Older Persons at Risk of Hospital Readmission

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BY
MONA KYNDI PEDERSEN

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AALBORG UNIVERSITY
DENMARK

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2003	MSc (Nursing), The Faculty of Health Sciences, University of Aarhus
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Clinical employments

2009-2011	Medical nurse and improvement consultant, Medical Department, Thy-Mors Hospital, North Denmark Region
1995-1996	Nurse at the Refugee Centre, Danish Red Cross, Hanstholm

1986-1989	Medical nurse at Thy-Mors Hospital, North Denmark Region
1983-1986	Surgical nurse at Herning Hospital
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Teaching

2001-2007	Lecturer at University College of Northern Denmark, North Denmark Region, The School of Nursing, Hjørring
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2010 – 2011	Project manager. Thy-Mors Hospital, North Denmark Region
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ENGLISH SUMMARY

Background

Hospital readmission, defined as a subsequent return to hospital shortly after discharge, is common and considered an adverse health outcome in older persons. Acute readmission of recently discharged patients puts additional pressure on clinical resources within health care services and support.

Despite the frequency of readmissions, there is still a relatively incomplete understanding of the broader array of factors pertaining to hospital readmission. Few studies have explored patients' experiences of circumstances and incidents leading to readmission. The current evidence on risk factors for hospital readmission may not be adequate to identify person at risk of readmission and to develop informed strategies and individual, targeted interventions in the heterogeneous population of older persons.

The overall purpose of the thesis was to explore and enhance the understanding of circumstances and determinants pertaining to readmission in older persons. The purpose was to identify, synthesise and expand the evidence-based knowledge of risk factors associated with readmission, and to identify the characteristics of older persons at increased risk of readmission. Furthermore, to explore readmission from the perspective of older persons and their experiences of how life conditions and critical incidents pertain to readmission.

Methods

The thesis was designed as a three-phase mixed methods approach combining and integrating quantitative as well as qualitative data. Initially we conducted a systematic review based on observational studies of risk factors for acute care hospital readmission in older persons. Concurrently, we constructed a database to explore demographic, social, health- and healthcare-related determinants associated with hospital readmission in older persons. This database comprised a historic cohort of persons aged 65 years and over admitted to a Danish public hospital between 2007-2010. The database was used in a cohort study on risk factors associated with acute hospital readmission within 30 days from discharge. Finally, the impact of life conditions and critical incidents pertaining to hospital readmission were explored in-depth in eight qualitative, double interviews with four community dwelling older males readmitted to hospital.

Results

Study I identified a number of risk factors associated with higher risk of readmission. These factors comprised sociodemographic determinants such as higher age, male gender, ethnicity and living conditions as well as indicators of impaired health. Prior admission, prolonged hospitalisation along with illness severity affected the risk of readmission. Although more studies concluded that certain diagnoses or comorbid conditions affected the risk of readmission, they did not agree on any particular disease, and diagnoses were not strongly associated with hospital readmission.

Study II indicated that person- and health-related factors were the dominant contributors to readmission. Demographic and social factors increasing the risk of readmission comprised male gender, low income and low socioeconomic group. Health-related factors associated with readmission were indicators of clinical instability and illness severity and included polypharmacy, comorbidity and frequent use of various types of health services one year prior to the index admission. Factors related to the current hospital admission were only weakly associated with risk of readmission. Another finding was that older persons at risk of readmission could be identified based on information available at the time of admission.

Study III highlighted the interconnectedness and dynamics of individual-level and contextual determinants associated with readmission. In a population of older male patients, life conditions provided the background and pre-conditions of an on-going process to balance life demands and the burden of illness and treatment. The critical incidents arose in everyday life, in face-to-face encounters between individuals and health care professionals when finding ways to navigate within and between health care system(s). Critical incidents became tipping points that could decrease or increase the resources and capacity of the individual or, on the other hand, further contribute to the burden of illness and treatment of older persons.

Conclusion

This thesis provides insight into the multifaceted and complex pattern of individual-level and healthcare related determinants associated with readmission in older persons. Moreover, it elaborates on how complex determinants of readmission interact and constitute the conditions for the course of care of the individual.

The key finding is that readmissions in older persons comprised the course of care rather than specific illnesses and distinct care episodes and readmissions should be considered as events in a complex, longitudional and cyclic pattern of life and health events of the individual rather than endpoints and adverse health outcomes in distinct and demarcated acute care episodes.

DANSK RESUME

Baggrund

En forholdsvis stor andel af ældre patienter bliver genindlagt kort tid efter at de er udskrevet fra sygehuset. For den ældre og dennes pårørende betyder en akut genindlæggelse et nyt brud på hverdagslivet, der kan opleves som en unødvendig belastning og foranledige usikkerhed. For hospitalet medfører akutte indlæggelser af nyligt udskrevne patienter et ekstra pres i en hverdag med begrænsede ressourcer. Genindlæggelser har dermed både store menneskelige og samfundsmæssige omkostninger.

Inden for sundhedsvæsenet er der derfor fokus på at reducere antallet af genindlæggelser. På trods af hyppigheden af genindlæggelser, mangler der forskningsbaseret viden om, hvad der karakteriserer den gruppe af ældre mennesker, der er i særlig risiko for genindlæggelse. Få studier har undersøgt patienters og pårørendes opleveler af genindlæggelser og der er fortsat er en ufuldstændig forståelse af de faktorer og omstændigheder, der har indflydelse på genindlæggelse blandt ældre.

Formålet med denne afhandling er at undersøge og øge forståelsen for de omstændigheder og faktorer, der har indflydelse på genindlæggelse og hvad der karakteriserer den gruppe af ældre, der er i særlig risiko for tidlig genindlæggelse. Herudover at udforske den ældres oplevelse af begivenheder og omstændigheder af betydning for genindlæggelse.

Metode

Afhandlingen har et mixed method design og baserer sig på tre delstudier, der kombinerer og integrerer kvantitative og kvalitative data. Studie I er et systematisk review baseret på eksisterende kvantiativ forskning om risikofaktorer for akut genindlæggelse inden for 30 dage efter udskrivelse og er baseret på analyse af registerdata fra danske offentlige registre. Studie II er designet som et cohortestudie med en historisk kohorte bestående af personer på 65 år eller ældre indlagt på et dansk offentligt hospital i perioden 2007-2010. Information om demografiske, sociale og sundhedsrelaterede data samt kliniske og administrative data relateret til hospitals indlæggelser og øvrige sundhedsydelser, koblet på individniveau og samlet i en database, og efterfølgende anvendt i den analyse af risikofaktorer og prædiktorer for genindlæggelse indenfor 30 dage efter udskrivelse. Studie III udgør den kvalitative del af afhandlingen og baserer sig på otte dobbelte interviews med fire ældre mænd,

der er indlagt akut kort tid efter udskrivelse. Det første interview foregår på hospitalet og det andet foregår i hjemmet inden for de første 1-2 uger efter udskrivelsen.

Resultater

På baggrund af det systematisk review af ni studier identificeredes en række risikofaktorer for genindlæggelse. Studierne var meget forskellige ift design og studiepopulation og derfor var det vanskeligt at sammenligne resultaterne på tværs af studierne. De påviste risikofaktorer var relateret til både sociodemografiske og helbredsrelaterede faktorer og den enkeltes medicinske historie forud for indlæggelsen; herunder alder, køn, etnicitet samt dårlig almentilstand, funktionsniveau og tidligere indlæggelser. Risikofaktorer ift indlæggelsen omfattede primært indlæggelsens varighed, indlæggelsesmåde samt udskrivelsen. Selvom flere studer konkluderede, at visse diagnoser eller komorbide tilstande påvirkede risikoen for genindlæggelse var der ikke grundlag for at pege på bestemte diagnoser eller comorbide tilstande.

Resultatet fra risikoanalysen viste, at sociodemografiske og sundhedsrelaterede faktorer samt forbruget af sundhedsydelser forud for indlæggelsen var de stærkeste prædiktorer for genindlæggelse. Demografiske og sociale faktorer forbundet med risiko for genindlæggelse omfattede køn, indkomst og socioøkonomisk gruppe. Sundhedsrelaterede faktorer omfattede comorbiditet, medicin og hyppig brug af forskellige former af sundhedsydelser et år før indlæggelsen. De faktorer, der var stærkest associeret med risiko for genindlæggelse var antallet af dage siden sidste indlæggelse samt hvis den aktuelle indlæggelse var akut, hvorimod kliniske faktorer og administrative forhold vedrørende den aktuelle indlæggelse ikke var stærkt forbundet med genindlæggelse. På baggrund heraf kunne det tyde på, at patienter, der er i særlig risiko for genindlæggelse kan udpeges på baggrund af informationer, der er til rådighed ved indlæggelsen.

Resultaterne fra den kvalitative undersøgelse viste, at risikoen for genindlæggelse var tæt forbundet med den enkeltes aktuelle livssituation og hverdagsliv, der var præget af flere samtidige konkurrerende sygdomme. De var overraskede over at det tog så lang tid at komme til kræfter igen efter en indlæggelse. Samspillet med de sundhedsprofessionelle og muligheden for at få hjælp kritiske sitationer havde afgørende betydning for og kunne både øge og mindske risikoen for genindlæggelse. I denne situation var de meget afhængige af, at der var sammenhæng på tværs af de forskellige instanser, at der var nogen der kendte deres forløb, tog medansvar og som de kunne kontakte.

Konklusion

Denne afhandling giver indsigt i hvordan risikofaktorer for genindlæggelser er forbundet med et multifacetteret og dynamisk mønster af sociodemografiske og sundhedsrelatede forhold, der påvirkes af organisatoriske og strukturelle vilkår i sundhedsvæsenet - tæt forbundet med den ældres livssituation. For at forstå

betydningen af risikofaktorer er der behov for at se genindlæggelser som en del af et samlet patientforløb over tid, snarere end en enkeltstående begivenhed med behov for akut behandling.

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Paper 2

Pedersen MK, Meyer G, Uhrenfeldt L. Risk factors for acute care hospital readmission in persons aged 60 and over from western countries: A systematic review.
(Submitted and accepted for publication)

Paper 3

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Paper 5

Pedersen MK, Mark E, Uhrenfeldt L. Life conditions and critical incidents associated with hospital readmission: Perspectives of older males.
(Submitted)

CHAPTER 1. INTRODUCTION

In most western countries, life expectancy increases and populations are ageing. Although trends differ between countries, more persons survive to an advanced age, and the proportion of persons aged 65 years or over is increasing (1). In 2015, one in four Danes was 65 years or older and the number of persons above 65 years is expected to increase to 25% by 2035 (2).

Although ageing processes are considered to be modifiable (1), the expected lifetime with long-standing illness (3) as well as the number of persons with complex clinical conditions and care needs (4) is expected to increase. Due to advances in medical science and active treatment of persons with multiple morbidities, patients require more intensive health management (5). This puts additional pressure on healthcare professionals and resources within health care services (5,6). To address these challenges, the development of appropriate and supporting health care services is imperative (7).

Use of health care services is the point where patients' needs meet the professional system and the patterns of use of health care services strongly depend on the life conditions and needs of the individual as well as the organisation of the health care system (8,9). The population of older persons is largely heterogeneous in terms of health status and self-sufficiency (2,10), which further affects patterns of health behaviour, health outcomes and health care use (1). The so-called male-female health paradox indicates that the expected lifetime with chronic illness and complex care needs is higher among older males compared with females (3). A Danish study showed significant gender differences in health care use and indicated a pattern of men having higher rates of hospitalisation, but lower rates of contact to their general practitioner compared to women (11).

