att ha medelhög eller hög risk för undernäring (IV).

Konklusionerna i avhandlingen är att NUFFE är ett enkelt användbart screeningsinstrument för identifikation av äldre patienter i riskzonen för undernäring. Testningen av instrumentet visade att tillräckliga bevis finns angående dess reliabilitet och validitet. Nutritionsscreeningen med NUFFE visade hög förekomst av patienter med medelhög eller hög risk för undernäring. Sjuksköterskornas nutritionsanteckningar visade brister, i jämförelsen med screeningsresultatet, vilket tyder på att samtliga patienter med medelhög eller hög risk för undernäring inte var identifierade av sjuksköterskorna. Samband fanns mellan äldre patienter i riskzonen för undernäring

och deras upplevda hälsa, egenvårdsförmåga och känsla av sammanhang, och vidare fanns samband mellan äldre patienters upplevda hälsa och egenvårdsförmåga och känsla av sammanhang. Dessa samband antyder att låg risk för undernäring uppträder tillsammans med upplevd god hälsa, högre egenvårdsförmåga och starkare känsla av sammanhang och att medelhög eller hög risk för undernäring uppträder tillsammans med upplevd dålig hälsa, lägre egenvårdsförmåga och svagare känsla av sammanhang.

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APPENDIX

The Nutritional Form For the Elderly (NUFFE)
(English version "NUFFE-ENG")

1. Has your weight changed in the past twelve months?
0 ❑ weight has either gone up or remained unchanged
1 ❑ weight has dropped somewhat
2 ❑ weight has dropped considerably

2. Do you eat the same amount of food now as you did a year ago?
0 ❑ More or the same as previously
1 ❑ Somewhat less than previously
2 ❑ Considerably less than previously

3. What is your appetite like now?
0 ❑ Good
1 ❑ Somewhat low
2 ❑ Poor

4. Do you eat at least one cooked meal/day?
0 ❑ Yes, always
1 ❑ Often
2 ❑ Seldom

5. What sized portions do you normally eat?
0 ❑ Large or ordinary portions
1 ❑ Fairly small portions
2 ❑ Very small portions

6. Do you eat fruit or vegetables on a daily basis?
0 ❑ Yes
1 ❑ Often
2 ❑ Seldom

7. Do you have the types of food that you need at home?
0 ❑ Yes
1 ❑ Often
2 ❑ Seldom

8. Do you normally eat together with someone else?

0 ❑ Yes
1 ❑ Sometimes
2 ❑ Very seldom

9. Do you get exercise every day?

0 ❑ I exercise a lot, for example by taking walks
1 ❑ The only exercise I get is indoors
2 ❑ Mostly I just sit down or lie in bed

10. Is it difficult for you to eat because of mouth or dental problems or due to difficulties in swallowing?

0 ❑ No
1 ❑ Sometimes
2 ❑ Yes

11. How much liquid do you drink in total per day?

0 ❑ More than 5 glasses/cups per day
1 ❑ 3-5 glasses/cups per day
2 ❑ Less than 3 glasses/cups per day

12. Do you have problems eating due to diarrhoea, constipation, feeling unwell or nausea?

0 ❑ No
1 ❑ Sometimes
2 ❑ Yes, often

13. Do you need help eating?

0 ❑ No
1 ❑ Sometimes
2 ❑ Yes, often

14. How many different sorts of medicine do you take per day?

0 ❑ none
1 ❑ 1-2 different medicines /day
2 ❑ 3 or more different medicines /day

15. Is it difficult for you to eat as a result of poorer health?

0 ❑ No
1 ❑ Sometimes
2 ❑ Yes, often

PAPER I

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RESEARCH PAPER

Developing and testing the Nutritional Form For the Elderly

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Söderhamn U, Söderhamn O. *International Journal of Nursing Practice* 2001; **7**: 336–341
Developing and testing the Nutritional Form For the Elderly

Undernutrition among elderly patients is a significant problem in nursing care. The aims of this study were to develop and test an instrument for identifying actual and potential undernutrition among elderly patients in clinical nursing care. A Likert-type scale consisting of 15 items was constructed. A consecutive sample of 56 elderly patients (>65 years) in a geriatric rehabilitation ward in western Sweden were interviewed with the instrument. The data were mainly analysed with non-parametric statistical methods. The results showed that the instrument was a fairly reliable scale with a Cronbach's alpha coefficient of 0.72. Evidence of validity concerning face validity, criterion-related validity—including concurrent and predictive validity—and construct validity was shown in the study group. Further testing is required if the instrument is to be used in clinical nursing care and research.

Key words: aged, nursing, nutrition, scale-testing.

INTRODUCTION

Undernutrition among elderly patients is an important problem in clinical care.[1–3] It is, therefore, of great value that nurses and other caregivers are able to assess actual and potential undernutrition in order to be able to act accordingly.[4] As both nurses and physicians sometimes have not been adequately trained in this field, nutritional assessment of the elderly patient may be incorrectly performed or even totally neglected.[5,6] Using reliable and valid instruments in nutritional assessment of elderly patients might improve the quality of data gathered for care planning. There are some well-known instruments designed for identifying undernutrition among patients; however, some of them are not made to reflect the situation among elderly people.[3,5,7,8] Furthermore, some instruments might be difficult to handle without special nutritional training and experience (e.g. some anthropometric measurements can be hard to carry out for inexperienced staff). There is a need for simple instruments without anthropometric measures that can be used by caregivers without nutritional training for identification of undernutrition among elderly patients.

The aims of this study were to develop and test an instrument for identifying actual and potential undernutrition among elderly patients in clinical nursing care. The specific research tasks were done in order to test the reliability, validity and comprehensibility of the instrument.

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METHODS

Instrument

A new instrument, the Nutritional Form For the Elderly (NUFFE), was constructed with the purpose of obtaining a simple, clinically useful tool for use in the nutritional assessment of elderly patients. The instrument was designed as a form that contains items that reflect functional, social, nutritional and health-related aspects of nutritional intake. The following 15 items were constructed that reflected issues that, according to the research, were considered to be of importance to the nutritional status of elderly people: weight loss, changes in dietary intake, appetite, intake of cooked food, portion size, intake of fruit and vegetables, possibility to obtain food products, company at meals, activity, tooth/mouth and swallowing difficulties, fluid intake, gastrointestinal problems, help with eating, number of drugs, and health status.[3,5,7–9]

The instrument was designed as a summated 3-point ordinal scale with 15 items. For each item, there are three options that are specific for the item. The most unfavourable option gives a score of two, and the most favourable option gives a score of zero. The intermediate option gives a score of 1. The maximum score total is 30, where a higher score indicates a higher degree of undernutrition or risk for undernutrition. Examples of the items of NUFFE are displayed in Table 1.

Study group

Fifty-eight consecutively chosen patients in a geriatric rehabilitation ward in western Sweden were asked to participate in the study August–November, 1998. All subjects were hospitalized in the ward during a study period of 4 months, and subjects satisfied the following inclusion criteria: (i) >65 years of age; (ii) lucidity; (iii) ability to communicate; and (iv) informed consent. Two patients did not want to participate because of little interest in the study. Amputees were at first included in the study, but because it was difficult to compute the body mass index (BMI) and the weight index of these patients, only five individuals from this group participated. Data about background variables, including age, sex, marital status, former profession, main medical diagnosis and medication, were collected from the patients or from patient records.

Table 1 Some examples of items of the scale

Item number	Item
4	Do you eat at least one cooked meal a day?
6	Do you eat fruit or vegetables every day?
13	Do you need help when you eat?

Fifteen male and 41 female patients participated in the study. Thirty-three individuals (59%) were single. The mean age of subjects was 78 years (SD = 6.7 years). Seventy-five percent of subjects had a background as blue-collar workers, 9% were white-collar workers, 9% were housewives and 7% were professionals. The mean length of hospital stay was 27 days (SD = 13.3 days) in the rehabilitation ward. Most participants (77%) suffered from musculoskeletal diseases or injuries such as hip fractures. Patients with neurological diseases such as stroke comprised 11% of participants. The remaining participants had various medical diagnoses.

Procedure

All participants were informed about the study by the first author (US) at the beginning of their hospitalization. This author also administrated the NUFFE. Each patient was interviewed with the instrument in the ward, mostly in separate rooms from other interviewees. The interview took about 15 min, and the items were read aloud directly from the form. The total summated score was calculated for each patient.

Weight and height of all participants were measured upon admission to the ward. The weight was then recorded again after 3 weeks and when discharged. For participants who were discharged after a period shorter than 3 weeks, the second measurements were taken solely at discharge. A digital electronic wheelchair balance (Tanita BWB-620; Umedico AB, Rosersberg, Sweden) was used, and the morning weight of each patient was measured to the nearest 0.01 kg. The height of each participant was measured either with equipment that had fixed head and foot sections that was used when the patient was in a supine position in bed, or with equipment attached to the wall if the patient was standing on the floor. In both cases, the height was measured to the nearest 0.5 cm.

Serum albumin levels were used in the study if the results of these tests were available in the patients' records. The measurements that could be used were serum albumin levels at admission, after 3 weeks, and/or at discharge.

The participants were asked if they found the instrument capable of assessing nutritional status among elderly people, including themselves. Furthermore, questions were asked about how they understood the content of the items, the language used and their own assessment of their nutritional status.

Statistics

Body mass index (BMI) and weight index were calculated at admission, after 3 weeks and / or at discharge. Weight index was calculated according to Björkelund *et al*. (Method 1) and Warnold and Lundholm (Method 2), respectively.[10,11]

NUFFE was treated as an ordinal scale and mainly non-parametric statistical methods were used. However, means and standard deviations are used in the presentation of obtained NUFFE scores for various groups.

As a measure of homogeneity, Spearman's rank correlation coefficients (two-tailed probability) were computed between each item and the total scale using the method described by Streiner and Norman (i.e. the correlation of the individual item was calculated when that particular item had been omitted from the scale total).[12] Reliability as homogeneity of the scale was also estimated using Cronbach's alpha coefficient.[13] Validity was addressed as face validity and criterion-related validity, including concurrent and predictive validity, and construct validity.

Face validity of the scale was assessed by asking the participants if they found that the instrument had the capability to give a meaningful estimate of their nutritional status at four levels: (i) to a very high degree; (ii) to some degree; (iii) to a low degree; and (iv) not at all.

Criterion-related validity was assessed by computing the Spearman's rank correlation (two-tailed probability) between obtained total score and three criteria, BMI, weight index and serum albumin levels, respectively. The hypothesis was that there should be a sufficient negative correlation between each criterion and the total score on the scale.

Concurrent validity was assessed by computing Spearman's rank correlation (two-tailed probability) between the patients' own assessments of their nutritional status and obtained total scores. The hypothesis was that there should be a sufficient negative correlation between self-reported nutritional status on a 3-point ordinal scale (bad, lowered to some degree, or good) and the total score of the instrument.

Predictive validity of NUFFE was addressed by calculating the difference in total score of the instrument at admission between patients who showed a lowered nutritional status according to two objective criteria (BMI lower than 24 kg/m^2 and serum albumin level lower than 36 g/L) at discharge, and patients with normal BMI and normal serum albumin levels at discharge. The difference between the groups was tested with the Mann–Whitney *U*-test (two-tailed probability).

Construct validity of the instrument was assessed by comparing mean scores between three different groups of risk patients that were expected to have high total scores on the scale with groups that were expected to obtain low scores. The differences between the groups were tested with Mann–Whitney *U*-test (two-tailed probability). Groups that were expected to consist of risk patients were those who subjectively were assessed at admission by the first author (US) as suffering from cachexia or decubital ulcer (risk group A). Another group of risk patients consisted of participants who, in an objective assessment of nutritional status had to satisfy two criteria for being characterized as undernourished, BMI lower than 24 kg/m^2 and serum albumin level lower than 36 g/L (risk group B). A third group of risk patients were those participants who had a cancer disease (risk group C).

The data were analysed with the Statistical Package for the Social Sciences, SPSS (SPSS, Chicago, IL USA).

