

Faculty of Health Sciences  
University of Southern Denmark

PhD Thesis

Improving quality of care for older medical patients

**Identifying patients at risk of readmission and factors influencing implementation of a readmission prevention program**

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## Preface

This PhD thesis is based on data collected from 2012 to 2014 as part of the inter-organizational collaboration in a post-discharge follow-up program. As such, it has necessarily involved a large number of collaborating persons and organisations, all of whom provided invaluable assistance in helping me to carry out my research and write this dissertation. The initial research was conducted under the auspices of the inter-organizational steering committee for Forebyggelse af U hensigt mæssige Indlæggelser (FUI) and Holbæk Hospital, Medical Department. Additional data collection was carried out under the supervision of the steering committee for the implementation of post-discharge follow-up visits in Region Zealand and involved collaborators from hospitals, regional administration, municipalities and general practitioners. Further, this PhD thesis was made possible due to the comprehensive monitoring and data collection carried out by health professionals at the hospitals and municipalities of Region Zealand.

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S.F.L.

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This PhD thesis is based on the following papers

### **Paper 1**

Lehn SF, Zwisler AD, Pedersen SH, Gjørup T, Thygesen LC. **Development of a prediction model for 30-day acute readmissions among older medical patients: The influence of social factors along with patient-specific and organizational factors.** To be submitted to BMJ Open Quality.

### **Paper 2**

Lehn SF, Zwisler AD, Pedersen SH, Gjørup T, Thygesen LC. **From hospital to municipality to general practitioner: patient-specific versus organisational barriers to effective care.** Submitted to: International Journal for Integrated Care.

### **Paper 3**

Lehn SF, Thuesen J, Bunkenborg G, Zwisler A-D, Rod MH. **Implementation between text and work: a qualitative study of a readmission prevention program targeting elderly patients.** Implement Sci. 2018 Mar 1;13(1):38.

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## **Appendices**

Appendix A	Screening questionnaire for the post-discharge follow up program 2012 at Holbæk University Hospital [in Danish].
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Papers	I, II and III

## **List of abbreviations**

ADL	Activity of Daily Living
AUC	Area Under Curve
GP	General Practitioner
OR	Odds Ratio
ROC	Receiver operator Curve

## Introduction

For years there has been increasing recognition of a large gap between the development of evidence-based practice and what is actually implemented into clinical practice to the benefit of the patients (1,2). Researchers agree that the challenges of implementation far outweigh the problems of developing improvements in interventions (3). For those programs that entail provider engagement across organizations and professional disciplines, the challenges become that much more difficult (4,5). In a world with increasing numbers of older people living with comorbidity and disabilities, where health care *needs to be* coordinated across organizations and disciplines, these challenges of inter-organizational implementation constitute a major concern (5). Nonetheless, certain areas of implementation have remained poorly researched. Specifically, we need more knowledge about the implementation of programs that seek to integrate care (6). In this area as well as others, the influence of context in implementation is widely acknowledged (1,7–9); yet, knowledge on exactly *how* context influences the process of implementation remains limited (9,10).

This PhD dissertation seeks to identify those elements that are most important when we introduce new inter-organizational health care programs intended to improve quality of care for older patients with multifaceted health problems. It is based on a case study of post-discharge follow-up visits in Denmark, the purpose of which is to prevent readmissions among older medical patients. In the following background section, I will first describe the challenges posed by readmissions generally, the characteristics of older medical patient, and the experiences with interventions to prevent readmission. I then go on to describe the Danish experiences with post-discharge follow-up visits to prevent readmission.

## Background

### Characteristics of older medical patients

The focus of this thesis is on the group of 'older medical patients', which here refers to patients aged 65 years or older who have been discharged from a medical department. The post-discharge group is rather heterogeneous in terms of diagnoses, Activities of Daily Living (ADL) and living conditions (11). However, there are important commonalities across the patient group and in the kinds of stressors that these patients experience due to hospitalization (12). Older individuals run a higher risk of comorbidity, disability and frailty, which relates to the physical process of ageing. With age, the homeostatic reserves of the body decline due to accumulated decline in many physiological systems during a lifetime (13). The speed of these ageing processes differs from one individual to another, of course. However, when physiological reserves gradually decrease, an older individual's vulnerability to minor stressor events such as infections increases (13). Older patients who are hospitalized run a high risk of complications such as pressure ulcers, delirium, infections and further functional decline (14). In addition, older patients are less likely to recover their functional ability once it is lost (15). One study showed that among American patients aged 70 years or older who were admitted with acute medical illness, about 30% experienced functional decline during hospitalization (15). Another characteristic of this group of older medical patients is a high occurrence of comorbidity, i.e., suffering from two or more coexisting diseases (16). An international review showed that within different populations aged 65 years or older, the prevalence of comorbidity ranged from 55-98%, and among hospitalized geriatric patients, nearly all suffered from co-existing diseases (17). These multifaceted health problems among vulnerable older medical patients has created an acute need for health care that operates across provider specialties and care organizations (18).

### Readmissions

The risk of readmission varies significantly for various patient groups. Older patients and patients initially admitted with medical diagnosis, such as diagnosis related to respiratory system or diagnosis related to genitourinary system, have a greater risk of readmission (19,20). In Denmark, the risk of readmissions among patients aged 67 years and older with specific diagnoses was 20% in 2016 (21), a level that corresponds to that among

American Medicare patients (22). The growing older populations, both in Denmark and globally, cause higher rates of morbidity and increased health care costs (23). Hence, prevention of readmission has been on the political, clinical and scientific agenda for many years (24,25).

Researchers in the U.S. and the UK estimate the potential national savings to be considerable (26,27), and in Denmark, a medical technology assessment showed that a specifically targeted readmission prevention program resulted in savings of 5,000 DKR per patient when all intervention expenditures and savings were included (28).

From a clinical perspective, a high frequency of acute readmissions can be an indicator of suboptimal quality of care. The quality problem may occur during the hospital admission period, in the transfer from hospital to patients' home where other providers, such as municipality nurse and GP, take over health care (29–32). A study of patients readmitted to a medical department showed that one-third of readmissions were related to suboptimal quality of care during index admission (33). Suboptimal quality of care during hospital admission includes errors in diagnosis or treatment, lack of follow-up on clinical tests or incorrect discontinuation of previously administered medication (33,34). However, suboptimal quality of care may also result from lack of communication in the transition from hospital to home (35,36), or lack of adherence to the specified treatment regime after discharge (37).

An important factor in successful readmission prevention programs is to target the intervention towards individuals at high risk (38). From a patient perspective, patient satisfaction does not necessarily increase with *more* care. In one qualitative study, patients experienced feelings of frustration related to both excessive and lacking health care (39). More is not necessarily better. In addition, from a health economics perspective, there is a strong incentive to target health care interventions to patients with specific needs (40).

#### *Prediction of readmission risk*

Older medical patients tend to have a higher risk of readmission; however, about 80% of older patients are not readmitted within the first month after discharge; hence in targeting interventions, there is a need to identify those patients who are in particularly high risk (21,22,38). Assessing risk of readmission is complex, and a study of clinical assessment among hospital staff has shown that providers often have difficulty in accurately predicting acute readmissions (41). The literature cites several risk factors: comorbidity,

polypharmacy, specific diagnosis, dependence on homecare and various social measures (20,42). However, to move from knowledge about risk factors to actual stratification of patients according to their risk, a more precise assessment is needed of the importance of the different risk factors (38,43). Most prediction models that have been developed for predicting readmission blend younger and older age groups or target specific disease groups (22). The models that have been developed for the non-disease specific group of 'older medical patients' almost all show low performance in discriminating readmitted patients from non-readmitted patients (40,44–46). Increasing attention is now being given to how social factors influence risk of readmission. Studies in the U.S. suggest that social factors in terms of e.g. race, health insurance and social support can serve as predictors for readmission among specific disease groups (47,48). In an Italian study, low level of education was shown to increase risk of readmission among patients with acute myocardial infarction (49). In Denmark, where the administrative registers provides valid information on social factors like civil status, children, income and education (50–53), it is possible to investigate whether more social factors alongside other important candidate predictors, can improve prediction of readmission among older patients.

### Interventions to prevent readmission

Older comorbid patients enter into a web of providers and medical care specialties, and *interaction with the health care system* has been reported as one of the main challenges in conducting a qualitative study of patients suffering from comorbidity (54). Multiple discontinuities exist within systems of care for older patients, and these discontinuities can interfere with the delivery of appropriate clinical care. This division of tasks between, respectively, types of providers (municipal social services, the hospital, the social-medical care) and the larger acute/continuous care divide have been described as a challenge for both patients and providers (18). Hence, important questions remain: how to overcome this fragmentation, and how to improve the quality of care in the transfer of the patient from hospital to the home so as to prevent acute readmissions. Recognizing the barriers for patients with multifaceted health problems, various interventions have been tested internationally with the goal of improving integration of care across the health care system, both in terms of enhancing quality and reducing hospitalization (55). Two reviews of studies on interventions to prevent hospitalization showed mixed results for the broader group of older patients and patients with chronic disease (31,55). In one of the reviews, the

meta-analyses showed significant reduction in readmission associated with interventions focused on hospital care and follow-up and on geriatric home assessment (31). Interventions that seek to improve continuity of care for comorbid patients often share specific characteristics in terms of integrating health care across professions and organizational settings (55). The inclusion of additional interacting components and extra organizational levels leads to more complexity in implementation (31); hence, interventions aimed at preventing readmissions among older medical patients often end up being complex in both their design and implementation (31,56).

#### *Implementation of readmission prevention interventions*

Though a variety of interdisciplinary and inter-organizational interventions have been tested with the aim of preventing readmissions among older and/or comorbid patients, we did not know whether the level of implementation influences readmission outcomes (31). In integrated care programs that operate across disciplines and organizations in health care, the professional adherence to program guidelines can be hampered by various interacting elements, such as insufficient integration across patient databases and lack of economic incentives among the providers to adhere to guidelines (6). However, we have no studies that have tried to test whether lack of adherence in an integrated care program depends on patient-specific characteristics (57). Since interdisciplinary interventions often require alignment of policies, delivery systems and other system factors, the influence of context is crucial (58,59). Context influences practice through the interpretation and actions of the health professionals, and it can be perceived by the health professionals as external demands (9,60). Understanding this interaction between external demands and everyday health care work is crucial to successful implementation, since contradictions between demands can influence actions and priorities in health care work (9).

#### **Experiences with the Danish post-discharge follow-up program**

Despite the complexity of conducting interventions aimed at improving quality of care for older patients, a 2007 Danish study by Rytter et al. showed promising results for an intervention aimed at reducing readmission among older medical patients (61). Rytter et al. conducted a randomized controlled trial of 333 patients aged 78 years or older, who had been discharged from a geriatric or internal medical ward at Glostrup Hospital, Denmark. The study showed a significant reduction of readmissions (12%) within 26 weeks after discharge in the intervention group compared to the control group (61). The intervention

consisted of three follow-up contacts: i.e. one home visit joined by the GP and municipality nurse one week after discharge and two subsequent GP contacts in the third and eighth week after discharge.

These results were given attention by Region Zealand, which subsequently developed local initiatives for post-discharge follow-up visits. The development of the Region Zealand model can be divided into two phases; test- and regional implementation phase.

#### Testing of the program

In 2011-12, an inter-organizational project group including health care directors from municipalities and hospitals in Region Zealand along with consulting GP's initiated a project to reduce hospitalization among older medical patients. Due to the impressive results of post-discharge follow-up visits from Glostrup Hospital, the project group was keen to test the intervention in the local setting. One hospital and six municipalities decided to test the feasibility of the program (62), while Holbæk University Hospital and three surrounding municipalities decided to test the effect of the intervention in a randomized trial conducted in 2012. Nevertheless, compared to the study from Glostrup Hospital, there were few changes in the intervention design related to how GPs would be involved in the study, additionally were there changes regarding inclusion of patients. The main outcome of interest in the Glostrup study was readmissions within 26 weeks after discharge; whereas, in the main outcome of interest in the Holbæk study was 30-day readmissions. However, the Holbæk study also reported on readmissions within 26 weeks (table 1).

Table 1: Comparison of two Danish studies of post-discharge visits performed by GP and municipality nurse, in terms of study design, level of completion, and effect on risk of readmission.