Hospital readmissions are known to be a significant contributor to increasing health care costs (12) and rates of readmission are widely used as an indicator of quality of care (13) and as an indicator of inappropriate use of resources (14). As an indicator of outcome, readmission transcends organisational boundaries in the health care system. Hospital readmissions thus represent a unique opportunity for identifying high-risk populations and for clinical management of complex care trajectories intersecting the acute care hospital system and the municipality care system.

This thesis addresses risk factors for hospital readmission in a largely heterogeneous population of older persons. To describe the patterns of risk factors pertaining to hospital readmission, this thesis explores a number of demographic and social determinants related to health and illness and the circumstances and events pertaining to hospital readmission from the perspective of older persons.

CHAPTER 2. BACKGROUND

Hospital readmission is common and subsequent admission to hospital of recently discharged patients is considered an adverse health outcome (4,15). In Denmark in 2013, 20% of discharges of persons aged 67 years and above were followed by acute readmission within 30 days (16). Although rates of readmission vary across countries and populations (12), the rate of readmission in Denmark is comparable to readmission rates in large international cohort studies (12,17,18).

Unplanned admission to hospital is emotionally challenging for older persons and their caregivers, and experienced as an unnecessary burden of illness, leading to anxiety and distress (19). Being transferred from one setting to another may be experienced as a critical event, unpredictable, scary and stressful for older persons and their caregivers (20).

There is evidence that the risk of readmission is cumulative and that readmissions are likely to be more complex and almost twice as likely to result in another readmission (21). In Denmark, reducing the rate of readmission and preventing hospital readmission have become political priorities to improve the quality of care and reduce unnecessary health expenses (22).

One way to prevent readmission and thus reduce the rate of hospital readmissions is to identify individuals at higher risk for adverse health outcomes (23,24), who could facilitate from targeted interventions. A systematic review by Hansen et al. (2010), found that successful interventions to prevent readmission were patient-centred, multicomponent, addressed the transition between hospital and community and were based on a longitudinal care relationship with health care professionals (25). However, such interventions should be focused on individuals at increased risk of readmission.

For the purpose of this thesis, a comprehensive literature search on risk factors, predictors and experiences of readmission among older persons was conducted.This literature search identified a number of previous reviews indicating that the topic of risk factors for hospital readmission has been studied for quite some time (4,26-29). Based on a meta-analysis of 44 studies published between 1973 and 1990, Soeken and colleagues (26) found that system level factors (e.g. hospital size), sociodemographic factors (e.g. living arrangements, race and type of insurance), and clinical factors were associated with risk of hospital readmission. Based on a systematic review of 14 prospective cohort studies published from 1996 to 2000, Campbell et al. (2004) found that sociodemographic variables such as age, gender and clinical factors such as diagnosis were not strongly correlated with outcome in older persons and the potential of these factors as “risk adjusters” was limited (4). In

a systematic review based on 83 international studies published from 1990 to 2003, Dobrzanska et al. (2004) (27) found that the risk of hospital readmission in older persons was not related to specific risk factors but to a fairly complex web of associations between sociodemographic determinants and inpatient care processes. In a systematic review of prospective cohort studies on risk of readmission in persons aged 75 and over, Garcia-Perez et al. (2011) found that dependency of social services and poor overall health condition prior to admission and previous admissions seemed to increase the risk of hospital readmission within 30 days after discharge (28). In addition, Garcia-Perez et al. (2011) compared risk factors associated with readmission within three months after discharge and risk factors for hospital readmission after three months and found that the factors associated with risk of hospital readmission differed according to the length of the follow-up period (28). However, these reviews did not deal with the same study populations, potential risk factors, follow-up periods and study designs, which might explain the reporting of diverging and sometimes contradictory results.

In a population of patients discharged home from general medicine services, Hasan et al. (2010) developed and internally validated a simple model for identifying persons at risk for hospital readmission shortly after admission to hospital. Hasan et al. included a range of easily obtainable predisposing factors such as sociodemographics, health condition and prior healthcare utilization and identified seven predictors of 30-day readmission (17). Even though Hasan and colleagues combined different data sources and included a broad range of variables in the model, the predictive performance was only fair (17). In a general population of patients aged 65 years and above, admitted to acute care hospital, Silverstein et al. (2008) developed a prediction model to be used in discharge planning (30). The data source of the model was readily available administrative data (data obtained for billing and reimbursement purposes) from seven acute care hospitals and the predictive performance was modest. Besides, neither of the studies (17,30) had access to reliable data on persons transferred or readmitted to other hospitals. However, 20-40% of patients are readmitted to different hospitals and for different reasons than the initial admission (12). Without ability to track patients over time, across providers and systems, the reliability of the results might be low. A systematic review of 26 risk prediction models by Kansagara et al. (2011), found that half of the models were designed for hospital comparison and the other half were clinical models designed to identify high risk patients (31). Most models had poor predictive ability and few models examined variables associated with overall health and function, illness severity, or social determinants of health. In addition, Kansagara et al. concluded that prediction of risk of hospital readmission is a complex endeavour due to the inter-relatedness between social, environmental and medical factors as well as system level factors such as coordination of and accessibility to health care services (31).

As readmission is a narrative – a subsequent or repeat return to hospital after discharge – the course of care leading to readmission needs to be explored from the

perspective of older persons. The patient has an intimate knowledge of the circumstances leading to hospital readmission. However, the perspective of older persons and their caregivers on readmission is still underexplored. Previous studies have evaluated patients' perspectives of hospital care by focusing certain aspects of the care process; i.e. the care time during hospitalisation (32,33), the discharge process (34) and post discharge experiences of community support and health services (35). These studies revealed a range of barriers for recovery and wellbeing of hospitalised and recently discharged persons. From interviews with patients, caregivers and health professionals, Slatyer et al. (2013) identified multiple points at which the care process could break down. The most common reasons for hospital readmission were medical conditions and complex care needs due to serious health problems and illness as well as challenges related to care interaction and transitional care (36). Based on interviews with older patients readmitted to hospital within 28 days of discharge, Dilworth et al. (2012), indicated that patient-provider communication such as lack of information sharing, receiving mixed messages, lack of discharge planning and not being back to full function at discharge were the main reasons for readmission (37). In a population of older male patients discharged to home with mobility impairments, Dossa et al., (2012) found that post-discharge breakdowns in communication impacted on continuity of care and recovery, leading to an increased risk of adverse outcomes and hospital readmission (38). In a study of veterans readmitted to medical and surgical units, Stephens et al. (2013) suggested that veterans found it difficult to navigate the health care system, experienced knowledge gaps, deferred power as well as complex psychiatric and social needs as the main reasons for hospital readmission. The authors concluded that to successfully reduce rate of hospital readmission, improvements of the process of care should focus on the care interaction between patients and providers increasing the sense of partnership between patients and providers (39). In addition, Stephens et al. found that the patient perspectives on reasons for readmission differed substantially from the those of providers (39).

This survey of primary studies and reviews on patterns of hospital readmission in older persons indicates that the problem of readmission is multifaceted and that attempts to identify a few, clear-cut reasons for hospital readmission seem over-simplified (40). Identification of older persons at risk of readmission and informed strategies to prevent hospital readmission must consider the perspective and health needs of the individual (41) as well as clinical and system level determinants associated with the entire care process (25,42). Thus, to enhance the understanding of the broader array of factors that influence readmission, we need to include persons who experience these care processes and complicated care trajectories at first hand (43).

2.1. SUMMARY

Despite the frequency of readmissions representing an unnecessary burden of illness and affecting negatively on health and wellbeing of older persons, there is still a relatively incomplete understanding of the broader array of factors pertaining to hospital readmission in older persons. The current evidence on risk factors for readmission is not adequate to identify person at risk of readmission and to develop informed strategies and targeted interventions in this heterogeneous population of older persons. Few studies have explored circumstances and incidents leading to readmission from the perspective of older persons. The knowledge of how these factors interact and integrate with the conditions of the individual remains limited.

2.2. PURPOSE OF THE THESIS

The overall purpose of the thesis was to explore and enhance the understanding of risk factors and circumstances pertaining to readmission in older persons. The purpose was to identify, synthesise and expand the evidence-based knowledge of risk factors associated with readmission, and to identify the characteristics of older persons at increased risk of readmission. Furthermore, to explore readmission from the perspective of older persons and their experiences of how life conditions and critical incidents pertain to readmission.

This thesis builds on and integrates the results from three studies.

Study I

The aim of study I was to identify and synthesise the best available evidence on risk factors for acute care hospital readmission in older persons.

The objectives of the study were:

- To develop a protocol for a subsequent systematic review of quantitative research on risk factors of hospital readmission in older persons
- To identify and synthesise existing evidence of the main risk factors for acute hospital readmission within one month after discharge in older persons from western countries.

Study II

The aim of Study II was to explore potential risk factors associated with acute hospital readmission in a nationwide cohort of older persons discharged from a Danish public hospital.

The objectives of the study were:

- To construct a multicomponent and inter-disciplinary database for clinical research on risk factors for readmission including data on demographic and social determinants linked with information on health and health care use, transcending organisational boundaries within health care systems.
- To identify risk factors and predictors of acute all-cause readmission within one month following discharge.

Study III

The aim of Study III was to emphasise the perspective of older persons and their experiences of circumstances and events associated with hospital readmission.

The objective of the study was:

- To explore and understand how life conditions and critical incidents pertained to hospital readmission in older persons.

2.3. DEFINITIONS

2.3.1. OLDER PERSON

The term *older* person varies across countries, across diverse populations and cultures within countries. The literature refers to different categories of being old; 'young-old', 'old-old' or 'oldest-old', in the range of persons known as older (1,7). In most western countries the chronological age of 65 years is accepted as a definition of becoming an older person - equivalent to retirement age (44). In this thesis follows the term *old* and *older*, unless otherwise indicated, the chronological age of 65 years and above.

2.3.2. READMISSION

Readmission might seem a simple term, but in reality it is complex to define. Unlike other indicators of hospital utilisation such as admission rates, length of stay and inpatient mortality, readmissions have no widely accepted parameters and there is no agreed definition available in the literature (14,45). Synonyms for readmission are rehospitalisation, inpatient readmission and return to hospital. The term readmission is used interchangeably with related but slightly different terms, i.e., early readmission, emergency admission, unplanned admission, unscheduled admission or non-elective admission (14).

As readmission is a subsequent or repeat return to hospital after discharge (46), the term *index admission* is used as the initial or first inpatient stay in a series of hospitalisations (45).

In this thesis, the term *readmission* is, unless otherwise indicated, used as an all-cause subsequent hospital admission. The term *all-cause* is used to clarify that the subsequent admission is not restrained by neither diagnosis nor specific conditions or geographical determinants.

2.3.3. RISK FACTORS

The term *risk* generally refers to the probability of a deleterious or adverse outcome during everyday life or an exposure to a risk factor (47,48). The term *risk factor* comprises aspects of personal behaviour or lifestyle, environmental exposures or inborn or inherited characteristics which are associated with a health-related condition considered important to prevent (49). Observational studies on risk factors observe the relationship between the exposure to a possible risk factor and the subsequent incident of the outcome of interest (48). Exposure to a risk factor can take place at a single point in time or during a period of time (48).