Ethics

This study was carried out according to the common ethical principles used in clinical research.[14] It was approved by the Research Ethics Committee of western Sweden (Medical Faculty, Gothenburg University).

RESULTS

Reliability

The reliability of the scale was reflected in the item–total score correlations displayed in Table 2. The Cronbach's alpha coefficient for the total scale was 0.72.

Validity

Face validity was reflected in the participants' views concerning the scale's capability to give a significant estimate of their nutritional status. About half of the participants (54%) found that the scale, to a very high degree, gave such an estimate, while 41% found that the scale, to some extent, gave a meaningful estimate of their nutritional status.

Table 2 Item–total score correlations (Spearman rank) $n = 56$

Item number	Item content	r_s	*P*-value
1	Weight loss	0.42	< 0.005
2	Changes in dietary intake	0.45	< 0.001
3	Appetite	0.64	< 0.001
4	Intake of cooked food	0.09	NS
5	Portion size	0.57	< 0.001
6	Intake of fruit and vegetables	0.39	< 0.005
7	Possibility to obtain food products	—	—
8	Company at meals	0.27	< 0.05
9	Activity	0.28	< 0.05
10	Tooth/mouth and swallowing difficulties	0.29	< 0.05
11	Fluid intake	0.21	NS
12	Gastrointestinal problems	0.24	NS
13	Help with eating	0.04	NS
14	Number of drugs	0.10	NS
15	Health state	0.66	< 0.001

Criterion-related validity assessed as correlations between total score and BMI, weight index and serum albumin levels, respectively, is presented in Table 3. Concurrent validity assessed as the correlation between the patients' views of their own nutritional status ($n = 56$) and the total score reached a value of $r_s = -0.72$ ($P < 0.001$).

Predictive validity of the instrument was reflected in the difference between mean total score at admission for the patients who at discharge had a normal nutritional status (mean = 8.8, SD = 4.0, $n = 46$) and those who had a lowered nutritional status (mean = 14.0, SD = 2.9, $n = 5$). The difference was significant ($P < 0.01$).

In Table 4, construct validity of the NUFFE is reflected in the comparison of obtained scores between known groups.

Patients' opinions about the instrument

Thirty-eight patients (68%) found that the NUFFE was a useful tool for assessing nutritional status among elderly people. Almost everyone (98%) declared that the content of the instrument was easy to understand and that the number of items were sufficient (93%). All participants found the language easy to understand.

Table 3 Correlations (Spearman rank) between total score and some criteria

Criterion	*n*	r_s	*P*-value
Body mass index (BMI)			
Admission	51	−0.37	< 0.01
After 3 weeks	22	−0.47	< 0.05
At discharge	50	−0.38	< 0.01
Weight index			
Method 1[a]			
Admission	51	−0.38	< 0.01
After 3 weeks	22	−0.48	< 0.05
At discharge	50	−0.40	< 0.005
Method 2[b]			
Admission	51	−0.38	< 0.01
After 3 weeks	22	−0.49	< 0.05
At discharge	50	−0.42	< 0.005
Serum albumin			
Admission	56	−0.37	< 0.01
After 3 weeks	18	−0.23	NS
At discharge	44	−0.55	< 0.001

[a] According to Björkelund *et al.*[10]

[b] According to Warnold and Lundholm.[11]

Table 4 Nutritional form for the elderly (NUFFE) scores for high-risk and low-risk groups and *P*-values

Groups with expected high scores			Groups with expected low scores			*P*-value
Group	*n*	Mean (SD)	Group	*n*	Mean (SD)	
Risk patients A (subjective assessment)	7	13.1 (2.0)	Non-risk patients A (subjective assessment)	49	8.7 (4.0)	< 0.005
Risk patients B (objective assessment)	7	13.7 (3.5)	Non-risk patients B (objective assessment)	44	8.6 (3.9)	< 0.005
Risk patients C (cancer disease)	2	18.0 (0)	Non-risk patients C (no cancer disease)	54	8.9 (3.8)	< 0.005

DISCUSSION

The aims of this study were to develop and test an instrument for identifying actual and potential undernutrition among elderly patients in clinical nursing care. As the instrument was designed as a self-report instrument, it is reasonable to expect that the experience and training of the administrator of the scale should not influence the outcome at all. The instrument consisted of 15 items and was easy to handle in the group of elderly patients that participated in the study. At first, some items did not seem to contribute to the reliability of the scale. The variation in score for those six items that did not correlate significantly with the total scale (i.e. items 4, 7, and 11–14 was small. Almost every participant indicated with item 4 (intake of cooked food) that they ate at least one cooked meal per day. All participants declared that they had the food they needed (item 7: possibility to obtain food products), which may assume that possibly all Swedish elderly people today have sufficient financial means to buy the food they need. If they cannot manage to purchase food themselves, they usually have the opportunity to get help from others, for example, the social service in the municipalities.

Many patients indicated with item 11 (fluid intake) that they drank 3–5 glasses / cups of liquid per day. Many individuals declared that they sometimes had difficulties with diarrhoea, constipation or nausea (item 12: gastrointestinal problems). A small number of patients needed help with eating (item 13), and most individuals used three or more different drugs every day (item 14).

Streiner and Norman recommend that items that do not reach an item–total score correlation of 0.20 should be deleted from the instrument in question.[12] However, secondary analysis of the above-mentioned items shows that discarding them does not alter the Cronbach's alpha reliability coefficient significantly (0–0.04).

Face validity of the NUFFE must be considered to be high because approximately 95% of the participants found that the instrument, to some degree, reflected their nutritional status.

The three criteria used in assessing the criterion-related validity of the scale, that is, the BMI, weight index and serum albumin level, were all useful as validation variables. Although different methods were used, correlations and *P*-values were quite similar for these different methods.

Total scores among the participants in this study suggest that a total score over 13 might indicate undernutrition. Eleven individuals had a total score over 13 at admission. Mean score in the study group ($n = 56$) was 9.2 (SD = 4.1) and median score was 9.0.

In conclusion, the results of this study showed that the NUFFE was a fairly reliable instrument for group-level comparisons. Evidence of validity concerning face validity, criterion-related validity— including concurrent and predictive validity—and construct validity was shown in the study group. However, further testing is required if the instrument is to be used in clinical nursing care and research.

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PAPER II

METHODOLOGICAL ISSUES IN NURSING RESEARCH

Reliability and validity of the nutritional form for the elderly (NUFFE)

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Reliability and validity of the nutritional form for the elderly (NUFFE)

Aim. The aim of this study was to test the reliability and validity of the Nutritional Form for the Elderly (NUFFE).

Background. The prevalence of undernutrition among older people in nursing homes and hospitals reaches high levels. Assessment of older patients' nutritional status is an important task for nurses in clinical care. To use a simple nutritional assessment instrument for older people is one approach for nurses. Examples of such instruments are the well validated Mini Nutritional Assessment (MNA) and the newly developed NUFFE.

Methods. A total of 114 consecutively chosen, newly admitted older patients in an elder care rehabilitation ward in western Sweden were interviewed using the NUFFE and MNA. Arm and calf circumferences, body mass index (BMI), and presence of pressure sores and skin ulcers were noted as part of the MNA on admission. Weight was monitored and BMI calculated on discharge. Serum albumin levels on admission and discharge were used if these were available in the records. Reliability of the NUFFE was measured as homogeneity. Criterion related validity, concurrent validity, construct validity, and predictive validity were assessed with different statistical methods. The regional research ethics committee approved the study.

Results. The results showed that the NUFFE is a fairly reliable and valid instrument for identifying actual and potential undernutrition among older patients.

Conclusion. The NUFFE is a simple tool for nurses to use to assess older patients with the aim of detecting undernourished individuals and those at risk for undernutrition. When doing a nutritional assessment with the NUFFE, the BMI ought also to be calculated. The assessment could also be combined with food intake recording for a period of time.

Keywords: care of older people, nutritional assessment, scale testing, undernutrition

Introduction

Assessment of older people's nutritional status is an important task for nurses in clinical care, because the prevalence of undernutrition among older patients in nursing home and hospitals reaches high levels, 30–60% (Guigoz *et al.* 1996). In a Swedish study, 28·5% of a study group consisting of aged hospitalized patients ($n = 501$), newly admitted to long-term medical care, were undernourished (Larsson *et al.* 1990). Furthermore, in a more recent study among older Swedish

people ($n = 261$), who were newly admitted to a community residential home, 33% were assessed to have undernutrition (Christensson *et al.* 1999). In another study with 57 old women acutely admitted to a Swedish university hospital with hip fracture, 15 (27%) were found to be underweight (Bachrach-Lindström & Unosson 1999).

Ageing is a complex phenomenon including physiological and psychological changes linked to social conditions. The physiological changes of ageing may also affect nutritional needs, and older people may be at increased risk of nutritional deficiencies because they cannot meet certain nutrient needs (Guigoz *et al.* 1996). Both protein-energy undernutrition and specific nutrient deficiencies are common in newly admitted and hospitalized aged patients (Unosson *et al.* 1992). Undernutrition is associated with high morbidity and mortality, as well as poor quality of life. Early detection of undernutrition is, therefore, important, and risk of undernutrition must be identified when older patients are admitted to hospital care (Guigoz *et al.* 1996). However, undernutrition in hospital patients has been underrecognized, and strategies for management have been underutilized (Tierney 1996). An assessment of nutritional status should be integrated as a standard procedure in order to prevent and treat undernutrition.

It is also of great importance that the nursing staff knows how to assess nutritional status (Christensson *et al.* 1999). Nurses are in an ideal strategic position to assess patients, and training improves detection skills (Tierney 1996). The nutritional status of hospitalized patients can be assessed by a variety of methods, for example objective anthropometric measurements, laboratory test results and clinical assessments with help of the medical history and physical examination (Detsky *et al.* 1987). To use a simple nutritional assessment instrument for older people is one approach. However, such instruments should be used in conjunction with a degree of clinical judgement in order to obtain valid assessments of patients (Lyne & Prowse 1999). Examples of such instruments are the Mini Nutritional Assessment (MNA) (Guigoz *et al.* 1996) and the newly developed Nutritional Form for the Elderly (NUFFE) (Söderhamn & Söderhamn 2001). In order to perform good clinical assessments of patients, the instruments must show a high degree of reliability and validity.

The study

Aim

The aim of this study was to test reliability and validity of the NUFFE.

Methods

Study group

A total of 114 consecutive newly admitted patients in an elder care rehabilitation ward in western Sweden were included in the study during a period of 9 months. The study was carried out during the autumn of 1999 and spring of 2000. All patients who were asked to join the study group and satisfied the inclusion criteria agreed to participate. These criteria were: 65+ years of age, being lucid, having the ability to communicate and the strength to carry through an interview, and informed consent. Amputees were excluded.

Data collection

The patients were interviewed at the beginning of their hospitalization by the first author (US) with the NUFFE and MNA. The interview took about 30 min, including arm and calf circumference measures (mid-arm circumference, MAC; calf circumference, CC). These measures were performed on the nondominant arm and leg unless this arm or leg was paralysed. A tape-measure was used for the circumferences. Arm circumferences were measured at the mid-point of the arm between the tips of the acromion process and the olecranon process. Weight and height were measured when the patients were admitted to the ward. A digital electronic wheel-chair balance (Tanita BWB-620, Umedico AB, Rosersberg, Sweden) was used and the morning weight was measured to the nearest 0·01 kg. Height was measured with measuring equipment consisting of a linear scale attached to the wall. If the patient was not able to stand up, measuring equipment with a fixed head and foot part was used in a supine position in bed. In both cases, the height was measured to the nearest 0·5 cm. Body Mass Index (BMI) was calculated on admission. Arm and calf circumferences and BMI were parts of the MNA. Weight was monitored and BMI also calculated on discharge. Presence of pressure sores and skin ulcers was noted as a part of the MNA.

Serum albumin levels on admission and discharge were used in the study, if the results were available in the records.

