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Undernutrition in hospitals

an evaluation of risk factors concerning the nutritional care process

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Publication date:
2010

Document Version
Accepted author manuscript, peer reviewed version

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Holst, M. (2010). *Undernutrition in hospitals: an evaluation of risk factors concerning the nutritional care process*. Center for Sensory-Motor Interaction (SMI), Department of Health Science and Technology, Aalborg University.

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**Undernutrition in hospitals:
An evaluation of risk factors concerning the
nutritional care process**

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2010

ISBN

ISBN (print edition): 978-87-7094-064-1
ISBN(electronic edition): 978-87-7094-065-8

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Original articles I-IV

List of original papers included

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

- I** Holst M, Rasmussen HH, Unosson M, The Scandinavian Nutrition Group. Well established nutritional structure in Scandinavian Hospitals is accompanied by increased quality of nutritional care. *e-SPEN* 2008 Nov 4(1):e1-e52.

- II** Holst M, Yifter-Lindgren E, Surowiak M, Nielsen KR, Mowe M, Carlsson M, Jacobsen BA, Cederholm T, Rasmussen HH. Nutritional Screening and Risk Factors in Elderly Hospitalized Patients: Association to Clinical Outcome? *J Nutr Health Aging*. Submitted 2010 Mar 8

- III** Holst M, Rasmussen HH, Laursen BS. Can the patient perspective contribute to quality of nutritional care? *Scand J Caring Sci*. Accepted for publication, May 2010

- IV** Holst M, Mortensen MN, Jacobsen BA, Rasmussen HH. Efficacy of serving bed side in-between meals. An intervention study in three medical departments. *e-SPEN* 2010 Feb;5(1):e30-e36.

Acknowledgements

The thesis is based on investigations carried out from 2006-2010, during my employment at Centre for Nutrition and Bowel Disease, Department of Gastroenterology Aalborg Hospital, Aarhus University Hospital & Center for Sensory-Motor Interactions (SMI), Department of Health Science and Technology, Aalborg University. The investigations were first of all carried out in Department of Gastroenterology, but also at Department of Infectious Disease and Department of Haematology, Aalborg Hospital, Aarhus University Hospital. Furthermore Departments of Geriatrics in Huddinge and Umeaa, Sweden were actively involved. The accomplishment of this thesis has demanded efforts, support and help from many devoted people. I therefore wish to express my sincere appreciation and gratitude to each and everyone who has contributed to this thesis, especially:

Consultant, MD, PhD., Henrik Højgaard Rasmussen, my tutor, mentor and closest daily colleague. Your devotion, concern, patience and support throughout these years have been unspeakable. Thank you for hour-long discussions and your extraordinary respect for my will-power towards the nursing aspects of nutritional care. RN, M.Sc. Nursing, Ph.D., Senior researcher, Birgitte Schantz-Laursen, my co-tutor, for your devotion to practicability and methodology, for sharing and comfort, and most of all, for seeing everything from above. Professor MD, Asbjørn M. Drewes, my scientific mentor, for believing in me and for encouragement. Thank your for your very special way of making things obvious. Tove Nygaard, RN, my “office-room mate”, for sharing ups and downs, for patience, and for great sense of humour. Consultant MD, Bent A. Jacobsen, for always being willing to discuss and work with data in the very last minute. Leaders, Susanne Svaneborg, Lotte Julin Hansen and Ulrik Tage Jensen and nurses, physician and dietician colleagues at CET, Gastroenterology Department, Ambulatory and 9Ø, as well as the Medical Centre of Aalborg Hospital, for showing interest and for giving me time and space. To Marie Nerup Mortensen for persistence, positive attitude and creativity. Management of Aalborg Hospital for giving priority to nutritional aspects and development and for nursing research. Colleague’s and Leader Charlotte Delmar at FOKSY, Department of Nursing Research for taking me in and for great inspiration. Fellow PhD students connected to FOKSY, Department of Nursing Research, especially Charlotte Bjørnes and Mette Grønkjær for fruitful discussions and good times. Den Sundhedsvidenskablige Forskningsfond, Region Nordjylland, for supporting my writing periode with ”Korterevarende Forskningsstipendie 2009”. To Aalborg University, Department of Health Science and Technology, for your scientific inspiration and especially Susanne Nielsen for practical advise and help.

Last but not least, thanks to my wonderful and supporting family and friends. Especially thanks to my children Nikolaj, Frederik and Anna for patience, love and sharing spare time. To their father, Jon and to my parents Anni and Paul for invaluable help and encouragement.

Summary

Nutritional risk (risk of protein energy-overnutrition) is seen in more than 30% of patients on admission to hospital. During hospitalization, patients seem to increase nutrition risk. Nutritional risk can be defined as adverse clinical consequences related to decreased nutrition intake. These consequences have been shown to be altered infections and delayed wound healing. Furthermore, prolonged length of hospital stay and rehabilitation, increased need for personal help, decreased quality of life and increased mortality have been described.

International guidelines have been developed to prevent and treat undernutrition. Despite this fact, patients still develop and increase nutritional risk in hospitals.

The aim of the thesis was to identify different aspects concerning the Nutritional Care process (NCP) defined as the nutritional course for patients and including 1) nutritional screening, 2) nutritional assessment and plan, 3) nutritional intervention, and 4) monitoring, evaluation and communication. Furthermore the aim was to evaluate whether looking at nutritional risk of hospitalized patients in a broader perspective may identify a chain of more or less coherent risk factors, in order to improve nutritional status of patients at nutritional risk, both individually and generally. These aspects included: I; The organisational structure, II; The screening and assessment procedure, III; The patient perspective and IV; The effect of a nutritional intervention. The thesis is based on a Mixed Methods Design, using quantitative and qualitative methodologies respectively, according to the aims of the single study.

The organisational structure

The study looked into nurses self reported practise in an organisational perspective and found that structure for working with nutrition was a necessity to enhance good nutritional practise. This important structure included engagement of leaders, having guidelines and specific tools, clear division of tasks, education and knowledge.

The screening and assessment procedure

The elderly patients were investigated in three different settings. Patients at nutritional risk as well as non-risk patients were included. Out of the findings it came clear, that special risk factors in elderly patients at nutritional risk ought to be sought when assessing the patients' nutritional status closer, and making nutrition plans. Risk factors for undernutrition by screening with three different screening tools in this group were not in agreement with those related to mortality within twelve months. The study concludes by questioning whether mortality was the relevant endpoint in this group.

The patient perspective

Severely undernourished patients were investigated in a qualitative study. The patient perspective in this study highly supported the need for nurses to show interest to the risk factors found in the former study.

Patients divided themselves into two groups. These groups had different needs for care. One group needed motivation and involvement from nurses, the other group needed strong paternalism / overtaking care to achieve their nutritional requirements. Nutritional risk factors found in the study of the elderly, could eventually be used to differ the patients into the two groups.

The effect of a nutritional intervention

The intervention study did not increase total nutrition intake, even though in between meals were served more often. On behalf of the experience from other studies referred to in this thesis, it can be questioned if all meals should be served by trained nurses. An argument for this could be, that nurses provide the total care for the patients. Thereby they could involve and motivate patients to better nutritional intake, and observe when patients are not applicable for motivation. Reflection and action could be taken directly upon these observations. The study concluded that poor clinical outcome in medical patients is directly associated to decreased nutrition intake.

The overall most important finding in this thesis was that nutritional risk factors exist at all levels from patient to staff and organisation. These nutritional risk factors interact dependently. Trying to fight or prevent nutritional risk in hospitals is therefore dependent on coherent factors that involve responsibility at all levels, from the individual nurse and physician, to the leaders of the departments, and the hospital management. Knowledge, education, organisation as well as clear and practicable tools, is extremely important. The most particular matter however, seems to be the professional attitude of using these assets in patients and their individual nutritional therapy, which must be cared for by experts and with caring heart.

Summary in Danish

Underernæring på sygehuse. En evaluering af risikofaktorer omkring ernæringspraksis

Tredive procent af alle syge hospitalsindlagte patienter er i ernæringsrisiko ved indlæggelsen. Begrebet ernæringsrisiko dækker over den risiko for komplikationer og for tidlig død, som er forbundet med utilstrækkelig indtag af næring. Infektioner, dårligere sårheling efter operationer samt længere genoptræning efter sygeforløb er komplikationerne som ofte er forbundet til utilstrækkelig næringsindtag. Udover de fysiske komplikationer er ernæringsrisiko belastende for patienters livskvalitet. Samfundsøkonomisk er ernæringsrisiko en stor omkostning på grund af længere indlæggelsestid og dyrere sygeforløb. Komplikationer som er forbundet til utilstrækkeligt indtag af næring kan reduceres ved tidlig identifikation og målrettet ernæringsbehandling. Gennem de senere år er der udarbejdet og implementeret nationale og internationale evidensbaserede retningslinier for identificering og behandling af patienter i ernæringsrisiko. På trods af disse retningslinier, har patienter fortsat utilstrækkeligt kostindtag under indlæggelsen og i efterforløbet.

Formålet med denne afhandling var at undersøge om man ved at se på patienters ernæringsrisiko i et større perspektiv, kunne se en række mere eller mindre afhængige faktorer, som har betydning for individuel og generel ernæringsrisiko hos patienter, og betydning for intervention i relation til dette.

Afhandlingen består af fire delstudier.

Den organisatoriske struktur

Første del af studiet undersøgte sygeplejerskers praksis i forhold til organisering af ernæringsterapi. Resultaterne pegede på at strukturen for hvordan man arbejder med ernæringsrisiko, såsom at have lokale retningslinier, viden, uddannelse, klar ansvarsfordeling og ledelsesopbakning, var en nødvendighed for at have en god praksis for ernæringsarbejdet hos patienterne.

Procedurer for ernæringsscreening og vurdering

Anden del af studiet så på faktorer der har betydning for ernæringstilstanden hos ældre indlagte patienter. Ældre har ofte flere medvirkende faktorer som nedsætter ernæringstilstanden. I studiet indgik ældre patienter > 65 år fra 3 forskellige afdelinger i henholdsvis Ålborg i Danmark, samt Umeå og Huddinge i Sverige. Undersøgelsen kunne identificere faktorer som bør indgå i den grundigere vurdering af den ældre patient i ernæringsrisiko, og planlægningen af dennes ernæringsbehandling.

Blandt disse faktorer var forskellige mål for kropssammensætning, fysisk styrke- og ydeevne, faktorer direkte relateret til kostindtag, herunder tandstatus, om der er svamp i munden, samt nogle psykiske og sociale forhold. Af studiet fremgik en tydelig sammenhængen mellem depression og ernæringsrisiko. Studiet viste en manglende sammenhængen mellem faktorer for ernæringsrisiko ved screening og faktorer for mortalitet indenfor 12 måneder efter indlæggelsen, og konkluderes med et spørgsmål om hvorvidt 12 måneders dødelighed er et relevant endemål for ernæringsintervention hos gruppen af ældre indlagte patienter.

Patienters oplevelse af betydelig underernæring

I det tredje studie blev patienternes oplevelse af betydelig underernæring i forbindelse med sygdom undersøgt i kvalitative interviews. Fundene af dette studie lægger op til en naturlig inddeling af patienterne i to grupper, en aktiv gruppe og en passiv gruppe, som hver især har behov for forskellige sygeplejetiltag. Patienterne i den aktive gruppe kunne motiveres til at øge deres kostindtag gennem involvering fra personalet. Dette krævede konkrete målsætninger bestående af mål for - og registrering af kostindtag. Registreringer skulle følges tæt af personalet for at virke motiverende. Den passive gruppe af patienter havde depressionslignende symptomer. Det medførte at de havde koncentrations- og hukommelsesbesvær, og følte ikke de var motiverede eller kunne motiveres til selv at være aktive i deres ernæringspleje. Hos denne gruppe må sygeplejersken tage over og sikre at patienten får tilstrækkelig ernæring. Fælles for begge grupper var at smerter, kvalme, oplevelse af at maden havde forvrænget smag,

samt tidlig mæthedsoplevelse, var grunde til ikke at spise. Bivirkninger til medicin oplevedes som en afgørende grund til disse gener, og derfor var patienterne også tilbageholdende med at bede om f.eks. smertestillende medicin. Patienterne oplevede ikke at sygeplejerskerne interesserede sig for eller tog aktivt del i deres spiseproblemer. De havde heller ikke forventning om at sygeplejersken kunne hjælpe dem med spiseproblemerne og henvendte sig derfor heller ikke selv til sygeplejerskerne for at få hjælp til disse.