		Study from Glostrup hospital 2007 (28,61).	Study from Holbæk Hospital 2012 (63).
Study design	Organizational setup	Seven Municipalities and GPs in these geographic areas were individually invited to participate. All seven invited municipalities and 63% of GPs participated.	Three municipalities were invited to participate, and GPs participated as part of a local financial agreement with the General Practice Agreement. All three invited municipalities agreed to participate in the study.
	Inclusion criteria	Patients aged 78 years and above, discharged from the geriatric or internal medical ward, and have had a minimum of two days' hospitalization.	Patients aged 65 years who had dementia or suspected dementia or at least two of the screened conditions (see appendix A).
	Exclusion criteria	Severe dementia, linguistic problems, terminal illness, and patients whose GPs did not want to participate in the study.	Patients who did not live in one of the three participating municipalities.
Proportion of patients who receive intervention	Proportion of included patients who received first post-discharge follow-up visit	93% patients	55% patients
	Proportion of patients who received second visit	78% patients	18% patients
	Proportion of patients who received third visit	72% patients	3% patients
Effect	Difference in readmissions between intervention- and control group after 26 weeks	26 weeks after index discharge, the intervention group had 12% less readmissions than the control group (23% relative readmission risk reduction).	At 4 weeks and 26 weeks after index discharge, there was <i>no difference</i> in readmissions between patients in the intervention group and patients in the control group.

The randomized trial from Holbæk hospital proceeded from February to September 2012. A total of 531 patients were included and randomized into either the intervention group (270 patients) or the control group (261 patients). The core intervention, post-discharge follow-up visits, was similar to the study from Glostrup hospital. However, unlike the study conducted at Glostrup Hospital, at the end of the trial period, the Holbæk study showed *no reduction* of readmissions in the intervention group compared to the control group; the rate of readmission was equal between the groups. Instead, what the study revealed was a lack of adherence to the intervention protocol by the participating healthcare professionals. Only 55% of the participating patients in the intervention group received the first visit, 18% received the second visit and just 3% received the third visit (63). These results resemble similar pragmatic trials from different regions of Denmark, demonstrating substantial gaps in implementation of post-discharge follow-up visits by GPs and municipality nurses. Studies conducted in five other parts of Denmark demonstrated rates of completion of first post-discharge follow-up visit ranging between 14% and 53% of referred patients (64).

In comparing the results published from 2007 to 2012 (61,63,64), it is not clear which factor produced the low effect on readmission in the Holbæk study. How could we sufficiently predict which patients had increased risk of readmission and, thus, target the intervention, and what determined the shortcomings in implementation of this inter-organizational program?

#### *Regional implementation*

Out of a consistent wish to improve continuity of care for older patients and with emphasis on the significant results from Glostrup Hospital in 2007 (28,61), the Danish healthcare officials decided in 2012 to scale-up post-discharge follow-up visits to a national level. This initiative entailed that all Danish regions, municipalities and GPs should offer post-discharge follow-up visits to frail elderly patients from the beginning of 2013 (65). Consequently, the unanswered questions from the Danish studies described above became even more urgent. Fortunately, however, monitoring data were collected in Region Zealand, which added new knowledge about the process of implementation.

## Aims and sub-studies

Overall, the aims of this thesis are to investigate those elements that are important when new inter-organizational programs are introduced to improve quality of care for older medical patients. In carrying out this study, I focus on the post-discharge follow-up program, the aim of which has been to improve care and prevent readmission among older medical patients. As underlined above, prevention of readmission most often entails activities to better integrate health care across hospital and primary health care settings. International experiences show the complexities of these activities; hence, questions arise as to (1) how to identify those patients with the greatest need for readmission prevention initiatives and (2) the actual intervention measures that can best meet these interdisciplinary, inter-organizational requirements. Hence, this thesis consists of three sub-studies, with the following aims:

- I. To develop a comprehensive model for predicting 30-days readmission among older medical patients, including potential predictors related to social, demographic organizational and health-related factors.**
- II. To examine the degree to which adherence to an integrated care program, which targets older medical patients is associated with patient-specific or organizational factors.**
- III. To explore how external demands influence implementation of an inter-organizational program by identifying the contradictions between the demands imposed by program implementation and the everyday work routines of healthcare staff.**

## Methods

In this section, I will introduce the analytical framework, concepts and setting used in all three sub-studies in this thesis. Subsequently, I describe the specific methods used in the individual studies, which included both quantitative and qualitative data. The methods used in the individual sub-studies are further described in the three papers, which form the body of this thesis.

### Analytical framework

#### *Multiple methods*

In this thesis, I explore elements which are important when introducing new inter-organizational health care programs. Focus is on two areas: *prediction of readmission risk* (sub-study I) and *implementation of inter-organizational interventions for older medical patients* (sub-studies II and III). In describing this work, I adhere to the philosophic approach of pragmatism that encourages the use of the specific research methods to address the research question (66,67). As noted by Johnson and Onwuegbuzie, “the bottom line is that research approaches should be mixed in ways that offer the best opportunities for answering important research (66). Hence, I utilize both quantitative and qualitative research methods to answer questions and fulfill the aims of this thesis. As described below, prediction of readmissions in sub-study 1 is based on quantitative methods of data analysis, while sub-studies II and III use respectively quantitative (substudy II) and qualitative (substudy III) methods to elucidate the overall question of what factors influence the implementation of an inter-organizational program. The strength of the quantitative methods utilized is that they can test hypotheses; they can explore the spread of a specific pattern in health care for older medical patients (i.e. readmissions and adherence to an intervention) (68). The qualitative methods utilized allowed me to understand the participants’ meanings and experiences, e.g. the reasons why specific patterns in health care appeared (informants’ reasons as to why implementation developed in a certain direction) (68).

#### *Clarification of concepts*

A few terms and concepts are crucial for the design and interpretation of this Ph.D. thesis and the sub-studies comprising it. The core concepts are quality improvement, implementation, context, readmissions and integrated care.

## Quality improvement

There is a lack of consensus on the term 'quality improvement' (69). However, the post-discharge follow-up program in Region Zealand can be defined as essentially a quality improvement program, in the sense that it aims to produce a positive change in the care provided to older medical patients (70). In this thesis, I use the term 'quality improvement' to describe evidence-based efforts to improve patient outcomes, inspired by the above understanding of improvement programs and Øvretveit et al.'s definition of improvement change (71).

## Implementation

Implementation can be understood as an actively planned and deliberately initiated effort to bring a given object into action (1). Implementation science often focuses on either the process of implementation or the implementation outcomes (1,72). Implementation outcomes can be measured in terms of 'implementation fidelity', that is, the degree to which an intervention is delivered as intended; the assumption here is that the level of fidelity probably influences the outcomes of the intervention (56,73); e.g. the readmission rate. As described by Carroll et al., an important aspect of fidelity is the level of adherence to the intervention guidelines, i.e. whether the intervention reaches all targeted patients and whether patients receive the planned intervention measures in accord with the proposed frequency and duration (73). In this thesis, I interpret adherence as the frequency and coverage of the post-discharge follow-up program.

## Context

In relation to the process of implementation, context can be understood as the characteristics and circumstances that surround an intervention (1). Context should not be viewed as something static. Rather, it interacts with, influences, modifies, facilitates or hampers the intervention and its implementation (1,10). Sub-study III in this thesis investigates the influence of contextual factors related to the process of implementing the post-discharge follow-up program. I operationalize influence of context as external demands, which are mediated into clinical practice by text-based material (74). Hence, my use of the concept of context is slightly different than what is common within the field of implementation science (1); and my interpretation should be described as *institutional* context. For elaboration of the theoretical background, see the sub-section below regarding sub-study III and paper III of this thesis.

## Readmission

In this thesis, 'readmission' is defined the first acute admission to any hospital department within the time interval of 4 hours to 30 days after index discharge. I define 'admission' as inpatients, in line with the Danish National Patient Register ('patient type 0') (75). Thus, emergency contacts and contacts with outpatient clinics are not included. In the literature, readmission has been subject to various definitions. However, readmission within 30 days, as in focus here, is the most common measure (42).

## Integrated care

The goal of integrated care is to enhance quality of life and quality of care for patients with complex health care needs cutting across multiple providers (76). In terms of integrated care, integration means methods designed "to create connectivity, alignment and collaboration within and between the cure and care sectors'(76). The concept of integrated care does not presuppose that integration is complete; rather, it highlights the movement towards a more complete and integrated system (76). In alignment with the interpretation above, I define the post-discharge follow-up program as an integrated care program, aiming to improve quality of care by strengthening the integration of GP and municipality nurse providers.

## Setting

Health care improvement and its outcome measures (e.g. readmissions) cannot be separated from the context in which it is embedded (10,77). Hence, it is important to note that the investigations in this thesis are based in the context of the Danish welfare state. The Danish health care system is tax-funded and provides universal access to health care (78). GPs are independent operators who enter into contracts with the regions and serve as gatekeepers to the next level of specialized health care (78). Municipalities provide health and social services to individuals with disease and disabilities (79), and they employ registered nurses as well as ancillary health care staff, home health aides, etc. Regions, mostly at hospitals, provide specialized treatment and care (79).

### *The post-discharge follow-up program*

In this thesis, I focus on the post-discharge follow-up program as a case of an integrated care program. In Region Zealand, the program had two phases: testing of the program in a part of the region in 2012, and the regional implementation from 2013 (as described in

pages 11-14 above). In both phases, the program proceeded as follows: Hospital staff administered screening to the program by using a screening questionnaire. If patients were eligible and wished to be included in the program, hospital nurses referred patients to the municipality, and the municipality nurses then arranged up to three joint visits together with the GP. The first visit was scheduled within one week after discharge: the GP and municipality nurse focused on medication, rehabilitation plan, hospital appointments, functional level, and need for further health care initiatives. At first, it was assessed whether the patient needed further visits (up to two more visits), and health care activities were coordinated between GP and municipality nurse. If needed, the second consultation was planned for the third week, and the third consultation took place in the eighth week after discharge.

## Study populations

Data obtained in this thesis is based on the patient populations who participated in the two phases of implementation of the post-discharge follow-up program, i.e. the testing of the program in 2012, and the regional implementation which began in 2013. Data on the regional implementation was obtained for 2014. More detail on the specific populations is described under the each sub-study.

## Registers

In sub-studies I and II, candidate predictors and co-variables were initially selected due to the existing literature and clinical assessment by the authors. I supplemented the clinical data with comprehensive data from eight different Danish administrative registers. All data were linked by personal identification number (80). The clinical data obtained regarding the specific admissions for each individual were then compared to data from the Danish National Patient Register, and all admissions were thoroughly re-identified based on the timing of admission and discharge. As shown in table 2, I also used register data to derive variables regarding demographic, social, organizational and health-related factors.

**Table 2: List of register-based information and registers.**

Type of data derived	Data source
<i>Demographic factors</i>	
Age Gender	Danish Civil Registration System (78)
City size	The Building and Housing Register (81)
<i>Social factors</i>	
Educational level	Danish Education Register (50)
Income*	Danish Income Statistics Register (82)
Children	Danish Fertility Database and Danish Adoption Register (81,82)
Spouse / marital status	Danish Civil Registration System (78)
<i>Organizational factors</i>	
Municipality (both patients and children)	Danish Civil Registration System (78)
Distance to GP	The Building and Housing Register (81)
Contact with GP Contact with emergency service doctor	Danish National Health Service Register (20)
Type of GP practice**	The Danish National Health Service Register (83)
Personal and practical assistance	Statistics Denmark <sup>1</sup>
<i>Health-related factors</i>	
Diagnosis (A and B diagnosis until 10 years prior to index admission) Admission details	Danish National Patient Register (75)
Medication	Danish National Prescription Registry (84)

<sup>1</sup> Based on municipal reporting.

\*This information was not used in study II.

\*\*This information was not used in study I.

### *Register-based categorizations*

In sub-studies I and II, I derived 34 co-variables from the different registers. In some cases, I made categorizations of the readily available information in the registers. These categorizations are elaborated below.

#### Educational level

Since distribution of educational level within the study populations was relatively homogeneous, we selected a simple categorization of educational level. Data were based on the DISCED-15 classifications by Statistics Denmark (85). Hence, we created a category for education related to basic school only (*basic school*). Likewise, *vocational*

*education* was categorized individually, whereas upper secondary school and any educational level above this were grouped into the category *higher education*.