Background variables – sex, marital status, former profession, main medical diagnosis, type of dwelling, and admission from home or emergency care unit – were recorded.

The instruments

The NUFFE is a new, simple, self-report tool for nutritional assessment of older patients. It is simple because it lacks anthropometric measures, which can be hard to carry out for inexperienced staff. The instrument is a summated three-point ordinal scale with 15 items. It involves dietary history (two questions about weight loss and changes in dietary

intake), dietary assessment (nine questions related to appetite, food and fluid intake and eating difficulties), and general assessment (four questions about possibility of obtaining food products, company at meals, activity, and number of drugs). Each item ranges between zero and two. The most favourable option gives a score of zero (0) and the most unfavourable a score of two (2). The intermediate option gives a score of one (1). Maximum score total is 30, where a higher score indicates a higher degree of undernutrition or risk for undernutrition. The original version of the instrument is in the Swedish language (Söderhamn & Söderhamn 2001).

Reliability and validity of the NUFFE have been tested in one earlier study in Sweden with 56 older rehabilitation patients. Reliability was measured as homogeneity with the Cronbach's α coefficient and as item to total score correlations. The results of the study showed that the NUFFE was a fairly reliable instrument (Cronbach's α coefficient 0·72) for group level comparisons. Evidence of validity (face validity, criterion related validity, including concurrent and predictive validity, and construct validity) was shown in the study group (Söderhamn & Söderhamn 2001).

In the present study, the NUFFE was validated against the MNA, which was developed in France and may be considered a rapid and simple tool for evaluating the nutritional status of frail older people. The MNA is composed of 18 items and involves anthropometric assessment (weight, height, arm and calf circumferences and weight loss), general assessment (six questions related to lifestyle, medication and mobility), dietary assessment (eight questions related to number of meals, food and fluid intake and autonomy in feeding), and subjective assessment (self-perception of health and nutrition). The scoring (maximum score is 30 points) categorizes the subject as wellnourished (24–30 points), at risk for undernutrition (17–23·5 points) or undernourished (<17 points) (Guigoz *et al.* 1996).

Validation of the MNA has been carried out in three studies with more than a total of 600 older people. In a developmental study, in Toulouse, France, with 105 frail older individuals and 50 healthy elders, the MNA was validated by using two criteria: clinical status and a comprehensive nutritional assessment of each patient. Clinical status consisted of a nutritional assessment performed independently by two physicians trained in nutrition without knowledge of the MNA results. Comprehensive nutrition assessment included measurement of anthropometric markers, evaluation of dietary intake and measurement of nutrition biochemistry markers. Clinical status was compared with biochemistry and anthropometry. The results showed that the MNA identically classified 92% of the subjects with their clinical status and 98% with the comprehensive nutritional assessment. The results also indicated that the MNA without biochemical indices could assess nutritional status. Another validation study was carried out with 120 frail elders in order to determine the discriminatory potential of the MNA and to classify the subjects into categories on a 30-point scale. Together with the MNA, clinical status, autonomy evaluation with an ADL scale, biochemical markers, and functional evaluation with grip strength were included in the study. The MNA classified 89% of the subjects identically to clinical status without biochemical indices and 88% with biochemical indices. The classification potential of the MNA was assessed by cross-classification of the subjects in the two studies. In the first study 72% were classified correctly (i.e. as wellnourished or undernourished) and in the second study 78% (Guigoz *et al.* 1996).

Statistics

Reliability was estimated as homogeneity by calculating the Spearman rank correlation between each item and scale total of the NUFFE. Correlation with the individual item was calculated when that particular item was omitted from the scale total (Streiner & Norman 1995). Homogeneity was also assessed with the Cronbach's α coefficient (Polit & Hungler 1999).

Criterion related validity of the NUFFE was assessed by using Spearman rank correlations between scale total of the NUFFE and three criteria – BMI, MAC and CC. Criterion related validity was also assessed as concurrent validity and computed as the Spearman rank correlation between scale total for the NUFFE and MNA.

Construct validity was assessed by comparing mean scores on the NUFFE on admission between patients with BMI lower than 24 kg/m^2 and those with higher BMI. Mean NUFFE scores were also compared between patients with pressure sores or other skin ulcers and those with no pressure sores or skin ulcers. Differences between the groups were tested with Mann–Whitney *U*-test (two-tailed probability). Construct validity was also estimated with factor analysis in a principal component analysis with varimax rotation.

Predictive validity was assessed by estimating the difference in total score on the NUFFE on admission between patients who at discharge had BMI lower than 24 kg/m^2 and serum albumin levels lower than 36 g/L and those with higher BMI and serum albumin levels. The difference between the groups was tested with Mann–Whitney *U*-test (two-tailed probability).

Ethics

Individual patients gave their oral consent when having read the patient information sheet. The Research Ethics

Committee of western Sweden (Medical Faculty, Göteborg University) approved the study. It was carried out according to common ethical principles used in human research (Polit & Hungler 1999).

Results

Forty-two men and 72 women participated in the study. Their ages ranged between 65 and 92 years of age. Mean age was 78·0 years (**SD** = 6·3). Ninety-four individuals (82·5%) were admitted to the rehabilitation ward from emergency care units in the hospital and 20 (17·5%) from their own homes. Mean length of hospitalization in the rehabilitation ward was 25·2 days (**SD** = 15·1), ranging from 6 to 77 days. The most frequent medical diagnoses among the participants were musculoskeletal diseases (53·5%), stroke (16·7%), and heart diseases (9·6%). One hundred and nine individuals lived in their own dwelling, one was living in a nursing home and four in residential homes. Forty-three (37·7%) were married, 20 (18·4%) not married and 50 (43·9%) widows or widowers. Ten (8·8%) were former professionals, 17 (14·9%) white-collar workers, 81 (71·1%) blue-collar workers, and six (5·3%) were housewives.

Reliability

The homogeneity of the NUFFE, measured as item to total score correlations, is displayed in Table 1. All items except 4, 8, 9, 13, and 14 were homogeneous in relation to the total scale. Cronbach's α coefficient was 0·70.

Table 1 Item–total score correlation (Spearman rank) for NUFFE ($n = 114$)

Item no.	Item content	r_s	*P*-value
1	Weight loss	0·31	0·001
2	Changes in dietary intake	0·56	0·000
3	Appetite	0·51	0·000
4	Intake of cooked food	0·06	0·563
5	Portion size	0·48	0·000
6	Intake of fruit and vegetables	0·26	0·005
7	Possibility of obtaining food products	0·20	0·032
8	Company at meals	0·10	0·309
9	Activity	0·12	0·210
10	Tooth/mouth and swallowing difficulties	0·25	0·008
11	Fluid intake	0·20	0·036
12	Gastrointestinal problems	0·40	0·000
13	Help with eating	0·09	0·329
14	Number of drugs	0·16	0·098
15	Health state	0·48	0·000

Table 2 Correlation (Spearman rank) between total score on the NUFFE and some criteria

Criterion	*n*	r_s	*P*-value
BMI			
Admission	114	−0·25	0·008
Discharge	112	−0·23	0·014
MAC			
Admission	114	−0·23	0·014
CC			
Admission	114	−0·25	0·008

Validity

Criterion related validity of the NUFFE, assessed as correlations between total score on the NUFFE and BMI (on admission and discharge), MAC (on admission), and CC (on admission), respectively, is shown in Table 2. All correlations were significant.

Criterion related validity on the NUFFE, assessed as concurrent validity and estimated as the Spearman rank correlation between the NUFFE and MNA reached a value of $r_s = -0{\cdot}74$ ($P = 0{\cdot}000$).

Construct validity of the NUFFE, calculated as obtained NUFFE scores for patients with BMI lower than 24 kg/m^2 and those with pressure sores or skin ulcers is shown in Table 3. Significant differences were found between the groups with expected high scores and those with expected low scores.

Construct validity estimated with factor analysis is displayed in Table 4. A six factor solution explained 64·9% of the variance. The Cronbach's α coefficient for Factor 1 was 0·76, for Factor 2, 0·48, for Factor 4, 0·04, and for Factor 5, 0·40. Alpha coefficients for the other two factors were not possible to compute.

Predictive validity, estimated as the difference in mean NUFFE score (M) on admission between patients who on discharge had low nutritional status ($M = 11{\cdot}0$, **SD** = 4·5) and those who had satisfying nutritional status ($M = 8{\cdot}1$, **SD** = 3·9) according to the criteria, reached a significant level ($P = 0{\cdot}019$).

Discussion

There is no simple, single diagnostic test of undernutrition, but there is agreement on the need for a combination of clinical and dietary assessment, anthropometric measurements and laboratory tests (Tierney 1996). The NUFFE has been developed in order to obtain a simple, clinically useful tool to help nurses to perform nutritional assessment of older patients. The items of the NUFFE reflect the issues that,

Table 3 Comparison of NUFFE scores for known groups (BMI and pressure sores/skin ulcers)

Groups with expected high scores			Groups with expected low scores			
Group	*n*	*M* (SD)	Group	*n*	*M* (SD)	*P*-value*
BMI <24 kg/m^2	40	9·7 (4·4)	BMI = 24 + kg/m^2	74	7·7 (3·7)	0·017
Pressure sores/skin ulcers	21	10·2 (3·9)	No pressure sores/no skin ulcers	93	8·0 (4·0)	0·005

*Mann–Whitney *U*-test.

Table 4 Principal component analysis of NUFFE ($n = 114$)

Items		Factor 1 Nutritional decline	Factor 2 Intake	Factor 3 Meal	Factor 4 Wellness	Factor 5 Daily habits	Factor 6 Ease	Communality h^2
1	Weight loss	0·486			0·470			0·573
2	Changes in dietary intake	0·761						0·671
3	Appetite	0·756						0·604
4	Intake of cooked food			0·861				0·781
5	Portion size	0·770						0·640
6	Intake of fruit and vegetables		0·563	0·497				0·734
7	Possibility of obtaining food products		0·871					0·778
8	Company at meals						0·870	0·780
9	Activity					0·858		0·813
10	Tooth/mouth swallowing difficulties				−0·423		0·405	0·500
11	Fluid intake					0·645		0·632
12	Gastro-intestinal problems	0·481	0·538					0·559
13	Help with eating				−0·601			0·490
14	Number of drugs				0·693			0·574
15	Health state	0·717						0·612

Only factor loadings with an absolute value > 0·400 are displayed in the table.

according to the literature, were considered to be of importance for the nutritional status of older people (Söderhamn & Söderhamn 2001).

Methods

The anthropometric measurements in the present study were MAC, CC, weight, height and BMI, which all are parts of the the MNA. Weight is not a definitive measure of undernutrition, but it is an indicator, and serial measurement over time provides evidence of deterioration or improvement. BMI between 19 and 25 kg/m^2 as a reflection of 'ideal body weight' has limited application to older people, because they are derived from measures based on younger adults (Tierney 1996). It is well known that BMI in the range of 20–25 kg/m^2 is not applicable to older people (Bachrach-Lindström 2000). Height and weight have increased in both middle-aged and older men and women in the 1990s in comparison with data from the 1970s. However, weight has increased more than height. This results in an increase in mean BMI. Mean BMI for Swedish people with the same mean age as the patients in this study has been found to be 25·6 kg/m^2 for males and 26·2 kg/m^2 for females (Björkelund *et al*. 1997). Using a cut-off value for undernutrition at 24 kg/m^2 among Swedish older people could be justified according to other researchers when taking these BMI values into account (Bachrach-Lindström 2000).

BMI by itself is not a sensitive indicator of undernutrition. It can be normal for some people to weigh less than what is usual for their height (McWhirter & Pennington 1994). It is routine practice to measure weight and height on admission. These measurements are easy to take. Serum albumin was formerly a standard measure in practice and research in the assessment of undernutrition. However, today it is more controversial, because low albumin values can have many other causes in ill older people (Tierney 1996). Albumin concentrations respond slowly to protein restriction and are more a reflection of the illness than of nutrient intake (McWhirter & Pennington 1994).