Effekten af ernæringsintervention

I det sidste studie undersøgte vi om det kunne lade sig gøre at øge kostindtaget hos medicinske patienter i ernæringsrisiko ved at fremme og forbedre serveringen af mellemmåltider. Selv om mellemmåltider og proteinrige drikke blev serveret oftere ved denne indsats, lykkedes det ikke at øge energi- og proteinindtaget pr. døgn hos patienterne. Studiet viste derimod en afgørende sammenhæng mellem energi- og proteinindtag og overlevelse hos medicinske patienter. Patienter der indtog <50% af deres energibehov havde fire gange øget risiko for at dø indenfor 30 dage efter indlæggelsen.

Det mest afgørende fund i denne afhandling er at ernæringsmæssige risikofaktorer eksisterer på alle niveauer fra patient til personale og i organisationen, og at alle disse faktorer er afhængige af hinanden. Det betyder at forebyggelse og behandling af underernæring på sygehuse, kræver stor ansvarlighed på alle niveauer, fra den enkelte sygeplejerske og læge, til afdelingsledelse og sygehusledelse. Viden, uddannelse og organisation, samt klare og håndterbare redskaber er særdeles vigtigt. Det allermest betydende synes dog at være den professionelle holdning hos personalet i klinisk praksis. Ved hjælp af faglige kompetencer og omsorg for patienten er de i stand til at yde en individuel ernæringsterapi hos den enkelte patient som er af stor betydning for dennes overlevelse og livskvalitet, og som derudover har en stor samfundsøkonomisk gevinst.

1. Introduction, hypothesis, aims and background

1.1. Introduction

Nutritional risk (risk of protein energy-overnutrition) is seen in more than 30% of patients on admission to hospital. During hospitalization, patients seem to increase nutritional risk, due to lack of sufficient nutrient intake. The definition of overnutrition and nutritional risk in the hospitalized patient has often been discussed(1-4). However, a clear definition does not exist(5). In this thesis, the definition of overnutrition is “A condition where the intake of protein and- or energy is reduced to an extent where measurable effects of body composition and tissue is seen, and where this influences the patients clinical course (own definition). Nutritional risk however, is defined as the risk of complications and adverse outcomes to disease that can be related to insufficient nutritional intake. These consequences have been shown to be altered infections, delayed wound healing, prolonged length of hospital stay and rehabilitation, increased need for personal help, decreased quality of life and increased mortality.

Screening all patients for nutritional risk on admission, helps to select those at nutritional risk, from those not at risk. The purpose of this procedure is to give priority to patients whose condition will, benefit from nutritional therapy. Methods for nutritional risk screening have been developed and validated in order to detect and treat nutritional risk in different populations. Clinical guidelines have been developed by different health associations. These suggest recommendations for good clinical practise and routines in different settings and populations(6-8).

A significant problem in these guidelines is however, that they give little specific insight in the clinical challenges that clinicians at all levels meet in contact with patients suffering from nutritional risk problems. This seems to be one of more reasons that overnutrition, is still a low priority area in clinical practise. The attitude of low priority might influence the maintenance of the very high frequency of nutritional risk.

In this thesis, factors that determine nutritional risk in hospitalized patients have been investigated and the clinical relevance and level of complexity are clarified at a level that makes it very clear where clinicians at all levels need to be alert and act upon these nutritional risk factors. The study approaches the complexity of nutritional care and the setup around the nutritional risk patient, from the level of organisation to the level of specific individual patient symptom treatment. All factors are to a broad extent included in clinical guidelines for handling nutritional risk in clinical practise. This study makes it conspicuous to clinicians and leaders, that nutritional risk and nutritional care, is part of the daily charge. In this thesis, the whole setup around the care and considerations for the nutritional risk patient will formerly be called the “Nutritional Care Process” (NCP). The content of the NCP will be described thoroughly in the “background” section.

The thesis consists of four papers, I, II, III and IV. These are referred to by their numerals. These studies are one by one, shortly described in the following paragraph. In the discussion, all hypothesis and study results are discussed together.

Paper I

The study aimed to investigate whether the quality of self reported nutritional practise among Scandinavian nurses was improved by having a thorough and specific implemented structure for nutritional practise in the departments. ESPEN (European Society for Enteral and Parenteral Nutrition and Metabolism) guidelines for organisation and practise around nutritional aspects were applied. The questionnaire based study showed that education, multidisciplinary team structure, a clear definition of responsibility and first of all, leadership, was of importance for good nutritional practise at bedside. The study underlined and validated the importance for leaders and hospital owners of giving attention and priority to comply with guidelines for organisation of nutrition as a manifest in order to improve clinical practise around nutrition.

Paper II

The study aimed to identify risk factors for undernutrition in hospitalized elderly >65 years of age, by three different screening tools and to determine the association between nutrition screening tools and assumed nutritional risk factors. Furthermore, the study aimed to investigate the association between risk factors and 12 months mortality.

The screening tools used were three different screening tools recommended for screening by the ESPEN (European Society for Clinical Nutrition and Metabolism). All three screening tools are validated for use in hospitalized patients and the elderly respectively. None of the screening tools are validated for use in the combination of acute disease (as in the hospitalized patients) and in the elderly population.

In clinical practise, screening tools are used for a selection of nutrition risk patients from those not at risk, in all hospitalized patients, regardless of group, age or other differences. Since nutrition screening is not individualized or aimed at hospital specialities or geographic conditions, the study aimed to look at nutritional risk in the hospitalized elderly and the challenges for these as a homogenous group. Due to the population of elderly patients, a correction for age, gender and Charlson comorbidity index(9) was made. Differences in the frequency of nutritional risk found between the settings, underline the differences in the group of elderly hospitalized patients.

At bedside, elderly patients were screened for undernutrition by MNA (Mini Nutritional Assessment Short form)(10), NRS-2002 (Nutrition Risk Score 2002)(11) and MUST (Malnutrition Screening Tool)(12), and investigated for risk factors associated to undernutrition. The frequency of nutritional risk in this population of old hospitalized patients ranged between 47-68% dependent of clinical setting and nutrition screening tool applied. A number of functional, nutritional, metabolic and social-psychological factors were found associated to nutritional risk in the elderly hospitalized patient. In this population, handgrip strength and fungus in the mouth seemed to be the only single risk factors associated to nutritional risk as well as to mortality within twelve months. While metabolic measurements were

associated to the clinical end point, these had no association to nutrition risk by the screening methods. Within the screening tools, a 67% agreement was found. The study found that an evaluation of functional i.e. handgrip strength and chewing abilities and psychological factors i.e. depression, may be advisable for elderly hospitalized patients at nutritional risk, regardless of screening tool. The study concluded by questioning 12 months mortality as a relevant endpoint for nutritional intervention in this population. However, a larger intervention study with targeted nutritional therapy for nutritional risk patients using different screening tools should be made, including relevant outcome measurements for the elderly population.

Paper III

The patient perspective of severe undernutrition during hospitalization was investigated in a qualitative interview study, in order to seek implications this might have to clinical care. The profound results of this investigation, was the parting of patients in two groups, where the one group were active and sought involvement, and the other was passive and needed nurses and physicians to take over the decisions and handle their nutritional therapy. The passive group was found to moreover need treatment with artificial nutrition, whereas the other group was in need of response, clear goal-setting, medical problem solving and guidance. When the staff (physicians and nursing staff) showed interest to symptoms and to nutrition intake registrations, the patients in the latter group found they were more active and would to a higher degree take responsibility for their achievements of nutritional requirements. Lack of appetite, pain, bad taste, nausea and early satiety were explained as main reasons for not eating sufficiently. Medication was often given as a reason for these problems, why patients often hesitated to take medication, especially pain medication. Despite these problems, patients found that nurses to a very low degree confronted these problems, and the patients did not find a cause to approach the nurses for a solution to the nutritional problems either.

Paper IV

This intervention study aimed to investigate whether improvement and bed side individualized serving of in-between meals in a pre- and post intervention group, could improve nutrition intake in hospitalized medical patients with infectious disease, haematological and gastroenterological diseases. Furthermore the study aimed to investigate the relation between clinical outcome measurements and nutrition intake in the patient group. Patient satisfaction with the intervention was tested in a questionnaire investigation. An improvement of the total nutrition intake was not seen by the intervention.

The serving of individualized in-between meals and supplements for patients was found necessary in order to sustain energy- and protein intake and optimize energy- and protein requirements in both groups. Energy- and protein-intake less than 50% was associated to a three, respectively, four times increase in

mortality within six months. Patients found that the intervention gave them a feeling of good care and hospitality.

Conclusion papers I-IV

This thesis in general showed that there are several risk factors that alone and coherently lead to and determine undernutrition in the nutritional care process in the hospital setting. The studies showed quite clear risk factors to be aware of at all levels of practise and that these are hand able and with supporting evidence. The thesis finds these factors to be mutual dependent and all need priority and practical attention, if undernutrition is to be prevented and treated in the hospital setting.

1.2. Hypothesis

General hypothesis:

Nutritional risk of hospitalized patients is based on a chain of more or less coherent risk factors, that all need to be identified and taken care of, in order to improve nutritional status of patients at nutritional risk, individually and generally.

Part Hypothesis

- I. The structure for and organisation around the nutritional care process in hospitals, is of conclusive importance to the actual nutritional risk care.
- II. The frequency of nutritional risk in the elderly is dependent on screening tools used and clinical setting. Identification of risk factors in patients at nutritional risk may improve clinical outcome.
- III. The patient perspective of being at severe nutritional risk through the course of disease and hospitalization may identify unacknowledged areas why patients eat insufficiently.
- IV. The serving of in-between-meals may be overseen and underestimated in the therapy of nutrition risk patients. Improved and individualized serving of in-between meals will improve nutritional care and patient outcome.

1.3. Aims

The overall aim of the thesis was to evaluate whether looking at nutritional risk of hospitalized patients in a broader perspective, can identify a chain of more or less coherent risk factors, that all need to be

identified and taken care of, in order to improve nutritional status of patients at nutritional risk, individually and generally.

Furthermore the aims were:

1. To investigate whether the quality of nutritional practise among Scandinavian nurses is improved by well organised *structure for nutritional practise*.
2. To investigate the frequency of elderly hospitalized patients at nutritional risk by *three different screening tools* and to investigate the association between these nutrition screening tools and assumed nutritional risk factors.
3. To evaluate *risk factors* for undernutrition in a cohort of elderly hospitalized patients and the association of these risk factors to three nutrition screening tools and 12 months mortality.
4. To evaluate whether the *patient perspective* of undernutrition during disease and hospitalization can contribute to knowledge of why patients have insufficient nutrition intake.
5. To investigate whether intensifying in-between meal serving can *improve nutrition intake* in hospitalized medical patients.
6. To investigate the *association between nutritional intake and clinical outcome* in a Danish cohort of hospitalized medical patients.

1.4. Background

1.4.1. Nutrition nursing and its origin

Undernutrition as a clinical condition in hospitalized patients has been acknowledged for more than a century. In 1859, Florence Nightingale, who was the confounder of nursing as a profession, wrote in “Notes on nursing”; “*Thousands of patients are annually starved in the midst of plenty, from want of attention to the ways which makes it possible for them to take food. I say to the nurse, have a rule of thought about your patients` diet*”(13). In the western world of today, we can indeed endorse to the statement of “in the midst of plenty”. The availability of food and artificial nutrition in hospitals is at all times present. However, undernutrition and the ways which makes it possible for patients to take sufficient food (nutrition) in hospital is still an area for “want of attention” from clinicians, more specifically nurses, doctors and dieticians.