#### Nearby living children

Denmark, with a population of 5.8 million, is divided into 98 municipalities. In this thesis, patients' children were categorized as *living nearby* if they lived in the same municipality or a neighboring municipality as the specific parent (i.e. the patient).

#### Personal and practical assistance

Homecare was categorized as a dichotomous variable with reference to the time period of index admission and one month back in time.

#### Type of GP practice

In the Danish National Health Service Register, GP practice is registered as either solo practice, shared GP registration number (i.e. sharing the patient list), or shared practitioner clinic (i.e. sharing clinic facilities, but not patient list). We kept the first as a single category, *solo GP practice*. However, shared GP registration number and shared practitioner clinic were categorized together as *shared GP practice*.

#### Primary diagnosis

Primary diagnosis was categorized according to the WHO ICD-10 Classification system (86). In sub-study I, the primary diagnosis was categorized into one of the three most frequent ICD-10 groups in the data: diagnose codes related to the respiratory system, diagnosis related to the circulatory system and diagnosis related to atypical symptoms. The latter category covered diagnoses related to the ICD-10 groups R ('Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified') and Z ('Factors influencing health status and contact with health services'). In sub-study II, primary diagnosis was categorized into atypical symptoms or other diagnosis (diagnoses not related to ICD-10 R or Z).

#### Charlson Comorbidity Index

In both sub-studies I and II, we calculated the Charlson Comorbidity Index (CCI). The CCI is based on 19 conditions, which are weighted by severity (87). The CCI score was calculated using information about primary and secondary diagnoses from all hospital contacts up to 10 years before index admission. Information on diagnosis was derived from the Danish National Patient Register (75).

### Spouse with or without comorbidity

We categorized patients as having a spouse or no spouse according to whether they were either married or lived in registered civil partnership. For partners, we also calculated CCI as described above. Partners with CCI of 0-1 were categorized as no comorbidity, and partners with CCI above 1 were categorized as comorbid.

### Chronic conditions

In sub-study I, we applied one more type of information of morbidity based on the Danish National Prescription Registry. We used Huber et al.'s categorization of 22 medication groups (Anatomical Therapeutic Chemical Classifications/ATC) that are prescribed for specific chronic conditions. The specific medication received thus indicated the patient's chronic condition (88). We categorized the chronic condition if the patient had received prescribed medication from the corresponding ATC-category within one year prior to index admission.

### Polypharmacy

We defined polypharmacy as patients receiving five or more prescriptions of drugs (unique ATCs) within the preceding three month prior to index admission (89).

### Missing values

There were missing values in both the quantitative sub-studies. Missing values existed for the variables *highest level of education*, *distance between patients home and GP* and *GP practice type*. Due to the general low level of education prior to 1946, we imputed missing values related to level of education (7% missing in both sub-study I and II) as the lowest educational category, *basic school*. In sub-study I, we made conditional imputation for *distance to GP* (12% missing in sub-study I) based on the known mean distance stratified by city size. In sub-study II, the level of missing data for *distance to GP* was high (21%) and we thus chose to exclude this variable from the multiple analysis. In terms of *type of GP practice* (9% missing), in sub-study II; we decided to exclude non-complete cases, since we had no further information on GPs that could rationalize conditional imputation.

## Sub-study I: Quantitative study of prediction of readmission among older medical patients

### *Study population*

The study population in sub-study I is based on data from the randomized trial of post-discharge follow-up visits conducted in Holbæk University Hospital and with the participation of three surrounding municipalities (Holbæk, Kalundborg and Odsherred) in 2012 (63). We obtained data on 770 patients who were consecutively screened to participate in the randomized trial. Inclusion criteria for participating patients were that they had to be 65 years or older, discharged from the Department of Medicine, and living in one of the three participating municipalities. Since the investigated intervention had no effect on readmission risk, and since the risk of readmission was similar among both participants and eligible non-participants, we included all screened patients in sub-study I regardless of their participation in the randomized trial.

### *Locally obtained data*

In 2012, participating physicians at the Medical Department, Holbæk University Hospital, completed screening questionnaires. Hence, we were able to obtain unique clinical screening data on e.g. non-diagnosed cognitive problems, loss in activity of daily living (ADL), social network and alcohol- or drug-abuse (see appendix A). The data from all the completed screening questionnaires was entered into a digital database. Information about prior admission, comorbidity and polypharmacy was derived from the registers; three variables -- dementia, alcohol abuse and social network -- were excluded from the analysis due to too few observations. Finally, two candidate predictors from the clinical screening were included in the analysis: assessment of cognitive problems ('Does the patient's behavior indicate cognitive problems [un-diagnosed dementia]?') and loss in ADL ('Has the patient experienced great ADL impairment compared to prior admission?').

### *Outcome*

The outcome of interest was acute readmissions to any hospital department in Denmark, occurring between four hours and 30 days after index discharge. Outcome data was based on data from Danish National Patient Register (75).

### *Analysis*

We included only candidate predictors with at least 10 readmissions for each predictor category. Consequently, in our model search we included 33 candidate predictors.

We developed the prediction model as a multiple logistic regression model with backward stepwise selection of predictors. Thus, we excluded candidate predictors with a p-value below 10%. We chose this liberal significance level to prevent exclusion of relevant predictors, as advised in the literature (90,91).

### *Validation*

The Brier score was calculated to assess overall performance (92). The discriminative ability of the model was assessed by calculating Area Under the Curve (AUC) in a Receiver operator Curve (ROC) (92). We assessed AUC from the interpretation that an AUC of <0.7 represents poor discrimination, 0.7–0.8 acceptable discrimination, 0.8–0.9 excellent discrimination, and 0.9–1.0 outstanding discrimination (91). Calibration of the model was assessed by constructing calibration plots that illustrated observed proportions of readmission in four groups separated by quantiles of risk versus predicted risks produced from the prediction model. Calibration intercept close to 0 and the slope close to 1 can be classified as 'good' (93). Finally, bootstrapping was performed and Brier score, discrimination and calibration measures were compared between the original model and a median of the bootstrapped estimates (91).

## **Sub-study II: Quantitative study of adherence to the post-discharge follow-up program**

### *Study population*

Sub-study II was based on a cohort of 1,659 patients who were consecutively screened to participate in the post-discharge follow-up program in the 17 municipalities and 6 acute care hospitals in Region Zealand in 2014. In 2014, patients aged 78 years or above were systematically screened for the post-discharge follow-up program. However, patients younger than 78 years could also be included if the health professionals assessed them to be eligible. Patients who were discharged to a rehabilitation center or other temporary residence were not included in the program. Patients were assessed as eligible if they suffered from at least three of following conditions: cognitive problems, alcohol- or drug abuse, psychiatric problems, deprived social network, lower ADL compared to prior

admission, serious and progressive disease, polypharmacy, need for ambulatory contact after discharge, prior admissions, problematic living arrangements, extended need for homecare or if the patient did not receive home care at all, or fall tendency (please see appendix B).

#### *Locally obtained data*

As part of program monitoring in Region Zealand, hospitals and municipalities in the region carried out extraordinary registrations of the activities within the program. This made it possible to measure adherence to the program protocol. Patients who were found eligible through screening had a specific code attached in their electronic journal and were thus identifiable. Further, municipalities registered those patients who had been referred for post-discharge follow-up visits, the date they received referral, and when the home visits had been conducted.

#### *Measures of adherence*

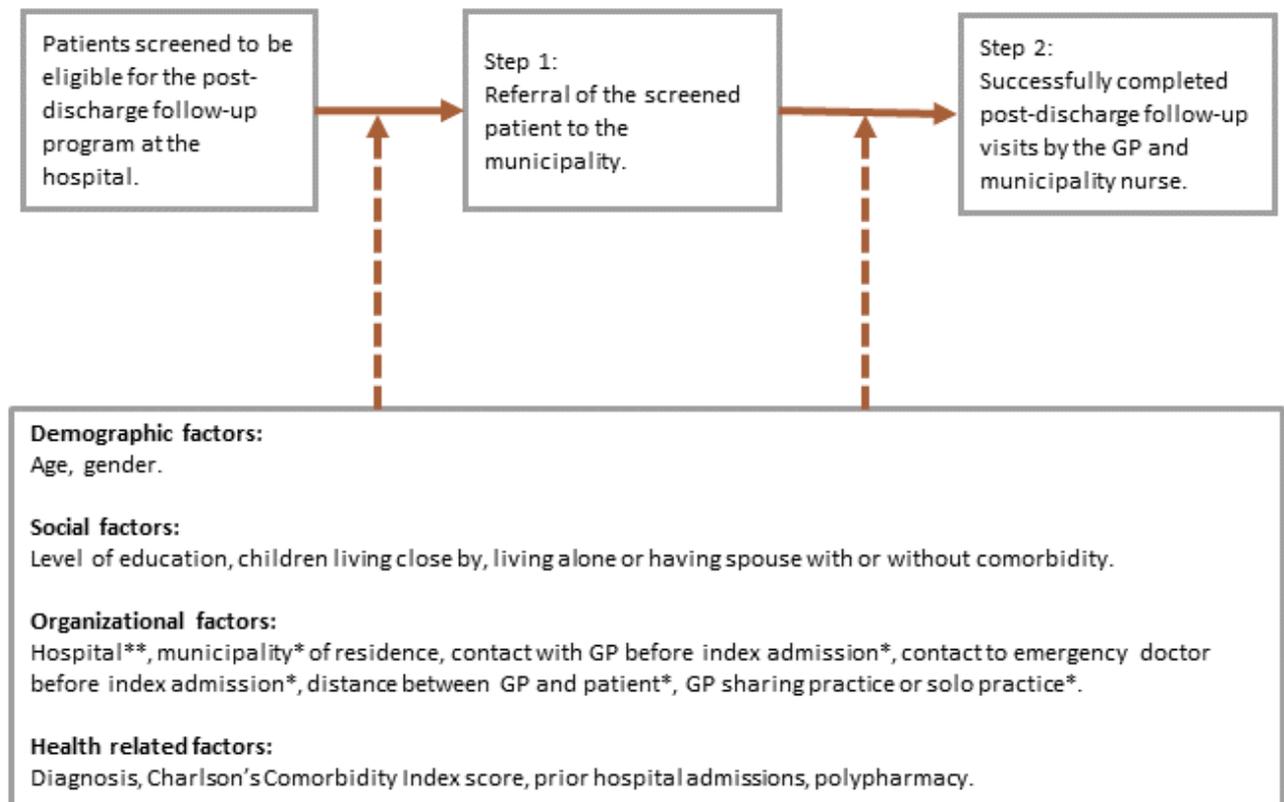
Based on monitoring data described above, we analyzed the level of adherence to the post-discharge follow-up program in two steps: adherence was thus interpreted as frequency and coverage of the program (73).

Steps of adherence (figure 1, below):

Step 1: Referral of the screened patient to the municipality.

Step 2: Successfully completed post-discharge follow-up visits by the GP and municipality nurse.

**Figure 1: Adherence measures related to the post-discharge follow-up program and potential factors affecting adherence (From paper II: Lehn et al. ‘Factors Affecting Adherence to Integrated Care’).**



\* Variables not analyzed in relation to adherence step 1.

\*\*Variables not analyzed in step 2.

### *Analysis*

We constructed two multiple logistic regression models for step 1 and step 2 of adherence, respectively. At the organizational level, information about hospitals was included only in the analysis of step 1. Information about municipality as well as GP and emergency doctor factors were included only in the analysis of step 2. We did not perform model-search as in sub-study I, since we aimed to explore both significant and non-significant results.

### Sub-study III: Qualitative study of external demands affecting implementation of a post-discharge follow-up program

The third sub-study was conducted as a qualitative study of how different groups of health professionals experienced a post-discharge follow-up program.

#### *Pre-understanding and entering into the field of research*

In qualitative research, the researcher is closely engaged with the research process.