Results

The study group was fairly homogeneous concerning medical diagnoses, with about half of the participants having musculoskeletal diseases.

Five items on the NUFFE (items 4, 8, 9, 13, 14) did not correlate significantly in relation to the total scale, because there was little variation in the responses. Most of the participants answered that they ate at least one meal with cooked food per day (item 4). That 20 individuals were not married, and 50 were widows or widowers may explain why they did not often have company at meals (item 8). Since the main diagnosis was musculoskeletal diseases, it is reasonable that many patients did not take walks frequently (item 9). Only a few patients needed help with eating (item 13). Most used three or more different drugs per day (item 14). With these items excluded, the Cronbach's α coefficient would reach a value of 0·75. Items 4, 13 and 14 did not show significant item to total score correlations in the previous study (Söderhamn & Söderhamn 2001), which could be explained in the same way as above.

Anthropometric measures are common parameters for assessing nutritional status (Tierney 1996), and the criteria – BMI, MAC and CC – were used to assess criterion related validity of the NUFFE. The results showed significant correlations between total score on the NUFFE and the criteria, which support criterion related validity of the instrument.

A strong indication of concurrent validity was reflected in the high negative, significant Spearman rank correlation between the NUFFE and the well validated MNA (Guigoz *et al.* 1996). However, there are a few obvious differences between the two instruments. In contrast to the NUFFE, the MNA contains items on anthropometric measures, independent living, suffering from psychological stress or acute disease, neuropsychological problems, and presence of pressure sores or skin ulcers. Both instruments contain items for dietary and general assessment (Guigoz *et al.* 1996, Söderhamn & Söderhamn 2001).

To assess construct validity of the NUFFE, two groups were investigated: patients with BMI lower than 24 kg/m^2 and those with pressure sores or skin ulcers. This BMI value was chosen because it is well known that it is normal for older people to have higher BMI than younger individuals (Björkelund *et al.* 1997). The same value was also used in the earlier study (Söderhamn & Söderhamn 2001). Furthermore, patients with pressure sores and skin ulcers were chosen, because undernutrition has been identified as a risk factor associated with pressure sores (Tierney 1996). The result obtained supports construct validity of the NUFFE.

Construct validity was also estimated by factor analysis. This showed a number of important indicators of undernutrition or risk of undernutrition. Factor 1 is always the most important factor. According to the literature, Factor 1 (nutritional decline) contains important issues for nutritional assessment (cf. Detsky *et al.* 1987, Tierney 1996). In this study group, Factor 1 could be used as a separate scale with a Cronbach's α coefficient of 0·76. Moreover, secondary analysis showed that Factor 1 appeared to have a high Spearman rank correlation with the MNA ($r_s = -0{\cdot}69$, $P = 0{\cdot}000$). However, the correlation was lower than for the total NUFFE scale. Three of the factors (Factors 2, 4, and 5) showed low Cronbach's α coefficients because only a few items loaded on them. The other two factors (Factors 3 and 6) each contained only one item.

The NUFFE could separate patients who were at risk for undernutrition from those who were not, when a combination of the criteria BMI lower than 24 kg/m^2 and serum albumin level lower than 36 g/L was used and the assessments on admission and discharge were compared with each other. This supports predictive validity of the instrument.

It may be suggested that a total NUFFE score greater than 11 indicates undernutrition in the study group. Twenty-five individuals had a total score greater than 11. Their mean MNA score was 16·1 (**SD** = 2·8) which corresponds with undernutrition for that instrument (Guigoz *et al.* 1996). Mean NUFFE score in the total study group ($n = 114$) was 8·4 (**SD** = 4·0) and median score 8·0.

It is important for nurses to have knowledge about risk factors in connection with undernutrition and be able to detect older patients who are undernourished or at risk for undernutrition. The assessment should at least take place at the beginning of the care episode. The NUFFE can be used in the nursing assessment in the beginning of the hospital stay and when the patient has been discharged and a new care period has started at home or in residential living. Together with the NUFFE, height ought to be measured and weight monitored so that BMI could be calculated. Assessment with the NUFFE could also be combined with food intake recording on a number of days. However, dietary data are prone to inaccuracy and are also time-consuming to collect (Tierney 1996).

Early detection of actual or potential undernutrition is of great importance so that treatment with nutritional support can be started. The possibility for nurses to work in a team, for example with dieticians and physicians, must also not be forgotten.

There are difficulties in validating instruments of this kind described in the nursing literature. Lyne and Prowse (1999) highlight the confusion concerning the use of nutritional terms. However, in our study, the term nutritional status has been used to indicate the result of an assessment based on different factors in combination, for example anthropometric measures and serum albumin. Risk of nutritional compromise may be difficult to assess with some instruments, as a few authors do not distinguish between nutritional status and

nutritional risk. In the present study, this distinction has, however, been clarified to some degree. Risk of nutritional compromise measured by the NUFFE was reflected in the assessment of its predictive validity. More studies are, however, needed to confirm these results.

Nutrition is a part of self-care, and self-care and health are linked to each other. According to Orem (1995), self-care is a human regulatory function that must be learned and deliberately performed continuously over time. One crucial self-care requisite is to maintain sufficient food and water intake in order to keep human functioning within norms compatible with life and health. Nurses should develop their ability to identify and conceptualize specific self-care requisites and therapeutic self-care demand.

An individual's self-care demand cannot be known until it is calculated (Orem 1995), and it is necessary for nurses to use reliable and valid methods in the nutritional assessment of older people. Furthermore, nurses have an important task in giving patients advice and education aimed at preventing undernutrition and encouraging healthy eating. Good diet has a role to play in maintaining health in old age (Tierney 1996).

Conclusion

This study has shown that the NUFFE is a fairly reliable and valid instrument for identifying actual and potential undernutrition among older patients. The instrument is a simple tool for nurses to highlight patients who are undernourished or at risk for undernutrition. It has been developed in the Scandinavian cultural context and should, at present, primarily be used there. However, validating instruments is an ongoing task, and further studies of the NUFFE are needed. Nursing assessment tools are relatively scarce in the Nordic countries and development and testing of such instruments must be considered an important contribution to the development of nursing.

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PAPER III

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Nutritional screening and perceived health in a group of geriatric rehabilitation patients

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ABSTRACT

Aims and objectives: 1) To perform a nutritional screening using the Nutritional Form For the Elderly and relate the results to perceived health in a group of geriatric rehabilitation patients and 2) to compare the screening results and nurses' nutritional notes in the nursing documentation.
Background: Undernutrition is an under-recognized problem among older patients. Using a screening instrument is a way to detect patients at risk for undernutrition.
Design: A cross-sectional study conducted in Sweden.
Methods: A sample of 147 geriatric rehabilitation patients was consecutively included and was interviewed with the screening instrument, questions about background variables, perceived health and health-related issues. Higher screening scores indicate higher risk for undernutrition. Parametric and non-parametric statistical tests were used. When nurses' nutritional notes in the nursing documentation

were corresponding to the content in any of the response alternatives for each screening item, the notes were marked as existent.

Results: The screening results showed that 55% of the patients were at medium risk and 14% at high risk for undernutrition. Patients in perceived ill health had higher screening scores than those in perceived good health. Associations were also found between receiving help, perceiving helplessness, not being active and not feeling satisfied and higher screening scores. The content of nine out of 15 items in the instrument was mentioned in a number of nursing records.

Conclusions: The prevalence of older patients at medium or high risk for undernutrition was high. To be at high risk for undernutrition was associated with perceived ill health. Nurses' nutritional notes in the nursing documentation showed deficiencies, indicating that all patients at medium or high risk for undernutrition were not identified.

Relevance to clinical practice: The results suggest that nurses need a screening instrument in order to highlight older nutritional at-risk patients in need of further awareness and investigation.

Key words: nurses, nursing, nutritional risk, older people, patients, undernutrition

INTRODUCTION

Undernutrition is a common but under-recognized problem among older patients (Clarke *et al.* 1998, Elia *et al.* 2005) that is characterized by insufficient dietary intake, poor appetite, muscle wasting and weight loss (Chen *et al.* 2001). Several studies have confirmed a high prevalence of undernutrition among older patients in hospital care. For example, Christensson *et al.* (1999) showed a prevalence of undernutrition in 43% of residents at municipal care facilities who had recently come from hospital care. In another study, Dormenval *et al.* (1998) reported similar figures in recently hospitalized older persons. Studies show that undernutrition among older patients has been (Larsson *et al.* 1990, Ek *et al.* 1996), and still is, a considerable problem (Bachrach-Lindström *et al.* 2001), and many patients at risk for undernutrition are not identified (Rasmussen *et al.* 2004).

According to Joosten *et al.* (1999) there are no standard diagnostic criteria for defining nutritional status in older hospitalized patients. Because methods vary in different studies, the frequency of undernutrition varies as well. Common objective diagnostic criteria are biochemical and anthropometric parameters, but different reference data are used for anthropometric measurements. Subjective nutritional assessment tools in order to identifying undernutrition among older patients are also common, for example the Mini Nutritional Assessment (MNA) (Guigoz *et al.* 1996) and the Subjective Global Assessment (SGA) (Detsky *et al.* 1987). This difference of methods and reference data will be accompanied by difficulties to compare results and conclude for clinical practice (Joosten *et al.* 1999).

The prevalence of undernutrition among older patients in hospital care is substantial regardless of which criteria are used (Joosten *et al.* 1999). It is of great significance, and a challenge for nursing staff, to detect patients at risk for undernutrition or suffering from undernutrition. However, there are difficulties in identifying and highlighting these patients. Kowanko *et al.*

(1999) showed in a study that most nurses were aware that they lacked the knowledge and skills needed to recognize and assess nutritionally vulnerable patients. Even if they had knowledge about risk factors and signs of undernutrition, this knowledge was not used consistently in practice.

The nutritional assessment in the geriatric admission assessment is of considerable importance, but nursing staff needs tools that facilitate their performance of a nutritional assessment. The use of a screening tool for detection of signs of undernutrition or risk for undernutrition in older patients should be a routine at the hospital admission for identifying risk patients (Gariballa & Sinclair 1998) who need more awareness and further investigation (Weekes *et al.* 2004). Moreover, an introduction of a nutrition screening instrument can improve the nursing-related documentation (Jordan *et al.* 2003). However, a screening instrument has to show evidence of reliability and validity. Furthermore, it needs also to be tolerable for the patients, easy and quick to administer and not time-consuming for the staff (Elia *et al.* 2005, Green & Watson 2005). A screening instrument also has to be able to cover and complete the screening for so many patients as possible. When anthropometry is integrated in the instrument, it can be hard to perform the screening for all staff in all patients (Weekes *et al.* 2004), because the staff has to be trained in order to minimize errors. It can also be difficult to perform anthropometrical measurements in non-ambulatory and disabled older people (Eveleth *et al.* 1998, Omran & Morley 2000). The Nutritional Form For the Elderly (NUFFE) is especially developed to be a simple clinical screening instrument. The items reflect nutritional issues that are important in order to highlight older patients at risk (Söderhamn & Söderhamn 2001, 2002).

In the geriatric rehabilitation care, older patients' nutritional status has an impact on the outcome of the rehabilitation. Undernutrition reduces the patients' ability to take an active part in their own rehabilitation (Westergren *et al.* 2001), since undernutrition is associated with low energy (Westergren *et al.* 2002) and physical disability (Clarke *et al.* 1998). These factors seem to contribute to an altered level of perceived health (Chen *et al.* 2001), and perceived health problems have been shown to be important in detecting older persons at risk for undernutrition (Christensson *et al.* 2002, 2003). Therefore, using a screening instrument ought to be a way to identify older nutritional at-risk patients and also patients who perceive themselves as being in ill health.

AIMS

The aim of this study was to perform a nutritional screening using NUFFE and relate the results to perceived health in a group of geriatric rehabilitation patients. A further aim was to compare the screening results and nurses' nutritional notes in the nursing documentation.

