Nutritional Screening of Older Patients
Developing, Testing and Using the Nutritional Form For the Elderly (NUFFE)

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Cover: “Eating in hospital” by Margaretha Herrman

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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
Söderhamn, U. 2006. Nutritional screening of older patients. Developing, testing and using the Nutritional Form For the Elderly (NUFFE). Linköping University Medical Dissertations No. 957, Department of Medicine and Care, Division of Nursing Science, Faculty of Health Sciences, Linköping University, SE-581 85 Linköping, Sweden. ISBN 91-85523-13-5. ISSN 0345-0082.

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 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

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

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


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

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>BACKGROUND</td>
<td>2</td>
</tr>
<tr>
<td>Ageing</td>
<td>2</td>
</tr>
<tr>
<td>Nutritional risk</td>
<td>2</td>
</tr>
<tr>
<td>Health</td>
<td>3</td>
</tr>
<tr>
<td>Self-care ability</td>
<td>4</td>
</tr>
<tr>
<td>Sense of coherence</td>
<td>5</td>
</tr>
<tr>
<td>Assumption about associations between central concepts</td>
<td>6</td>
</tr>
<tr>
<td>Nutritional screening or nutritional assessment</td>
<td>6</td>
</tr>
<tr>
<td>Objective nutritional measurements</td>
<td>7</td>
</tr>
<tr>
<td>Some nutritional instruments</td>
<td>9</td>
</tr>
<tr>
<td>Nursing documentation</td>
<td>11</td>
</tr>
<tr>
<td>Summary of risk factors for undernutrition</td>
<td>12</td>
</tr>
<tr>
<td>AIMS</td>
<td>13</td>
</tr>
<tr>
<td>METHODS</td>
<td>13</td>
</tr>
<tr>
<td>Design and setting</td>
<td>13</td>
</tr>
<tr>
<td>Samples</td>
<td>13</td>
</tr>
<tr>
<td>Development of a new screening instrument</td>
<td>15</td>
</tr>
<tr>
<td>Data collection</td>
<td>16</td>
</tr>
<tr>
<td>Study I and Study II</td>
<td>16</td>
</tr>
<tr>
<td>Study III and Study IV</td>
<td>16</td>
</tr>
<tr>
<td>Procedures, analyses and statistics</td>
<td>17</td>
</tr>
<tr>
<td>Testing reliability and validity of NUFFE</td>
<td>18</td>
</tr>
<tr>
<td>Estimating sensitivity, specificity and predictive values of NUFFE</td>
<td>19</td>
</tr>
<tr>
<td>Nutritional screening using NUFFE</td>
<td>21</td>
</tr>
<tr>
<td>Comparison between screening results and nursing documentation</td>
<td>22</td>
</tr>
<tr>
<td>Screening results related to perceived health</td>
<td>22</td>
</tr>
</tbody>
</table>
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 (Söderhann 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
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 & Bohmer 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 & Axelson 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-
Energy 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 hist-
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-
According 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/m² is a recommended reference interval for individuals over 65 years (Beck & Ovesen 1998). Ranhoff et al. (2005) have found that BMI <23 kg/m² 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 impeded 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

<table>
<thead>
<tr>
<th></th>
<th>MNA</th>
<th>MNA-SF</th>
<th>MUST</th>
<th>NRS-2002</th>
<th>NST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass Index (BMI)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Cut-off point of BMI</td>
<td>&lt;23.0</td>
<td>&lt;23.0</td>
<td>20.0</td>
<td>&lt;20.5</td>
<td>20.0</td>
</tr>
<tr>
<td>Demand on measured weight</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Demand on height measure</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Mid-arm circumference (MAC)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Calf circumference (CC)</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculation of weight loss in percent</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculation of food intake in percent</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developed in country</td>
<td>France</td>
<td>France</td>
<td>UK</td>
<td>Denmark</td>
<td>UK</td>
</tr>
<tr>
<td>Available in the Swedish language</td>
<td>x</td>
<td>x</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

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

13
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.