1.4.2. Nutritional risk. Frequency, epidemiology and consequences

The frequency of nutritional risk is reported in more than 30% of hospitalized patients on admission, and even more patients increase or develop undernutrition during hospital stay(II;IV) (1-4). This frequency varies between populations regarding medical and surgical specialities, as well as age groups(II;IV) (3;14-17). Whether the screening tools used in the different studies is predictive for the frequency of nutritional risk in the different populations, remains to be answered. Nutritional risk in the hospitalized patient is evoked as a consequence of the combination of disease related factors and factors related to nutrition intake(8;10;11;18-28). Hospitalized, diseased patients often have an increase in resting energy expenditure, thus, the energy and protein requirements are increased(29-31). During disease however, most patients have an interrupted regulation for the feeling of hunger and appetite. Also early satiety, nausea and pain, are amongst problems that compromise patients ability to respond adequate to the nutritional demands of increased metabolism(II;III;IV)(32-34). This way a shortage of energy, protein and other nutrients quickly appear as adverse effects on body shape, size, composition and function(II)(2;35;36).

The association between nutritional risk in hospitalized patients and increase in morbidity covering altered infections, pressure sores, cardiac failure i.e., and clinical outcome has been well documented(II;IV)(15;29;37-42). A connection between undernutrition and depression in patients as well as community dwelling elderly has been described(II;III)(43-45). A few studies emphasize that nutrition risk patients are in altered need of nursing care. This statement is underlined by the higher prevalence of morbidity(32;44;46-50). Increased morbidity, longer hospital stay, extended time of recovery and not the least, the dependency that comes with the altered need of care, deteriorates quality of life for patients(III)(51-55).

In addition to the remarkable personal costs for nutritional risk patients, the socioeconomic costs of nutritional risk are substantial(III)(56-59).

1.4.3. Barriers for nutritional strategies and therapies in the hospital setting

It has been determined, that inadequate knowledge, lack of instructions and the attitude amongst hospital staff towards nutritional risk, are considerable barriers to inadequate nutritional care in hospitals. This has been investigated in patients and among staff. Nutritional risk patients in general are not aware of what to eat when their appetite is decreased, and find that they have insufficient help to their choice of adequate nutrition from the staff. Education of staff however seems to be insufficient in order to improve practise around nutrition(I)(60-70).

Giving priority to the implementation process of nutritional therapy, including having standards and procedures as well as the focus from leaders, often seems to be a problem. A Danish study took interest in the implementation procedure and found, that departments who considered investigating local barriers for nutrition therapy and addressed those, had physicians who took interest in nutrition, had leaders who gave

priority and responsibility, had clear division of responsibility between the task forces and who had hard working fiery souls and clinical standards, did much better than the other departments in practising good clinical nutrition(I)(63;71-73;73).

Barriers for nutrition focus among the staff has among others been the lack of evidence to the effect of nutrition therapy, especially regarding clinical controlled trials, which are regarded the best documentation for effect among hospital staff, mainly physicians. These studies are however not very likely to be made, due to human rights and ethical considerations. Studies referred to by opportunists are often of older date and constructed with healthy subjects that do not reflect the problems patients have with eating or disease. Other studies reflect starvation of healthy subjects, which of course gives a good hint of the risks of starvation and its implications to body composition and physical and psychological health, however still they did not consider the confounding risk of acute disease. Therefore relevant studies are more often of quasi-experimental character (Grade B) or even Grade C evidence. These studies however find sufficient evidence to prevent and treat nutritional risk in hospitalized patients, in the institutionalized and in the elderly(47;52;63;71;73-87).

Meta analysis	Ia	A
Systematic review	Ia	A
Randomised controlled study	Ia	A
Controlled non-randomised study	IIa	B
Cohort investigation	IIb	B
Diagnostic test (Direct)	IIb	B
Case-control investigation	III	C
Diagnostic test (Indirect method)	III	C
Resolution analysis	III	C
Descriptive investigation	III	C
Small series	IV	D
Review	IV	D
Expert evaluation	IV	D
Leading article	IV	D

Grading of evidence. Translated from Danish (88)

1.4.4. The nutritional care process

In order to give priority of special nutritional intervention to relevant patients, screening with regard to nutritional status and acute disease have been developed and validated in different populations(II)(10;11;20;89;90). The course of the patient starts by nutritional screening. ESPEN Guidelines for Nutrition Screening recommend five issues to be considered in all patients admitted to hospital. Initially on admission, a simple nutritional screening is to be done, to identify patients at actual nutritional risk. Subsequently for patients at nutritional risk a thorough nutritional assessment is to be completed. This stage leads to an individual evaluation of nutritional requirements, and a plan for nutrition therapy and care. Monitoring and defining of outcome should be structured in order to reconsider therapy and care-planning. Finally, communication around results of screening, assessment, plan and monitoring should be communicated to other health care professionals, when the patient is

transferred, either back to the community or to another institution(8;27;28). The nutritional care process is illustrated in figure 1.

These stages are supported by the European Council, whom after a survey of nutrition practise in hospitals throughout Europe, recommends better education and that hospital management give better priority to nutrition(71). In the survey, the European Council found poor education in all staff groups and lack of support to nutritional practise. These statements lead to the question whether nutritional practise among nurses is in fact better, where the organisational structure around nutritional aspects reaches the recommended.

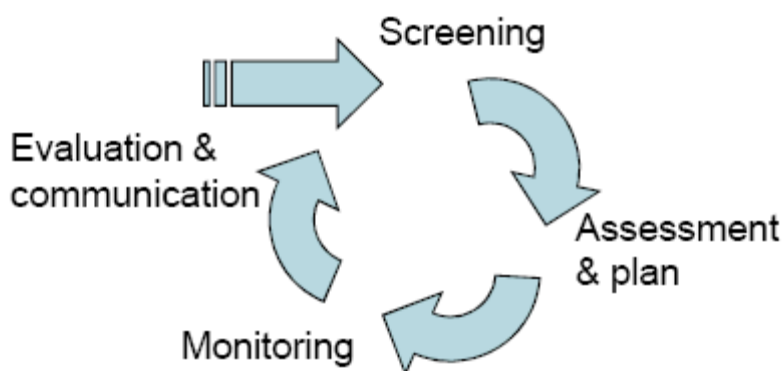


Figure 1. The nutritional care process (I-IV)

1.4.5. Nutritional challenges in different hospitalized populations; surgical, medical and the elderly

Within the hospital setting, there are many different challenges depending of population and specialities. A profound description of all different problems in this thesis will lead too far. However, the understanding of a few differences in the populations of adult patients shall be illustrated.

The surgical patients

Roughly generalized, surgical patients have a more planned course during hospital stay i.e. Fast Track Surgery / Enhanced Surgery(91;92). The surgery itself involves stress metabolism, most often referred to as “surgical stress”. With surgical stress, the body increases its metabolism, demanding more energy and especially protein. Fulfilling nutritional goals by targeted nutrition therapy is evident to decrease complications, especially by strengthening the immune response. Unfortunately the procedure of surgery also implicates nausea, pain and decreased mobility, dependent on the extent and localisation of the surgery. These are challenges for the care team around the patient. In planned surgery however, barriers for nutritional therapy can often be managed because of the staffs possibilities to be experienced with the patient course, and due to specific guidelines and standards(6;61;74;75;93;94).

The medical patients

Looking up medical patients and nutritional risk in databases, the hits are sparse. The elderly, intensive care patients and dialysis patients add up. Looking at patients in other medical settings, the comparability between the studies is low. Most often studies are prevalence studies, which expresses the extent but not the content of the problem (II;III;IV). A generalisation is hard to acquire on medical patients, which is most likely not only caused in the missing studies, but also caused by incomparable problems in the hospitalized medical patient. Our study (IV) looked into patients admitted to departments of haematology; infectious diseases and gastroenterology & hepatothology.

The *haematological patients* are often characterized with many hospitalizations for a period of a year or more. Treatment to the disease in this group causes mucositis, which makes the patient's mouth and throat very sore and swollen. Another side effect is severe diarrhoea. The patients suffer from particular fatigue, and often they have depression-like symptoms (II;III). These patients are for longer periods of time, unlikely to have sufficient nutrition intake without specially targeted treatment.

Infectious disease patients are a heterogeneous group and their nutritional problems therefore vary. Many patients are older, have concomitant diseases and need a high extent of nursing care and help. Others are younger and have less need for active help, i.e. AIDS patients, where medical treatment influences their body composition in a way that they are likely to feel overweight and refrain from eating, while they are in fact at nutritional risk. This very different approaches demand expertise and experience in the team caring for the patient.

In gastroenterology the patients vary including inflammatory bowel disease and gastroenteritis patients with pain, nausea and diarrhoea, whom are likely to not eat due to these symptoms. Frequent small meals, motivation and some times parenteral nutrition are needed. Other patients are the hepatothological patients, typically suffering from cirrhosis, where nutrition treatment is absolute necessary for recovery. These patients often suffer from encephalopathy, are irritable, un-concentrated and forgetful. They have absolutely no appetite and artificial nutrition is often needed, however tubes and lines are a nursing task for constant observation.

For all the diagnosis and departments, patients seem to respond better to treatment when nutritional requirements are met. However, the problems and care interventions to meet these patients' requirements are very different and challenging. Unfortunately these are to a very low degree described(13;54;57;64;67;82;95-97).

The elderly patients

Aiming at increasing quality of care in hospital, the eye catches the many elderly admitted to hospitals. In the elderly population, the confounding of lower bodily activity, lack of appetite and chronic disease has been described as risk factors related to undernutrition. A reduced intake of essential food items seems to be general within the elderly population at baseline. Evidence suggests that depressive symptoms and reduced quality of life is specifically associated to elderly with decreased nutritional

status(32;43;44;98;99). In studies of clinical outcome and wellbeing in the elderly population, it has therefore also been recommended, that body mass index (BMI) should be higher in the elderly, than recommended in the younger adult population(36;48;100;101). Hence, considering the high frequency of nutritional risk described, impaired outcome and quality of life, and the increase in the elderly population, clinicians have reason to be alert about the nutritional status of elderly patients.

1.4.6. Tools for nutritional risk screening

Nutrition screening is a fast and simple way of selecting patients at risk of complications related to insufficient nutrition intake, from those not at risk. Screening tools should be validated in clinical trials. Furthermore, the demands for a targeted nutritional screening tool are, that it is prognostic, specific, practicable, monitoring and economic.

Screening tools for undernutrition are developed and validated for diversified populations. Some moreover regard the implications of physical baseline status and nutrition intake in home living elderly or nursing home residents. Others are targeted hospitalization in combining the interaction of actual nutrition status and acute disease. None of the recommended screening tools are however thoroughly described for the combination of risk factors per acute disease, confounding with those of old age(II)(10;11;25). However, different screening tools have been compared in different clinical settings. In addition to the nutrition screening, body composition and physical strength have formerly been used for assessing nutritional status in different populations. In the elderly, this has moreover been done in studies of community dwelling elderly and rehabilitation programmes. The association between nutrition screening and assessment tools and clinical outcome in the hospitalized elderly remains to be further investigated(II)(2;16;20;21;26;35;39;89;102-109). Screening tools however are unspecific and aimed at a first selection between patients at risk, from those not at risk.

1.4.7. Lack of tools for nutritional assessment in the nutritional care process

After the screening procedure lies the more complex procedure of individual nutritional assessment. Nutritional assessment is an in-depth evaluation of both objective and subjective data related to an individual's food and nutrient intake, lifestyle, and medical history (II;III;IV).

Once the data is collected and organized, the practitioner can assess and evaluate the nutritional status of that person. The assessment leads to a plan of care, or intervention, designed to help the individual to either maintain the assessed status or attain a healthier status. Regarding the fairly superficial degree of education towards nutritional risk and intervention described earlier, it seems shallow to suggest a specific evaluation of nutritional status without giving more specific tools to handle the assessment with. Validated recommendations in the assessment of and nutritional care planning for the elderly patients seem necessary to fulfil the recommendations from European Council.