METHODS

This cross sectional study was carried out in a geriatric rehabilitation hospital ward in western Sweden during a period of about 24 months, from the end of August 2002 to the turn of the year 2004/2005 with pauses during two summer months in 2003 and 2004. The ward was chosen because a variety of medical diagnoses were present among the patients. The inclusion criteria were: 65+ years of age and having ability to communicate and co-operate in an interview. Individuals who were excluded were patients who were amputees, had bandages or plaster casts that could not be removed, received enteral or parenteral nutrition, suffered from loss of vision (not able to read) or hearing, were not able to give details about their current situation and, finally, those patients (n=9) who were cared for by the first author (US). Readmitted patients who had earlier been included in the study were also excluded.

Sample

One hundred sixty three consecutively older rehabilitation patients were asked to participate in the study. Sixteen patients did not wish to participate due to lack of interest, and the remaining 147 (90%) patients were included.

Data collection

The patients were interviewed during their two first weeks in the geriatric rehabilitation ward by the first author (US), using the NUFFE instrument (Söderhamn & Söderhamn 2001, 2002), a question about perceived health, five questions related to health and background variables such as age and sex. The question about perceived health and the health-related questions (receiving help regularly from another person in order to manage daily life, having close contacts with other people, perceived helplessness, being active and feeling satisfied with life) could be answered with yes or no. Main medical diagnoses were collected from the patient records. Height and weight were measured at admission to the ward. Height was measured, using equipment attached to the wall, to the nearest 0.5 cm. Patients who could not stand upright were measured in bed using equipment with adjustable foot and head parts. Weight was measured to the nearest 0.01 kg in the morning before breakfast using a digital electronic wheelchair (Tanita BWB-620, Umedico AB, Rosersberg, Sweden). The patients had only light clothes on and were without shoes. Body Mass Index, BMI (kg/m^2), was calculated. The existing nursing documentation (admission notes and daily notes) in the electronic patient record regarding nutritional issues, which was recorded until the interview took place, was printed out by the first author (US) and coded with the same number as the interview. The patients' and nurses' names could not be identified.

The used screening instrument NUFFE

The nutritional screening instrument NUFFE is a summated ordinal scale with 15 three-point items reflecting dietary history (weight loss, changes in dietary intake), dietary assessment

(appetite, food and fluid intake, eating difficulties), and general assessment (possibility of obtaining food products, company at meals, activity and number of medications). Each item ranges between zero and two. The most favourable option gives a score of zero, the most unfavourable option a score of two, and the intermediate option a score of one. Maximum score total is 30. A higher score indicates higher risk for undernutrition (Söderhamn & Söderhamn 2001, 2002).

A secondary analysis of the data in an earlier study (Söderhamn & Söderhamn 2002), regarding sensitivity, specificity and positive predictive value according to Fletcher and Fletcher (2005), showed that the cut-off point for being at medium risk for undernutrition (sensitivity 71%, specificity 86% and positive predictive value 97%) was a NUFFE score ≥6 when the MNA scores ≤23.5, indicating risk for undernutrition, were used as a standard. The cut-off point for being at high risk for undernutrition (sensitivity 70%, specificity 98% and positive predictive value 88%) was a NUFFE score ≥13 when MNA scores <17, indicating undernutrition, were used as a standard (Guigoz *et al.* 1996, Söderhamn & Söderhamn 2002).

NUFFE has been tested concerning reliability and validity in two earlier studies, where it was shown to be a fairly reliable instrument with obtained values of the Cronbach's alpha coefficient of 0.72 and 0.70, respectively (Söderhamn & Söderhamn 2001, 2002). Validity was confirmed through statistically significant correlations between NUFFE and certain criteria, i.e. BMI, mid-arm circumference, calf circumference, and total scores of MNA. The Spearman rank correlation coefficient between NUFFE and MNA reached a level of –0.74 (Söderhamn & Söderhamn 2002). It was shown in the two studies (n=56, n=114) that NUFFE could identify patients at risk for undernutrition (Söderhamn & Söderhamn 2001, 2002).

Ethical considerations

Each patient, who fulfilled the inclusion criteria, received oral and written information about the study, and afterwards gave his or her consent to participate. The study was approved by the Research Ethics Committee of western Sweden (Medical Faculty, Göteborg University, Ö 527-01).

Data analysis

All data were treated confidentially and were computer analysed with SPSS® for Windows, version 13.0. Statistical significance was defined as a p-value <0.05.

Since no statistically significant differences were found between males and females, regarding NUFFE scores, they were treated as one group. For identifying patients at medium risk and patients at high risk for undernutrition, the cut-off points for NUFFE scores were set to ≥6 and ≥13, respectively. BMI was calculated and the cut-off point <24 kg/m^2 for identifying at-risk patients was used (Beck & Ovesen 1998).

Means and standard deviations (SD) were used to describe interval data and medians and inter-quartile ranges to describe ordinal data. Differences concerning age and BMI between participants and non-participants were tested with Student's *t*-test for unpaired data (two-tailed significance). To test differences between groups with BMI≥24 kg/m^2 and BMI<24 kg/m^2, with perceived good and ill health and with perceived helplessness and no helplessness, respectively, concerning NUFFE scores, Mann-Whitney *U*-test (two-tailed significance) was used. Chi-square test with Yates' continuity correction (two-tailed significance) (Altman 1999, p. 252) or Fisher's exact test were used regarding differences between health-related variables and background variables.

One-way ANOVA with Bonferroni post-hoc test was used to test differences concerning age and BMI between the three groups at low risk for undernutrition (NUFFE scores <6), at medium risk for undernutrition (NUFFE scores 6–12) and at high risk for undernutrition (NUFFE scores ≥13). Chi-square test was used for testing differences between these three groups regarding nominal data. In order to identify between which groups (between low and medium risk, between low and high risk and between medium and high risk) the differences were to find, chi-square test or Fisher's exact test were used. Multiple comparisons were adjusted with the Bonferroni method (Altman 1999, p. 211).

To compare the screening results of the interviews with NUFFE and the collected nursing documentation for each patient, the nurses' nutritional notes were read and scrutinized. When notes were identified as corresponding to any of the response alternatives for each NUFFE item, the notes were marked as existent.

RESULTS

Mean age in the study group (n=147) was 77.0 years (SD 6.1). However, the non-participants were older, with a mean age of 80.9 years (SD 6.1) compared to the participants (p=0.017). The ages of the participants ranged between 65 years and 91 years. There were no differences found between participants and non-participants concerning sex or BMI. Background variables in the study group are displayed in Table 1.

Nutritional screening and perceived health

Median NUFFE scores in the study group were 7 (inter-quartile range 5-11). Forty six patients (31%) were identified with a NUFFE score <6, indicating to be at low risk for undernutrition. Eighty one patients (55%) scored between 6 and 12, indicating to be at medium risk for undernutrition, and 20 (14%) scored ≥13, indicating to be at high risk for undernutrition. These three nutritional at-risk groups are displayed in Table 2 in relation to some background variables, BMI, perceived health and health related variables.

Sixty one (41%) patients had a BMI<24 kg/m^2. Median NUFFE score for patients with BMI≥24 kg/m^2 (n=86, 59%) was 6 (inter-quartile range 5-10) and 8 (inter-quartile range 6-

12.5) for those with BMI<24 kg/m^2 (p=0.028). Patients who had higher BMI values (≥24 kg/m^2) felt satisfaction with life compared to those with lower BMI (<24 kg/m^2), who were not satisfied with life (p=0.006).

An association between risk for undernutrition and perceived ill health was shown (cf. Table 2). Patients who perceived ill health (n=87, 59%) had median NUFFE score 8 (inter-quartile range 6-11) and patients who perceived good health (n=60, 41%) had median NUFFE score 6 (inter-quartile range 4-9.75) (p=0.011). The patients in perceived ill health were also at greater risk to perceive helplessness (p<0.001), not being active (p=0.033) and not feeling satisfied with life (p=0.001) than those in perceived good health.

Patients who perceived helplessness (n=53, 36%) had higher NUFFE scores, median 9 (inter-quartile range 6-12.5), compared to those with no perceived helplessness (n=94, 64%), median 6.5 (inter-quartile range 5-9) (p=0.004). Perceived helplessness was also associated with a feeling of not being satisfied with life (p<0.001).

Comparison between screening results and nursing documentation

The content of NUFFE items 1, 3, 5, 6, 9, 10, 11, 12, and 13 were present in a number of nursing records, with frequencies ranging from 1 to 132 (Table 3). No notes were found in the nursing documentation on issues reflecting the content of the remaining NUFFE items, i.e. item 2 (changes in dietary intake), item 4 (intake of at least one cooked meal per day), item 7 (possibility to obtain food products), item 8 (company at meals), item 14 (number of medications) and item15 (health state affects eating).

In the nursing records, 29 patients had a special nutritional care plan, which indicated that nutritional problems had been identified by the nurses. Of these 29 patients, 11 scored ≥13, 13 scored between 6 and 12, and five scored <6 in the interview using NUFFE. Of the 101 (69%) patients identified by NUFFE as being at medium or high risk for undernutrition, 24 had a nutritional care plan. Out of these 101 patients, 48 individuals were not identified as risk patients when using the BMI cut-off point <24 kg/m^2 and were not highlighted in the nursing documentation as at-risk patients with a nutritional care plan.

DISCUSSION

The performed nutritional screening using NUFFE showed that 69% of the older rehabilitation patients in this study were at medium or high risk for undernutrition. Westergren *et al.* (2002) found that 46% of older (≥65 years) rehabilitation patients were at risk for undernutrition or had suspect or manifest undernutrition. However, those patients were assessed with SGA. That instrument is initially developed for hospitalized surgical patients and is composed by history and physical examination (Detsky *et al.* 1987). It is not appropriate as a screening instrument due to its complexity. NUFFE is, however, especially developed to be a simple instrument for screening older patients at risk.

A limitation of the present study is that many patients admitted to the ward were excluded, since they did not fulfil the inclusion criteria. The aim with a screening is obviously to screen as many patients as possible. Without screening procedures more than half of the patients at risk for undernutrition are not identified (Elia *et al.* 2005). This may indicate that the frequency of at-risk patients in the ward was higher than this screening could identify. However, amputees and patients with bandages and plaster casts that could not be removed had to be excluded due to difficulties to measure their real body weight. Furthermore, an inclusion criterion was to be able to communicate and co-operate in an interview. This criterion was set because a more comprehensive data collection was done at the same time but not reported here, requiring, for example, that the patients were able to read. Therefore, many patients with poor vision had to be excluded. Patients with parenteral and enteral nutrition were chosen to be excluded, which can be seen as a limitation, because, according to Weekes *et al.* (2004), these patients always have to be highlighted as patients at high risk for undernutrition. Other patients who were excluded were younger than 65 years. But the broad exclusion criteria in this study are not judged to limit the clinical usefulness of NUFFE. The fact that NUFFE does not contain anthropometry makes it more suitable for patients who can not be weighted. If the questions in NUFFE are read aloud, the patients with poor vision can be screened. The clinical usefulness of NUFFE is not considered to be limited by the fact that the non-participants were older than the participants. All patients who are able to answer the questions in NUFFE can be screened.

It is known that disease and nutrition interact with each other (Jeejeebhoy 2000), but Covinsky *et al.* (1999) concluded in a study that undernutrition in older hospitalized patients with medical illness was not explained by greater illness severity or co-morbidity. This supports the results of the present study, since there were no differences in prevalence of diseases or disorders between the groups with a NUFFE score <6, a NUFFE score in the interval 6–12 and a NUFFE score ≥13. However, no patients with stroke were present in the group with a NUFFE score ≥13 (cf. Table 2). The reason for this may be that this group was quite small (n=20). Age may have some importance for being at high risk for undernutrition in the study group, since the patients with a NUFFE score <6 were statistically significant younger than those with a NUFFE score ≥13. This circumstance point out that if the non-participants had been included in the study, the prevalence of patients at high risk had increased. In a study among older patients Ek *et al.* (1991) found that women older than 79 years of age had a higher frequency of undernutrition than those women who were younger. But Gazzotti *et al.* (2000) could not find any differences in age related to MNA scores in older patients with acute illness.