In this thesis, the risk factors of interest is neither condition- nor discipline-specific and person level as well as disease and healthcare system related determinants pertaining to hospital readmission among older persons will be explored.

2.3.4. LIFE CONDITIONS AND CRITICAL INCIDENTS

In this thesis, *life conditions* are understood as circumstances, events and facts of life that the individual experience as supportive or demanding for functoning and wellbeing in everyday life. Life conditions relate to the individual, the relational and/or the system- and policy-level (50,51) and can be experienced as either supportive or obstructive, but not as sufficient or decisive for an outcome to occur. The term *incident* is defined narratively as a course of events with an distinct start and end. The term *critical* is used if the incident is perceived as decisive and sentinel for an outcome (52,53).

2.4. ETHICAL CONSIDERATIONS

In this thesis, ethical considerations encompass the concerns related to the individual as well as the society as a whole. Evidence-based health care addresses the concerns and questions regarding global health and care needs raised by clinicians and patients and implicates knowledge generation, knowledge synthesis, knowledge transfer and utilisation of knowledge within clinical practice and health systems to achieve improvements in global health (54).

The thesis was approved and registered with the Danish Data Protection Agency under the North Denmark Region´s joint notification of health research (Journal ID 2008-58-0028) (Appendix B). Statistics Denmark approved the acquisition of data (Project-ID 703817) (Appendix C) and contract for the use of data and data processing was signed.

All person identifiers were removed from the data set, data was stored at Statistics Denmark and only the main researchers (MKP and SLC) and the data manager (OSR) had full online access and took responsibility for the integrity of the data (55).

Ethical considerations were made throughout the whole research process
and the ethical guidelines of the Helsinki Declaration (56) as well as the ethical guidelines for nursing research in the Nordic countries (57) were followed.

The participants received both oral and written information about the study and were asked to provide written consent (Appendix D) if they agreed to participate.

CHAPTER 3. METHODS

This section describes the methodology, the mixed methods framework, the research design, methods and materials used in Study I, II and III in this thesis.

3.1. MIXED METHODS FRAMEWORK

There is a growing interest in research approaches combining various methods and perspectives and to match methods to the research question of interest (58-60).

This thesis consists of a combination of quantitative and qualitative studies. To combine multiple frameworks and epistemiological stances in mixed methods has been widely discussed in the literature (59), described as the paradigm war or as different epistemiological stances (61). The concept of evidence is from a philosophical standpoint related to epistemological ideas of knowledge and rationale (62). According to Denzin (2012) the epistemiological discussions within mixed methods research are closely connect to the discussion of the conceptualisation of evidence and evidence-based research (63) and related to the consideration of what constitutes evidence in healthcare professions.

A mixed methods approach is suited to address a multifactetted research aim and is an integrated research approach where the researcher or a team of researchers mixes or combines both quantitative and qualitative methods in a single inquiry (58,59,64). The fundamental principle of mixed methods research is that the researcher(s) gathers and integrates quantitative and qualitative i) research questions, ii) designs and methods, iii) data-collection and analytical techniques as well as iiii) quantitative results and qualitative findings (65).

To increase the value of combining quantitative and qualitative approaches, the integration should be conducted in such a such a way that the mix of quantitative and qualitative components provides a picture of the problem or phenomena studied, more fully than either approach alone (59,61,64).

Rationale

With regard to the study objectives of this thesis of risk factors for readmission it was necessary both to seek evidence of measures of risk and to identify the characteristics of high-risk groups, but also to understand how these risk factors influenced the risk of readmission in older persons. The rationale behind combining the quantitative and qualitative studies was to explore the extent of risk as well as to complement and enhance the understanding of the complex patterns of risk factors for hospital

readmission in older persons. As such the use of a mixed methods approach had a complementary and expanding purpose.

Mixed methods design

A multistage mixed methods framework inspired the research design of this thesis (66). The multistage mixed methods framework is categorised as an advanced mixed methods approach using multiple stages and various combinations of approaches of quantitative and qualitative data collection and analysis (66).

The overall study consisted of three stages and combined convergent (Stage I and II) and sequential (Stage III) components. The convergent component included two quantitative studies (studies I and II), conducted within a similar timeframe (66). See Figure 3.1.

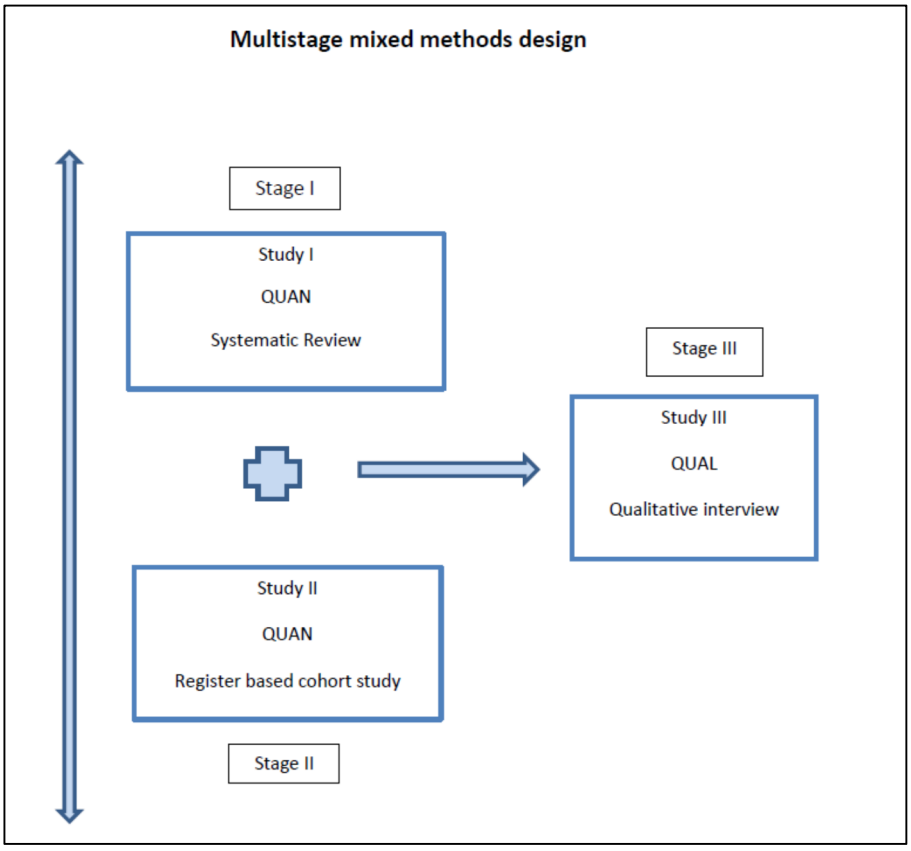


Figure 3.1. *The figure illustrates the mixed methods design. The convergent component (stage I and stage II) was followed by and informed the sequential component (stage III).*

Integration

The rationale for mixing the quantitative and qualitative components informs the methodological choices and design and the strategy for integration depends on the rationale and study questions (66). In this thesis, the integration was conducted in various ways and took place at the level of design, methods and interpretation and reporting level. For an overview of integration, see Table 3.1.

The aim of the convergent component was to identify and synthesise the best available evidence of risk factors and predictors of hospital readmission in western countries (Study I) and to supplement existing evidence with evidence on risk factors and predictors of hospital readmission based on the results from a cohort of Danish inpatients (Study II). Data collection and analysis in Study I and II generally occurred in a parallel approach.

Study III formed an exploratory sequential component, conducted as a qualitative interview study. The aim of the sequential component was to examine the perspectives of a high-risk population of older persons and to explore their experiences of conditions and critical events associated with readmission. Based on the results from studies I and II, the participants in Study III were purposefully sampled and identified as a high-risk population. As the results from Study I and Study II informed the sampling strategy and inclusion criteria in Study III, the integration between the convergent (Study I and Study II) and sequential component (Study III) took place at the method level.

The integration of the interpretation and reporting level occurred through various narrative and weaving approaches. As each study was analysed and published separately, the integration at the reporting level of the overall study occurred through a staged process. In this thesis, the reporting of results from each study occurred contiguously in a separate section. Finally, in the discussion section the results and findings from studies I, II and III were merged through a joint discussion and interpretation.

Table 3.1. *Levels of integration*

Integration levels	Study I and study II	Study III	Integration principles
Design	Convergent	Sequential	Multistage - convergent sequential
Method		Results from Study I and Study II	Building

		informs the sampling strategy and inclusion criteria in Study III	
Interpretation and reporting **(Papers)**	Study I and Study II published separately	Study III published separately	Staged
Interpretation and reporting **(Thesis)**	Results from Study I and Study II reported in the same section	Findings from Study III reported in the same section as studies I and II	Contiguous and weaving
Interpretation and reporting **(Thesis)**	Joint discussion and interpretation of results in discussion and conclusion	Joint discussion and interpretation of main findings in discussion.	Merging
Rationale **(Thesis)**	Study I and Study II: To explore and complement	Study III: To explore and understand	The thesis: To explore, complement, understand and expand

3.2. STUDY I

Study I was conducted as a systematic review of observational studies on risk factors of hospital readmission in older persons from western countries. A registered peer reviewed protocol (Paper 1) guided the conduct of the systematic review (Paper 2). All steps were reported in adherence to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) Statement (67).

Material and methods

The systematic literature search was carried out January 2014 in the following databases: PubMed, Embase, CINAHL, TRIP Database and PsycINFO. The search strategy was developed in collaboration with a research librarian (Table 3.2).

Table 3.2 *Overview of search terms distributed on Population (P), Interventions/Exposures of Interest (I), Comparator (C), Outcome (O) and Study types (S)*

PICOS elements	Search terms
Population	Aged (MesH) OR aged (tiab) OR elder* (tiab) OR old*(tiab)
Interventions/exposures of interest	Risk (MesH) OR risk (tiab) OR predict*(tiab) OR characteristic*(tiab)
Comparator	(No comparator in this review)
Outcome	Patient Readmission (MesH) OR readmission*(tiab) OR rehosp*(tiab) OR re hosp* OR readmit*(tiab)
Study types	Epidemiologic Studies (MesH) OR Registries (MesH) OR epidemiology (Subheading) OR Epidemiology (MesH) OR epidemiolog*(tiab) OR cohort*(tiab) OR registries (tiab) OR registry*(tiab) OR observati*(tiab) OR descriptive*(tiab)
Limitations	Published 1 January 2004 to 31 December 2013 in English, German, French, Swedish, Norwegian and Danish languages.

The keywords and search terms relate to the elements in the PICOS. The above-mentioned keywords are PubMed MesH terms (MesH). Synonyms were used, when searching the other databases. Terms for free text search were truncated (*) and should be located in title or abstract (tiab).

An additional search for dissertations, theses, reports etc., included MedNar, Google and relevant homepages. Conference abstracts, dissertations and editorial letters or commentaries were tracked for related journal papers. Finally, the search was

supplemented by hand searching reference lists of included studies and recent reviews for additional studies.