Not only elderly patients suffer from undernutrition in hospitals. Despite guidelines, more than half of patients have a daily intake of energy- and protein less than 75% of their requirements, and 40% lose weight during hospitalization(II;III;IV)(3;17;63;73).

Reasons for this insufficient food intake are described as multiple and of different complexity. Insufficient knowledge from hospital staff about nutritional needs and lack of attention to nutritional problems, especially among nurses, has been described(I)(22;60;63;65;73;110-112).

Actively involving patients in own nutritional care, and tutoring patients, has in clinical controlled trails amongst specified patient groups, been seen to increase patient energy intake (III)(84;113). This is underlined by investigations pointing out, that patients have rather concrete expectations to their nutritional care, but they do not seem to express them to the staff (III)(112;113). Seeking to understand why the undernutrition problem still occurs at this rate, it comes clear, that the patient perspective of undernutrition during disease and hospitalization, and the implications this focus might bring to nutritional care, has not been thoroughly enlightened.

Nutrition plan: The serving of meals has been shown to have a low priority among nurses(64;72). One study showed that especially those who take interest in nutrition education and care have no practical influence on the patients nutrition intake, since they do not relate directly to the patient(114). There is sufficient evidence, that nutrition risk patients need in-between meals including energy and protein rich sip feed supplements (supplements), in order to reach their nutritional requirements. However it has been shown, that in-between meals are not eaten by patients and are not served adequately(IV)(65;113;115). Skipping meals has in nursing home residents been shown to decrease total nutrition intake(IV)(116). Whether the serving of in-between meals and making sure that patient's actually have these served makes a difference in optimizing nutrition intake and improving clinical outcome, remains to be answered.

Monitoring and evaluation: Food intake should be monitored in all patients at nutritional risk(III;IV). Food intake registration is used for following the patient's actual energy-and protein intake closely, monitoring to which degree the patient has fulfilled his nutritional requirements. The evaluation of this registration in clinical practise, often leads to prescribing of enteral or parenteral nutrition, or other medical interventions.

Communication: When the patient has been screened for nutritional risk, the patients should be informed about this, and about the actions needed to be taken (I;III). As formerly described, evidence supports the active involving of patients at this state. When the patient is transferred to home or other health care settings, the ones taking over the care of the patients, is to be informed of the nutrition state and plan.

As of today there is yet a tendency from clinicians to focus on either disease or nutrition, leaving the nutritional part to dieticians and kitchen staff, whom know very much about food, but need cooperation into how to get the food past the barriers of the disease related factors which makes the patient unable to eat. The nutritional care process should incorporate the best of knowledge in all parts of the team around

the patients' nutritional needs and problems. Nurse theorists give priority to nutrition as an element of basic care, but also in the perspective of strong and weak paternalism. The nurse evaluates and acts upon the nursing care needed in the individual patient and the situation. Regarding nutrition nursing care, this care should not only regard serving of meals, but should evaluate the nutrition risk patients overall problems with eating and acknowledge where and when to take the role of the supporting care and problem solving or overtaking and handling care(I-IV)(95;117;118). These reflections and actions are unlikely to be completed if the nurse does not have the fundamental attitude, a supportive organisation, adequate knowledge and tools to care for the nutritional risk patient through the nutritional care process.

2. Methods and material, analyses and ethical considerations

2.1. Considerations of combining research methods

In order to be able to look at different sides of the research question it was necessary to use methods from two different research traditions; methods from traditional science and from social science. In traditional science it is common to use quantitative methods and in social science there is a tradition for using qualitative methods.

The quantitative methods gather empirical evidence systematically using formal instruments aiming at numeric results. To the extent possible, researchers use mechanisms designed to control the study, so that biases are minimized and precision and validity are maximized. The blinded randomized controlled trial is considered the best evidence (Evidence grade A), which however is very complicated to achieve in nutrition research. Other quantitative methods, as used in this study are “non-experimental descriptive research” and “between-subjects design”. Analysis is done by developed statistics. Qualitative research aims at describing and understanding phenomenon's and lived experiences. The qualitative research methodology also used distinguished methods, most often interviews, observations and narratives. In qualitative research, measurements and numbers are most often used to describe something, rather than as evidence, i.e. a description of the demographics. The analysis process of qualitative data typically involves four intellectual processes: Comprehending, synthesizing, theorizing and reconceptualising. The actual analysis of data begins with a search for pattern and regularities. This leads to themes, which involves the discovery of communalities and variations across subjects(113-116).

In both traditions, the aspect of validity refers to the degree to which an instrument measured what it was intended to measure. Reliability in both traditions refers to the degree of consistency with which the instrument or method measures what it was designed to measure(114;117). Whereas generalizability in the traditional science is the extension of research findings and conclusions from a study conducted on a sample population to the population at large, generalizability in qualitative studies is to which extend a theory grounded in the data can be transferred to similar situations or people (113;p 292).

2.2. Triangulation of methods or “Mixed Methods Design”.

Basically triangulation means having a view at something from more angles. In research triangulation is applied when two or more sources of data, methodological approaches, theorist or analytical methods are used to enlighten a phenomenon (118-120). Triangulation thereby gives the opportunity to investigate and understand more angles.

When using methods triangulation there are principles which have to be followed:

1. The methodological choices have to be anchored in the epistemological diversity and complexity of the clinical practice in order to be able to describe and conceptualize the complexity of human response to various health care situations.
2. The choice of methods and this complexity must be explicit in the presentation.
3. The alternative perspective used must be recognized as springing from dissimilar research traditions and presented such as.

When following these principles qualitative and quantitative approaches provide different, non-competing knowledge and the different sets of knowledge have equal importance and weight. Findings originating from different methods can represent worthwhile challenges to each other, and this process provides a richer and perhaps more authentic description of the issue under investigation(119)

2.3. The overall method of this thesis

This thesis, which aims to evaluate whether looking at nutritional risk of hospitalized patients in a broader perspective can identify a chain of more or less coherent risk factors, consists of four individual studies, three where a quantitative method is used and one with qualitative method.

The quantitative method is used to identify eventual numeric nutritional risk factors to nutritional therapy in the organisation as well as in populations. Within the quantitative methods, methodologies of descriptive analysis and quasi-experimental intervention studies are used. The qualitative approach is used in order to understand the perspective of the patient. This is indeed needed when the final scope of looking at coherent risk factors and eventually wanting to tie them to clinical practise. Using Mixed Methods Design in this study allows each of the methods in the studies respectively, to fulfil their aims. Finally, the triangulation will allow the main aim of the thesis – the broader perspective, to be fulfilled.

In the following the four studies and their methods are separately described

2.4. Methods and material paper I, II, III, IV

2.4.1. Methods and material paper I

The study was designed as a questionnaire based investigation of Scandinavian nurse's practise and attitudes towards the clinical nutritional care process. The questionnaire consisted of 32 questions of performance versus attitudes towards the nutritional care process; screening for nutrition risk, making care and therapy plans for at risk patients and monitoring. Other issues were own perception of knowledge, education, guidelines and tools available. Finally the questionnaire emphasized the organization around nutritional aspects in the nurses department, and possible barriers for the nutritional care process and implementation of this. The questionnaire was sent to 6000 nurses, in departments of gastrointestinal medical and surgery; orthopaedic surgery; general medical; oncology and intensive care units in Denmark, Sweden and Norway, 2000 for each country. A definition of well-defined structure (w-DS) and less-defined structure (p-DS) was made according to ESPEN Guidelines(8;27). The nurses were classified as working at w-DS departments if three or more of the five organisational markers were met. Organisational markers were: 1) A multidisciplinary nutrition team 2) A resource person within nutrition,

3) Guidelines for identification of patients at risk of undernutrition, 4) Assignment of responsibility, 5) Education for nursing staff. Otherwise they were classified as working at departments with p-DS. The results for the three countries were analysed together. Descriptive statistics was used to calculate the response frequency. To test the statistical difference between the two independent groups (w-DS vs p-DS) we used for nominal data, Chi-square (χ^2) test and for ordinal data, Mann–Whitney U-test. A multiple regression analysis with organisational structures (w-DS and p-DS) as dependent variables, and age, time since graduation, type of hospital, education and knowledge as independent variables was done and these were included as continuous variables. The level of significance was defined as $p < 0,05$. The data were analysed using SPSS.

2.4.2. Methods and material paper II

The study was designed as a prospective cohort follow-up study. The study included patients from three departments in university hospitals in Denmark and Sweden, i.e. Department of Medical Gastroenterology (26 beds), Aalborg, Denmark, Department of Geriatrics, Umeå (72 medical, orthopaedic surgery and stroke beds), and Department of Geriatrics, Huddinge (20 beds), Sweden. The patients were either admitted from the emergency ward, as in Aalborg and Umeå, only or both acutely and by referral from other departments as in Huddinge. In all three cohorts screening methods and risk factors were evaluated. The Danish cohort furthermore included clinical outcome in the evaluation. During a six months period, all patients ≥ 65 years of age, admitted to the departments for ≥ 24 hours were consecutively considered for participation in the study. The included patients were screened for nutrition risk by Malnutrition universal screening tool (MUST), Mini Nutritional Assessment (MNA) and (Nutritional Risk Screening) NRS-2002(8;27).

BMI was calculated. The patients were asked to recall weight loss in kg within the past three months. Triceps skin fold thickness (TSF) was measured by a Holtian caliper (Holtial Ltd. Crymuch, United Kingdom) at the midway point between acromion and olecranon of the dominant arm.



Measurement of triceps skinfold thickness

Arm muscle circumference (CAMA) was calculated from (MAC) and (TSF) as AMC in centimetre (cm) = MAC (cm) – $0,314 \times TSF$ (cm). Fat Free Mass (FFM) was measured by Norland XR-36 DXA scan - instrument system number 6853. Fat Free Mass Index (FFMI) was defined as fat free body mass in kg/m

height². DEXA scan was done for the Danish cohort who met the criteria's of the investigation i.e. patients with metallic material and patients who could not lie flat during the procedure were excluded.

Apart from the screening evaluations a structured interview based on a questionnaire consisting of twenty six questions concerning functional capacity, social and psychological matters and need of care was performed. The questions delineated potential risk factors, e.g. functional, biochemical, psychological and social, for being classified as at nutritional risk. Dental health and oral condition, i.e. chewing problems and fungus in the mouth were examples of functional risk factors. Self assessed taste disturbances, nausea and constipation were included in the questionnaire. Other functional risk factors included were daily life abilities, like ability to walk to the refrigerator and need of assistance during meals. Muscle strength by hand grip dynamometry (HH dynamometer with 0.1% accuracy, CITEC, The Netherlands) was measured. Blood samples were collected from the patients on the morning after the patient was included, and analyzed according to se-albumin and se-CRP. Short Portable Mental Status Questionnaire (SPMSQ)(120) (121) was carried out in order to evaluate the cognitive function. Furthermore, the patients were asked to estimate their general mood; i.e. feeling good, sad or depressed. The questions were phrased in order to make clear that it was the current situation on the day of inclusion that was asked for. To address the social situation the patients were asked if they had weekly or more frequent contact with children or other close relatives.

Twelve months mortality was investigated in the Danish cohort. Charlson comorbidity index and mortality within twelve months were obtained from the hospital patient database system.

Data analysis was carried out using the statistical package SPSS. Kappa was used to evaluate agreement variability. McNemars test was used for paired dichotomous trait, to match pairs of subjects regarding screening tools. Students T-test, Fishers and Mann Whitney's test were used for binary and ordinary data, accordingly, to evaluate the difference between the screening tools and to correlate to nutritional risk factors. Chi-squared analysis was used to test for significance. A Kaplan Meier plot with survival within twelve months, as the dependent variable, in relation to screening tools and risk factors was made. Multiple regression analyses were performed to evaluate the impact of the various screening tools and risk factors on clinical outcome (in the Danish cohort), and corrected for age, gender and Charlson comorbidity index.