Study I
- 58 patients fulfilled the inclusion criteria for participation
- 2 patients did not wish to participate
- 56 patients included

Study II
- 114 patients fulfilled the inclusion criteria for participation
- 114 patients included

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

Study III and Study IV
- 172 patients fulfilled the inclusion criteria for participation
- 16 patients did not wish to participate
- 156 patients agreed to participate
- 9 patients were cared for by the author and this was an exclusion criterion in Study III
- 147 patients included in Study III
- 12 patients did not have the strength to complete the entire data collection procedure and did not participate in Study IV
- 144 patients included in Study IV

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

<table>
<thead>
<tr>
<th>Important areas</th>
<th>Nutritional issues</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dietary history</td>
<td>Weight loss</td>
<td>Scanlan et al. (1994), Evans-Stoner (1997), Chen et al. (2001)</td>
</tr>
<tr>
<td></td>
<td>Changes in dietary intake</td>
<td>Detsky et al. (1987), Guigoz et al. (1996), Wissing et al. (2000)</td>
</tr>
<tr>
<td></td>
<td>Intake of cooked food</td>
<td>Guigoz et al. (1996), Margetts et al. (2003)</td>
</tr>
<tr>
<td></td>
<td>Portion size</td>
<td>Detsky et al. (1987)</td>
</tr>
<tr>
<td></td>
<td>Intake of fruits or vegetables</td>
<td>Guigoz et al. (1996), Margetts et al. (2003), Zulkowski and Coon (2004)</td>
</tr>
<tr>
<td></td>
<td>Tooth, mouth or swallowing difficulties</td>
<td>Scanlan et al. (1994), Wipke-Tevis and Stotts (1996), Soini et al. (2003), Andersson et al. (2002), Asai (2004)</td>
</tr>
<tr>
<td></td>
<td>Fluid intake</td>
<td>Guigoz et al. (1996), Thomas et al. (2002)</td>
</tr>
<tr>
<td></td>
<td>Problems with eating due to gastro-intestinal problems</td>
<td>Scanlan et al. (1994), Cotton et al. (1996), Rolfes et al. (2006)</td>
</tr>
<tr>
<td></td>
<td>Help with eating</td>
<td>Sidenvall and Ek (1993), Guigoz et al. (1996), Asai (2004)</td>
</tr>
<tr>
<td></td>
<td>Health status affecting eating</td>
<td>Wipke-Tevis and Stotts (1996), Margetts et al. (2003)</td>
</tr>
<tr>
<td></td>
<td>Activity</td>
<td>Guigoz et al. (1996), Gariballa and Sinclair (1998), Shum et al. (2005)</td>
</tr>
<tr>
<td></td>
<td>Number of medications</td>
<td>Bennett and Creamer (1993), Guigoz et al. (1996), Asai (2004)</td>
</tr>
</tbody>
</table>
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 $\geq 24$ 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) (Söderhann 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 (m²)) 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

<table>
<thead>
<tr>
<th>New test=NUFFE</th>
<th>Gold standard=MNA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Case</td>
</tr>
<tr>
<td>Case</td>
<td>A</td>
</tr>
<tr>
<td>Non case</td>
<td>C</td>
</tr>
</tbody>
</table>

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

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

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

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

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 $\geq 24$ 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>
<thead>
<tr>
<th>Table 6. Background variables among the participants in Studies I-IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study I n=56</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Sex</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Civil status</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Former profession</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Type of dwelling before admission</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Admission to geriatric rehabilitation</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Professional home care before admission</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Main medical diagnosis</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
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

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

<table>
<thead>
<tr>
<th><strong>Criterion</strong></th>
<th><strong>n (I)</strong></th>
<th><strong>r_s(I)</strong></th>
<th><strong>p-value (I)</strong></th>
<th><strong>n (II)</strong></th>
<th><strong>r_s(II)</strong></th>
<th><strong>p-value (II)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI at admission</td>
<td>51</td>
<td>-0.37</td>
<td>0.007</td>
<td>114</td>
<td>-0.25</td>
<td>0.008</td>
</tr>
<tr>
<td>BMI after 3 weeks</td>
<td>22</td>
<td>-0.47</td>
<td>0.026</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI at discharge</td>
<td>50</td>
<td>-0.38</td>
<td>0.006</td>
<td>112</td>
<td>-0.23</td>
<td>0.014</td>
</tr>
<tr>
<td>Weight index ^a^ at admission</td>
<td>51</td>
<td>-0.38</td>
<td>0.006</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight index ^a^ after 3 weeks</td>
<td>22</td>
<td>-0.48</td>
<td>0.026</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight index ^a^ at discharge</td>
<td>50</td>
<td>-0.40</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight index ^b^ at admission</td>
<td>51</td>
<td>-0.38</td>
<td>0.006</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight index ^b^ after 3 weeks</td>
<td>22</td>
<td>-0.49</td>
<td>0.021</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight index ^b^ at discharge</td>
<td>50</td>
<td>-0.42</td>
<td>0.002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum albumin at admission</td>
<td>56</td>
<td>-0.37</td>
<td>0.005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum albumin after 3 weeks</td>
<td>18</td>
<td>-0.23</td>
<td>0.354</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum albumin at discharge</td>
<td>44</td>
<td>-0.55</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAC at admission</td>
<td>114</td>
<td>-0.23</td>
<td>0.014</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CC at admission</td>
<td>114</td>
<td>-0.25</td>
<td>0.008</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^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