Hence, it is relevant to attach a few considerations of my position as a researcher (94):

From 2009 to 2012, I was employed as project coordinator in an inter-organizational project where we tested post-discharge follow-up visits as a pragmatic randomized trial (previously described in the background section) (63). I was also initially involved in the implementation of another post-discharge follow-up program in Region Zealand in 2012/13, occupying a shared position between Holbæk Municipality and Region Zealand. In both cases, my job as a coordinator of the two projects was to assist the inter-organizational steering boards, facilitate meetings and workshops, communicate decisions and to obtain and disseminate monitoring data. At the end of 2013, I left the program administration. However, during 2014, it was decided to scientifically investigate the implementation of this inter-organizational program in Region Zealand, and I obtained the opportunity to reengage with the program in the role of researcher and PhD student. My commitment to Region Zealand was to create two evaluation reports as national publications (95,96). The sub-studies in this thesis was performed independently as scientific publications. The data collection started in 2014, and in 2015 my employment at the Department of Medicine at Holbæk Hospital as PhD student under the supervision of Lau C. Thygesen, Ann-Dorthe Zwisler, Solvejg G.H. Pedersen, Thomas Gjørup and Morten Hulvej Rod began.

From my experience, my role as project coordinator has given me considerable insight into the experiences and struggles of health professionals involved in inter-organizational cooperation in general and in post-discharge follow-up programs in particular. I believe this hands-on experience is an advantage when studying the complex field of inter-organizational health care. During my employment as project(s) coordinator, I encountered a high level of motivation from the involved health professionals to solve the problems confronting frail older patients. But I also observed the professionals' many frustrations with 'how the system worked' and the mutual mistrust between health care

provider groups. It is very likely that in the qualitative investigation of sub-study III, my focus as a researcher was influenced by my former work with the post-discharge follow-up program (97). The seed of interest in the influence of contextual factors originated in the practical experiences with the program, meeting health professionals who on the one hand recommended the program to improve quality of care for older patients, but on the other hand expressed great frustration with the work.

#### *Data*

To capture social interactions among health professionals who participated in the post-discharge follow-up program, we conducted five interdisciplinary focus group interviews based on a strategy of maximum variation sampling (98). Hence, as far as possible, focus group participants came from a range of hospitals and municipalities; they represented all relevant health care professionals at each interview as well as differences in gender and level of professional experience. A total of 24 health professionals participated in the focus groups. All focus groups lasted for about two hours. They were audio recorded and then transcribed (4). Data was initially analyzed as a thematic analysis published in Danish (95); however, this analysis did not shed light on *how* circumstances influenced the process of implementation. We thus performed this secondary analysis of these data with a focus on the tension between the institutional context and the post-discharge follow-up program.

#### *Theoretical framework – operationalization of context*

To analyze the dynamic relationship between context and implementation, we adhered to the conceptual understandings of institutional ethnography (99). As emphasized by Smith (100), the author of this sociological perspective, health professionals in their daily work struggle to balance between demands of the local setting and requirements from the external environment (e.g. specific guidelines, requests to document and use digital tools). Contradictions might arise between the various demands of the local work setting and external demands, as revealed in text-based materials (100). Thus, the staff's experience of disjunctures between different or even conflicting requirements becomes a key element in how the health professionals set priorities and carry out their daily work, and especially in the implementation of new procedures or interventions, no matter how well-intentioned (74).

Inspired by Smith and colleagues, we operationalized the ‘institutional context’ as the text-based materials that guide and coordinate health professionals’ work (60,101). In health care work, text-based materials appear as e.g. instructions and guidelines. These materials, often formulated by managers or advisors operating outside the local work setting, are intended as a coordinating pillar for the work of health professionals. These materials specify their tasks, outline decisions to possible problems, describe lines of authority, and specify how, how often and with whom these tasks should be carried out. Text-based materials thus mediate ruling ideas and perceptions of health care work, and serve as part of the integration of new ideas into practice (60). In our study, the text-based materials functioned as the institutional context, and it was these materials which the focus group participants experienced as influencing their daily work with implementation (99).

### *Analysis*

Focus group data was analyzed on the basis of sensitizing concepts (102). Special attention was paid to disjunctures in the triad between demands of the post-discharge follow-up program, existing work in the local setting and various text-based materials. The main author listened and read the transcribed focus group interviews several times, and in this process, sections with essential meaning related to the pre-defined categories were extracted and debated with co-authors.

As a starting point, we identified and mapped the chain of text-based communication that was implicit in the post-discharge follow-up program. We then read and listened to the focus group interviews in order to identify patterns of disjunctures between the post-discharge follow-up program and other demands on the health professionals’ work, and how these were mediated by text-based materials. We utilized the text-based materials in the analysis whenever focus group participants mentioned how these materials influenced their work with the post-discharge follow-up program.

## Results

This section summarizes the results of the three sub-studies. The results are discussed in more detail in the actual papers of this thesis.

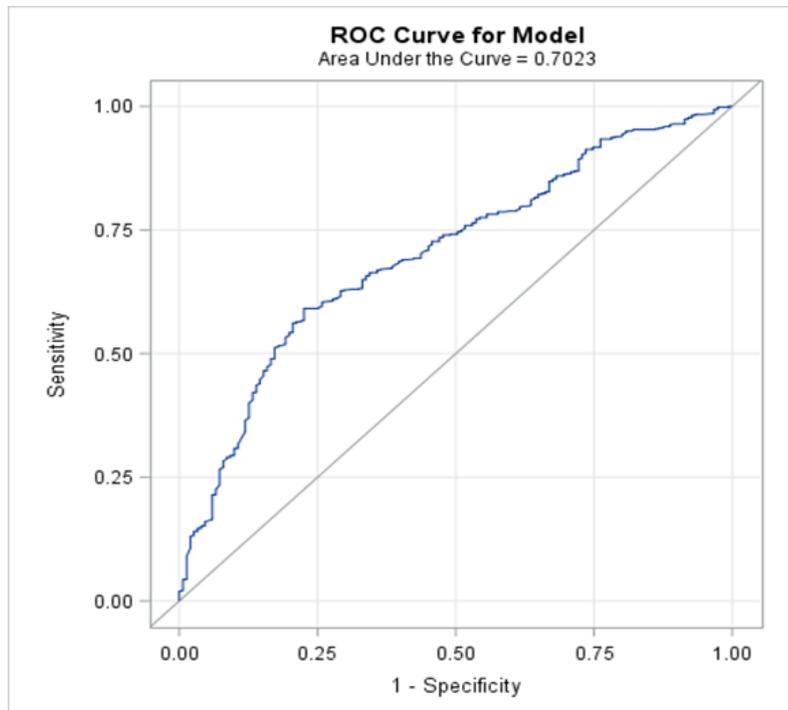
### Sub-study I: Quantitative study of prediction of readmission among older medical patients

Of the 770 patients screened for eligibility to participate in the randomized trial of post-discharge follow-up visits in 2012, 151 patients (20%) were readmitted. The total population of patients had a median age of 78 years. Further, they were characterized by low educational level, the majority (50%) had primary school as their highest level of education, 55% had no spouse and their level of comorbidity was high (60% had a CCI score of 2 or more).

Based on comprehensive data, we developed a model to predict 30-day readmissions among older medical patients with acceptable discriminative ability (see figure 2 below), and good calibration. The model revealed the following predictors of acute 30-day readmission: being male, low education, prior contact with emergency doctor, primary diagnosis related to the respiratory system, CCI score of four or more, length of hospital stay of six days or more, cognitive problems, and belonging to three different pharmacy groups related to chronic conditions.

In addition, we analyzed prediction of early readmission risk, within seven days from discharge. We did not include this analysis in the paper (appendix C), since statistical power was low due to few readmissions. In the preliminary analysis of a seven-day prediction model, the following predictors were included in the final model: gender, spouse, level of income, contact with emergency doctor, CCI and acid disorders (see appendix C).

**Figure 2: ROC curve for the final prediction model of acute 30-day readmission among older medical patients.**



### Sub-study II: Quantitative study of adherence to the post-discharge follow-up program

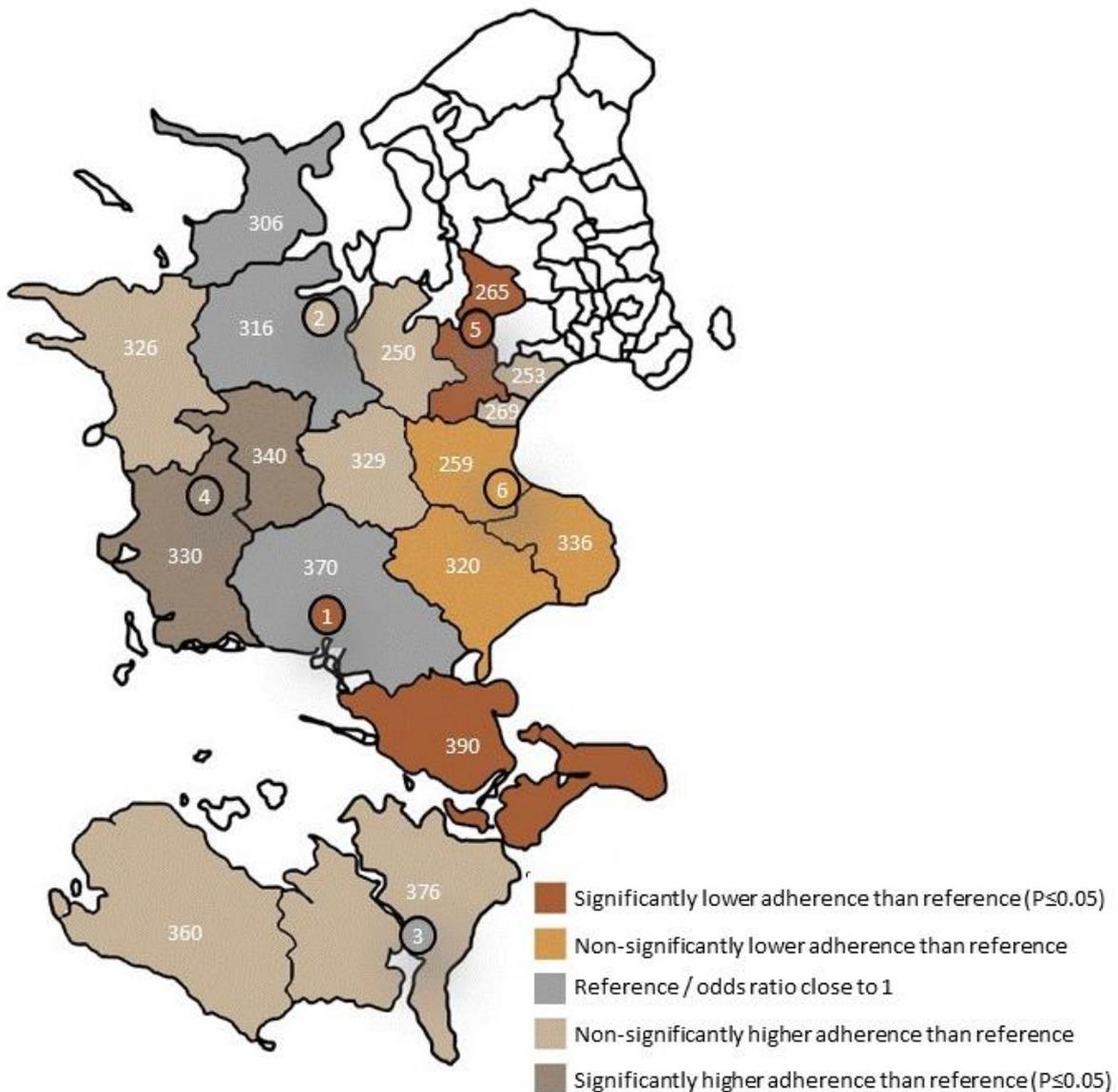
In 2014, a cohort of 1,659 hospitalized patients was found to be eligible to participate in the post-discharge follow-up program in Region Zealand, Denmark. Of these, 1,141 patients (69%) were successfully referred to the municipality for possible participation in the project (adherence step 1). The total population (n=1,659) had a median age of 84 years, 54% had not had schooling above the level of basic school, 66% had no spouse and 60% had a CCI of two or more.

After discharge, 142 patients died or were readmitted within seven days and were thus not able to receive post-discharge follow-up visits. They were excluded from any further analysis (adherence step 2). We further excluded 90 patients from the analysis due to missing values related to type of GP practice. Of the 956 patients in the analysis with complete data, who were eligible to receive post-discharge follow-up visits, 513 patients (54%) actually participated.