Study selection

The inclusion criteria were primary studies of persons aged 60 years or older from western countries, admitted to hospital as inpatients and discharged to their homes or residential care facilities. To be sensitive to various definitions of being old, an agreed United Nations decision, the age 60+ was used as the cut off for a person being old in Study I (44). Exposures of interest considered person-level determinants such as sociodemographics factors, factors related to health and illness and health care utilisation. The outcome was readmission to acute care hospital within one month of discharge as primary or secondary outcome. Observational study designs evaluating risk factors for hospital readmission and reported results through measures of risk were included. Studies focusing on populations discharged from/readmitted to psychiatric wards or for palliative care, studies restricted by diagnostic categories or medical conditions, experimental studies and studies developing or validating screening tools were excluded.

Table 3.3. *Study selection process*

Study selection process	Number of records
Records identified through database search	6139
Additional records identified	64
Records after duplicate removal	4122
Full papers assessed for eligibility	195
Studies included for critical appraisal	23
Studies included in narrative synthesis	9

Two reviewers screened titles and/or abstracts independently (n=4122). Full articles were retrieved for all studies apparently meeting the inclusion criteria (n=195) and assessed for eligibility by two reviewers (Appendix E). Disagreements about the eligibility were resolved through consensus finding among reviewers. In case of missing information or unclear data, the corresponding or senior author of primary studies was contacted for further information. The reasons for exclusion concerned

study population, outcome, study objective, research question under study and study types.

Methodological quality

The quality of included studies was assessed by the standardized Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Comparable Cohort/Case Control studies (47,68).

After pilot testing, the interpretation of the checklist items was discussed and two reviewers worked independently to determine to which extent each of the included studies constituted a risk of bias.

Table 3.4 *Critical assessment results. Checklist items from the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Comparable Cohort/Case Control studies (47).*

Checklist item	Y	N	UC	NA
Q1: Is the sample representative of patients in the population as a whole?	4	4	1	-
Q2: Are the patients at a similar point in the course of their condition/Illness?	1	1	-	7
Q3: Has bias been minimised in relation to selection of cases and controls?	5	2	1	1
Q4: Are confounding factors identified and strategies to deal with them stated?	4	3	2	-
Q5: Are outcomes assessed using objective criteria?	5	4	-	-
Q6: Is follow-up carried out over a sufficient time- period?	1	-	-	8
Q7: Are the outcome of people who withdrew described and included in the analysis?	-	4	4	1
Q8: Are outcomes measured in a reliable way?	4	-	5	-
Q9: Is appropriate statistical analysis used?	7	2	-	-

Y= Yes, N=No, UC=Unclear, NA=Not applicable

Any disagreement between the reviewers was resolved through discussion or by consulting the third reviewer and consensus was reached. Potential flaws regarding the appropriateness of the statistical methods were presented and discussed with a statistician before final assessment. At the end of this process, nine studies were included in the narrative summary and synthesis of statistically significant quantitative results.

Data extraction

The data extraction sheet (Appendix F) covered information on the study design, the settings, populations, the study period, the outcomes and the exposures/risk factors under study and the results related to the observation period of one month after discharge. Two reviewers extracted data independently and disparities were resolved after checking for accuracy and discussion.

Data analysis and synthesis

Meta-analysis was not possible due to clinical and methodological heterogeneity of the studies, and statistically significant quantitative findings were narratively summarized and included in a meta-summary. The results were statistically significant based on either the 95% confidence interval (CIs) and/or if the P-values were equal to or less than (≤) 0.05 in multivariable analysis.

The Joanna Briggs Institute Comprehensive Review Management System (CReMS) software version 5.3 was used for protocol development and reporting and Meta-Analysis of Statistics Assessment and Review Instrument (MAStARI) was used for critical appraisal, data extraction and data synthesis.

3.3. STUDY II

Study II was designed as a register-based cohort study including two stages; construction of a database (Paper 3) and the subsequent analysis of risk factors for readmission (Paper 4). The analysis of risk factors for hospital readmission was based individual level linkable information from Danish population-based registers. The cohort was a historic cohort of Danish patients discharged alive from Danish public hospitals in the period from 1 January 2007 to 31 December 2010.

Materials and methods

Since 1968, all Danish citizens have been assigned a unique central identification number, which makes it possible to link information between different nationwide registers and to follow individuals over time and through different parts of the public sector. Statistics Denmark offers remote access to data on individual level that is necessary to carry out research projects (69).

The availability of these data sources enabled the construction of a database called OPRA (Older Persons at Risk Assessment), prepared for the subsequent analysis of risk factors for hospital readmission (Paper 4) and various postdoc studies of adverse health outcomes and subgroup analyses in older persons.

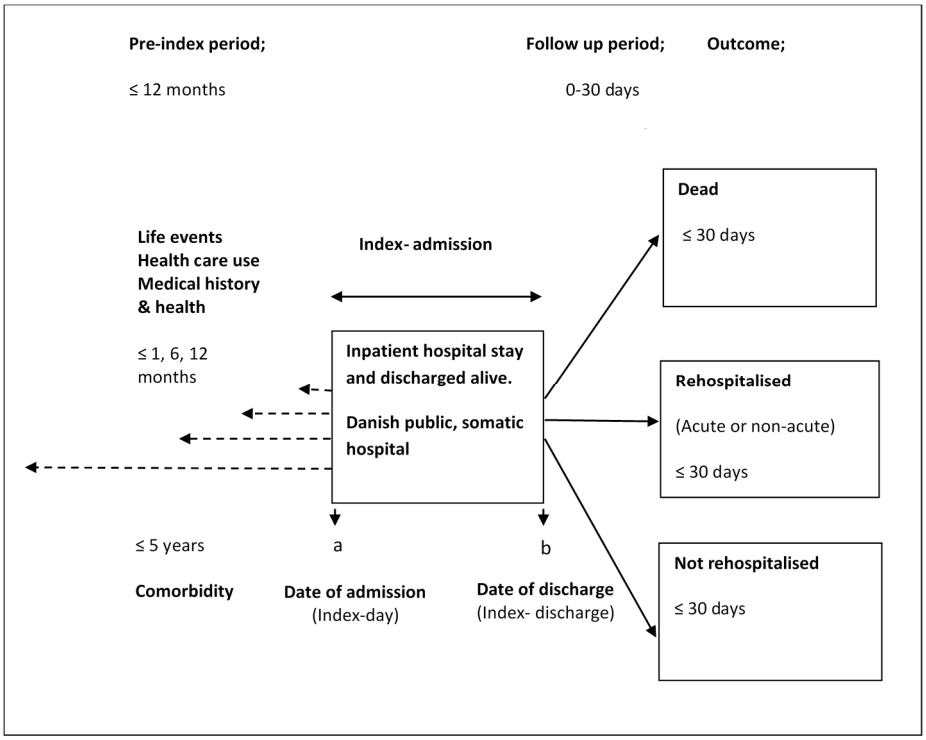
The utility of these data sources in health research depends on the transparency of the options and choices made during the design phase (70,71).

Pre-modelling

Before examining any specific data or conducting analysis, the overall design, definitions, strategies for potential analyses and analytical units were outlined in a conceptual model and operationalised through a manual.

For an illustration of the overall conceptual model, definitions and outcome, see Figure 3.2.

Figure 3.2: *Conceptual model*



The study period comprised a four-year period from 1 January 2007 to 31 December 2010. From The Danish National Registry of Patients (DNRP) all inpatient stays at any Danish public, somatic hospital between 1 January 2007 and 31 December 2010 were included.

The sampling strategy was based on a general approach and the study population comprised all persons aged 65 years and above who at least once classified as inpatients and discharged alive during the study period. Inpatient stays at psychiatric hospitals, private hospitals and hospices were not included.

The term index admission distinguished between the index episode and a potential subsequent readmission. Transfers between wards or hospitals were linked and considered as one admission if the time between discharge and the subsequent admission was less than five hours. For patients admitted more than once during the study period, each admission counted as unique.

Data were extracted and linked retrospectively for each index admission including a one-year pre-index observational period to describe potential patterns in health- and life-events (Figure 3.2 and Table 3.7). Data on principal (primary) diagnoses from admissions and outpatient-clinic visits during a five-year pre-index period was used for calculation of the Charlson Comorbidity Index score (72,73). For patients with multiple admissions these variables were dynamic and varied for the each index admission.

The follow-up period comprised the period from the date of discharge and lasted 30 days or until death, which ever came first. As most recent studies use one month (28-30 days) as the standard for follow-up (74), readmission within 30 days after discharge from the index admission was used to define the follow-up period. A subsequent admission within 30 days from discharge following the index admission was classified as a readmission. If a subsequent admission followed the index admission within 30 days from discharge, this admission was a readmission, and thus became an additional index admission.

Variables

Data distinguished between information related to the pre-index period, the index admission period and the follow-up period. For each index admission, variables were included to describe sociodemograhics, health characterics and health care use prior to the index admission.

A brief overview of variables is shown in Table. 3.7.

Table 3.7 *Overview of potential risk factors according to the pre-index, index admission and various outcome measures related to readmission or death.*

Pre-index				**Index admission**	**Outcome**
Demographics	Socio-economics	Health characteristics	Health care use	Organisational & clinical information	Outcome (Readmission & Mortality)
Age Gender Ethnicity Country of origine Citizenship Address Municipality	Education (grades) Occupation Income Marital status Social support/number of persons in the household Life events	Primary care services Medical history: Diagnosed with Dementia or Neoplasm Comorbidity Prescribed medication High Risk Medication Diagnoses (primary)	General Practitioner (GP) Emergency Physician (GP on call) Emergency Department Outpatient-clinic Inpatient stays at hospital Days hospitalised Days since discharge Readmissions	Site (hospital region, hospital, department, medical specialisation) Date/hour of admission and discharge Transfer Length of stay Diagnoses Intensive care Ambulatory Care Sensitive Condition# at discharge In-hospital death	Site (hospital region, hospital, department, medical specialisation) Way of referral (non-acute/acute) Length of stay (readmission) Diagnoses Ambulatory Care Sensitive Condition# at discharge Number of days before readmission Death within 30 days Number of days alive within 30 days

Ambulatory Care Sensitive Conditions (ACSCs): Conditions for which hospital could be prevented by interventions in primary care (75).

The cohort study

The study population was a historic cohort of admissions and individuals enrolled in the OPRA database from 1 January 2007 to 30 September 2010.

The aim was to identify risk factors and predictors for acute all-cause readmission within one month following an index hospital visit. The primary outcome was acute all-cause readmission within 30 days from discharge. The secondary outcome was acute all-cause readmission and/or death within 30 days.

Potential risk factors

Patient-level variables comprised various sub-categories of demographic and socioeconomic variables, health characteristics and health care use, information in principle available before admission. Admission-level variables comprised sub-categories of clinical and organisational variables related to the index admission.

Statistical analyses

The statistical analyses in the cohort study were both descriptive and analytical.

For cohort presentation, continuous variables were described by mean and standard deviation (SD) or median and inter quartile range (IQR). As the majority of variables were highly skewed, lower percentiles and median showed zero, and mean was preferred over median for reporting of the main part of continuous variables. Number and percentages described categorical cohort characteristics.

Data was analysed through univariable and multivariable analysis, modelling readmission as the dependent variable, and explained by groups of exposure variables associated with hospital readmission. The unit of analysis was any patient's index admission and clustering was performed at patient level.

Statistical modeling distinguishes between explanatory and predictive modelling. In this analysis, we combined an explanatory approach and a predictive approach (76,77). The analysis consisted of two steps; quantification of i) strength of association between risk factor and outcome and ii) predictive performance. The associations between exposure variables and the outcomes were quantified by the Wald test statistics (78) obtained from a logistic regression with acute, all-cause readmission and/or death as the dependent variable and potential risk factors as independent variables. For each risk factor, we calculated a univariable, a multivariable as well as a multi-level weight. The p-value would be the ideal choice, but due to the numerical issues the large sample size caused many p-values to be exact zero.