2.4.3. Methods and material paper III

As the focus on this study was to investigate how individual patients experienced being undernourished a qualitative method with a phenomenological hermeneutic approach inspired by Kirsti Malterud was used(122). Semi structured interviews were carried out with twelve patients at severe nutritional risk. The participants were selected by qualitative sampling, in order to find patients who were experienced with severe undernutrition, in relation to the actual hospitalization(123). The participant criteria's were that

they needed to be able to be articulate around their experiences, and to be screened and aware of severe nutritional risk (screening score by NRS-2002).

A semi-structured interview guide inspired by Kvale was used (123) According to Kvale each interview is considered to be rich if the interviews are seen from the patients perspective in the meaning that it is the patients own experiences viewed in relation to the concrete life situation that obtain a language. Interviews continued until data satiety was achieved(123).

The interviews were recorded by “ICH audio sound recording software”. Subsequently interviews were transcribed by interviewer and re-read for understanding.

Data were analysed using a qualitative content and constant comparative method(123). Meaningful data were compared within the single interview, as well as between interviews. The analysis continued until data-satiety was achieved in clear and stable patterns, that did not change with adding interviews. The interviews were then coded into smaller units of meaning to the research question. Of these, four themes were found to repeat themselves in all interviews. The quotations presented in the result section represent these themes by typifying the data. Quotations were translated into English by author and confirmed by co-authors.

2.4.4. Methods and material paper IV

A between-subjects design intervention study. Intervention: A manned trolley served in between meals, including sip feed supplements to patients at bedside in three medical departments (haematology, gastroenterology and infectious disease). Nutrition intake was registered before and after the intervention. Clinical outcome: Length of stay (LOS), six months mortality and patient satisfaction were investigated. Independent samples test and Pearson’s chi-square test were used for comparisons; logistic regression analysis and Kaplan Meyers plot for outcome.

2.5. Analyses

The studies were statistically analysed separately. The statistical analysis conducted in study I, II and IV were both descriptive and analytic. Relative frequencies were compared with Chi-square test and Fishers exact test in all three papers. Multiple logistic regression analysis and Kaplan Meyers plot for outcome. The level of significance was defined as $p < 0.05$. The data were analysed using SPSS.

The between-methods triangulation contributes by allowing the importance of quantitative data to be supported or rejected by the patient perspective, to the extent when these subjects are mentioned. This will be followed up in the discussion.

2.6. Ethical considerations

Patients were given written and oral information prior to inclusion. The patients gave written consent to participate in the studies. The studies were conducted according to the rules of the Helsinki Declaration of 2002, and approved by the local ethic committee.

3. Results

3.1. Presentation of the main results of this thesis

The overall aim of the thesis was to evaluate whether looking at nutritional risk of hospitalized patients in a broader perspective can identify a chain of more or less coherent risk factors, that all need to be identified and taken care of, in order to improve nutritional status of patients at nutritional risk, individually and generally. The results and findings of this thesis shows that *nutritional risk factors are connected in ways that emerges an understanding why focus on one part i.e. having guidelines or education does alone not improve the individual patients nutrition intake*. In the following the results of the individual studies will be presented according to the papers published and to the aims of this study. The gathered analysis will be summarized in the discussion section.

3.1.1. Results paper I

In paper I, we aimed to investigate whether the quality of nutrition practise among Scandinavian nurses was improved by well organised structure for nutrition practise. In total 2759 nurses, responded to the questionnaire. Demographic data are shown in table 1.

Table 1
Demographic data concerning 2759 nurses in three Scandinavian countries

Demographic data	Total (%)	DK (%)	N (%)	S (%)	p-value
Total number of responders N = 2759					
Nurses response rate	46	35	32	33	ns
Gender					
Male	7	3	9	8	0.0005
Female	93	97	91	92	
Age (years)					
<30	19	17	28	13	0.0005
30–39	31	33	33	29	
40–49	32	34	27	34	
50–60	16	15	11	23	
>60	1	1	2	2	
Graduated year					
<1974	9	9	7	11	0.0005
1975–1984	21	23	14	22	
1985–1994	27	29	22	29	
1995–2004	45	38	57	39	
Working at					
University hospital	40	38	45	35	0.0005
Other hospitals	60	62	54	65	

DK, Denmark; N, Norway; S, Sweden.

Ninety percent of the respondents had a positive attitude towards screening the patients' for nutritional status on admission. Barely one third of the nurses actually performed nutrition screening routinely for all patients on admission (Table 2). Almost all the respondents agreed that a nutritional care plan should be

initiated within 72 hours for patients with compromised nutritional status or those with reduced dietary intake. The nurses more often weighed the patients on admission, than during hospital stay or at discharge. While almost fifty percent had a routine to weigh all patients on admission, only six percent undertook this at discharge (Table 2). There was an around 45% discrepancy between what the nurses wanted regarding weighing their patients, and what they actually experienced was carried out in their wards. Nearly all nurses agreed that the patients' energy requirements should be determined before prescribing nutritional therapy. Similarly they agreed that energy intake should be monitored for those at nutritional risk. Only between 15% and 31% of the nurses, answered that this was routine for all patients in their departments (Table 2). The frequency of monitoring patients' nutritional intake was very different between the countries (Table 4). Documentation of nutrition care plan in patients' records was regarded important by a majority of the nurses (93%). Only a minority answered that such documentation was always included in the patient records in their daily practice (13%)(Table 2).

A well defined structure (w-DS) was found in 49,4% of the participants departments, while 50,6 % had a poor-defined structure (p-DS) for the organisation of nutrition matters. The nurses who worked at departments with w-DS had a higher frequency for screening and weighing the patient on admission opposed to the nurses working in departments with p-DS (P<0.0001). Simultaneously, they had a higher rate of actually determining the patients' energy needs, monitoring energy intake for those at nutritional risk and for documentation of the nutritional care plan in the patients records (P<0.001) (Table 2).

Table 2
Attitudes and practice concerning the nutritional care process in departments with a well defined structure and a poor-defined structure in Scandinavian hospitals

Nutritional care process	Attitude: entirely or largely agree	Practice: yes, this is a routine in all patients at my department			
		Total group (%)	Total Departments with w-DS ^a (%)	Departments with p-DS ^a (%)	p-Value*
Nutrition status should be evaluated in all patients on admission	90	27	81	46	0.0001
All patients should be weighed at admission	93	48	83	34	0.0001
Energy intake should be taken in account on wards rounds	92	15	80	32	0.0001
Energy requirements should be determined before prescribing nutrition therapy	97	31	88	41	0.0001
Ongoing checks of risk patients achieving the desirable level of 24-hour energy intake	97	19	80	57	0.0001
Nutrition care plan should be included in the patients' records	93	13	60	31	0.0001

w-DS, well defined structure; p-DS, poor-defined structure.

*p-Values refer to a comparison between departments with w-DS and p-DS.

^a Percentages refer to the total group who take care of the nutritional process in practice.

3.1.2. Results paper II

In paper II, the aim was to investigate the occurrence of nutritional risk in old hospitalized patients as a homogenous group, by three screening tools and to evaluate the association between nutrition screening tools and assumed nutritional risk factors. Furthermore, the association between risk factors and clinical outcome and the predictive value of three screening tools regarding 12 months mortality were investigated.

Over a 6 month period 233 patient's ≥ 65 years, admitted to three medical departments in respectively Aalborg, Denmark (n=101), Umeaa (n=45) and Huddinge (n=87), Sweden (S) were consecutively included in the study.

Screening tools: Altogether, nutritional risk was found in 68% of patients by the MNA, in 47% when assessed by MUST, and 54% by NRS-2002 ($P < 0.0001$). Lowest frequency of nutritional risk was seen in Huddinge regardless of screening tool ($P < 0.0001$). A moderately good agreement was found between NRS vs. MNA and MUST (kappa 0.52-0.55) and less between MNA and MUST (kappa 0.38). The overall agreement of the screening tools was 67%. Table 3 shows the association between nutritional screening tools and risk factors.

The study found nutritional, functional, metabolic and social-psychological elements associated to nutritional risk in the population.

Nutritional elements: Weight was measured in 232 of the 233 patients. Weight loss $> 5\%$ was seen in 28 % of the participants. Only two were unable to account for whether they lost weight. A wide range of BMI was seen (12-46). $BMI \geq 24$ was seen in 45%. Corrected arm muscle area (CAMA) was below the recommended standard in 13% of the population, whereas skin fold below 10 mm was seen in 33% of the patients (recommendations for the elderly population are unclear). Weightloss was found in 89-98% of patients at nutritional risk. BMI below 22 was found in patients at nutritional risk. Low fat free masse, skinfold below 1.2 Cm, were risk factors according to all three screening tools.

Functional elements: handgrip strength ≤ 12.4 , and chewing problems were risk factors according to all three screening tools. Also the lack of ability to walk to refrigerator, and the lack of ability to shop for own groceries were associated with nutrition risk by all tools.

Metabolic elements: Having more than three tablets a day was associated with nutrition risk by all tools. Haemoglobin, Albumin, CRP, natrium and kalium were not specifically correlated to nutrition risk in any of the settings or the nutrition screening tools.

Social-psychological elements: Frequent contact with children or relatives, was not associated to nutritional risk by any of the tools. Feeling depressed was the most significant single risk factor according to all three screening tools.

Table 3. Association between nutritional screening tools and risk factors

Screening tool	NRS-2002		MNA		MUST	
	Not at risk	At risk	Not at risk	At risk	Not at risk	At risk
Functional risk factors						
Not able to walk to refrigerator %	29	71*	39	61*	32	67*
Need help in meal situation %	53.6	46.4	17.2	82.8*	39.3	60.7*
Hand grip kg, mean (SD)	14.5 (7)	12.4(7) *	15.8(6)	12.3(7) *	14.4(7)	11.4(7) *
Chewing difficulty %	26.8	73.2*	19.5	80.5*	43.9	56.1*
Constipation %	48.1	51.9	32.5	67.5*	46.3	53.7
Taste disturbancy %	21.1	78.9*	9.5	90.5*	40.5	59.5*
Nausea %	18.9	81.1*	7.1	92.9*	32.1	67.9*
Fungus in mouth %	8.7	91.3*	12.5	87.5*	50.0	50.0
Biochemical risk factors						
CRP mg/l, mean (SD)	28.2(28.2)	36.4(46.4)	50.5(69.2)	48.1(59.3)	32.9(49.8)	35(34.8)
Albumin mg/l, mean (SD)	33.7 (5.1)	32.7(4.7)	40 (2.8)	32.3(4.4)	32.7 (4.4)	33.2(5.2)
Anthropometric measurements						
BMI, mean (SD)	25.3 (6)	22.3 (5)	26.8 (6)	22.2 (5)	26.7 (5)	21.2 (5)
FFMI, kg, mean (SD)	38 (8)	31 (6) *	44 (11)	34(6) *	35(7)	35 (7)
Triceps skinfold cm, mean (SD)	1.4 (0.7)	1.39 (0.9)	1.57(0.9)	1.31 (0.9)	1.58 (0.8)	1.19 (0.9)
Social and psychological risk factors						
Depressive mood ¹ %	21	79*	2	98*	32	68*
Contact to relatives less than weekly%	50	49	36	63*	53	46

*P <=0.005 level of significance

¹Patients self estimated mood

Clinical outcome: Table 4 shows the association between risk factors and 12 months mortality. *P-albumin below 30 g/l and CRP* were significantly associated to mortality within 30 days, five months and one year (P<0.05). *Handgrip strength <12 mmHg* was associated to mortality (P<0.05). Fat mass index <10% measured by bio impedance (BIA) was not significantly associated to mortality within twelve months (0.066). Fat free mass index <12 (NS), and triceps skinfold <1.2 (NS) were not associated to mortality.

The study specifically indicates that an *evaluation of dental and oral health, fat-mass by measurement of skin fold, functional condition by measurement of handgrip and psychological health would be appropriate on hospital admission for elderly patients at nutritional risk when associated to nutritional risk by screening with validated screening tools.* On the basis of very little connection between the screening methods and twelve months mortality, a discussion was however raised whether mortality as clinical end point was relevant in the population. Figure 2 illustrates the elements in nutritional risk factors among elderly patients.