We analyzed the influence of 11 variables on adherence step 1. The hospital from which the patient was discharged and whether the patient had received homecare were significantly associated with higher probability of referral. Further, we analyzed the influence of 15 variables on adherence step 2. Of these, the municipality of residence being female and attending a shared practice GPs were significantly related to higher probability of receiving home follow-up visits.

As described above, organizational factors had significant influence on the level of adherence in both adherence step 1 and step 2. The geographical differences of level of adherence are illustrated in figure 3 (not included in paper II). In the figure, the brown colours indicate higher adherence than the statistic reference organization, whereas red colours indicate lower adherence. Thus, figure 3 illustrates a tendency that those hospitals with lower level of adherence (step 1) were located within municipalities that also have lower levels of adherence (step 2).

**Figure 3: Map of Zealand (Denmark) illustrating the level of adherence to the post-discharge follow-up program. Data are derived from the two multiple logistic regression models (step 1 and 2). Hospitals (circles) and municipalities (marked geographic areas) are coloured according to whether odds ratio are higher or lower than the statistic reference organization and whether the difference is significant. The reference hospital is no. 3 and the reference municipality is no. 316. The statistic reference organizations are coloured grey (along with organizations with OR close to one).**



### Sub-study III: Qualitative study of external demands affecting implementation of a post-discharge follow-up program

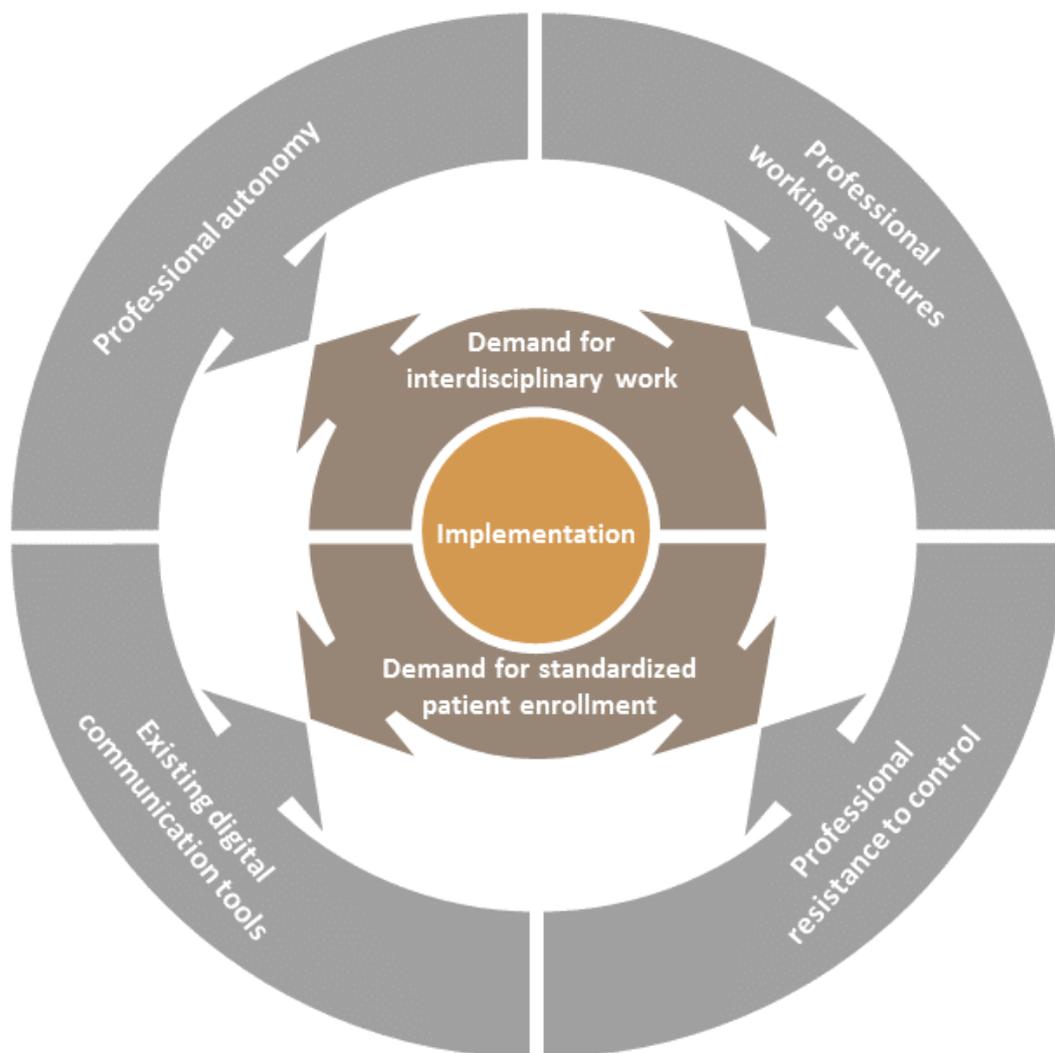
Mapping of the post-discharge follow-up program revealed that the program relied on a long chain of text-based communication. The chain of text-based communication started from a paper-based screening questionnaire at the hospital setting, continued via a three-fold digital registration of enrolled patient and the hospital, digital referral to the municipality, digital coordination between GPs and municipality nurses and, finally, documentation of visits by municipality staff and GP's. If the text-based screening, referral at the hospital or coordination in the primary health sector failed, patients would not receive the intended post-discharge follow-up program.

The focus group participants described major disjunctures between demands of the post-discharge follow-up program, their existing work in the local setting and various text-based materials that from our theoretical understanding (see methods section), communicated external demands. As illustrated in figure 4 (the inner circle), the post-discharge follow-up program introduced two major demands in the health care setting that created tension with existing structures in their work: (1) a demand to standardize patient enrollment (screening and referral), and (2) a demand for greater interdisciplinary cooperation (interdisciplinary screening assessment and joint visits). The health professionals described how productivity requirements within each organization required them to prioritize among work tasks, with the result that lower priority was given to implementation of the post-discharge follow-up program. The explanation for the low priority given to the program lay in the disjunctures between the task requirements of everyday work and the demands imposed by the post-discharge follow-up program. Both types of demands were articulated by the text-based material. As showed in figure 4, the demand for standardized patient enrollment contradicted the structures of digital communication and the perception of a high degree of out-side control of the health professional's work. The digital communication were fed by text-based instructions for how to time and use inter-organizational digital communication. In addition, the program requirement for interdisciplinary work created disjunctures with a structure of autonomy common to professional work and mono-professional working structures. In the primary health care setting, the structure of professional autonomy was fed by the General

Practice Agreement and the mono-organizational working structures were enhanced by various financial incentives embedded in the organization of work.

This analysis showed that disjunctures between the requirements of the program and the everyday work tasks were fed by text-based materials that ended up affecting the implementation of the post-discharge program.

**Figure 4: How implementation of major requirements of the post-discharge follow-up program conflicted with the health professionals' everyday work tasks (from Paper III: Lehn SF, Thuesen J, Bunkenborg G, Zwisler A-D, Rod MH., 'Implementation between text and work: a qualitative study of a readmission prevention program targeting elderly patients', *Implement Sci.* 2018,13(1):38.**



## Discussion

In this thesis, I investigated improvement of health care quality for older medical patients, focusing on prediction of acute 30-day readmission and implementation of an integrated care program to prevent readmission. In each of the papers included in the thesis, I have discussed the results of the individual studies. In this section, therefore, I will combine the findings of the three studies, how they relate to each other, and how they contribute to a fuller understanding of improvement of health care quality for older medical patients. Finally, I will discuss methodological considerations, the limitations of the three sub-studies and suggest avenues for further research.

### Discussion of results

The post-discharge follow-up program, the aim of which was to reduce readmissions among older medical patients, was tested in a pragmatic randomized trial conducted in 2012 in one hospital setting and in three municipalities in Regions Zealand (63). Subsequently, in 2013, the program was scaled-up to be implemented in all hospitals, municipalities and GPs of the region. These two phases of preliminary testing and full implementation provided data to investigate a specific intervention to improve health care quality among a group of older patients.

#### *Older medical patients and risk of readmission*

Knowledge about which kinds of patients have high risk of readmission is important when designing and targeting programs to improve quality of care (31). Based on data from clinical screening in the pragmatic randomized trial of the post-discharge follow-up program in 2012, and on data from administrative registers, we developed a readmission prediction model (sub-study I). We tested 34 candidate predictors that had been initially selected based on a literature search on risk factors for readmission and clinical assessment of relevant factors. The final model consisted of 11 predictors that could help clinicians and researchers in predicting readmission risk so as to select the appropriate group of high risk patients to receive preventive intervention. The model includes demographic, social, organizational and health-related predictors. Assessed from the strength of the association, 'cognitive problems (not diagnosed dementia)' was the strongest predictor of readmission: the readmission risk for these patients was twice that of patients without cognitive problems. This information was a clinical parameter obtained

from bedside through the screening questionnaire. Another study of older patients with heart failure indicated a large under-documentation of cognitive impairment (30 out of 132 cases) by physicians working in the hospital setting (103). However, the prediction model in sub-study I indicates that it is important to document and communicate information about patients' clinically assessed cognitive problems to care providers in the transition of care from hospital.

In recent years, increasing attention has been paid to the potential role of social factors in predicting all-cause readmissions among older patients (47,48). In sub-study I, we tested several social candidate predictors related to spouse and spouse's level of CCI, the presence of children living nearby, and level of education and income. In the final prediction model, low educational level stood out as a relevant predictor (OR 1.80 (CI 0.95-3.41)), which lends support to the results from studies of readmission among patients with cardiac disease or pneumonia (49,104). The positive association between educational level and health status, while well-established, is not yet fully understood. Research has shown that the influence of education on health in general increases with increasing age (105). Differences in readmission among educational groups can have various explanations, e.g. acute treatment of patients with acute myocardial infarction has been found to be applied differently according to the patient's socioeconomic background (106), while other studies have shown that patients' ability to adhere to treatment varied according to their socioeconomic status (107). Consequently, the influence of social factors should be included in the planning of health care interventions.

The final prediction model included the following predictors: being male, having prior contact with an emergency doctor, having a diagnosis related to the respiratory system, high CCI, longer hospital stays and belonging to one of three different pharmacological groups. Accordingly, risk of readmission was related to factors beyond the specific diagnosis leading to hospitalization. Clinicians and researchers need to attend to a broad range of factors when stratifying patients according to risk of readmission. When planning programs to reduce readmission, the potential mechanisms behind risk factors should be elucidated (31). Patients at risk of readmission have high health care utilization (59), and researchers have proposed that more integration of care across providers could overcome some of the social challenges in health care utilization (108).

*The implementation of integrated care explored through a readmission prevention program*

There is an increasing interest in methods to integrate care for older and multi-morbid patients (76). Sub-studies II and III explored the factors affecting implementation of the post-discharge follow-up program in Region Zealand, Denmark. Supported by the literature, the findings of sub-studies II and III revealed that essential challenges encounter implementation of integrated care programs, where health professionals are engaged across disciplines and organizations (109). Sub-study II found a low level of adherence to the post-discharge follow-up program. Moreover, the municipality received referral from the hospital (adherence step 1) in only 69% of eligible patient cases. Further, only 54% of the referred patients received a post-discharge follow-up visit (adherence step 2). A previous study has indicated that adherence among GPs to an alcohol prevention intervention was dependent on patient-specific characteristics such as age and occupational status (57). In addition, a previous monitoring report of the post-discharge follow-up program, based on the reporting from municipality staff, indicated that GPs sometimes cancelled visits because they considered that it 'was not relevant' for the patient (96). We did not have information about the precise reasons why GPs assessed that the post-discharge follow-up visits were not relevant in the specific cases, nor do we know whether municipal staff were part of these decisions. Nevertheless, based on similar findings from an alcohol prevention program (57) and in a previous monitoring report of the post-discharge follow-up program (95), it seemed reasonable to hypothesize that patient-specific factors, e.g. patient health status, as well as organizational factors influenced the GPs' decision and hence, the overall level of organizational adherence to the program. However, sub-study II revealed something different. This study showed that gender was the only patient-specific factor associated with level of adherence (step 2). Level of adherence in sub-study II was instead associated with organizational factors, and adherence differed significantly at *all* organizational levels: i.e., hospitals (adherence step 1), municipality (adherence step 2) and type of GP (adherence step 2). It is likely that differences in adherence levels between hospitals, between municipalities and by GPs reflected the style of inter-organizational cooperation within the program. In figure 3 in this thesis, the hospitals (results derived from adherence step 1) and municipalities (results derived from adherence step 2) of Region Zealand illustrate whether odds ratio (OR) was higher or lower than the statistic reference organization, and whether the difference was

significant. The map shows that hospitals with low adherence (step 1), were geographically surrounded by municipalities which also had low adherence levels (step 2), and vice versa for high-adherence hospitals. This pattern might indicate that program adherence by the individual organizations is interdependent with adherence levels in the cooperating health care organizations (hospitals, municipalities and GP) (59). Accordingly, contextual factors specifically related to this integration of care across health care had a major influence on the implementation of the program procedures.