Sum scores and cut-off values of NUFFE for identifying patients at medium risk or at high risk were used to describe the nutritional screening at group level. In nursing practice, where NUFFE will be used on an individual level, the cut-off value ≥6 can be used for screening older patients, i.e. detecting those at medium or high risk for undernutrition. The particular nutritional problems that are identified when NUFFE is used should be the issues that are focused in the further investigation and planned intervention. To routinely use a nutritional

screening instrument with high sensitivity for detecting older nutritional patients at risk is, according to Teo and Wynne (2001), important for not denying them the benefits of intervention, for example supplementation. In a controlled randomised study, Gazzotti *et al.* (2003) showed that older at-risk patients who had not received oral supplementation experienced a statistically significant weight loss during their hospital stays and after their hospitalization periods.

BMI<24 kg/m^2 is the recommended cut-off value for identifying older at-risk patients (Beck & Ovesen 1998). In the present study NUFFE could identify medium and high at-risk patients despite a BMI value ≥24 kg/m^2. This cut-off value can not alone identify all patients at risk, because patients with, for example, unintentional weight loss combined with BMI≥24 kg/m^2 will not be identified (Kruizenga *et al.* 2003). Therefore, Beck and Ovesen (1998) suggest that BMI<24 kg/m^2 or any degree of weight loss in older patients should be used in combination with other parameters in simple screening methods. On the other hand, if NUFFE is used as the sole screening method, patients with cachexia but without weight loss or changes in dietary intake during the past year can be missed to be identified as at-risk patients. It should be recommended that for these patients and identified medium and high at-risk patients, BMI ought to be calculated and food intake recorded for a number of days in the further investigation.

In this study the patients in perceived ill health had statistically significant higher NUFFE scores than those in perceived good health. This indicates that good nutritional status may contribute to good health in older patients, which is in line with Gariballa and Sinclair (1998), and, moreover, that the opposite is related to impaired health status (Vetta *et al.* 1999).

Functional independence is, according to Devons (2002), the most important factor in the maintenance of quality of life. An association between undernutrition in older patients at admission to hospital and dependence in activities of daily living after discharge was found by Covinsky *et al.* (1999). Similar results were also shown in the present study, because patients with perceived helplessness were at higher risk for undernutrition than those who did not perceive themselves as being helpless. Perceived helplessness is also a risk factor for low self-care ability (Söderhamn *et al.* 2000). It is therefore reasonable to believe that to be at high risk for undernutrition contributes to helplessness and that this aggravating circumstance has an effect on older people's ability to care for themselves concerning nutritional issues. Accordingly, Drewnowski *et al.* (2003) suggest that screening tools concerning health related quality of life should be incorporated in nutrition assessment programs for older patients, because inadequate nutrition compromises physical and mental health and the ability to function independently.

The nursing documentation showed that important nutritional issues for older patients were absent in many nursing records. However, notes about the patients' activity levels were present in most of the records. The high occurrence of these notes can be explained by the considerable importance activities have in rehabilitation care. But the remaining nutritional issues

(according to NUFFE) were less frequent and in some cases even non-existent in the nursing documentation. Such an important issue as appetite was present in slightly more than half of the nursing records. Weight loss was only present in slightly more than a tenth of the records. Other important issues not highlighted in the nursing records included changes in dietary intake and health state affecting eating.

Another item in NUFFE deals with the number of medications used and this issue was not present in the nursing records. Documenting the number of medications is not usually done by nurses, as this is documented elsewhere in the patient record. Nevertheless, this is relevant in the nutritional assessment of the older patient, because a high number of medications influence nutritional status negatively (Gazzotti *et al.* 2000). Usually, nurses' notes deal with identified problems, and, accordingly, the absence of problems is not documented. But this was not the case in the nursing records studied, because both the presence and absence of nutritional problems occurred in the notes.

Reasons for not documenting important nutritional issues were not investigated in this study. But according to current Swedish legislation, registered nurses are obliged to document in the patient records (SFS 1985, SOSFS 1993). In Sweden only a few studies have been carried out concerning nurses' nutritional notes in patient records. Kumlien and Axelsson (2002) have found that nurses' notes about nutritional problems often are vague and unspecific, and according to Ehrenberg and Ehnfors (2001), there is incongruence between nurses' oral reports and what they are documenting.

Shortcomings in hospital records concerning information on nutritional risk were shown in a study carried out in Denmark. About 32% of the patients at risk had a nutritional care plan, and these plans were of varying quality (Rasmussen *et al.* 2004). A lower figure was found in the present study, where 24% of the patients at medium or high risk for undernutrition had a nutritional care plan. The content of these plans was not examined. Since the data collection was performed during a period of up to two weeks after admission to the ward, this can imply that the nurses, for patients who were interviewed in the beginning of this period, had not had the time to accomplish a nutritional care plan in all cases.

In another Danish study, Kondrup *et al.* (2002) found that the main reasons that nurses did not perform nutritional screening were lack of instructions and lack of guidelines. It is therefore of great importance that nurses appropriate knowledge about nutritional risk factors and signs of risk for undernutrition in order to identify at-risk patients. Furthermore, they need knowledge about how to proceed an investigation in order to perform a nutritional assessment and, moreover, how to document it in the nursing record. To use NUFFE routinely, regarded as a reliable and valid screening instrument and easy to administer, can be a way to ensure that important questions are asked and a help for nurses to highlight at-risk patients.

CONCLUSIONS

It was shown in this study that the prevalence of older patients at medium or high risk for undernutrition was high. To be at high risk for undernutrition was associated with perceived ill health. Nurses' nutritional notes in the nursing documentation showed deficiencies, indicating that all patients at medium or high risk for undernutrition were not identified. This suggests that nurses need a screening instrument in order to highlight older at-risk patients in need of further awareness and investigation.

Further studies must be conducted to determine reasons for nurses being impeded from performing a proper nutritional assessment of older patients. Moreover, studies dealing with nutritional issues and perceived health and possible associations to self-care in older rehabilitation patients should also be prioritized.

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Contributions

Study design: US, MB-L and A-CE designed the study. Data collection and analysis: US performed the data collection. US carried out the data analyses together with MB-L and A-CE. Manuscript preparation: US wrote the manuscript together with MB-L and A-CE.

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Table 1 Background variables in the study group (n=147)

		Males n=71 (48%)	***Females n=76 (52%)***	***P-value***
Age (years)	mean (SD)	77.7 (6.2)	76.5 (6.0)	0.25
Civil status	married (n)	42 (59%)	22 (29%)	
	single/widow/er (n)	29 (41%)	54 (71%)	<0.001
Former profession	professionals/ white collar workers (n)	31 (44%)	26 (34%)	
	blue collar workers/ housewives (n)	40 (56%)	50 (66%)	0.31
Type of dwelling before admission to hospital	own home (n)	68 (96%)	74 (97%)	
	residential living (n)	3 (4%)	2 (3%)	0.67
Admission to geriatric rehabilitation	from home/residential living (n)	9 (13%)	10 (13%)	
	from another ward (n)	62 (87%)	66 (87%)	1.0
Professional home care before admission	have home care (n)	16 (23%)	23 (30%)	
	no home care (n)	55 (77%)	53 (70%)	0.38
Main medical diagnoses	orthopaedic disorders (n)	26 (37%)	34 (45%)	0.41
	heart/lung diseases (n)	15 (21%)	18 (24%)	0.86
	stroke (n)	17 (24%)	13 (17%)	0.41
	other diagnoses (n)	13 (18%)	11 (14%)	0.69

Table 2 Patient groups with low risk for undernutrition (A=NUFFE scores <6), medium risk for undernutrition (B=NUFFE scores 6-12) and high risk for undernutrition (C=NUFFE scores ≥13) in relation to some background variables, BMI, perceived health and health related variables

		Group A NUFFE scores <6 n=46 (31%)	***Group B NUFFE scores 6-12 n=81 (55%)***	***Group C NUFFE scores ≥13 n=20 (14%)***	***P-value***
Age (years)	mean (SD)	75.2 (6.1)	77.3 (5.6)	80.4 (7.0)	0.006[b]
Sex	males	21 (46%)	37 (46%)	13 (65%)	
	females	25 (54%)	44 (54%)	7 (35%)	0.28
BMI (kg/m^2)	mean (SD)	26.1 (4.4)	26.1 (5.1)	22.2 (3.5)	0.003[b, e]
Perceived good health	n	25 (54%)	31 (38%)	4 (20%)	
Perceived ill health	n	21 (46%)	50 (62%)	16 (80%)	0.026[a]
Receiving help regularly	n	16 (35%)	34 (42%)	16 (80%)	
Not receiving help regularly	n	30 (65%)	47 (58%)	4 (20%)	0.002[b, e]
Close contacts with other people	n	45 (98%)	81 (100%)	20 (100%)	
No close contacts with other people	n	1 (2%)	0 (0%)	0 (0%)	0.33
Perceived helplessness	n	12 (26%)	28 (35%)	13 (65%)	
No perceived helplessness	n	34 (74%)	53 (65%)	7 (35%)	0.009[b, d]
Being active	n	39 (85%)	57 (70%)	6 (30%)	
Not being active	n	7 (15%)	24 (30%)	14 (70%)	<0.001[c, e]
Feeling satisfied	n	40 (87%)	65 (80%)	7 (35%)	
Not feeling satisfied	n	6 (13%)	16 (20%)	13 (65%)	<0.001[c, f]
Main medical diagnoses:					
Orthopaedic disorders	n	18 (39%)	34 (42%)	8 (40%)	0.95
Heart/lung diseases	n	11 (24%)	16 (20%)	6 (30%)	0.59
Stroke	n	9 (20%)	21 (26%)	0 (0%)	0.036[d]
Other diagnoses	n	8 (17%)	10 (12%)	6 (30%)	0.16

Nutritional Form For the Elderly (NUFFE), Body Mass Index (BMI)

[a] Statistically significant difference between group A and C ($p<0.05$)

[b] Statistically significant difference between group A and C ($p<0.01$)

[c] Statistically significant difference between group A and C ($p<0.001$)

[d] Statistically significant difference between group B and C ($p<0.05$)

[e] Statistically significant difference between group B and C ($p<0.01$)

[f] Statistically significant difference between group B and C ($p<0.001$)

Table 3 Screening results with NUFFE items 1, 3, 5, 6, 9, 10, 11, 12, 13 compared to the content in the nursing records (n=147)

NUFFE item number	*NUFFE items*	*Response alternatives and screening results n (%)*	*Present in number of nursing records n (%)*	*Content in the nursing records (n)*
9	Activity	Exercise a lot 36 (25) indoors 97 (66) sitting/laying 14 (10)	132 (90)	walking (9) walking with device (64) walking with device/staff (36) walking with staff (7) wheelchair (16)
3	Appetite	good 88 (60) somewhat low 39 (27) poor 20 (14)	81 (55)	good (40) decreased (18) poor (17) different statement (6)
5	Portion size	large or ordinary 91 (62) fairly small 46 (31) very small 10 (7)	32 (22)	want small portions (3) eating good (5) eating full portion (2) eating half portion (3) eating small portion (7) eating poor (12)
1	Weight loss	no loss 58 (40) somewhat loss 45 (31) considerably loss 44 (30)	21 (14)	no loss (3) little loss (2) loss (5) great loss (11)
13	Help with eating	no 145 (99) sometimes 1 (1) yes, often 1 (1)	21 (14)	eat themselves (21)
10	Tooth/mouth or swallowing difficulties	no 123 (84) sometimes 17 (12) yes 7 (5)	20 (14)	no swallow difficulties (10) swallow difficulties (6) swallow/mouth problem (1) poor teeth (1) mouth problem (2)
12	Problems to eat due to gastrointestinal problems	no 126 (86) sometimes 17 (12) yes, often 4 (3)	16 (11)	diarrhoea (1) diarrhoea/nausea (2) nausea (10) no nausea (2) constipation (1)
11	Fluid intake	>5 glasses/day 62 (42) 3-5 glasses/day 80 (54) <3 glasses/day 5 (3)	7 (5)	drink a lot (5) poor drinking (1) drink restriction (1)
6	Intake of fruit or vegetables	yes 105 (71) often 21 (14) seldom 21 (14)	1 (1)	Like fruit and vegetables (1)

Nutritional Form For the Elderly (NUFFE)

PAPER IV

Submitted for publication

Self-care ability and sense of coherence in older nutritional at-risk patients

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Contributors: All authors contributed to the study design. US performed the data collection and outlined the first data analyses and the manuscript drafting. All authors were engaged in the final data analyses and manuscript writing. No conflicts of interest are declared.