A receiver operating characteristic (ROC) analysis was used for predictive analysis. Calculation of the area under the ROC curve (AUC) was based on univariable and multivariable screening within all exposure variables (79). For validation of the predictive performance, we chose a split-sample design and various categories of variables, when calculating AUC (80,81). For validation, the cohort was divided in a two-third derivation cohort and a one-third validation cohort (80).

All statistical procedures were performed using SAS (version 9.4, SAS Institute Inc. SAS Campus Drive, North Carolina, USA) and STATA (version 14.0, Stata Corp, College Station, Texas, USA).

3.3. STUDY III

Study III was the sequential component and conducted as individual, face-to-face interviews with four male participants acutely admitted to an department of internal medicine at a Danish university hospital.

The study had a qualitative research design, using the Critical Incident Technique (CIT) (52,53). The CIT approach provides a systematic, though open-ended methodology, sensitive to the perspective of the individual (52,53). The CIT literature describes the individual interview as the preferred method of data collection to ensure detailed and reflected descriptions of circumstances and specific incidents, positive and/or negative, associated with an outcome (53). The interviews were double interviews conducted bedside at the hospital and followed by a second in-depth interview in the participant's home 1-2 weeks after discharge.

As researcher I was involved in the whole research process and had to be conscious of the risk of reproducing common sence knowledge (53,82). I chose to write a number of narratives about care episodes involving older persons based on my experiences as a nurse in a hospital setting. The writing up of these stories was followed by sharing and discussing them with post-graduate students, colleagues and supervisors. Through their comments, questions and reflections I gained a deeper insight into my fundamental values and prejudices and the necessity to distinguish between my position and perspective as a person, woman, daughter and hospital nurse from that of the researcher.

Sampling strategy and inclusion criteria

In line with the mixed methods design, the strategy for sampling of participants in Study III was strategic, informed by the preliminary results from Study I and II.

Thus, the inclusion criteria (see Box 3.1) were based on the following considerations; 1) represent risk factors identified as significantly associated with increased risk of hospital readmission in studies I and II, and 2) be based on information easy obtainable in the clinical setting.

Persons who were not able to provide informed consent and admitted or transferred for palliative care were not included.

Box 3.1 *Inclusion criteria*

- Male patients
- Between the age 65 and 75 years
- Admitted acutely for medical reasons
- One or more hospital admissions (all-cause and anywhere) within the previous three months
- Taking five or more prescriptive drugs per day
- Expected to be discharged to their previous address

Recruitment of participants

Recruitment and interviews with acutely ill, older hospitalised persons for research purposes is recognised as difficult (83,84) both due to the vulnerability of this population (84) and a clinical setting putting people under pressure (6).

To guarantee patient confidentiality and to minimize disruptions and interferrance with patient care, the first line nurse managers at two internal medical wards acted as gatekeepers. Initially, the gatekeepers were individually introduced both orally and in writing to the study purpose and asked to identify and invite patients eligible for participation (Appendix G). The gatekeepers were also provided with an information letter with information to the staff and with a leaflet containing information to potential participants (Appendix H).

To minimise the risk that eligible patients were discharged or transferred before I could approach the patient, I called the first line manager every morning to ask for eligible patients and/or visited the two medical wards on a daily basis over a seven-week period.

The staff contacted eligible patients and asked if they were interested in participating. Only if patients showed an interest in participating I contacted the potential participants and provided further oral and written information about the study. Before obtaining written consent, the participants were assured anonymity and confidentiality and they were informed that they could withdraw from the study at any time without any consequences. They were given my e-mail address and telephone number which they could use for contact and if they needed further information.

The inclusion criteria and sampling strategy for Study III were based on markers of risk (identified in studies I and II), indicating that eligible participants experienced a sudden level of clinical instability and acute illness. Thus, I had to spend more time than expected on approaching the potential participants. In more cases I had to return to the ward on several occasions to inform the patient, obtain informed consent and plan the interview. When I informed the potential participants and we planned the interview, I noticed whether they seemed to suffer from any impairments, such as hearing loss or visual impairment or needed assistance for mobilisation. I included this when planning the interview.

Eight patients were eligible. Two patients declined beforehand to participate in the post-discharge interview. One eligible patient was discharged unexpectedly before the first interview could take place and one patient was transferred to another ward for palliative care.

Four eligible patients ended up signing the informed consent form.

Interviews

The interview guide was informed by the methodological literature of CIT (52,53,85) and based on a narrative approach (82).

The interview guide was divided into two parts and structured according to the scope of the interview at the hospital (Interview 1) and in the home of the participant (Interview 2) (Appendix I). The interview guide was primarily used to structure the dialogue during the interview (82), and was easy to modify and adjust according to the setting and the conditions of the participants. The participants were encouraged to be as specific and concise as possible, which might limit the time required for the interview (53).

Box 3.3*: Questions to elicit the narratives of critical incidents.*

Type of question	Questions
Broad open question	• Please tell me about…. (e.g. the time after you were discharged from hospital)
Specifying questions	• What happened? • What did you or other persons do – or did not do – that had an effect?
Probing questions	• What preceded and contributed to the incident?

	• What did you experience as the most critical event?

During the interviews I was aware not to pace the participants and to show empathy and respect by taking the time to listen to their stories. The interview commenced with a broad open question: Please tell me the story about ……?. If necessary, specifying questions to elicit the narratives of critical incidents or probing questions were used aiming for a deeper understanding of the impact of life conditions and incidents experienced as critical (Box 3.3). To preserve the chronology and illuminate the coherence of events associated with admissions and readmissions, a time-line of events and circumstances related to the processes of care was constructed during the first interview (86). This time-ordered list of events formed the basis for the construct of a critical incident chart (Appendix J) (86), which was explored for further reflection and deeper mutual understanding during the second interview.

During the interview, I was observant and sensitive to the vulnerable situation and the overall conditions of the participants. For example, three participants had oxygen therapy during the interview at the hospital and one of them also during the interview at home. Before the interview started, I therefore asked the participants to tell me if they found it was too demanding to go through the interview. In addition, the participants were regularly asked during the interview if they were feeling unwell or needed a break.

The first interview took place bedside at the ward and/or in an room next to the ward. All participants shared room with other patients and even though alternatives were available, three out of four participants preferred to be interviewed at the bedside. Thus, on more occasions the interview was interrupted while visitors or hospital staff entered the room.

One participant was transferred to another ward before discharge and I decided to ask this participant if we could expand the first interview with a further interview. This interview took place while the participant was still hospitalised, and focused on how he had experienced being transferred instead of discharged as planned.

The second interview took place in the home of the participant. In this private setting, I had to perceive myself as a guest. As all four participants were married, I expected that their wife might be present during the interview. I therefore asked the participants at the end of the first interview whether they wanted the second interview to continue as a dialogue between themselves and me or if they preferred a next of kin to participate. All four participants answered that they preferred to continue the dialogue with me. Nevertheless, in two out of four interviews the wives were at home during the interview. They did not participate in the interview, but gave small comments.

During the second interview, I paid specific attention to the reactions of the participant and the general atmosphere during the interview. The comments from the wives and my observations contributed as background knowledge and enriched my understanding of the everyday life and life story of the participant but were not included in the analysis.

All interviews were digitally recorded, and immediately after the interview downloaded and stored on my personal and locked computer. Furthermore, the critical incident chart was reviewed and a contact summary sheet with basic information for each participant and notes on reflections were drafted.

Analysis

The data went through a two-step consecutive transcription process. At first, a research assistant transcribed all interviews verbatim and marked if passages or words in the interview were unclear or seemed to be obscure. Subsequently, I reviewed all transcriptions for accuracy, filled in blank spaces if possible, misunderstandings were corrected and notes of silence, sighs, laughter, posture and gestures were added if missing in the transcription. The transcription procedure resulted in 150 A4 pages.

The data analysis was conducted as an inductive process (52,53,87) encompassing two phases; a descriptive within-case analysis, and followed by an cross case analysis (86).

Within case analysis

Each interview was re-listened and the transcripts were read repeatedly to obtain a sense of the whole. The individual transcript was analysed to identify descriptions of circumstances and events related to the scope of the study, and used as the unit of analysis (52,87). Descriptions of e.g. the childhood, youth and working life of the participants served as background. Based on iterative reading, the text was coded sentence-by-sentence and text marked as life conditions and critical incidents were coded sentence-by-sentence. To identify and differentiate between what was considered life conditions and critical incidents, this initial coding was followed by a second coding (section by section) and sequences of text was coded and categorised as either condition (code named CON) or critical incident (code named CI) to develop categories (86,88).

Cross case analysis

The cross-case analysis was a comparative analysis and conducted based on a horisontal analysis between transcripts (53). A final coding (pattern coding) was conducted to identify themes of life conditions and main areas of critical incidents

(86,88). Through reading and rereading of transcripts, codes and categories, segments of text were grouped, as overarching themes of conditions of life and main areas of narratives of critical incidents. Through comparison of the participants' comments about similar events and conditions, a deeper understanding of the meaning of and the impact on the context and circumstances related to the conditions of life and critical events emerged. With specific attention to inconsistencies and contradictory statements, subareas of critical incidents were displayed (86).

All transcriptions were imported into the computer program for QSR NVIVO 10 for Windows to organise and retrieve textual data (88).

CHAPTER 4. RESULTS

In this section the results and findings from Study I, Study II and Study III are summarised. The results and findings are presented in more details in the five papers and therefore only briefly described in the thesis.

4.1. STUDY I

Description of the sample

Nine studies were included in the narrative summary and synthesis. The studies were published in English language between 2005 and 2013, and comprised ten countries from three continents and included 280,690 participants ranging from 100 to 208,690 persons in the individual studies. The clinical and methodological diversity between studies and the various types of populations examined, appears from Table 4.1.

The population consisted of both men and women. Seven out of nine studies included persons aged 65 years and older (21,89-94), while one study included persons aged 70 years and over (95), and one study (96) included persons aged 75 years and over. None of the studies included persons between 60 and 65 years. The hospital services covered medical services (21,93,96), medical & surgical services (95), or hospital services were not specified (91). Four studies considered services either within geriatrics (92,94), rehabilitation (90), or injury related hospital stay (89).

Based on a narrative summary and synthesis of quantitative results we found several significant risk factors pertaining to hospital readmission. The results comprised 'Pre-admission variables' (Table 4.2) and 'Admission variables (Table 4.3). The results were termed significant based on either the 95% Confidence Interval (CI) and/or if the P values were equal to or less than (≤) 0.05 in multivariable analysis. Tables 4.2 and 4.3 illustrate the candidate variables and variables significantly associated with either higher (↑) or lower (↓) risk of hospital readmission.

The most frequent risk factors associated with readmission were previous admissions (91,95,96), in-hospital transfers (89), and longer length of stay (89,95). Furthermore, predisposing factors such as male gender and increasing age (21,89) as well as health characteristics such as impaired functional capacity, increased dependency in activities of daily living, poor overall condition as well as major geriatric problems enhanced the risk of readmission (93,96). Although more studies indicated that specific medical conditions or comorbidities influenced the risk of readmission (89-91,93,95), these studies did not agree on any disease in particular and in this review, diagnoses were not strongly associated with hospital readmission.