The influence of organizational context on adherence, which was revealed in sub-study II, was further explored in sub-study III. Many researchers emphasize the influence of context on implementation (1,8,10,110). Moreover, according to Dopson and Fitzgerald, context should be seen as an interacting element in the implementation process (9). In a previous analysis of the qualitative data (95), we categorized the data according to five aspects of implementation, as suggested by Damschroder et al. (8). However, this categorization did not help in understanding how contextual factors influenced the process of implementation. Therefore, in order to gain a deeper understanding, we developed a new, more comprehensive analysis in sub-study III. To illuminate the data from a new perspective, we were inspired by a sociological perspective on how the institutional context -- in the form of text-based material -- exerted its influence in everyday health care work (60,101). Most text-based material that is used in health care work originates from the external environment and thus functions to articulate institutional requirements on staff work routines and work task (99). Hence, in utilizing the text-based material in the analysis, we gave a voice to the institutional context. From this analysis, we gained a richer understanding of the dynamics between the local implementation processes and parts of the institutional contexts.

Focus group interviews with health professionals involved in the implementation of the program described how working across disciplinary and organizational boundaries sometimes gave rise to challenges and tensions in their work. We found that the program in focus introduced new demands for how the professionals should perform their work in the local health care setting. Health professionals described two major demands that were introduced by the post-discharge follow-up program, and which created problems with their work routines: (1) standardized patient enrollment and (2) interdisciplinary work. On the other hand, the contradictions between program

demands and existing work routines, were mediated largely by text-based materials that defined their professional roles and the nature of their inter-organizational cooperation. The request to use a paper-based screening tool in enrollment of patients to the post-discharge follow-up program confronted the professionals' experience of increasing levels of text-based documentation in health care work. Furthermore, guidelines on how to use digital communication hampered the health professionals' work in scheduling referrals from hospital to municipality. The existing organization of work for nurses and physicians interacted with the need to coordinate the post-discharge follow-up program in both hospital and municipality, and the General Practice Agreement fed into a structure of professional autonomy among GPs that sometimes enhanced and at other times impeded the coordination of joint visits with municipal nurses. Other studies have also reported how contextual regulations influence implementation and practice. Privacy protection laws, for example, influence implementation of electronic medical records throughout the USA (111), and standardization of patient records is re-shaping nursing practice in Canada (112). However, sub-study III also revealed that the contradictory demands in implementation of the post-discharge follow-up program were intensified by the fact that the program operated *across* health care organizations and disciplines.

As mentioned above, sub-study II showed that hospitals, municipalities and GPs differed in adherence. From the focus group data, it was not possible to assess whether the contradictory demands were stronger in the one setting than in the other. Nevertheless, other factors might have also played a role. As described in the introductory section of this thesis, the implementation of a post-discharge follow-up program in Region Zealand was carried out in two phases from 2012 to 2014: the preliminary testing phase (nine municipalities and three hospitals) and the full-fledged regional implementation phase (17 municipalities and six hospitals). Nine municipalities and three hospitals had initially volunteered to engage in the post-discharge follow-up program during the testing phase, and thus had longer experience with the program than did the remaining institutions who joined in phase 2. Figure 3 indicates that these testing-phase hospitals and municipalities had higher levels of adherence (hospitals 2, 4 and 6, and municipalities 253, 259, 306, 316, 326, 329, 330, 336, 340). It could be hypothesized that various elements lay behind the differences in adherence. The hospitals and municipalities that participated in the testing phase had been working with the post-discharge follow-up

program for a longer time when we obtained data to measure adherence in 2014. In addition, these hospitals and municipalities had volunteered to participate in the program, whereas the remaining four hospitals and six municipalities were included in the post-discharge follow-up program as part of a (political) top-down decision. On the one hand, a more bottom-up based approach in the testing phase might have ensured a higher level of motivation among participants; on the other hand, the organizations that volunteered in the testing phase were potentially more prepared for the organizational change embedded in the program (8).

### *Cross findings*

The prediction model developed in sub-study I showed that clinicians should attain a broad perspective when assessing the patients' risk of readmissions. In addition to the clinical and health-related observations, aspects of the wider patient trajectory and surroundings are crucial to the outcomes following discharge. At the same time, however, sub-study III highlights that introducing a new, paper-based screening questionnaire, does not align with the existing work routines in the work settings. Other tools could or should have been involved so as to ensure a comprehensive approach when planning patient care at discharge.

The results related to gender differences in, respectively, sub-studies I and II seemed paradoxical. On the one hand, sub-study I showed that men had a higher risk of readmission; on the other hand, sub-study II revealed that women had a greater chance of receiving post-discharge follow-up visits, as readmission prevention, than did men (adherence step 2). The literature on gender differences in health report that women live longer, yet experience greater morbidity and disability than men (113). In relation to health care utilization, women tend to make more use of preventive and diagnostic services, whereas men make more use of emergency services and are more often hospitalized (113,114). Hence, previous studies seem to support the findings of the two sub-studies. An American study of gender differences in utilization of preventive care suggests that a generally lower interaction between men and health care providers reduces the probability of their seeking or being administered preventive care services (114). In sub-study II, however, the included patients had already agreed to participate in the post-discharge follow-up program. Hence, we cannot conclude that men were more likely to refrain from participating in the post-discharge follow-up program.

From this thesis, we have found that the factors that *surround* older patients, i.e., specific elements of health care utilization and social factors, can have crucial influence on patient outcomes. Likewise, factors that surround an integrated care program can have crucial influence on implementation. Sub-study II informed us that it was primarily those factors attached to the organizations, and most likely the mutual influence among the organizations that increased or decreased the level of adherence to the program. In addition, sub-study III concluded that structures within and across organizations were experienced by the health professionals as extremely important for implementation, and that the demands introduced by the program came into conflict with their everyday work routines.

## Methodological considerations

The three sub-studies in this thesis have different study designs, data sources and different strengths and limitations. They were based on data from clinical screening, health care monitoring or focus group interviews. In addition, Danish administrative databases were a major source of information for sub-studies I and II. In this sub-section, I first describe methodological considerations in relation to the quantitative sub-studies (I and II) and to the qualitative sub-study III.

### *Quantitative studies*

The prediction model developed in sub-studies I and II were based on data from hospitals and municipalities in Region Zealand, Denmark. The sub-studies utilized unique screening data. These data provided us with important information about the patients, and were supplemented by register data.

### Sample size

In sub-study I, we had statistical power by including only candidate predictors with at least 10 cases per one degree of freedom. However, the sub-study was limited by the fact that the study population was relatively small (n=770). Sub-study II was based on the total cohort of patients screened eligible to the post-discharge follow-up program in Region Zealand in 2014, and thus, a greater number of included patients (n=1,659). However, a relatively small study population in step 2 (956 patients who were successfully referred from hospital to municipality) could also potentially lead to decreased effect sizes.

### Generalizability and selection bias

The fact that just one hospital participated in the collection of data in sub-study I must be considered a limitation. Moreover, during the study period (February to September 2012), 2,026 patients were admitted and discharged alive from the Medical Department at Holbæk University Hospital. We compared descriptive data for this total group of patients (n=2,026) with the screened patients (n=770), and we found no differences in relation to age, gender, municipality of residence and educational level between the groups. The prediction model has not yet been externally validated, which limits our knowledge of its generalizability (115).

### Data coverage

In general, Danish administrative registers are characterized by high quality and high data coverage (116). In this thesis, out of 36 different variables in the two sub-studies I and II, three variables were prone to missing values: distance to GP, type of GP and educational level. In most cases, the percent of missing values was small, and as far as possible, we chose to impute missing values by conditional imputation (117). In sub-study II, we made two exceptions, since we had a high level of missing values concerning distance to GP (21%), we excluded this variable from the analysis. In relation to type of GP (9% missing), we had no additional information about the GP characteristics; further, we considered the information to be missing at random and that the reason for the missing data was unrelated to the outcome (118). Hence, we chose to exclude the incomplete cases of type of GP from the analysis.

### Definition of the population group

In sub-study I, we defined older patients as those aged 65 years and older. Nonetheless, the physical consequences of ageing vary among individuals (13). Any age-dependent cut-off age for 'older patients' has an element of randomness, and some studies suggest a cut-off age of 75 years and more for define today's 'older patients' (42). Nonetheless, the majority of literature related to readmission risk among older patients remains based on patients starting at age 65 or older (20,44,45,119). Adhering to this definition allowed us to compare results with the existing literature.

### Readmission risk as indicator of quality of care

Risk of readmission has been studied since the early 1970s (120), and risk of acute all-cause readmissions is widely used as an indicator of health care quality (29–31,33,34). However, the legitimacy of using readmissions to measure the quality of care has been the subject of debate among health care researchers (121). Different approaches have been developed to distinguish between ‘avoidable’ and ‘unavoidable’ readmissions, and a review from 2011 reported that among readmissions, the risk of avoidable readmissions ranges from 5% to 79% (122). Furthermore, the authors conclude that there is no consensus on what kind of readmissions should be considered avoidable and which factors should be included in the analysis; e.g., clinical, systemic or family factors (122).

Another aspect of readmission frequency as a quality indicator considers time to follow-up. A recent study from Australia suggests that the very short-term readmissions (i.e. within seven days after discharge) have different trajectories than readmissions occurring within eight to 30 days from index discharge (123). In sub-study I of this thesis, we originally intended to develop and validate prediction of readmission within seven days from discharge in addition to the 30-day risk prediction model. As a test, we calculated a seven-day prediction model despite a low number of readmissions within seven days after discharge. More potential predictors could not be included due to lack of observations (see appendix C). However, in these incomplete extra analysis of seven-day readmission risk, the final model showed that gender, contact with emergency doctor, CCI and acid disorders predicted seven-day readmission, a finding that did not suggest any sort of different patient trajectory compared to the 30-day readmission model (109). Nevertheless, the extra analysis showed that not having a spouse predicted seven-day readmission risk. A smaller study (n=181) of patients with coronary artery bypass surgery showed that living alone was a major predictor of 30-day readmission (124). Living alone has been associated with lifestyle risk behaviour, delay in seeking treatment and non-adherence to medical treatment (124). Hence, it seems surprising that the 30-day readmission model did not reflect this pattern (110).

### Measures of adherence

In sub-study II, we were able to explore level of adherence due to unique monitoring data obtained by hospitals and municipalities in Region Zealand and supplemented with substantial register data. However, the type of data available limited the study. Data were

not available for the group of patients who had been screened and found ineligible for the post-discharge follow-up program. Thus, we could not assess the level of adherence related to screening of patients at the hospital, though, as shown in sub-study I, the gap between admitted patients and sufficiently screened patients could be rather large. Moreover, we were not able to obtain data on the quality of the post-discharge follow-up visits carried out, i.e. whether the visits were performed according to the protocol (73).

#### *Qualitative sub-study (sub-study III)*

Sub-study III was a secondary analysis of five focus group interviews performed in different parts of Region Zealand in 2014. Data was obtained from semi-structured interviews using open-ended questions, using an interview format originally designed to investigate 'conditions that influence the inter-organizational implementation of post-discharge follow-up visits, as perceived by the health professionals'. The new, yet related, research question in sub-study III in this thesis (how external demands influence implementation) emerged from the empirical data when I was reviewing the taped interviews. Despite the fact that this new focus was applied to analysis of data already obtained, we experienced that the new focus was well covered by the focus group discussions.

#### *Reflexivity*

Though I have done research and written this thesis as a health science researcher, I have primarily been engaged as a coordinator of the post-discharge follow-up program. This prior work could certainly have coloured my focus and interpretation of data. Interpretation of qualitative data is a subjective activity; however, it is still relevant to consider the possibility of personal bias (97). During the process of analysis, we encountered this issue by continuously discussing data and analytical findings within the group of researchers (see paper III), and we succeeded in developing common interpretations of the data.