Abstract

Objective: To investigate self-care ability and sense of coherence in geriatric rehabilitation patients nutritionally screened using the Nutritional Form For the Elderly and to relate the patients' perceived health to self-care ability and sense of coherence.

Design: Cross-sectional study.

Setting: A geriatric rehabilitation ward in a hospital in western Sweden.

Subjects: Of a consecutively recruited sample of 172 patients (65+ years), 16 did not take part due to lack of interest and 12 could not fulfill the entire data collection procedure, why 144 were included in the study.

Methods: The patients were interviewed using three instruments, one question about perceived health, health-related questions and background variables. Statistical methods were used.

Results: Patients at medium or high risk for undernutrition had lower self-care ability ($p<0.001$) and weaker sense of coherence ($p=0.007$) than patients at low risk for undernutrition. Lower self-care ability, being single and admitted from another hospital ward were found to be predictors for being at medium or high risk for undernutrition. Patients who perceived good health had higher self-care ability ($p<0.001$) and stronger sense of coherence ($p<0.001$) than patients who perceived ill health.

Conclusions: There is an indication that older patients at low risk for undernutrition have a greater capability to care for themselves than patients at medium or high risk for undernutrition. Perceived ill health in older patients is associated with lower self-care ability and weaker sense of coherence.

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Keywords: aged, geriatric rehabilitation care, health, nutritional screening, salutogenic perspective

Introduction

It is known that the number of geriatric rehabilitation patients who are at risk for developing undernutrition or are suffering from undernutrition is high (Westergren *et al*., 2002; Poulsen, 2005). Studies among older patients have shown associations between undernutrition and decreased functional ability with dependency in activities of daily living (Covinsky *et al*., 1999; Gazzotti *et al*., 2000).

Self-care is the practice of activities for maintaining life, health and well-being. According to Orem's self-care theory, there are a number of universal self-care requisites, such as sufficient intake of fluid and food. These self-care requisites must be met and, therefore, specific actions are required in order to live and maintain health. However, self-care actions have to be known to the individual as well as be within the capabilities of the person (Orem, 2001). Moreover, the realisation of various self-care activities requires motivation and a certain level of self-care ability (Söderhamn 2000; Orem, 2001). An individual's self-care ability is the capacity to care for oneself. But this self-care ability can be exercised or not, because human beings are acting subjects, with their own free will, who are making conscious choices. When self-care actions are realized, the self-care ability has been exercised (Söderhamn *et al*., 1996a; Söderhamn *et al*., 1996b).

Older people's functional ability and self-care ability have been found to be related to perceived health (Avlund & Holstein, 1998; Söderhamn *et al*., 2000). However, according to Antonovsky (1987), a determining factor for maintaining health is also the individual's sense of coherence (SOC). SOC is the central concept in Antonovsky's salutogenic theoretical model that is designed to advance the understanding of stressors, coping and health. It is not built on a specific type of coping strategy but on factors, which are, in all cultures, a basis for successful coping with stressors. According to Antonovsky, SOC, with the three core components comprehensibility, manageability and meaningfulness, is regarded as a major determinant for maintaining one's position on the health ease/dis-ease continuum (Antonovsky, 1987; 1993).

We have, however, found no studies among geriatric rehabilitation patients regarding associations between self-care ability, SOC and being at risk for developing undernutrition. This knowledge ought to be of great importance for health care professionals in geriatric care.

The aim of this study was to investigate self-care ability and sense of coherence in geriatric rehabilitation patients nutritionally screened using the Nutritional Form For the Elderly (NUFFE) and to relate the patients' perceived health to self-care ability and sense of coherence.

Methods

Sample

Participants were recruited from a geriatric rehabilitation ward in a hospital in western Sweden during a period of about 24 months, from the end of August 2002 to the turn of the year 2004/2005, with pauses during two summer months in 2003 and 2004. For inclusion in the study, the following criteria had to be fulfilled: 65+ years of age and ability to communicate and co-operate in an interview. Exclusion criteria were being an amputee, having bandages or plaster casts that could not be removed, having received enteral or parenteral nutrition, suffering from loss of vision (not being able to read) or hearing, not being able to provide details about one's current situation and, finally, being readmitted and having previously been included in the study. A consecutively recruited sample of 172 patients who fulfilled the inclusion criteria was asked to participate in the study. Sixteen patients did not take part in the study, due to lack of interest. Twelve patients did not have the strength to complete the entire data collection procedure and were thus excluded. Therefore, the total participants included amounted to 144 (84%).

Study design

The participants were interviewed during their two first weeks in the geriatric rehabilitation ward by the first author (US). Three instruments were included in the interview, i.e. the Self-care Ability Scale for the Elderly (SASE) (Söderhamn *et al*., 1996a; 1996b), the Swedish version of the 29-items SOC scale (Antonovsky, 1991) and NUFFE (Söderhamn & Söderhamn, 2001; 2002). In addition to the instruments a question about perceived health, four questions related to health (receiving help regularly from another person in order to manage daily life, perceiving helplessness, being active and feeling satisfied with life) and some background variables (Table 1) were asked. The question about perceived health and the health-related questions could be answered with yes or no. Main medical diagnoses of the participants were collected from the patient records.

The instruments

For assessing the patients' self-care ability, the instrument SASE was used. SASE, a summated ordinal scale with 17 five-point items, is based on Orem's (1995) view that self-care agency consists of self-care activity and self-care ability and Pörn's (1984; 1993) theory of health and adaptedness with the three components repertoire, environment and goal. A person's repertoire comprises his or her abilities, i.e. knowledge of how to perform actions or having the technique for performing them. The items are reflecting areas of concern for older people such as activities of daily living, mastery, well-being, volition, determination, loneliness and dressing. Each item score ranges from 1 to 5 scores, i.e. totally disagree to totally agree. Score of 3 is being neutral score. Four items are negatively stated and must be reversed in the summation of the scores. The total score can range between 17 and 85. A higher score indicates a higher perceived self-care ability (Söderhamn *et al*., 2000). A cut point was set to

<69 for low scores and ≥69 for high scores for assessing a self-care ability according to the results from a study among home dwelling older people (Söderhamn *et al*., 1996b). SASE was developed and tested in Sweden, and evidence has been shown that it is a reliable (Cronbach's alpha coefficient 0.68–0.88) and valid instrument (Söderhamn *et al*., 1996a; 1996b; 2000).

The SOC scale is a semantic differential scale with two anchoring phrases on the ordinal level, with each item ranging from 1 to 7 scores. The scale consists of 29 items. These are distributed as follows: eleven items are addressing comprehensibility, ten items addressing manageability and eight items addressing meaningfulness. Thirteen of the items are formulated negatively and must be reversed before summation. Total score ranges from 29 to 203, with a high score expressing a strong SOC. The SOC scale was initially developed and tested in Israel but has been translated into many languages and has been used in several studies in various countries. The scale has been shown to be a reliable (Cronbach's alpha coefficient 0.82–0.95) and valid instrument (Antonovsky, 1987; Antonovsky, 1993). The Swedish version of the original 29-item SOC scale has been tested regarding reliability (Cronbach's alpha coefficient 0.79–0.90) and validity in adults (Langius *et al*., 1992; Langius & Björvell, 1993). Reliability (Cronbach's alpha coefficient 0.92) and validity of the Swedish version has also been tested in physically active older people (Söderhamn & Holmgren, 2004).

The nutritional screening instrument NUFFE is a summated ordinal scale with 15 three-point items. It involves dietary history, with questions about weight loss and changes in dietary intake, dietary assessment with questions about appetite, food and fluid intake and eating difficulties, and general assessment with questions about the possibility of obtaining food products, company at meals, activity and number of medications. Each item ranges between 0 and 2. The most favourable option gives a score of 0, the most unfavourable option a score of 2, and the intermediate option a score of 1. Maximum score total is 30. Higher screening scores indicate higher risk for undernutrition (Söderhamn & Söderhamn, 2001; 2002). In an earlier study (Söderhamn *et al.*, accepted 2006) secondary analysis of data from Söderhamn and Söderhamn (2002) regarding sensitivity, specificity and predictive value according to Fletcher and Fletcher (2005) was performed. The analyses showed that the cut point for being at medium risk for undernutrition was a NUFFE score ≥6 when scores ≤23.5, indicating risk for undernutrition, from the instrument Mini Nutritional Assessment (MNA) (Guigoz *et al*., 1996) were used as a standard. The cut point for being at high risk for undernutrition was a NUFFE score ≥13 when MNA scores <17, indicating undernutrition, were used as a standard. NUFFE was developed in Sweden and has been tested concerning reliability (Cronbach's alpha coefficient 0.70–0.72) and validity, and it was shown to be a fairly reliable instrument with evidence of validity (Söderhamn & Söderhamn, 2001; 2002).

Statistics

Descriptive statistics were used for describing the study group. Numbers (n) and percentages (%) were used for nominal data, medians and inter-quartile ranges for ordinal data and mean values and standard deviations (SD) for interval data.

Since major parts of the data are at nominal and ordinal levels, mainly non-parametric statistic methods were used (Svensson, 2001): chi-square test with Yates' continuity correction (two-tailed significance) or Fisher's exact test and Mann-Whitney *U*-test (two-tailed significance). Student's *t*-test for unpaired data (two-tailed significance) was used for testing differences between groups regarding age.

A multiple forward stepwise (conditional) logistic regression analysis was performed to investigate possible predictors for being at medium or high risk for undernutrition. The dependent variable was to be screened as being at risk for undernutrition (to be at medium or high risk for undernutrition was coded as 1 and to be at low risk for undernutrition was coded as 0). Independent variables were age, SASE scores, SOC scores, and dummy variables such as civil status (single or widow/-er, coded as 1, and married coded as 0), having home care before admission (coded as 1) or not (coded as 0), admission to the rehabilitation ward from another hospital ward (coded as 1) or from home/residential living (coded as 0), perceived good health (coded as 1) or not (coded as 0), receiving help regularly (coded as 1) or not (coded as 0), perceived helplessness (coded as 1) or not (coded as 0), being active (coded as 1) or not (coded as 0) and feeling satisfied (coded as 1) or not (coded as 0). The choice of independent variables was based on variables that in univariate analyses reached a p-value of <0.2 (Altman 1999, p 349) when patients at medium or high risk for undernutrition were compared to patients at low risk for undernutrition. The number of independent variables in relation to sample size is suitable, according to Altman (1999, p 349).

The data were analysed using SPSS® for Windows, version 13.0. Statistical significance was defined as a p-value <0.05.

Ethics

The patients who fulfilled the inclusion criteria received oral and written information about the study, and those who gave consent to participate were included in the study. The study was approved by the Research Ethics Committee of western Sweden (Medical Faculty, Göteborg University, Ö 527-01).

Results

Participants and non-participants

The study group consisted of 67 (47%) males and 77 (53%) females. Age ranged from 65 years to 91 years, and mean age was 77.1 (SD 6.0) years. No statistically significant diffe-

rence in age was found between men and women (p=0.59). No differences between the participants (n=144) and the non-participants (n=28) were found regarding background variables, except that the non-participants were older, with a mean age of 79.9 years (SD 6.0) (p=0.026). The background variables, e.g. civil status and medical diagnoses of the participants, are presented in Table 1.