Table 4. The association between nutritional risk factors and 12 months mortality

Variable	Odds ratio	Confidence interval	P-value
<i>Functional</i>			
Able to walk to refrigerator	0.351	0.119 – 1.031	0.057
Need help in meal situation	2.571	0.780 – 8.472	0.121
Hand grip >12 mm/Hg	0.878	0.786 – 0.980	0.021
Chewing difficulty	1.546	0.570 – 4.192	0.391
Constipation	1.2	0.451 – 3.191	0.715
Taste difficulties	1.025	0.421 – 2.493	0.957
Nausea	1.375	0.545 – 3.466	0.499
Fungus in mouth	3.673	1.193 – 11.308	0.023
<i>Biomedical</i>			
CRP > 10 mmol /l	1.366	1.018 – 1.834	0.037
Albumin > 30 g/l	0.893	0.830 - 0.961	0.002
<i>Anthropometry measurements</i>			
BMI < 20.5	1.560	0.569 – 4.079	0.364
Fat Free Mass Index (normal)	0.945	0.353 – 2.529	0.911
Fat Mass Index (normal)	0.882	0.772 – 1.008	0.066
<i>Social and psychological</i>			
SPMSQ (No cognitive dysfunction)	0.514	0.278 – 0.948	0.033
Not depressed	0.522	0.165 – 1.655	0.270
Contact to relatives less than weekly	0.816	0.255 – 2.604	0.731

Results by logistic regression analysis are corrected for gender, age and Charlson index.

3.1.3. Results paper III

Paper III aimed to evaluate whether the patient perspective of undernutrition during disease and hospitalization could contribute to knowledge of why patients had insufficient nutrition intake. The interviews to a very high contributed to the understanding of why patients ate insufficiently despite of the implementation of formal guidelines. These findings could be an important key when wanting to improve nutrition intake in hospitalized patients at nutritional risk.

The units of meaning identified in the interviews were clustered into the following four significant themes: “Physical and psychological impact”; “Reasons for not eating / impact of medication”; “Motivation and expectations to staff” and “The role of others”. The findings divided the patients into two groups; the “passive group”, and the “active group”, who due to the findings in this study should be cared for differently. Figure 3 illustrates the division of barriers for nutrition intake and intervention in the “Passive” and the “Active group”.

Common for both groups: Patients were all aware that they had meaningful trouble with eating sufficiently, and that this affected them negatively in many ways. They expressed a significant understanding that nutrition was needed to get well. This understanding came out of experiences from relatives or media about others who had lost weight in connection with disease and of information from staff. Physically, the *patients felt exhausted, irritable and vulnerable*. They drew a direct line to poor nutrition intake as the reason for this.

Lack of appetite, pain, bad taste, nausea and early satiety were explained as main reasons for not eating sufficiently.

The amount of *medication*, especially tablets, was mentioned as a barrier for appetite, and as a reason for bad taste. Some were reluctant to take *painkilling medication*, even though they found that pain prevented them from eating sufficiently and made them inactive. Patients did not consult the nurse about these problems. However they were reluctant to take medication, the patients were fully aware that medication was needed in treatment of their underlying disease, and expressed full confidence in this. A patient, who during disease had suffered from a depression, was under the impression that *antidepressant medication* in combination with parenteral nutrition treatment helped her regain motivation, including attempting to eat. Patients referred to pain and nausea medication as being given pro necessity, after breakout of symptoms, as being common.

Above all the mentioned reasons for not eating, *“I simply can’t”* /or couldn’t/, was however the most common.

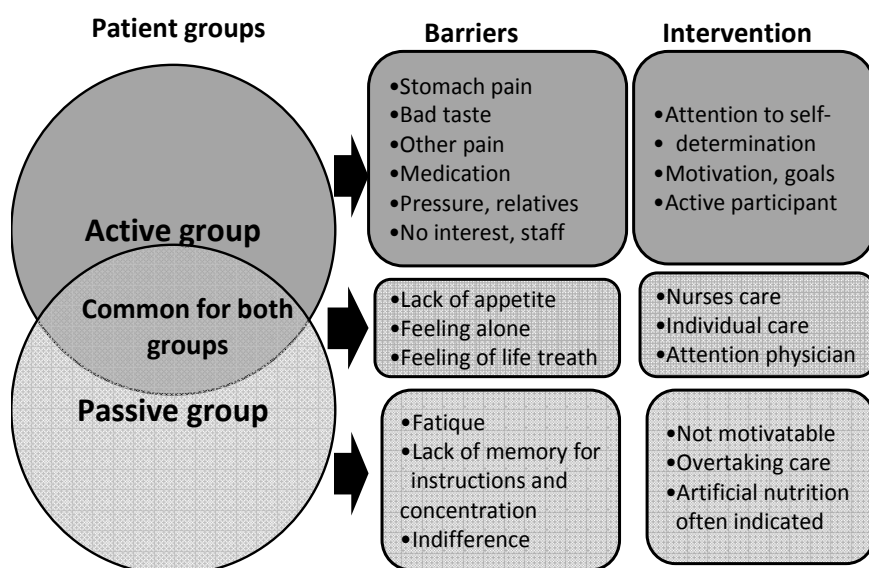
For both groups a lack of expectation towards the nurse to be of professional assistance was seen. The patients did not consult the nurse with trouble regarding their difficulties in eating i.e. bad taste or pain, even though they had an idea what the problem was, and were able to be articulate about it during the interview. Figure 2 shows uniformity and differences between the groups.

The passive group: Psychologically, in patients who found they eat very much too space, there was an experience of feeling of ignorance, lack of concentration and abandoning hope. Lateness was a common experience related to little eating, where patients found that they couldn’t keep up with the speed in the hospital. For instance during rounds, they suddenly found it hard to understand information given and asking indebt questions was simply not possible, because the time was passed whenever they got to the point when they were ready. If the interviewed patient was speaking of this as a phase passed, the memory for the period of time very superficial.

The same patients referred to a kind of physiological ignorance to everything going on around them. They had the feeling that things were falling apart for them, but felt too exhausted to do anything about it, and after a while they just stopped caring. They referred to the staff’s attempts to encourage them to eat and drink at this state as feeling unimportant. In spite the fact, that they basically believed, that nutrition was necessary for their recovery, they were *insusceptible for motivation*.

The active group: Patients whom appeared more active and involved, were much more articulate about their experiences during the interview session, and had a clear attitude to what they found was best for them, and what they found was good and less good care. They were quite clear that nutrition therapy had helped them. Many of them could refer in words what the dietician and the physician had said to them about it. Help and practical advice from nurses was only mentioned to a very little degree. *Goal setting was important and was used around nutrition intake and physical activity. Nutrition recording were mentioned as regarded a double-edged sword. First of all, it was important to the patients that they knew which goal to reach (their daily requirements). If the recordings were followed up by the staff daily and the staff took interest in it, the recordings were regarded very highly. Especially patients referred to conversations about their daily intake, with their physician on rounds. When opposite to this, the recordings where not followed up, and the staff did not seem to care at all, the recordings were found demotivating, meaningless and destructive to the confidence between the staff – especially the nurses, and themselves.*

Figure 2. Barriers for nutrition intake and intervention in the “Passive” and the “Active group”



3.1.4. Results paper IV

In this study we aimed to investigate whether intensifying in-between meal serving in an intervention study could improve nutrition intake in hospitalized medical patients. Furthermore, the aim was to investigate the association between nutrition intake and clinical outcome in a Danish cohort of hospitalized medical patients. Energy requirements (median values) before and after the intervention were 1642 kcal (1200-2150 kcal) vs. 1608 kcal (1200-2400 kcal). Protein requirements (median values) before and after were 71.6 grams (55-95 grams) before vs. and 70.3 after (55-105 grams). The mean energy intake before and after the intervention period, was 81.4 vs. 78 percent of requirements (NS). For protein

the mean intake was 64 vs. 67 percent of calculated requirements before the intervention (NS). *Overall, there was no increase in the mean protein or energy intake for the mean total of the whole group together.* Protein supplements were significantly more often served to the patients after the intervention (57% vs. 26 %) (P<0.001). In-between meals were served to the patients more often after the intervention period (93% vs. 89% (NS)), however in-between meals at baseline were served more frequently than expected. This increase in the served in between meals and supplements did however not influence the total daily intake of energy and protein in the patients. Outcome measurements were investigated in 239 patients. *A significant correlation was found between insufficient energy intake (< 50% of requirements) and increased mortality within 6 months (P=0.002)(Figure 3).*

The study thereby insinuates an advantage in using protein supplements and in-between meals to improve outcome goals in medical patients. *Furthermore, a correlation between an insufficient protein intake (< 50% of requirements) and increased six months mortality was found (P=0.04)(Figure 4).* Age, gender, length of stay (LOS) and speciality, were not predictive factors for the serving of in-between meals.

In a logistic regression analysis concerning energy intake, age, sex, LOS and specialties as predictive factors for mortality within six months, we only found a low energy intake (P=0.009) and medical specialty (P=0.007) as independent predictive factors. Furthermore, a low protein intake was an independent predictive factor, however only nearly significant (P=0.056) (data not shown). We did not find any correlation between LOS and intake of energy or protein, neither before nor after the intervention period (NS). Furthermore, no correlation was found between numbers of re-admittances and energy- and protein intake before or after the intervention period (NS).

Figure 3. Percent energy intake vs. six months survival

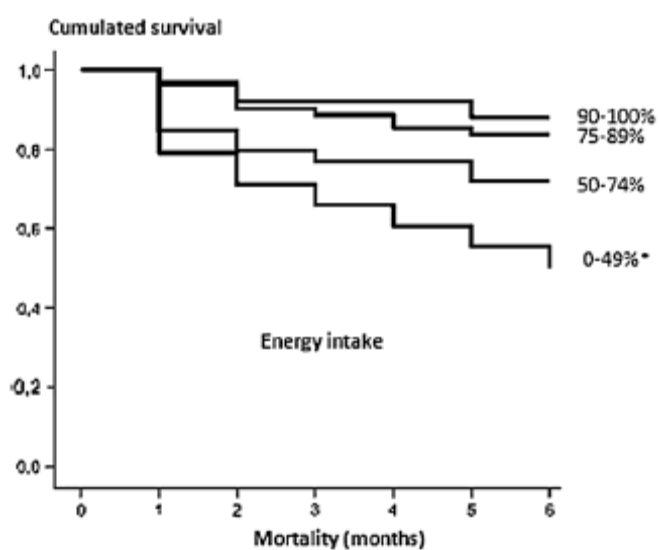


Fig. 1. Cumulated survival (Kaplan-Meier plot) within 6 months after discharge from three medical departments compared to energy intake.

Fig. 4. Percent protein intake vs. six months survival

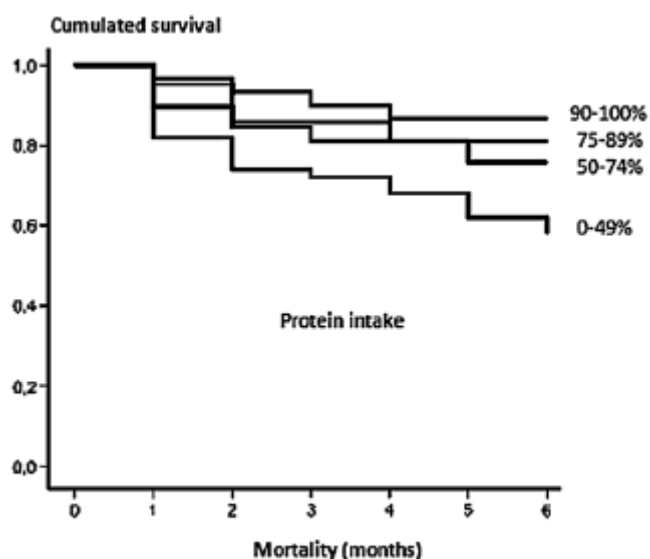


Fig. 2. Cumulated survival (Kaplan-Meier plot) within 6 months after discharge from three medical departments compared to protein intake.