Table 4.1 *Description of included studies*

Study	Study design	Population
Cornette et al., 2005 [95] (Belgium)	Design: Cohort study Data source: Interviews	Persons aged 70+, admitted to hospital for acute medical or surgical reasons n=585
Espallargous et al., 2008 [93] (United Kingdom, Spain, Italy, Finland, Greece, Poland)	Design: Cohort study Data source: Hospital notes, interviews, linked with administrative information	Persons aged 65+, admitted to hospital for medical reasons n=1667
Laniece et al., 2008 [96] (France)	Design: Cohort study Data source: Clinical assessment linked with administrative data	Persons aged 75+, admitted to hospital for medical reasons n=944
Pines et al., 2010 [91] (United States)	Design: Cohort study Data source: Medical records	Persons aged 65+ admitted to an inpatient service from the emergency department and discharged to home within 24 hours
Dinescu et al., 2012 [92] (United States)	Design: Cohort study Data source: Medical records	Persons aged 65+ admitted to hospital for medical reasons from geriatric inpatient service) n=514
Dombrowski et al., 2012 [90] (United States)	Design: Case-control study Data source: Medical records	Persons aged 65+, discharged from hospital and admitted to post-acute rehabilitation unit n=50 (case) n=50 (control)
Robinson et al., 2012 [21] (New Zealand)	Design: Cohort study Data source: Nationwide registries	Persons aged 65+ , admitted to hospital for acute medical reasons n=95,318 (admissions)
Spector et al., 2012 [89] (United States)	Design: Cohort study Data source: Registries (statewide)	Persons aged 65+ with injury related hospitalisation n=208,193
Fisher et al., 2013 [94] (United States)	Design: Cohort study Data source: Medical records, telephone call, billing records	Persons aged 65+ admitted for medical reasons to an acute care unit for older persons n=111

Table 4.2 *Preadmission level determinants, candidate variables and significant results*

Variables (preadmission)	Candidate variables	Significant results
Sociodemographic	Age Gender Marital status Ethnicity Education Living conditions Social support Working status Income Insurance Living area	Increase of age ↑ [21,89] Male gender ↑ [21] Female gender↓ [89] Ethnic minority ↑ [21] Ethnic minority ↓ [91] Socially deprived area ↑ [21] Living in rural area ↓ [21]
Health characteristics	Body Mass Index Functional characteristics Mobility level Cognitive capacity Self-rated health Overall conditions Visual impairment Falls Incontinence Medication Medical history Comorbidity	Lower functional status ↑ [93] Dependent in feeding ↑ [96] Poor overall condition ↑ [96] Presence of pressure sores ↑ [96] Visual impairment ↓ [96] History of solid tumour ↑ [90]
Health care use	Home care services Prior hospital admission	Prior hospital admission ↑ [89,95-96]

Table 4.3 *Admission level determinants, candidate variables and significant results*

Variables (admission)	Candidate variables	Significant results
Clinical	Main system affected (i.e. respiratory system) Diagnosis Delirium Geriatric conditions (immobility, fall, chronic confusion, acute confusion, incontinence) Injury severity and diagnostic classification Laboratory values Patient safety events	Main system affected ↑ [93] Number of geriatric conditions ↑ [93] Respiratory system ↑ [95] Genito-urinary system affected ↑ [95] Diagnosis of congestive heart failure ↑ [91] Gastro-intestinal condition ↑ [90] Serum albumin low ↑ [90] Injury severity ↑ [89] Type of injury ↑ [89] Blood transfusion ↑ [89] Infection ↑ [89] Major surgery ↓ [89] Patient safety indicator event ↑ [89]
Organisational	Way of referral 24-hour observation Length of stay (LOS) Intensive care Complexity level Acute or elective Discharge destination Discharge disposition agreement Ward or hospital characteristics	First seen in the emergency department ↑ [89] Transferred from other facility ↑ [89] Prolonged LOS ↑ [95] DRG adjusted LOS longer than expected ↑ [89] Discharged to nursing home (NH) ↑ [89] Discharged with home health care ↑ [89] Hospital centre ↑ [93]

4.2. STUDY II

Description of the OPRA Database

The OPRA database comprised variables and potential covariates for future analyses. Paper 3 describes data and variables included in OPRA in more details. During the period from 1 January 2007 to 30 September 2010, we identified 1,267,752 index admissions in a study population of 479,854 unique individuals aged 65 years and above and discharged alive from an inpatient hospital stay at a Danish public hospital.

Description ot the cohort

The characteristics of the study population (n=479,854) are described in Table 4.4. The majority of the study population were females. With 43% of persons classified within one of the five highest age groups, the group with those aged 80 and over was highly represented. The proportion of subjects with basic school as highest completed education represented 46% of the persons included. The majority of the study population were Danish citizens. More than half of the study population contributed with more than one index admission during the study period.

The primary and secondary outcomes of the index admissions (n=1,267,752) are described in Table 4.5. The major part of index admissions were neither followed by readmission nor death in the 30-day follow-up period. While a minor number of index admissions were followed by a planned readmission, one in five were followed by an acute readmission within 30 days from discharge.

Table 4.4 *Characteristics of the study population*

Study population	**Total**
Persons, N	479,854
Gender, n(%)	
Male	215,828(45.0)
Female	264,026(55,0)
Year of birth, n(%)	
1941-	75,862(15.8)
1936-1940	104,073(21.7)
1931-1935	94,226(19.6)
1926-1930	84,508(17.6)
1921-1925	67,989(14.2)
1916-1920	37,561(7.8)
1911-1915	13,181(2.7)
-1910	2,454(0.5)
Educational level, n(%)	
Basic school (1-10 years)	220,834(46.0)
Upper secondary (11-12 years)	139,217(29.0)
Higher Education (13-14 years)	9,520(2.0)
Higher Education (15-16 years)	13,820(2.9)
Higher Education (17-18 years)	37,132(7.7)
Higher Education (19 years)	158(<0.1)
Unknown	59,173(12.3)
Index admissions – number per person, n(%)	
1	208,116(43.4)
2	107,196(22.3)
3	60,568(12.6)
4	35,456(7.4)
5 or more	68,518(14.3)

Table 4.5 *Outcomes – 30-day readmission and 30-day mortality*

Outcome		Subtotal, n(%)	Total, n(%)
30-day readmission			
No event			910,896(71.9)
Readmission (planned)			86,498(6.8)
	Planned readmission, not followed by death within 30 days	84,366(6.7)	
	Planned readmission, followed by death within 30 days	2,130(0.2)	
Readmission (unplanned)			239,077(18.9)
	Unplanned readmission, not followed by death within 30 days	209,374(16.5)	
	Unplanned readmission, followed by death within 30 days	29,703(2.3)	
30-day mortality			
Death (without readmission)			31,283(2.5)
	Readmission (planned) and death	2,130(0.2)	
	Readmission (unplanned) and death	29,703(2.3)	
Death within 30 days			63,116(5.0)

Admission characteristics

Table 4.6 and Table 4.7 describe the overall characteristics of pre-index variables and varaibles related to the index admission, respectively. As patients could experience multiple admissions during the study period, the individual patient was allowed to contribute with several index episodes in the study cohort.

More than half of the patients had at least one comorbid condition with a moderate or high Charlson Comorbidity Index Score. The mean number of prescribed and reimbursed types of medicine six months prior to admission was 8.3 (SD 5.1)eight and nearly one in three patients were prescribed with morphine.

Table 4.6 describes the pattern of health care use one year prior to the index admission. The mean number of visits at the GP indicates that these patients were frequent users of outpatient as well as hospital facilities.

Table 4.7 illustrates the administrative characteristics of the index episodes. The majority of index episodes were medical. The mean length of stay (LOS) was 6.1 (SD 10.4) days. A minority of index admissions included transfer to intensive care facilities and/or intensive observation.

Table 4.6 *Pre-index characteristics*

Health characteristics and health care use	**Total** (n=1,267,752)
Primary health care services (previous month), n (%)	
No help required	673,573(53,1)
Practical care	84,444(6.7)
Personal care	31,669(2.5)
Personal care and practical care	116,360(9.2)
Unknown	361,706(28.5)
Medication (previous six months)	
Number of medications, mean (SD) (reimbursed prescription drugs)	8.3(5.1)
High Risk Medication, n (%)	
Morphine	378,702(29.8)
Insulin	67,038(5.3)
Anticoagulants	146,052(11.5)
Charlson comorbidity index score (five years), n (%)	
None (0)	615,376(48.5)
Low (1-2)	499,064(39.4)
Moderate (3-4)	104,872(8.3)
High (≥5)	48,440(3.8)
Medical history (previous year), n (%)	
Dementia (primary or secondary diagnosis)	21,857(1.7)
Neoplasm (primary diagnosis)	154,856(12.2)
Health care use (previous year), mean (SD)	
Attendance, general practitioner (GP)	9.0(7.4)
Attendance, GPs on call	0.8(2.0)
Attendance, emergency department (ED)	0.7(1.3)
Attendance, outpatient-clinic, days	5.4(13.4)
Number of hospitalisations	1.7(3.2)
Number of days hospitalised	9.2(18.5)
Number readmissions (30 days)	0.7(2.7)

Table 4.7 *Admission characteristics*

Characteristics – Index admissions	**Total** (n=1,267,752)
Index admission	
Type of services	
Medical (index discharge) n (%)	755,489(59.6)
Surgical (index discharge), n (%)	512,263(40.4)
Illness severity	
Intensive care needs, n (%)	38,817(3.1)
Length of stay (LOS)	
LOS at admission (Index), days, mean (SD)	6.1(10.4)
LOS at final department (discharge), days, mean (SD)	5.2(7.8)
In-hospital transfers	
Number of medical specialities involved, mean (SD)	1.1(0.4)
Number of departments involved, mean (SD)	1.2(0.6)

Risk assessment

All calculated weights from the univariable and multivariable & multilevel analyses as well as the measures of the predictive performance based on the ROC analysis are presented in Table 2 in Paper 4, and thus only briefly mentioned in this thesis.

Table 4.8 *List of the ten most important patient- and admission-level factors associated with risk of acute readmission within 30 days. The sequence of the factors is based on the size of weights obtained from multivariable and multilevel regression analysis.*

Sequence	Readmission within 30 days	Weights Multivariable & multilevel analysis	Weights Univariable analysis
1	Way of referral (planned or acute)	6,954	15,679
2	Days since previous discharge	1,288	10,731
3	Gender	768	653
4	Personal income	580	1,320
5	Socioeconomic group	430	4,283
6	Charlson comorbidity index score	415	5,936
7	Number of prescribed drugs	308	5,055
8	Number of previous 30-day readmissions	93	4,135
9	Number of visits at the GP or GP on call	91	2,079
10	Admitted due to medical or surgical reasons	89	2,418

The risk factors strongly associated with acute readmission were, either directly or indirectly related to indicators of clinical instability and illness severity of the individual. Health related determinants included polypharmacy, comorbidity and frequent use of various types of health services one year preceeding the index admission. Acute admission and the number of days since a recent hospital discharge was the factors most strongly associated with readmission. Admission level factors were only weakly associated with risk of hospital readmission. Male gender, low income and low socioeconomic group indicated a higher risk of acute readmission within 30 days from discharge.