My former role as a project coordinator could have influenced the participant interaction in the focus group interviews, where I was the focus group moderator. In introducing myself to the focus group participants, I described my role as a researcher and the fact that we were interested in all types of experiences with implementation.

It has been emphasized that qualitative data should incorporate a wide range of different perspectives in order to represent viewpoints of more than just one narrow group of people (97). We have attempted to meet this principle by having all relevant

disciplines represented in the focus groups: i.e., GPs, nurses working for the municipal services,, the municipality care managers, medical secretaries, hospital physicians and hospital nurses. Nevertheless, GPs (3 participants) and hospital physicians (3 participants), who were key providers in the program, were slightly underrepresented in the focus groups compared to other professional groups such as hospital nurses (7 participants) and municipality nurses (4 participants). The focus group data was thus sufficient for analyzing the over-all structures in implementation of the post-discharge follow-up program; however, the data sample was too small to conduct an analysis of geographical differences. In addition, it would have been valuable to delve deeper into the text analysis, and perform, for example, a discourse analysis, if more time and resources had been available.

## Implications

Improving quality of care for older medical patients is a major concern for clinicians, researchers and policymakers. In this thesis, I have addressed the critical challenges of how to identify patients at risk of readmission, and the critical challenges of implementation of an integrated care program that operated across health care organizations and disciplines. Importantly, the sub-studies indicate that researchers and health care providers need to gain a broader perspective on older medical patients and the integration of care to improve health care quality. At the patient level, many factors related to the patient and the patient circumstances, such as cognitive problems, educational level and prior contact with emergency doctor were predictors of readmission, indicating that a broad perspective on older medical patients and health care planning should be applied during admission and discharge. At the program level, implementation of an integrated care program largely depended on how the program requirements align with the institutional context and, hence, the existing work in health care practice.

Ensuring the broader perspective on older medical patients and pointing out patients high risk of readmission can be challenging in a busy clinical work setting. Since the implementation of another paper-based screening tool into practice, according to sub-study III, came into conflict with existing work requirements in the daily health care setting, other tools and approaches should be developed, such as digital data collection and education of health professionals. At the same time, though, we should acknowledge that

digital reminders an education is just one step on the way, since sustaining focus and priority is dependent on an array of factors.

Integration of care cannot be limited to specific levels in the health care system, such as the provider level (59). This point is empirically underscored in sub-studies II and III. Exploration of adherence to the post-discharge follow-up program indicated that health professionals do not differentiate among eligible patients when adhering to program guidelines. On the contrary, except for differences related to gender, the challenges of adherence were to be found at the organizational level, with great differences in adherence among hospitals, municipalities and GPs. In addition, the qualitative analysis in sub-study III emphasized how factors external to the post-discharge follow-up program interacted with the process of implementation. Based on these insights, we need to deal with the various levels of the health care system when implementing integrated care programs. We need to deal with health professionals as occupational groups, with organizations, across organizations, and with the health care system as a whole. How can we align new demands that come with any intervention with the existing task requirements of professionals in their everyday work? Researchers and decision-makers need to acknowledge this issue in the very early phases of program planning.

In this thesis, I have investigated implementation in the phases of regional implementation. Future research should generate knowledge from integrated care programs that can engage with each level of the health care system. In addition, further research should seek out knowledge from organizations whose integrated care initiatives succeed in achieving high levels of adherence. Additionally, future studies should externally validate the prediction model developed in substudy I of this thesis, and create more knowledge on the mechanisms behind the risk differences in health care utilization related to both gender and educational level, since these factors have been understudied phenomena among the older age groups.

## Conclusion

In this thesis, I have explored important elements when new inter-organizational programs are introduced to improve quality of care for older medical patients. The program studied here involved the prediction of readmission among the older patients and the factors affecting implementation of inter-organizational program targeting older medical patients. In sub-study I, I developed a model to predict acute 30-day readmission among older medical patients based on social, demographic, organizational, and health-related factors. The prediction model showed acceptable discriminative ability and good calibration. Moreover, sub-study I showed that older medical patients most at risk of readmission have high health care utilization and that risk can be predicted by factors related to both the individual and the wider patient trajectory.

In sub-studies II and III, the investigation focused on the implementation of an integrated care program to prevent readmissions. Sub-study II found a low level of adherence to essential parts of the post-discharge follow-up program in Region Zealand in 2014. The low level was indicated by the proportion of referrals from hospital to municipality (69% adherence) and the low proportion of successfully completed post-discharge follow-up visits by GP and municipal nurse (54% adherence). Low level of adherence in terms of referral from hospital to municipality was associated with organizational factors: i.e. two hospitals had significantly lower levels of adherence, and adherence was lower if the patient did not receive home care prior index admission. Low level of adherence in terms of unsuccessfully completed post-discharge follow-up visits was associated with demographic and organizational factors; i.e. being male, living municipality municipalities with significantly lower adherence and being listed with a solo practice GP.

In the qualitative study (sub-study III), I found that institutional context, understood as text-based material, influenced the implementation of the post-discharge follow-up program. Conflicts arose between the demands introduced by the post-discharge follow-up program and the requirements in the professionals' everyday work routines. These existing demands were connected to different text-based materials that set guidelines for how inter-organizational communication should be carried out and how the professionals should cooperate. However, the health care professionals found it difficult to reconcile the program demands with their work routines. As a consequence of conflicting

requirements, the health professionals did not always perform the demanded procedures of the post-discharge follow-up program as intended.

## English summary

### Introduction

Provision of high quality health care for older medical patients with multifaceted health problems has faced challenges due to fragmentation of the health care system. Improvement of health care quality for older medical patients should include precise targeting of interventions and implementation of methods to integrate care. One way to measure quality of care in the transition from hospital to home among older medical patients is to focus on the frequency of acute readmissions. Prediction models to predict all-cause acute 30-day readmission among older medical patients have almost all reported low performance. Programs to improve health care quality and reduce/prevent readmissions often entail integration of care across health care providers. Implementation of integrated care programs faces various challenges in terms of organizational and cultural differences among the inter-organizational program stakeholders. Hence, the literature has called for more knowledge on adherence to integrated care programs and on the influence of contextual factors in the process of implementation.

### Aims

This PhD thesis aims to develop and internally validate a model to predict 30-day readmission among older medical patients. Moreover, it seeks to explore the factors that influence implementation of integrated care programs targeting older patients who risk readmission to hospital following discharge. The thesis is divided into three sub-studies with the following aims:

- To develop and internally validate a model for predicting 30-days readmission among older medical patients (sub-study I).
- To examine the degree to which adherence to an interdisciplinary, post-discharge follow-up program targeting older patients is associated with patient-specific factors and organizational factors (sub-study II).
- To explore how contextual factors, perceived as external demands, influence the implementation of an inter-organizational program. Hence, the goal here is to show the contradictions between the demands imposed by program implementation and everyday work routines in health care (sub-study III).

## **Methods and material**

The research for the three sub-studies was based on data derived from testing and regional implementation of a post-discharge follow-up program in Region Zealand, Denmark, which aimed to improve the quality of care and reduce readmissions among older medical patients. The program provided for joint visits by GP and municipal nurse in the patients' home within one week after discharge. Sub-studies I and II were quantitative observational studies, whereas sub-study III was qualitative and based on focus group data. Sub-study I (n=770) was based on data from a clinical screening of consecutive patients who were aged 65 years or older and who had been discharged from the medical department at Holbæk University Hospital in 2012. Sub-study II was based on the cohort of patients who were screened and found eligible for post-discharge follow-up visits at a hospital in Region Zealand in 2014 (n=1,659). Level of adherence was measured according to two essential steps of the post-discharge follow-up program: referral of the screened patient to the municipality (step 1) and successfully completed post-discharge follow-up visits (step 2). The list of candidate predictors in sub-study I and co-variables in sub-study II was derived from data provided by various Danish administrative registers. Sub-study III was based on data from five interdisciplinary focus group interviews with a total of 24 health professionals engaged with implementation of the post-discharge follow-up program.

## **Results**

In sub-study I, a readmission prediction model was developed with acceptable performance and no indication of overfitting in the internal validation. The model showed that demographic, social, organizational and health-related factors predicted acute all-cause 30-day readmissions; i.e. being male, low education, prior contact with emergency physician, diagnosis related to the respiratory system, not being diagnosed due to atypical symptoms, cognitive problems, high CCI, longer hospital stays and three different pharmacy groups related to chronic conditions. Sub-study II showed a low level of adherence to the post-discharge follow-up program in both step 1 (69% adherence) and step 2 (54% adherence). Moreover, adherence to referral from hospital to municipality was associated with the particular hospital from which the patient had been discharged, and whether the patient had received nursing- or homecare assistance from the municipality prior to admission. Level of adherence in terms of successfully completed post-discharge

follow-up visits was associated with gender, municipality of residence and whether the GP operated alone or in shared practice. Sub-study III confirmed that implementation of the post-discharge follow-up program was intensively influenced by contextual factors related to the inter-organizational work of the program. Thus, the post-discharge follow-up program introduced new demands related to patient enrollment and interdisciplinary work that came into conflict with the professionals' existing work routines in their health care work. The study further found that the conflicting demands were embedded in the institutional logic of the organization.

### **Conclusion**

Based on the studies in this PhD thesis, a comprehensive model for prediction of acute all-cause 30-day readmission among older medical patients was developed. The thesis further showed that adherence to an integrated care program that operates across organizational levels is heavily dependent on organizational factors. Implementation of a new integrated care program is potentially subject to contradictory demands that originate in the very institutional context in which health professionals work.

## Dansk resumé

### Baggrund

Fragmenteret behandling og pleje til ældre medicinske patienter kan øge risikoen for behandlingsfejl. For at sikre ældre medicinske patienter den rette behandling, er det nødvendigt at kunne identificere patienter, der er i særlig risiko for genindlæggelse. Internationalt er flere prædiktionsmodeller til genindlæggelser blandt ældre medicinske patienter blevet udviklet, men modellerne er ikke tilstrækkeligt præcise. Forskning viser desuden, at indsatser til patienter i øget risiko, der skal integrere behandling på tværs af sektorer og forebygge genindlæggelser kan være vanskelige at implementere. Ikke alle patienter modtager den planlagte behandling. Organiseringen og det omgivende samfund, samlet betegnet *kontekst*, kan have en betydning for, hvordan nye tiltag integreres på tværs. Der stilles mange krav til de sundhedsprofessionelles arbejde såvel i mødet med patienter, kolleger og organisation som i det omgivende samfund. Når der opstår modsætningsforhold, mellem de krav der stilles til arbejdet, kan det have betydning for implementering af nye tiltag. Vi mangler viden om, hvad der betyder mest i gennemførelsen af nye procedurer samt *hvordan* kontekstuelle forhold blander sig i implementeringsprocesser.

### Formål

- At udvikle og internt validere en model der kan prædiktere akutte genindlæggelser blandt ældre medicinske patienter (delstudium 1).
- At undersøge i hvilken grad gennemførelsen af en ny tværsektoriel indsats målrettet ældre medicinske patienter er associeret med patient-specifikke faktorer og organisatoriske faktorer (delstudium 2).
- At undersøge hvordan eksterne krav har indflydelse på implementering af et tværsektorielt forebyggelsesprogram til ældre medicinske patienter. Herunder at undersøge modsætningsforhold der opstår imellem de krav som det specifikke program pålægger de sundhedsprofessionelle, og de krav som allerede eksisterer på i forhold til sundhedsarbejdet (delstudium 3).