Table 5. Logistic regression analysis

Variables		Univariate analysis			Multiple analysis		
		Serving in-between meals			Serving in-between meals		
		OR	95% CI	p-value	OR	95% CI	p-value
Age	Year	0,99	[0,96; 1,03]	0,73	1,00	[0,96; 1,04]	0,95
Sex	Men	1		0,99	1		0,76
	Female	1,00	[0,38; 2,63]		1,24	[0,31; 4,89]	
LOS*	Days	1,05	[0,98; 1,12]	0,18	1,03	[0,97; 1,10]	0,37
Departments	Infectious	1		0,070	1		0,27
	Haematology	1,62	[0,56; 4,69]		3,19	[0,78; 13,0]	
	Gastroenterology	0,18	[0,03; 1,30]		1,00	[0; 10]	

*LOS = length of stay

Logistic regression analysis concerning age, sex, LOS and departments as predictive factors for serving in-between meals in three medical departments. Linearity regarding the two continuous variables age and LOS was found, and these were included in the regression analysis as such.

4. Discussion

The following discussion will evaluate the results of the different studies, and their meaning to the nutritional care process. In paragraph 4.1, the used methods will be discussed. In paragraph 4.2, the findings are discussed in subheadings related to the aims of this study and the nutritional care process.

4.1. Methodological considerations; internal and external validity

In paper I, the design was a questionnaire study. The questionnaire investigation is a feasible way to collect highly structured data, when the researchers knows exactly what answers they are looking for and when self-reported data. Other advantages are low cost, access to larger populations within a short period of time and a not very time consuming data analyses procedure with modern techniques. The disadvantages of the questionnaire study are a commonly relatively low response rate and the risk of overlooking potentially important responses due to the tight structure. Testing a questionnaire in smaller samples beforehand is very useful, in order to adjust the questionnaire for understanding. In this study we aimed at testing self-reported attitudes in a large population and physical area. The questionnaire in this study was previously tested among Danish doctors and nurses(70). In acknowledgement of the relatively low response rate, conclusions should of course, be interpreted with caution. An analysis of the non-respondent group was for practical reasons not performed. If the respondents were, as intended, chosen consecutively, the answers are not given by nurses who take the most interest in nutrition, and the data hereby provides a moreover general picture of nurses` knowledge, attitudes and practices towards

nutrition, however coincidental. If this is not quite the fact, bias could be that the nurses are the most interested in nutrition. Thereby the responders opposed to the nurse in general, should have increased knowledge, more positive attitudes and find practice regarding nutrition better.

The three out of five structure markers chosen (w-DS and p-DS) was a pragmatic cut off. The idealistic goal obviously, is the department where all criteria's are met. However more than half (three out of five), was chosen in order to present positive attitude to departments in development of good nutritional practise, as professional experience shows that the first steps of development are the hardest obtainable. Whether a department that meets all the recommended standards for organisation structure is better qualified for nutrition practise is of course likely, but calls for further investigation, along with the investigation of whether one of the structure markers is more important than others. The method of this study was of good validity underlined by the lean on clinical guidelines and former tested questionnaire. A direct association to the organisation of clinical practise becomes clear.

In paper II, the design was a combination of screening by validated methods, structured interviews and physical investigations. Outcome measurement data were gathered. The design focused on clinical practise relevance. The size of the cohort, especially since the settings were not quite equal, limited the validity of the study. However the study aimed to investigate general problems in the elderly population related to nutrition. These problems were found very much comparative despite of the differences within the settings, which support the method and the results, and also the screening methods as being general for the population. The clinical practise focus in the method especially causes that the results are interpretive and useful directly in clinical practise as it is today. A gold standard for which screening tool to use for the population is still missing. The results of this observation study showed, that a prospective randomised intervention study would be needed, to finally clarify if any of the used screening tools could be applicable as the "Gold Standard".

In paper III, the design was a qualitative interview investigation. The design had a phenomenological and hermeneutic understanding, since lived experiences were investigated. Qualitative interviews are characterized with a smaller sample size in a certain context. The data expresses a subjective content of meaning to the interviewed person at the time and in the actual context. Qualitative interviews are not intended to be validated with generalisability towards a larger population. Data are validated by internal analysis. The validity of a qualitative interview study is seen by the understanding it brings to the subject in similar populations. Bias to the method is the risk of implicit understanding from the interviewer, which is sought retrieved by awareness. The study adds to interpretation of why circumstances where patients do not eat sufficiently and the impact especially nurses and physicians have on this by their attitudes and actions towards the patients' nutritional intake

and problems related to this. The clinical impact of this study and basis for further investigation could be remarkable.

In paper IV, a between-subjects design study with an intervention was conducted. The group of patients admitted to hospital at the time before the intervention was compared with the other group of patients admitted to hospital at the time six months into the intervention. This comparison between two different groups, the high amount of data excluded due to insufficient fulfilled forms and the assumed influence of intervention bias in the first group, diminished the validity and the specificity of the study. The outcome analysis in the broader medical population and the connection of this to nutrition intake confirms the necessity of nutritional support in a very low investigated group. The study is therefore expected to be of great importance as a starting shot to clinical nutrition in the medical settings and to practice related research of clinical nutrition in these settings, in the future.

Overall the methods of the studies and the results complete each other by their distinct clinical relation.

4.2. Discussion of the findings

The meaning of organisational structure to quality of nutrition nursing care

In paper I, a direct correlation between having a good or less good structure for nutritional practise was found. A pragmatic cut off for three out of five structures was set, and it can be emphasized that nutritional practise would have been even more significantly better, if all five organisational structure markers were met. Earlier studies have indirectly looked into this. Both Lassen et al. (64;65;72) and Rasmussen et al.(73), found that implementation of nutritional strategy, was significantly better in departments, where the leader was devoted to the change, and had assignment of responsibilities to the different tasks as well as clear procedures. Kondrup et al.(63), found in a cross sectional study, that lack of procedures and management were barriers to nutritional care. Rasmussen furthermore found, having one or more fiery souls in a department, was important for the implementation process.

Even though ESPEN Guidelines and the European Council(8;71) recommend organisation of nutrition strategies, and wise men in the field have applauded for structure more than ten years ago, this has earlier been very sporadically investigated internationally, and maybe therefore it seems that the priority to organisation of nutritional aspects is not very widespread (I)(124). The Nutrition Day initiative (www.nutritionday.org) is attempting to look into the subject and will hopefully soon publish a verification of this study to improve the amount of evidence that seems adequate to document the need for priority to improvements in practise.

Nutritional assessment specifically aimed at elderly nutritional risk patients

Paper II indicates that special risk factors for undernutrition in the elderly population are related to nutritional risk by screening with three different validated instruments recommended by the ESPEN

guidelines. Some of these risk factors are implemented in some of the screening tools, and others are not. For instance, BMI and weightloss are both included in all screening tools, and are both predictive for risk associated to all tools. Acute disease is regarded in two screening tools (NRS-2002 and MUST), and chronic disease in two tools (NRS-2002 and MNA). Risk factors regarding nutritional status, functional impairment, metabolic impairment and psychological- and social health were seen. These factors were shown to be related to nutrition risk by screening, and could therefore advantageously be investigated for as a standard during nutritional assessment of the elderly patient found to be at nutritional risk. However, these were not all also associated to mortality within twelve months. Regarding nutritional status, it has formerly been emphasized that BMI in the elderly should exceed 24(14;36;48;100;125). The BMI alone does however not reflect the distribution of body components or of physical strength and abilities, which seem to be even more important in the population. *Poor body composition has earlier been shown to impact clinical outcome in the population(20;20;30;89;100;126). In this study, weightloss, skin fold thickness below 10 mm, low calf circumference and upper arm circumference was seen frequently. Former studies have indicated a correlation between these parameters and clinical outcome as well as poor life quality for the elderly(36;47;48;127). Recommendations towards these parameters are however far too vague, for the parameters to be used and interpreted for nutritional assessment by nurses in general clinical practise.* One could therefore emphasize, that BMI \leq 24 in the elderly patients (cut of age also not verified), may be followed by anthropometry measurements and an evaluation of physical status. The need for specific and clear instructions on how to manage assessment is underlined by a Swedish study that investigated the agreement between two independent observers assessing elderly patients for nutritional risk factors with the same instrument and comparing them. For both there was a relative low agreement between the assessments(16). The study emphasizes that nurses are well trained in using the screening and assessment tools.

Albumin and CRP were not significantly associated to nutrition risk by screening tools, however associated to mortality. The value of CRP to diagnose nutritional risk has been discussed, and the discussion seems only exceeded by the discussion of the impact of Albumin(15;16;19;26;29;42;109). This study (II), will acknowledge that acute-phase response and standard blood test was in fact associated with poor clinical outcome in the patients. *The serum secretory proteins are however correlated with other indicators of illness severity and adverse outcomes, and are therefore not specific markers of nutritional risk, and however easy to access and often a part of routine analysis, they cannot be recommended for the purpose of nutritional assessment and prescription of nutritional therapy and care in the hospitalized elderly population.*

Oral health as fungus in the mouth, sufficient teeth and dentures that fit, were found to be risk factors. This has been looked into earlier, however, in literature it seems that taste, smell and texture of food which makes people with bad oral health able to have sufficient oral intake, are only interesting to dieticians, whereas it is the nurses who actually care for the patients in daily practise(33;82;83;128-130).

Psychologically, depression in this study was the most convincing risk factor for undernutrition, as it was associated to nutritional risk by all screening methods ($p < 0.001$). In this study the feeling of a depressive condition was not associated to mortality within twelve months. Depression in the elderly especially, but also in other groups has formerly been clearly associated to nutritional risk, and in some studies also related to a poor clinical outcome and decreased life quality(32;43;45;98;127;131). In this study, the feeling of depressive mood was not associated to clinical outcome. *However, we find that depressive conditions, is necessary to consider in nutritional risk patients in hospital. This is supported by the results of study III, linking depressive condition to poor nutrition intake and the ability to participate in nutritional therapy. Despite of this, there are no clear recommendations or integration in guidelines for actions related to this very serious matter(28).* Some has discussed which comes first – undernutrition or depression. Nevertheless, the high frequency of depression among the elderly hospitalized patients at nutritional risk deserves further examination (discussed under paper III) and eventually antidepressant medication therapy. Furthermore, depression symptoms tested by evidence based depression scales, and directly related to assessment of undernutrition in the elderly and finally adding clear therapy suggestions, calls for further investigation in a larger cohort.

Of social evaluated risk-factors, living alone and having frequent contact with children or other close relatives were only significantly related to nutrition risk by one of the screening tools. Living in special senior facilities was seen to be a risk factor in relation to two of the screening tools, but also living in original home facilities was found to be a risk factor by these tools. Although these factors have been found evident in un-hospitalized elderly, this study does not find basis to add these items to a generalised assessment scale, but should of course be assessed for the elderly at discharge form hospital.

The patient perspective contributes to knowledge of why patients have insufficient nutrition intake

Paper III sought the patient perspective of undernutrition in the attempt to understand clinical implications this might have to nutritional care. Even though some of the findings have been earlier been considered in questionnaire investigations(65;113). These questionnaire investigations give structured answers to structured questions, resulting in a good glimpse at the prevalence of a subject. The understanding of the implicit meaning to patients, has however been sought in the present qualitative interview study. In this study, the patients furthermore found reason to relate to nursing actions, or lack of such. Generally, the reasons found for not eating sufficiently support those seen in quantitative investigations (24;33;54;63;65;111). *The patients expressed that they found the impact of medication to nutrition intake extremely high, and side effects to medical treatment were acknowledged as severe barriers for nutrition intake. Although medical encyclopaedias describe nausea and taste differences in association with many different kinds of medication, this has not earlier been thoroughly described from a users perspective (34;128).*

Physically and psychologically the patients differed into two groups. One group was the active patients, whom needed active involvement, motivation from staff and follow up on nutritional. These patients contributed to own nutritional therapy with setting goals for themselves. This group could be compared with a cohort of orthopaedic patients whom were hospitalized for arthroplasty and replacement surgery, formerly described with the need for active involvement (113). These orthopaedic patients were not necessarily at nutritional risk at baseline, and if regarded at nutritional risk, they would most likely belong in the category of patients defined in this active group.