The predictive performance of the model was internally validated in the randomly derived one-third validation cohort. For the primary outcome of acute all-cause readmission within 30 days, the AUC for the entire model was 0.71 (95% CI 0.707-0.711). The predictive performance for the secondary outcome of acute all-cause readmission and/or death within 30 days was higher with the AUC 0.74 (95% CI 0.741-0.753) for the entire model.

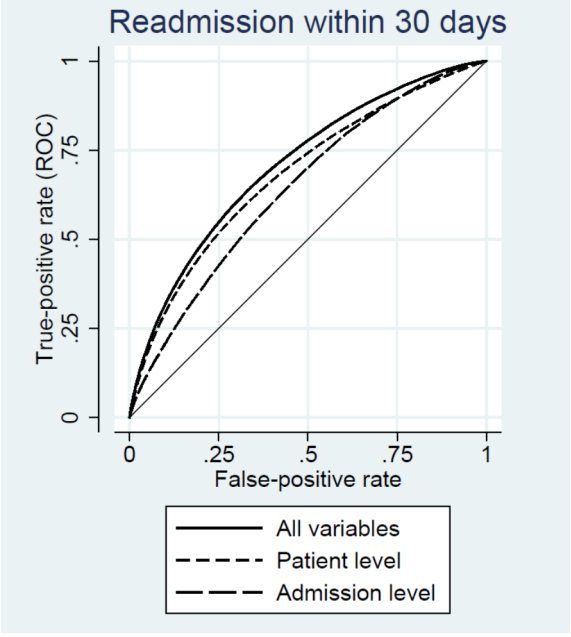


Figure 4.1 *Receiver operating characteristic (ROC) curve showing the relationship between patient- and admission-level factors and acute readmission within 30 days from discharge. Area under the ROC curve: 0.71 (95% CI 0.707-0.711) for the entire model, 0.68 (95% CI 0.680-0.685) for patient level factors, 0.64 (95% CI 0.641-0.646) for admission level factors.*

Table 4.9 *Predictive performance reported as AUC (Area under the (ROC) Curve).*

Level	Categories of variables
Patient level AUC: 0.68 (95% CI 0.681-0.685)	**Demograhic and socioeconomic factors** AUC: 0.59 (95% CI 0.589-0.595)
	Health characteristics AUC: 0.65 (95% CI 0.649-652)
	Health care use AUC: 0.65 (95% CI 0.646-0.650)
Adminsion level AUC: 0.64 (95% CI 0.641-0.646)	**Clinical factors** AUC: 0.59 (95% CI 0.593-0.597)
	Organisational factors AUC: 0.63 (95% CI 0.631-0.635)
Total	**Total**
Readmission AUC: 0.71 (95% CI 0.707-0.711)	**Readmission or death** AUC: 0.74 (95% CI 0.741-0.753)

4.4. STUDY III

Description of the sample

The sample consisted of four male participants in their seventies. They were all married and lived in their own detached houses. They had adult children and grandchildren. The participants received between 12 and 15 different types of prescribed drugs a day

The participants suffered from various health problems such as constipation, breathlessness, insomnia, anxiety, pain and fatigue. All participants were readmitted acutely to hospital either due to deterioration of chronic illness (chronic kidney disease, chronic obstructive pulmonary disease) or due to complications and adverse events associated with treatment (infection and side effects of therapy).

Table 4.10 *Characteristics of the study participants*

Age	Marital status	Inpatient stays previous year and days hospitalised[1]	Reason for readmission	Duration (Current admission)	Number of prescribed drugs a day
73	Married	3 (37)	Exacerbation of COPD	16 days	12
72	Married	3 (126)	Acute episode of unconsciousness Infectious disease (STA)	15 days	15
74	Married	2 (18)	Renal insufficiency (CKD)	10 days	14
73	Married	3 (20)	Infectious disease (STA)	8 days	14

[1] *The current admission included. Abbreviations (STA: Staphylococcus Aureus, CKD: Chronic Kidney Disease, COPD: Chronic Obstructive Pulmonary Disease)*

Three of the participants had been hospitalised three times within the previous year and one participant twice. The total number of days in hospital during the previous year ranged between 18 and 126 days.

Findings

Life conditions and critical incidents were closely connected. Life conditions provided the background for and pre-conditions of an on-going process seeking to balance life demands and the burden of illness and treatment in everyday life. Critical incidents were tipping points, increasing or decreasing the life demands and resources of the participants and thus played a decisive role in the course of care and risk of readmission.

Table 4.11 *Dominant themes of life conditions and areas of critical incidents pertaining to hospital readmission*

Life conditions
Ambiguity of ageing
Living with the burden of illness
Realisation of dependency
A growing sense of vulnerability and mortality
Critical incidents
Trying to manage
Back home again - a period of recovery
Care interaction
Being a health care user - navigating within and between health care system(s)

Life conditions

The themes of life conditions that emerged from the interviews were: 1) Ambiguity of ageing, 2) Living with the burden of illness, 3) Realisation of dependency, and 4) A growing sense of vulnerability and mortality; here described by themes and illustrated through quotations (Box 4.2).

The theme *Ambiguity of ageing* described the participants' reflections on the relationship of ageing, health and illness in everyday life. On one hand they realised that ageing was leading to limitations or deficits in health and wellbeing. On the other hand, they did not see themselves as old. When comparing themselves with persons of similar age, they did not link their physical deficits with ageing.

The theme *Living with the burden of illness* described how the participants accepted disease and illness as a condition of life. Due to worsening of existing morbidities and emerging disease, they described the previous year as a hard and demanding period of life. They were both physically and emotionally affected by illness and treatment.

The theme *Realisation of dependency* described how the participants depended on practical and emotional support from their next of kin, friends and neighbours. All four participants experienced that they relied on support from their wives. A dependency that could be annoying and demanding when the patient-caregiver relationship was not supportive.

The theme *A growing sense of vulnerability and mortality* described previous and current experiences of helplessness and of being exposed. They realised that mortality and vulnerability was a a part of life associated with both ageing and illnesses.

Box 4.2 *Themes of life conditions*

Themes	Experiences
Ambiguity of ageing	I started to feel it (tiredness) again ….well, yes I know that I'm not 20 years anymore but…… You can't even tell I'm 75 years soon and they don't think I'm ill
Living with the burden of illness	Well I've tried many things…and I'm not afraid of the hospital …well … I used to be earlier But I'm still sick…I'm not getting over it. That's actually what you have to come to terms with….that this is how it is
Realisation of dependency	It's the damn thing about it…in a way you….you are kind of stubborn and want to manage yourself and…well I couldn't I was feeling bad when I was discharged [previous admission]. It was kind of lucky that H [wife] could help me when I needed to go to the toilet or…..…
A growing sense of vulnerability and mortality	Well I'm not sick like that …I mean helpless…but I was the other times I've been on the other side once ……..where it was really close to the end….but they [the hospital] brought me back to life again

Critical incidents

Each participant contributed with between eight and 22 narratives of critical incidents and a total number of 52 narratives were identified. Each of these narratives comprised one or more critical incidents pertaining to hospital readmission.

The critical incidents arose in everyday life, in face-to-face encounters between patients and health care professionals and finding ways to navigate within and between health care system(s) (Box 4.3).

The analysis revealed four main areas of critical incidents: 1) 'Trying to manage' 2) 'Back home again – a period of recovery' 3) 'Care interaction' and 4) 'Being a health care user - within and between health care system(s)'.

Trying to manage

Critical incidents concerned achieving the skills and insight into reacting adequately if the situation escalated and it was a major concern how to manage the situation without causing turmoil and being a burden to significant others. In most cases, the relationship with significant others was perceived as supportive, but could also be inhibiting which could directly or indirectly lead to hospital readmission.

Back home again – a period of recovery

Critical incidents related to the immediate post discharge period. During this period, the participants perceived themselves as extraordinarily exposed and in need of time to recover and regain strength and wellbeing. They were astonished that the process of recovery was considerably longer than the acute care episode and they experienced themselves as extraordinarily vulnerable and at risk of a subsequent hospital readmission.

Care interaction

Critical incidents comprised the communication and interaction between the patient and the health care providers. The most frequently described incidents concerned communicative issues related to knowledge sharing and reciprocity. Critical incidents were supportive when based on dialogue, mutual understanding and actively asking for patient experiences and needs related to health and treatment.

Being a health care user - within and between health care system(s).

Critical incidents concerned navigating between different sections of the health care system and provider-provider coordination within sectors and across sectors. If the participants experienced being discharged with unsolved problems, and if post-discharge care and treatment was not coordinated, these situations were experienced as inhibitive critical incidents. When experiencing acute symptoms, feeling unsure and not having the resources and knowledge to manage adequately, readmission for immediate treatment was perceived as the best option. In such situations, negotiating with gatekeepers was experienced as unmanageable and demeaning and in worst case it increased the burden of illness and led to an exacerbation of the disease.

Box 4.3 *Critical incidents – main areas and interpreted supportive and inhibitive incidents*

Interpreted critical incidents: Supportive	Main areas of critical incidents	Interpreted critical incidents: Inhibitive
-Seeing the patterns and understanding what is going on -Knowing what to do if the situation escalates - Peer support - emotional and practical -Next of kin able to react adequately in acute situations	**Trying to manage**	-Not being able to understand what is going on -Having the feeling of being a burden to significant others -No supportive relationship between patient and spouse -Next of kin not able to act adequately in acute situations
-They let me stay at the hospital until the situation had stabilized -Acceptance of perceived weakness and unpredictability without becoming anxious (patient and next of kin) -Coming back to normality and daily routines -Something to look forward to – having projects and aims	**Back home again – a period of recovery**	-Discharged without feeling any better -Hard to regain overview of the medication when discharged -Discharged unexpectedly and the discharge was not planned ahead -Post-discharge complications (i.e. infection) and upcoming diseases -Adverse effects from medication and treatment without being informed (i.e. constipation, fall, oxygen)
-Clinicians took the time to listen and answered my questions -Clinicians asked to gain deeper insight into the situation -We found a manageable and realistic solution together -They (*physicians*) keep an eye on me and call me if necessary -They (*home care nurses*) called and asked if any support was needed -They *(hospital nurses)* were putting pressure on me to accept home health care when I was discharged	**Care interaction**	-Clinicians seem busy – always keeping an eye on the clock (*general practitioner*) -They (*clinicians and nurses*) merely focused on the symptoms or specific tasks without considering the situation as a whole -I could not explain my situation to them (*emergency department and emergency physician*) and felt abandoned without support -No support for patient input or invitation to participate in decisions -We had to take all the initiative ourselves to make things happen -They followed the routines without asking if anything or something else was needed -Information about the treatment was delayed or restricted
-They follow the same standards -I have been there so often that I know their routines -I know who and how to contact them (access to gate-keepers) -I was allowed to be admitted directly to the inpatient ward -I have 'my own' physician (*primary care physician*) and he knows my situation	**Being a health care user - navigating within and between health care system(s)**	-Felt like left in limbo when discharged -Not knowing who to contact -The routines were suddenly changed and we had to immediately adapt and find new ways -Mixed information from different specialists -Follow-up procedures unclear -Discontinuity (gaps) in care and treatment due to shifts between providers, wards, inpatient and outpatient services -Lack of capacity in municipality care services (e.g. waiting list for rehabilitation)

CHAPTER 5. DISCUSSION

In this section the main findings from studies I, II and III will be merged through a joint discussion with references to previous research. This discussion will be followed by a methodological discussion of the strengths and limitations of the mixed methods approach and the methods used to generate the findings in Study I, II and III.