### Metoder og materialer

Gennemførelsen af de 3 delstudier tager udgangspunkt i det tværsektorielle forebyggelsesprogram, Opfølgende Hjemmebesøg, i Region Sjælland i perioden 2012-

2014. Kerneydelsen i programmet er 1-3 fælles besøg af egen læge og hjemmesygeplejerske. Delstudie 1 og 2 er prospektive observationelle studier. Delstudium 1 baseres på patienter i alderen fra 65 år og op efter, der i 2012 blev screenet med henblik på inklusion af i et kontrolleret randomiseret studium af Opfølgende Hjemmebesøg. I delstudium 1 indgik alle screenede patienter, uanset deres deltagelse i forsøget (n=770 patienter). I delstudium 2 indgik kohorten af patienter, der i Region Sjælland 2014 blev screenet til at modtage opfølgende hjemmebesøg (n=1.659 patienter). Gennemførelse af programmet blev vurderet på baggrund af om 1) om kommunen modtog henvisning fra hospitalet, og 2) om det første opfølgende hjemmebesøg blev gennemført. Begge kvantitative delstudier blev suppleret med omfattende data fra danske administrative registre. Delstudium 3 tog udgangspunkt i 5 fokusgruppeinterviews med i alt 24 sundhedsprofessionelle, der til dagligt arbejdede med Opfølgende Hjemmebesøg på tværs af kommuner, hospitaler og almen praksis i Region Sjælland i 2014.

## Resultater

Vi udviklede en model til prædiktion af akutte genindlæggelser blandt ældre medicinske patienter (delstudium I). Modellen omfatter 11 sociale, demografiske, organisatoriske og helbredsmæssige faktorer. Nærmere betegnet at være mand, lavt uddannet, have haft kontakt med vagtlæge op til indlæggelsen, at få en diagnose relateret til respirationssystemet, at få en klar diagnose frem for at blive udskrevet med atypiske symptomer, kognitive problemer, høj comorbiditets score, flere sengedage på hospitalet og 3 farmakologiske grupper prædikterede akutte genindlæggelser inden for 30 dage efter udskrivelsen. Validering af modellen viste, at den i tilfredsstillende grad udpegede patienter der blev genindlagt (AUC =0.70). Analyserne i delstudium 2 viste, at sandsynligheden for at kommunen modtog en planlagt henvisning på patienter, der skulle indgå i Opfølgende Hjemmebesøg, afhang af hvilket hospital patienten blev udskrevet fra, og om patienten modtog hjemmepleje forud for indlæggelsen. Sandsynligheden for at første opfølgende hjemmebesøg blev gennemført afhang af patientens køn, hvilken kommune patienten boede i, og om den praktiserende læge tilhørte solopraksis eller praksisfællesskab. Resultaterne fra delstudium 3 viste ydermere, at implementeringen af det tværsektorielle program, var influeret af den institutionelle kontekst som programmet indgik i. Opfølgende Hjemmebesøg introducerede nye krav om *standardiseret visitation af patienterne til programmet og øget tværfagligt samarbejde*. Forhold der modsatte sig

eksisterende strukturer i de sundhedsprofessionelles arbejde. De eksisterende strukturer blev intensiveret af udefrakommende bestemmelser om kommunikation og fagroller.

### **Konklusion**

Vi udviklede en model til prædiktion af akutte genindlæggelser blandt ældre medicinske patienter. Modellen inkluderer sociale, demografiske, organisatoriske og helbredsmæssige faktorer. Ligeledes afhang gennemførelsen af det tværsektorielle program især af den organisatoriske kontekst. Kvalitative data viste, at de sundhedsprofessionelle oplevede modsat rettede krav i deres arbejde, som påvirkede implementeringen af det tværsektorielle forebyggelses program. Afhandlingen peger på, at mange forhold bør inddrages, hvis vi vil forbedre behandlings kvaliteten for ældre medicinske patienter. Både hvad angår prædiktion af risiko for genindlæggelse og implementering af en forebyggende indsats, bør samarbejdsflader og kontekst inddrages i planlægningen af nye tiltag.

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Appendices and papers

## Appendix A

Screening questionnaire for the post-discharge follow up program 2012 at Holbæk University Hospital [in Danish].

**Projekt opfølgende hjemmebesøg: Screeningskema til inklusion af patienter**  
 Medicinsk afdeling, Holbæk Sygehus (januar – november 2012)

**Inklusionskriterier:**

- Patienter på 65 år eller derover, der udskrives fra medicinsk afdeling, Holbæk Sygehus til eget hjem, plejehjem eller aflastningsplads.
- Patienter med adresse i Holbæk, Odsherred eller Kalundborg kommune.
- Patienter der overflyttes til anden afdeling/hospital er **ikke** omfattet af tilbuddet.
- **Opfølgende hjemmebesøg tilbydes til patienter der er kendt dement/ hvor der er begrundet mistanke om demens – ELLER patienter som opfylder 2 eller flere af de øvrige inklusionskriterier.**

Label med patientens

- Indlæggelsesdato
- CPR
- Navn
- Adresse
- Navn på praktiserende læge

<b>Demens</b>	Sæt X	
Patienten er kendt dement eller der er begrundet mistanke om demens	JA _____  Patientens bør tilbydes deltagelse. Gå videre til udskrivelse/ samtykke nederst på siden.	NEJ _____  Afkryds venligst øvrige inklusionskriterier nedenfor

Øvrige inklusionskriterier <i>Hvis patienten falder inden for min. 2 inklusionskriterier, bør patienten tilbydes deltagelse i projektet.</i>	Sæt X
<b>Tidligere indlæggelse</b>	
Patienten har været indlagt på sygehus (uanset type af afd.) 2 eller flere gange de fortløbende 12 måneder.	
<b>Tab af ADL funktioner</b>	
Patienten har stort tab af ADL* funktioner i forhold til før indlæggelsen <small>* Activity of Daily Living: f.eks. af- og påklædning, spisning, personlig hygiejne, indkøb, telefonering eller tilsvarende.</small>	
<b>Comorbiditet</b>	
Patienten er i aktiv medicinsk eller kirurgisk behandling for flere sideløbende somatiske tilstande*. <small>*Indbefatter både somatiske tilstande, der har ført til indlæggelsen og behandlingskrævende somatiske tilstande i øvrigt.</small>	
Patienten er i aktiv behandling for en eller flere psykiatrisk(e) tilstand(e)*. <small>*Indbefatter både psykiatriske tilstande, der har ført til indlæggelsen og behandlingskrævende psykiatriske tilstande i øvrigt.</small>	
Patienten får 6 eller flere slags receptpligtig medicin.	
<b>Kognitive færdigheder</b>	
Patientens adfærd giver mistanke om kognitive forstyrrelser/problemer* (hvor der ikke er begrundet mistanke om demens)? <small>*Eks. koncentrations-, hukommelses- og rumopfattelsesbesvær, fornægtelse og/eller manglende sygdomserkendelse.</small>	
<b>Misbrug</b>	
Patienten har et misbrug som påvirker patientens sociale, psykiske og fysiske funktionsniveau.	
<b>Sociale forhold</b>	
Patienten har et belastet socialt netværk*. <small>* Eks. Dødsfald i nær familie, dårlig kontakt til nær familie/omgangskreds, svær sygdom i nær familie, patienten føler sig ensom - eller lignende problemstillinger.</small>	
Patienten skal have øgning i hjemmehjælp/ hjemmesygepleje i forhold til før indlæggelsen.	

Dato for udskrivelse: D. \_\_\_\_\_

Patienten udskrevet fra afsnit: \_\_\_\_\_

Lægens initialer \_\_\_\_\_ **Patienten (evt. pårørende) har givet samtykke til at deltage i projektet: Ja \_\_\_\_\_ Nej \_\_\_\_\_**

## Appendix B

Screening questionnaire for the post-discharge follow up program 2014, hospitals in Region Zealand [in Danish].



## SCREENING TIL FØLGE-OP ORDNING

Medicinske og geriatriske afdelinger i Region Sjælland, samt ortopædkirurgisk afdeling Køge Sygehus

### Screeningsprocedure:

- Patienter i alderen 78 år eller ældre screenes.
- Patienter yngre end 78 år kan screenes, hvis der ud fra et fagligt skøn er behov for dette.
- Patienter der **ikke** udskrives til eget hjem inkluderes **ikke** i ordningen.

Sæt  
X

Patientens adfærd giver mistanke om kognitive forstyrrelser\*, herunder demens, der har betydning for, hvordan patienten mestrer sin hverdag.

\* Eks. Delir, konfusion, koncentrations-, hukommelses- og rumopfattelsesbesvær.

Patienten har et misbrug af medicin, stoffer og/eller alkohol, der har betydning for, hvordan patienten mestrer sin hverdag.

Patienten har en psykiatrisk sygdom, der har betydning for, hvordan patienten mestrer sin hverdag.

Patienten har et belastet socialt netværk:

- Har for nylig mistet ægtefælle
- Bor sammen med syg eller overbebyrdet ægtefælle
- Bor alene og har spinkelt netværk
- Er selv omsorgsgiver.

Patienten har et væsentligt lavere funktionsniveau/ADL niveau i forhold til før indlæggelsen.

Patienten er ud fra ernæringscreeningen scoret til at være ernæringstruet svarende til en score på 3 eller derover.

Patienten lider af svær kronisk, progredierende\* somatisk eller psykiatrisk sygdom

\*Inden for måneder

Patienten skal efter udskrivelsen have 6 eller flere forskellige lægemidler\*.

\*Lægemidler der fremgår af det Fælles Medicinkort.

Patienten har efter udskrivelsen 2 eller flere udredningsmæssige, behandlingsmæssige og plejemæssige aftaler, der skal koordineres.

Patienten har, inden for de forudgående 6 måneder, haft mindst 1 akut hospitalskontakt\* ud over den aktuelle.

\*Herunder også skadestuekontakter

Der er mistanke om boligforhold, der i patientens aktuelle helbredstilstand, forhindrer patienten i at klare dagligdagen.

Patienten har øget behov for praktisk hjælp, personlig pleje og/eller sygepleje efter udskrivelsen.

Patienten skal efter udskrivelsen ikke modtage kommunale plejeydelser\*.

\*praktisk hjælp, personlig pleje og/eller sygepleje.

Patienten har uforklaret fald-anamnese, hvor årsagen endnu ikke er endeligt fastlagt.

Hvis der opnås 3 eller flere X'er: **SE INSTRUKS PÅ BAGSIDEN**

### Samlet konklusion på screening samt tværfagligt skøn:

Patienten visiteres ikke, eller ønsker ikke følge-op

Patienten visiteres til følge-op

## Appendix C

Results from the development and internal validation of a 7-day readmission prediction model.

## Results – 7 day prediction model

<b>Acute readmissions within 7 days from discharge<sup>1</sup></b>				
50 (6%) readmitted patients				
	Predictors	Categories	OR (CI)	P-value
Health related factors	Charlson Comorbidity Index score	0-1	-	0.0625
		2+	1.91 (0.97-3.78)	
	Contact with emergency service doctor within last month up to index admission	No	-	0.0469
Yes	1.82 (1.01-3.29)			
Sociodemographic factors	Gender	Female	-	0.0719
		Male	1.78 (0.95-3.33)	
	Spouse	No	1.98 (1.03-3.78)	0.0399
Yes		-		
Income	Equal to or less than median income	-	0.0388	
	More than median income	0.52 (0.28-0.97)		

<sup>1</sup>Following covariates were not included in the model because of lack of observations: thyroid disease, psychological disorder (sleep disorder and/or depression), gout disease, glaucoma, bone diseases, epilepsy, diabetes, and cardiovascular disease.

	Measure	Acute readmissions within 7 days from discharge)	
		Development	Bootstrap
<b>Overall performance</b>	Brier score	0.058	0.057 (0.043-0.071)
<b>Discrimination</b>	AUC	0.697	0.721 (0.654-0.784)
<b>Calibration</b>	Calibration intercept	0.003	0.002 (-0.007-0.010)
	Calibration slope	0.960	0.969 (0.844-1.114)

<sup>1</sup> Following covariates is not included in the model because of lack of observations (besides above mentioned): thyroid disease, psychological disorder (sleep disorder and/or depression), gout disease, glaucoma, bone diseases, epilepsy, diabetes, and cardiovascular disease.

## Paper I

Lehn SF, Zwisler AD, Pedersen SH, Gjørup T, Thygesen LC. **Development of a prediction model for 30-day acute readmissions among older medical patients: The influence of social factors along with patient-specific and organizational factors.** To be submitted to BMJ Open Quality.

Paper I er ikke med i denne webudgave. Kontakt forfatteren for flere oplysninger.

## Paper II

Lehn SF, Zwisler AD, Pedersen SH, Gjørup T, Thygesen LC. **From hospital to municipality to general practitioner: patient-specific versus organisational barriers to effective care.**

Submitted to: International Journal for Integrated Care.

Paper II er med i denne webudgave. Kontaktforfatteren for flere informationer.