The other group was characterized with fatigue, indifference and being unsusceptible for motivation to participate in own nutritional therapy. These patients described their psychological condition comparable to depression, as seen in the elderly patients in the former study(32;43;45;98;127) (II). In the clinical setting these patients did not participate and would not ask for or consume supplements if these were served (IV). Therefore these patients would most likely often need artificial nutritional support, as those who had past the condition behind them, referred to at the epoch-making prescription from the memorable physician who they felt saved their lives.

A major problem however found in this study was, that nurses do not approach patients on matters that decrease nutritional intake and patients do not turn to the nurse about them either. This lack of professional assistance and alertness to nutritional problems has formerly been enlightened as a problem, i.e. the lack of targeted serving of meals, attention to weightloss and poor eating(64;65;113). In the present study, formerly due to the applied method, patients were much more articulated about given and non given attention from the task forces. *The nurses did not attend to the individuals' nutritional problems in a professional problem solving way, and the patients did neither divert the attention from nurses directly towards the eating problem, which were most often pain, nausea, bad taste, early satiety or just no appetite.* Other studies have emphasized barriers to nutritional intake among patients seen from a professional point of view (I). This study will underline that nurses need to raise their perspective to improve nutritional care(108), which makes the focus on organisation (I) and tools for specific assessment (II), even more necessary and appropriate to the profession.

Why intensifying in-between meal serving did not improve nutrition intake

The main findings of the present study (paper IV), underline the evidence that the outcome of hospitalized medical patients is improved by sufficient nutrition. Subsequently, the study demonstrated the necessity of using protein supplement drinks and in-between meals to improve outcome goals in medical patients. An overall improvement of nutrition intake was however not achieved by introducing intensified in-between meals. The lack of measurable effect from the intervention can be discussed in diversified perspectives. First of all, there was a very high exclusion rate for food intake registrations. This was due to a large number of insufficiently completed registration forms. In the literature this registration problem does not seem thoroughly described, although this is a very important issue, since many intervention

studies are based on food-intake registration. Many methods are developed for this, but none are quite as detailed as the present. *The inaccuracy of nutrition registration seems just as problematic in clinical practise. In practise, food intake registration is used for following the patient's actual energy-and protein intake closely. Furthermore, this registration in clinical practise, often leads to prescribing of enteral or parenteral nutrition, or other medical interventions.* Another issue is the risk of over- or under reporting by patients as seen by other groups i.e. alcohol treatment therapy(132). This problem could occur, if patients are registering themselves, and especially if the monitoring is not followed up closely by professionals (III). *The lack of active involvement of patients from physicians and nursing staff is a well known barrier against the patient taking charge of own nutrition treatment and actually eating more (III); (65;113).* In this study, uneducated staff served meals at bedside. The impact of this choice, which was made for economic reasons, remains unclear. In another study, nurses give the impression, that serving meals is not an interesting task(64). In the meantime, many studies show that nurses have positive attitudes to working with nutritional risk in practise(I) (67;68;108). Whether the serving of meals is included in the positive attitudes to working with nutrition has not been sought, and was not emphasized in our study of attitudes (I). Having meals served in individual ways and having the professional discussion with the nurses around nutrition, however seems important regarding motivation of patients to take actions on nutritional therapy (III); (113). Further investigations will hopefully give evidence to whether serving of meals should have priority as an important task for nurses. Nursing theorists supports nurses giving attention to not only nutrition, but to the actions patients need help to handle(13;95;117).

The implication of intervention bias should also be discussed. A substantial body of evidence supports the stand that introducing any kind of intervention will in evidently lead to focus on the subject. Thus, as meaningful as registering food intake is to practise, the focus on insufficient intake in a nutrition risk patient could most likely lead to immediate action from the caretaker (65;65;115). In ethical considerations this could also be the main reason why randomised controlled studies in the field of oral nutrition have not been practised for many years. The question of intervention bias is supported by the fact, that the pre-and post measurement group, both have a relatively high intake of energy and protein compared to the intake in studies in general.

Finally, the assumption of intervention bias is supported by the calculated increase of supplements and protein-and energy dense ice creams delivered to the departments from the kitchen, during the pre measurement period. This method of collecting secondary data from kitchen delivery has formerly been used and published in another intervention study(66). Nutrition supplements and in-between meals are however significantly more often served to patients, in the post measurement period. The increased frequency of patients having served in-between meals and supplements and still not having a larger total energy- and protein intake, leads to a few more questions. *The feasibility to introduce more food to nutrition risk patients during the few available hours of daytime remains a question. Furthermore, the relatively high intake during the pre measurement leaves only little potential for improvement.*

Whether introducing a prolonged daytime meal schedule or a manned trolley taken to the bedside in the evening can increase energy and protein intake, also remains to be answered. Thus, it seems appropriate to investigate if prolonging the total hours of daily meal service and expanding the in-between meal trolley services also to the evenings, makes a difference. *Furthermore, it remains unknown whether the same amount of energy and protein given to patients in smaller and more frequent dose, makes a difference to clinical outcome.*

Poor nutrition intake is associated to clinical outcome in hospitalized medical patients.

Mortality in our study (paper IV) was higher in patients receiving less than 50% of their daily requirements, concerning energy and protein. *The serving of supplements and in-between meals alone, were related to a higher achievement of energy and protein requirements – again related to all outcome measurements.* The link between these supports the stand that nutrition supplements and in-between meals should be an important part of the treatment of medical risk patients, alongside with antibiotics and other treatment. Even if this intervention study does not account for an increase in total energy and protein intake, the serving of in-between meals and supplements, seem to have a secondary important role to clinical outcome.

Whether the few days of hospitalization and thereby few days of nutrition therapy will in fact in itself change clinical outcome can be discussed. *Nevertheless, the few days in hospital are days where optimal nutrition therapy, and planning of post hospital therapy as well as teaching patients, can hopefully make a difference in the longer term. This is supported by the evidence, that nutrition guidance in the short time outpatient clinic can improve outcome(84).*

Looking at nutritional risk factors in a broader perspective is necessary to improve nutritional care and fulfil the nutritional care process in clinical practise

As seen from the former discussion, many things influence the nutritional status and therapy of patients in hospitals. We found that the structure for working with nutrition, including engagement of leaders, having guidelines and specific tools, clear division of tasks, education and knowledge is a necessity to enhance good nutritional practise(6;8;16;27;28;66;68;71-73;124) . Special risk factors in elderly patients at nutritional risk ought to be sought when assessing nutritional status, and making nutrition plans. The patient perspective in our study highly supported the need for nurses to show interest to the risk factors found in the former study(18;29;33;45;53;65;98;113;128;131;133;134). Patients divided themselves into two groups, which should be attended to differently. One group needed motivation and involvement from nurses, the other group needed strong paternalism / overtaking care. The nutritional risk factors found in the study of the elderly, could eventually be used to divide the patients into the two groups(43;84;98;120;135;136). The intervention study did not increase total nutrition intake, even though in between meals were served more often. On behalf of the other studies included in this thesis, it can be

questioned if all meals should be taken care of by trained nurses who also care for the patients, and who could involve and motivate patients to better nutritional intake, and who could observe when patients are not applicable for motivation, and act upon this observations. The study concluded that poor clinical outcome in medical patients is directly associated to decreased nutrition intake.

This thesis shows that the broader perspective and good and clear practise at all levels, is necessary to achieve appropriate nutritional care, and to fulfil the nutritional care process.

5. Future studies

5.1. Ongoing studies

The ongoing studies can in general be characterized by a desire to improve the nutritional care process in the clinical setting. An investigation including multi-professional nutrition teams in a university hospital is going on. Twenty-six departments with multi-professional nutrition teams are participating in this study, focusing on improvement of nutritional practise.

In the same setting, a cross-sectional questionnaire investigation concerning communication between nursing staff and patients has just been finished with participation of 280 patients.

The demand for a better nutrition registration tool found in this study, has lead to a co operation with Aalborg University about development of a more practicable tool for nutrition registration for clinical practise and research purposes. This work has recently been initiated.

5.2. Related studies in consideration

Further investigations will hopefully give evidence to whether and how serving of meals should have priority as an important task for nurses. The design of this study is in consideration.

5.3. Perspectives to clinical practise

In clinical practise time and resources are short. Therefore assignments which are less evidence based and less practicable and less concrete, seem to be overruled by other priorities. The process of this thesis and my daily work in the hospital setting has taught me that nurses and physicians are most responsive to their specific speciality and draw back on generalisation. In my future work in clinical practise as well as in the research on which development is based, I will concentrate on specificity and practicability within nutritional problems related to the specific specialities, aiming to implement nutrition as evidenced practise.

6. Conclusions

The overall most important finding in this thesis was that nutritional risk factors exist at all levels from patient to staff, as well as in the structure of the organisation, and that these interact dependently. Trying

to fight or prevent nutritional risk in hospitals is therefore dependent on coherent factors that involve responsibility at all levels, from the individual nurse and physician, to the leaders of the departments, and the hospital management. Knowledge, education, organisation as well as clear and practicable tools, are extremely important. The most particular matter however, seems to be the professional attitude of using these assets in patients and their individual nutritional therapy, which must be cared for by experts and with caring heart.

This study found that quality of Scandinavian nurses self reported nutrition practise was improved by well organised structure for the nutritional care process. A very high frequency of patients at nutritional risk was found. Differences in frequency was seen between settings and screening tools. Risk factors for nutritional risk were to a low extent reflected in 12 months mortality. Elderly patients at nutritional risk should be assessed for nutritional risk factors in order to have timely and targeted actions for the planning of sufficient nutritional therapy. Focus should be on oral health, body composition and functional abilities. Finally, but not least, it seemed that depression was the most associated to nutritional risk. Testing for depression with a validated depression score for the elderly and fungus in mouth should be considered routinely. Other clinical end points than mortality should be considered in upcoming investigations. The study contributed to clinical practise, especially by focusing on the way nurses and physicians with close individual assessment, attitude and determination, could influence the nutritional intake and thereby the whole recovery process of the undernourished patients. A division into two groups was found. These should be cared for differently concerning nutritional attention and therapy. The patients in “Passive group” felt fatigue and without initiative and could not be motivated to increase nutrition intake by guidance. They should therefore be followed closely by the nurses and treated systematically. Enteral or parenteral nutrition will often be needed in this group of patients. Patients in the “Active group” needed to be cared for with active individual involvement, motivation by goals and follow up by nurses. Self-determination was important to these patients and therefore the individual approach was even more important.

Patients do not expect the staff to be able to remove or minimise the symptoms that decreased their nutrition intake. Nurses should work much more targeted and individualized around the patient’s nutrition recordings. These should be followed up during the day. When patients did not meet their nutritional requirements, the nurse should look into barriers and reflected adequately to find solutions to these problems.

Intensifying in-between meal serving had no effect on the overall protein and energy intake of hospitalized medical patients. A direct association between nutrition intake and clinical outcome in a Danish cohort of hospitalized medical patients was found. Mortality within six months was independently associated to a low energy intake and to a low protein intake.

Abbreviations

AMC: Arm muscle circumference (MAC (cm) – 0,314xTSF)

BMI: Body Mass Index

CAMA: Corrected Arm Muscle area

ESPEN: European Society of Enteral and Parenteral Nutrition and Metabolism

FFM: Fat free body mass

FFMI: Fat free body mass in kg/m height²

MAC: Mid Upper Arm Circumference

MNA: Mini Nutritional Assessment

MUST: Malnutrition universal screening tool

NRS: Nutritional Risk Screening (NRS-2002)

TSF: Triceps skin fold thickness (TSF)

Se-albumin: Serum content of albumin

Se-CRP: Serum content of reactive protein

SPMSQ: Short Portable Mental Status Questionnaire

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