<table>
<thead>
<tr>
<th>Groups with expected high NUFFE scores</th>
<th>n</th>
<th>Median (inter-quartile range)</th>
<th>Groups with expected low NUFFE scores</th>
<th>n</th>
<th>Median (inter-quartile range)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with cachexia or decubital ulcer (group A, Study I)</td>
<td>7</td>
<td>14 (11-15)</td>
<td>Patients without cachexia or decubital ulcer</td>
<td>49</td>
<td>8 (6-11)</td>
<td>0.004</td>
</tr>
<tr>
<td>Patients with BMI &lt;24 kg/m² and albumin &lt;36 g/L (group B, Study I)</td>
<td>7</td>
<td>14 (10-18)</td>
<td>Patients with BMI ≥24 kg/m² and albumin ≥36 g/L</td>
<td>44</td>
<td>8 (6-11.75)</td>
<td>0.003</td>
</tr>
<tr>
<td>Patients with cancer diagnosis (group C, Study I)</td>
<td>2</td>
<td>18 (18-18)</td>
<td>Patients without cancer diagnosis</td>
<td>54</td>
<td>9 (6-11.25)</td>
<td>0.017</td>
</tr>
<tr>
<td>Patients with BMI &lt;24 kg/m² (Study II)</td>
<td>40</td>
<td>9.5 (6-14)</td>
<td>Patients with BMI ≥24 kg/m²</td>
<td>74</td>
<td>7 (5-10)</td>
<td>0.017</td>
</tr>
<tr>
<td>Patients with pressure sores/skin ulcers (Study II)</td>
<td>21</td>
<td>10 (8-12)</td>
<td>Patients without pressure sores/skin ulcers</td>
<td>93</td>
<td>7 (5-10)</td>
<td>0.005</td>
</tr>
</tbody>
</table>

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 under-nutrition. 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-
Predictive 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/m² 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.
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. 2003).
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.
Att vara i riskzonen för att utveckla undernärning eller att vara undernärt 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 näringsstillstånd 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.


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, koda des och avidentifierades (III).

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 nutri-
tionsstatus. 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 närings-
tillstånd (BMI <24 kg/m² och serumalbumin <36g/L) och ett normalt näringsstillstånd (BMI ≥24 kg/m² och serumalbumin ≥36 g/L) (p=0.012 (I), p=0.019 (II)). Begreppsvvaliditet visades genom statistiskt signifikanta skillnader i NUFFE-poäng mellan grupper av patienter med för-
väntade 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 åter-
fanns i 55% av journalerna och uppgifter om viktförlust i 14% av journalerna. När screenings-
resultatet relaterades till patienternas upplevda hälsa framkom samband mellan risk för under-
näring och upplevda 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 ut-
sträckning än de som hade låg risk för undernäring (p=0.014). De som hade medelhög eller hög risk för undernäring hade också lägre egnvårdsförmåga (p<0.001) och svagare känsla av sam-
manhang (p=0.007) än de som hade låg risk för undernäring. De som upplevde god hälsa hade högre egnvårdsförmåga (p<0.001) och starkare känsla av sammanhang (p<0.001) än de som upplevde dålig hälsa. Att ha lägre egnvårdsförmåga, 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. Sjuk-
sköterskornas nutritionsanteckningar visade brister, i jämförelsen med screeningsresultatet, vil-
ket tyder på att samtliga patienter med medelhög eller hög risk för undernäring inte var identi-
fierade 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 medellåg 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

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