Self-care ability and SOC in patients screened using NUFFE

The obtained SASE median score in the study group was 61 (inter-quartile range 53–69.75). A total of 40 (28%) patients had high SASE scores (≥69) (median score 74, inter-quartile range 72-77), indicating a higher self-care ability, and 104 (72%) had low SASE scores (<69) (median score 57, inter-quartile range 50-62), indicating a lower self-care ability. No difference in age was found between the patients with lower and higher SASE scores (p=0.1).

Statistically significant differences in SASE median scores were found between the patients at medium or high risk for undernutrition (n=99, 69%) compared to those at low risk for undernutrition (n=45, 31%) (Table 2). However, no difference in SASE scores was found when the patients at medium risk (n=81, 56%) were compared to those at high risk (n=18, 13%) (p=0.75).

The SOC median score in the study group was 152 (inter-quartile range 133–163). Statistically significant differences in SOC median scores were found between the patients at medium or high risk for undernutrition compared to those at low risk for undernutrition (Table 2). When the medium at-risk patients were compared to the high at-risk patients, no difference in SOC scores was found (p=0.28).

Predictors for being at medium or high risk for undernutrition

Three predictors for being at medium or high risk for undernutrition emerged in the logistic regression analysis, i.e. lower self-care ability, being single and having been admitted from another hospital ward (Table 3).

Perceived health in relation to self-care ability and SOC

Sixty (42%) patients perceived good health and 84 (58%) perceived ill health. The patients who perceived good health had a statistically significant higher SASE median score (median score 68, inter-quartile range 58-74) than those patients who perceived ill health (median score 57.50, inter-quartile range 48-66) (p<0.001).

The SOC median score for the patients who perceived good health (median score 158, inter-quartile range 144-173) was also found to be statistically significant higher than for those patients who perceived ill health (median score 141.50, inter-quartile range 129-157) (p<0.001).

Discussion

Patients who were at medium or high risk for undernutrition were found to have lower self-care ability than those who were at low risk for undernutrition. This result indicates that the patients at medium or high risk for undernutrition have less capacity to care for themselves, i.e. they could not fully perform the required self-care actions in order to meet their self-care requisites, e.g. maintaining a good nutritional status (Orem, 2001). This is also in line with the result from the logistic regression analysis, whereby one of the obtained predictors for being at medium or high risk for undernutrition was found to be lower self-care ability or, the opposite that higher self-care ability contributes to lower risk for undernutrition.

Besides higher self-care ability, the low at-risk patients also had stronger SOC than those at medium or high risk for undernutrition. A possible explanation for this circumstance can be that self-care activities are realized to a greater extent when a certain level of the SOC components comprehensibility, manageability and meaningfulness is present, i.e. self-care ability can be exercised, according to Söderhamn *et al*. (1996b) and Orem (2001). In addition, according to Antonovsky's intention, the SOC scale should be used as a whole scale and is not intended to be examined in subscales (Eriksson & Lindström, 2005).

The fact that self-care ability and SOC are synchronized, i.e. the patients who had lower self-care ability had weaker SOC and those who had higher self-care ability had stronger SOC, was also an observed tendency by Ageborg *et al*. (2005). Langius and Björvell (1993) found the same association between functional status and SOC among young, middle-aged and older people, i.e. the stronger the SOC, the less pronounced the dysfunction. But, according to Ekman *et al*. (2002), such an association could not be seen between functional ability and SOC in a study among older patients with severe chronic heart failure and healthy individuals when a shorter form of the SOC scale was used. Heart failure patients had limited functional abilities compared to healthy individuals, but their SOC scores did not differ between them.

The association found in this study between lower self-care ability and to be at medium or high risk for undernutrition can be compared with the results from another study among geriatric rehabilitation patients whereby undernourished patients received more help with personal care than did well-nourished patients (Brantervik *et al*., 2005). Low body weight in older patients, indicating a poor nutritional status, has also been found to be associated with more dependency in activities of daily living (Bachrach-Lindström *et al*., 2000). Furthermore, weight gain in undernourished geriatric rehabilitation patients during their hospital stay could improve their function in basic activities of daily life (Poulsen, 2005). Diminished functional ability, together with diminished cognitive function, has also been seen to be associated with nutritional risk in older patients (Pearson *et al*., 2001) and with undernutrition in frail older service flat residents (Ödlund Olin *et al*., 2005).

In the study group, no difference was found in age between patients with low and high self-care ability. However, age has been found to be a risk factor for low self-care ability, among home dwelling older people, assessed with SASE (Söderhamn *et al.*, 2000). Accordingly, the

self-care ability may decrease with advanced age, which is a natural result of ageing. Such a decrease in self-care ability has been seen in older people over a ten-year period, and this decline was seen in both healthy and unhealthy lifestyle habits (Haveman-Nies *et al.*, 2003).

The SASE median score obtained in this study group of patients (mean age of 77 years) was 61 (mean 61) and is lower compared with a group of home-dwelling older people, in the age group 75-84 years, who obtained a SASE mean value of 66.55 (Söderhamn *et al.*, 2000). Regarding SOC, the SOC score tends to increase with advanced age when studies are compared in relation to different age groups (Eriksson & Lindström, 2005). However, such an increase in SOC median score was not seen in the present study group of older patients (median 152 and mean 149) in comparison with the mean score of 151 in a Swedish sample in the age span of 26-70 years (Langius & Björvell, 1993). The obtained SOC median score was also similar to a mean score of 150 in Swedish physically active older people (mean age of 73 years) (Holmgren & Söderhamn, 2005).

Being single was one of three predictors obtained for being at medium or high risk for undernutrition. An association between being at nutritional risk and living alone among older patients has been shown by Brantervik *et al.* (2005), but in another study (Pearson *et al.*, 2001) such an association could not be seen in older individuals. In a study among older women it was shown that for those women who lived alone, the cooking and eating could be influenced in a negative way and perceived more as an obligation, due to lack of psychosocial meaning (Gustafsson & Sidenvall, 2002). Moreover, Gustafsson *et al.* (2002) have also shown that older women with perceived disabilities in food-related work tended to have a lower energy intake than did those without disabilities.

Another obtained predictor for being at medium or high risk for undernutrition in this study was having been admitted to the rehabilitation ward from another hospital ward. This can also be explained in the opposite way, i.e. having been admitted to the rehabilitation ward from home or residential living contributes to a lower risk for undernutrition. In this study, most of the patients (n=126, 88%) had been admitted to the rehabilitation ward from another ward in the hospital. Of the patients (n=18, 13%) admitted from their own homes, three had residential living. That older patients in hospital are being at greater risk for undernutrition than those who just had been admitted from home is in line with the results from a study among young and older patients by Rasmussen *et al.* (2004), who found a statistically significant relationship between lengths of stay and weight loss. This can be compared to Gazzotti *et al.* (2003), who showed statistically significant weight loss during the hospital stay in older patients not receiving oral supplementation. Furthermore, Margetts *et al.* (2003) have shown in a study that older male patients in hospital were more likely to be at medium or high risk for undernutrition.

Some of the independent variables in the logistic regression analysis were correlated to each other. The range of Spearman's rank order correlation coefficients was between 0.04 and 0.46, with the high correlations between SASE and SOC and between perceived helplessness

and feeling satisfied. However, these correlations are not likely to be considered as high correlations under these circumstances. Furthermore, according to Altman (1999, p 350) it is advantageous to use stepwise regression, since misleading findings due to high correlations can not occur with this regression model.

In an earlier study (Söderhamn *et al.*, accepted 2006), we found an association in older patients between being at high risk for undernutrition and perceived ill health, which is in line with the results from a study by Margetts *et al*. (2003). In this study it was shown that patients at medium or high risk for undernutrition, beside more perceived ill health, also had lower self-care ability and weaker SOC than low at-risk patients. Moreover, an association between health and self-care ability and SOC, respectively, was also shown in this study since the patients who perceived good health had higher self-care ability and stronger SOC than those who perceived ill health. The association obtained between good health and higher self-care ability is consistent with the results from a study among home-dwelling older people by Söderhamn *et al*. (2000), in which perceived health was obtained as a predictor for self-care ability. It is logical that there is an association between health and self-care ability assessed by SASE, since SASE is based on a theory of health (Pörn, 1984; 1993). But such an association has also been seen in older people between perceived health and self-care ability, whereby exercised self-care ability was assessed through questions about activities of daily living. The observed association was that both health and self-care ability decreased over a ten-year period. However, this decrease was lower for active people compared to inactive people. But such effect on health and self-care ability was not seen in a high-quality diet compared to a low-quality diet (Haveman-Nies *et al.*, 2003). In a longitudinal study by Lee (2000), older people's assessment of their health was associated with functional decline and mortality, i.e. persons who assessed their health negatively were at higher risk of functional decline and death.

Furthermore, the association between good health and stronger SOC in this study confirms Antonovsky's (1987) theoretical model that SOC is a factor in maintaining health. That health and SOC are related to each other has been shown among both young and middle-aged people (with a shorter form of the SOC scale) (Johnson, 2004), and as well as older patients (Schneider *et al.*, 2004). This association has also been seen in a group of physically active older people, in which SOC was found to be a positive predictor for perceived good health (Holmgren & Söderhamn, 2005).

Conclusions

In conclusion, the patients at medium or high risk for undernutrition had lower self-care ability and weaker SOC than those at low risk for undernutrition. This indicates that older patients at low risk for undernutrition have the capability to care for themselves to a greater extent. Furthermore, perceived ill health is associated with lower self-care ability and weaker SOC. In order to increase knowledge about possible associations between self-care ability, SOC,

health and risk for undernutrition, further studies, e.g. longitudinal studies, among different patient groups are necessary.

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Table 1 Background variables in the study group (n=144)

Background variables		
Age	mean (SD)	77.1 (6.0)
Sex	male (n)	67 (47%)
	female (n)	77 (53%)
Civil status	single (n)	30 (21%)
	married (n)	63 (44%)
	widower/-er (n)	51 (35%)
Former profession	housewife (n)	8 (6%)
	blue collar workers (n)	80 (56%)
	white collar workers (n)	38 (26%)
	professional (n)	18 (13%)
Type of dwelling before admission to hospital	own home (n)	139 (97%)
	nursing home (n)	2 (1%)
	residential living (n)	3 (2%)
Admission to geriatric rehabilitation ward	from home/residential living (n)	18 (13%)
	from another ward (n)	126 (88%)
Professional home care before admission	having home care (n)	40 (28%)
	no home care (n)	104 (72%)
Main medical diagnosis	orthopaedic disorders (n)	60 (42%)
	heart/lung diseases (n)	33 (23%)
	stroke (n)	27 (19%)
	other diagnoses (n)	24 (17%)

Table 2 Differences between patients at low risk for undernutrition and patients at medium or high risk for undernutrition according to SASE scores, SOC scores and perceived health

		Patients at low risk for under-nutrition NUFFE scores <6 n=45 (31%)	***Patients at medium or high risk for undernutrition NUFFE scores ≥6 n=99 (69%)***	***P-value***
Age (years)	mean (SD)	75.64 (6.2)	77.76 (5.9)	0.051
SASE scores	median (inter-quartile range)	68 58-74	58 51-66	<0.001
SOC scores	median (inter-quartile range)	155 143-167.5	146 131-161	0.007
Perceived good health Perceived ill health	n n	26 19	34 65	0.014

SASE: Self-care Ability Scale for the Elderly; SOC: Sense of coherence

Table 3 Predictors for being at medium or high risk for undernutrition in the study group (n=144)

Dependent variable	***Predictors***	***R^2 Nagelkerke***	***B***	***SE***	***df***	***P-value***	***OR (95% CI)***
Medium or high risk for under-nutrition		0.275					
	Being single		1.390	0.427	1	0.001	4.014 (1.739; 9.266)
	Having been admitted from another hospital ward		1.167	0.600	1	0.052	3.213 (0.991; 10.422)
	SASE scores		–0.079	0.020	1	<0.001	0.924 (0.888; 0.962)
	Constant		3.993	1.382	1	0.004	54.200

SASE: Self-care Ability Scale for the Elderly