5.1. DISCUSSION OF MAIN FINDINGS

The purpose of this thesis was to identify, synthesise and expand the evidence-based knowledge of risk factors pertaining to readmission of older persons. Findings from Study I and Study II suggested that the patterns of risk factors associated with readmission in older persons were multifaceted and comprised both patient- and admission-level determinants. While Study I identified a number of distinct risk factors associated with readmission, the results from Study II indicated that readmissions were associated with various categories of risk factors related to the course of care of the individual rather than distinct care episodes and single determinants. Findings from Study III highlighted the interconnectedness and dynamics between individual-level and healthcare related determinants associated with readmission.

Sociodemographic characteristics

The population of older persons is largely heterogeneous in terms of health and disability (1,10) which might explain the inconsistent and mixed associations between demographic characteristics and readmission (Study I and II) in this thesis. These findings are comparable to the systematic review by Calvillo King et al. (2013), suggesting that demographic factors were not strongly associated with readmission (97). Even though some studies (Study I) indicated that higher age led to increased risk of readmission, age was not found to predict readmission in Study II. In a number of studies (18,21,30) the association between age and readmission tends to plateau when persons reach their seventies or eighties. The theme "Ambiguity of ageing" (Study III) illustrated that these older males realised that the fact that they were ageing was leading to age-related limitations and health deficits; however, the participants did not associate their age with the risk of re admission and poor health outcome in itself. Similarly, to Calvillo King et al. (2013) (97) we found (Study I and II) that socioeconomic determinants were associated with readmission. These findings might indicate social disparities according to health and accessibility to health care but also that retirement and ageing are associated with decreasing socioeconomic status and economic restraints and thus correlated with age-related life changes such as changing residence, bereavement or illness among next of kin.

We expected that risk of readmission might be associated with life changes and social events and included markers of social instability and significant social events (i.e. be widowed) as covariates in Study II, but surprisingly we did not find any association with readmission. We also included (Study II) indicators of social support (marital status, family-type, and number of persons in the household) but did not find any associations with readmission. However, similar to Slatyer et al. (2013), Study III illustrated that especially spouses seemed to have an important role as caregivers and the support from next of kin, friends and neighbours was important as a stabilising factor (36). While we did not find any association with marital status and readmission (Study II), Hasan et al. (2010) (17) found a reverse association between being currently married and readmission indicating that the presence of social support might result in early discharge of frail patients. Findings from Study III illustrated that the capacity of the next of kin and a non-supportive patient/caregiver relation could increase the life demands of the individual, and might have a negative impact on health outcomes (98).

We found that male gender was associated with increased risk of readmission (Study II), which has been corroborated in previous research(18,21,30). The so-called male-female health paradox indicates that the expected lifetime with chronic illness and complex care needs is higher among older males compared with females (3). These gender differences might explain various health outcomes (11,99) and/or relate to diverging patterns in health care use and health behaviour among males and females (100). Similarly, a Danish study showed significant gender differences in health care use and men having higher rates of hospitalisation, but lower rates of contact to their general practitioner compared to women (11).

Health characteristics

Similar to Donzé et al. (2014) (101) and Stäck et al. (2012) (18) we found (Study II) that readmission was associated with the medical history of the individual and underlying comorbidities rather than the medical condition leading to the index admission. Although more studies encompassed in Study I concluded that certain diagnoses or comorbid conditions affected the risk of readmission, it was not possible to point at specific diagnoses or particular medical conditions associated with increased risk of hospital readmission. In a systematic review of ageing with chronic multi-morbidity, Marengoni et al. (2011) (102) found that the prevalence of multi-morbidity in older persons ranged from 55-98% and found a significant effect of multi-morbidity on disability, quality of life and healthcare utilisation. The theme "Living with the burden of illness" (Study III) illustrated that being chronically ill and having multiple co-existing morbidities periodically brought these partipants in situations where they felt unable to manage without help from the health care system. They suffered from serious health problems and complications and adverse events associated with care and treatment. It was a major concern for these older males to manage and have the skills to react adequately if the situation escalated and not to

cause turmoil and become burden to their significant others. While previous studies included in Study I (95,96) indicated that risk of readmission increased with functional decline and poor overall health, we did not find any association between readmission and receiving primary health care services one month prior to the index episode (Study II). However, we found that the number of prescribed drugs was strongly associated with readmission, which indicates a high level of comorbidity and/or multimorbidity (103,104) and/or chronic illness, which might lead to readmission due to adverse drug events (105).

Use of health care services

We found (Study II) that persons at higher risk of readmission were frequent users of hospital- and out-patient health care services during the previous year, which is largely in agreement with previous studies (17,18,95). We also found that indicators of future readmission were related to the nature the course of care rather than single events and individual encounters with various health care professionals. Stäck et al. (2009) identified frequent use of health care services as a strong predictor of readmission (18) and having a regular physician was a significant predictor of readmission in a study by Hasan et al. (2010) (17). Similarly, we found (Study II) that readmission was strongly associated with the number of contacts with general practitioners or emergency calls prior to the admission. According to Shippee et al. (2012), fragmented and disruptive care increase the patient complexity, reduce the capacity for self-care and increase the burden of illness and treatment (106). Findings in Study III illustrated that care-interaction and communication with healthcare professionals as well as navigating within the health care system, could be either supportive or increase the risk of readmission, which complement previous findings (37-39). The findings in Study III illustrated that proactive care, continuing relationships with health care professionals over time, knowing who to ask for advice and being actively involved in decisions concerning care and treatment was supportive and decreased the risk of future readmission.

Admission-level factors

The health outcome of patients with complex needs is more likely to be affected by organisational factors(107). In Study II, admission-level factors associated with risk of readmission concerned the way of referral (acute or planned), while clinical factors such as diagnosis and intensive care treatment were only weakly associated with risk of readmission. Prolonged length of hospital stay has been documented as risk factor in a number of previous studies (12,17) and systematic reviews (28) and in two studies in Study I (89,95). In Study II, we did not find a strong association between the length of the hospital stay and acute readmission, while a current length of stay > 2 days was a predictor of readmission in a study by Hasan et al. (2010) (17). A prolonged length of stay may be an indicator of the severity of illness and progression

of disease, but might also be related to the organisation of post-acute structures and system-level determinants.

The lack of discharge readiness has been identified as a contributing factor to readmission in qualitative studies (108). The findings from Study III illustrated that the patients were aware that limited resources and high demands for hospital beds might influence the discharge planning and the busyness and stress of the staff affected them negatively. On the other hand being discharged too early and not being back to full functioning was an emotional strain for the male participants. Thus, it remains unclear whether the participants preferred several readmissions or fewer and longer admissions.

Post-discharge

We found that the number of days since a previous discharge was strongly associated with increased risk of readmission (Study II). Findings from Study III illustrated that the transition from hospital to home as well as the post-discharge period is critical. As described by Krumholz (2013) (109), recently hospitalised patients are not only recovering from illness but also need to recover after the stressful hospital atmosphere. Thus, the period immediately after discharge was a high-risk period with increased vulnerability and risk of adverse health outcomes (109,110).

There is evidence that the risk of readmission is cumulative and that readmission was almost twice as likely to result in another readmission (21). Coleman et al. (2004) identified 46 different types of care patterns during the 30-day post-discharge period and four out of ten episodes were followed by more transfers between low- and high-intensive care environments (42). Findings from Study III illustrated that one of the main challenges for the particpants in the post-discharge period was to navigate between different sections of the health care system and to find ways to obtain adequate care and advice.

In the systematic review containing 42 trials, Leppin et al. (2014) concluded that effective discharge interventions to prevent unplanned 30-day readmission were characterised by being multicomponent, involving more persons in care delivery, supporting patient capacity for self-care and providing comprehensive, postdischarge support to patients and caregivers (111). The findings from Study III illustrated how the male participants struggled to recover and regain strength to balance life demands and the burden of illness and treatment in everyday life. The decision to return to hospital was not taken lightly and the particpants feared further admissions. However, none of the participants questioned whether the current hospital readmission could have been prevented and readmission was not described as a critical incident per se. From the perspective of the participants and caregivers, readmission may as well be experienced as a relief rather than a burden, which is in line with a recent qualitative survey study (41).

5.2. STRENGHTS AND LIMITATIONS

Mixed methods approach

In this thesis, the mixed methods approach was used for both complementarity and for expansion of the evidence-based knowledge and understanding of risk factors for hospital readmission (59,61) and concerned integration and the joint discussion of results and findings from Study I, II and III. Neither the quantitative data nor the qualitative data alone could expand the knowledge of risk factors and circumstances pertaining to readmission in older persons.

The conduct of rigorous mixed methods research must pay attention to the methodological standards for the quantitave and qualitative components and the data must be processed in relation to the different methods as well as the integration of the quantatitave and qualitative components on various levels (59,64,112). One of the main issues was to establish a team of supervisors ensuring representation of both quantitative and qualitative expertise. In this research the team of supervisors were experienced researchers within qualitative, epidemiological and statistical research.

Conducting mixed methods studies is both time- and resource-intensive, which is a notable challenge that must be recognized and planned for (58). Thus, it is decisive to address the relative timing of each component during the research process. This multistage design including convergent (Study I and II) and sequential (Study III) components turned out to be more time- and resource-intensive than expected and the design of the model and the priorities were continously considered and adjusted during the research process. The data collection and analysis in Study I and Study II informed each other through certain interactive elements. The development of the search strategy (Study I) was e.g. inspired by the process of identifying variables and preparing the database used in the cohort study (Study II). Furthermore, the design of the cohort study and strategy for the statistical analysis benefitted from the critical appraisal process of studies included in the systematic review. As the sampling strategy and inclusion criteria for Study III were based on the risk factors identified in Study I and II, Study III could not be initiated before the data collection and data analysis in Study I and II were completed. Due to the time perspective, Study III was thus initiated based on the preliminary results of Study II; this turned out to benefit the risk analysis in Study II because the preliminary qualitative findings actually paved the way for including additional variables.

Despite these advantages, the mixed methods approach may have been on the expence of the depth and deeper understanding within either the quantitative or qualitative components of the thesis. It may have been relevant to go deeper into the analysis of the impact of health care use and patient preferences (Study III) or to conduct gender-specific or subgroup analysis in the cohort study (Study II). The staged and separate reporting of Study I, II and III calls for a mixed methods paper to further integrate and expand the findings from this thesis. Besides, the limited time

and space did not allow for further conceptional, theoretical and philosophical considerations.

Study I

The main strength of study I was the coherent and rigorous approach to synthesise previous research of risk factors for hospital readmission. The review process was based on the Joanna Briggs Institute standards for synthesis of evidence of risk (47,68) and supported by software and standardised tools. A study protocol was written and peer reviewed in advance outlining all steps in the subsequent systematic review. Thus, all steps in the review process were carried out in a reproducible and transparent way, which increased the reliability of the findings.

To obtain the most rigorous data, two independent reviewers conducted each step in the review process and all differences were resolved by discussion to reach consensus and/or by consulting a third reviewer. Another strength was the involvement of an experienced research librarian in the development of the search strategy and database searches to systematically identify relevant littrature and reduce the risk of publication bias. Furthermore, a biostatistician was consulted and involved in the critical appraisal of the statistical analyses and assessment of the significance of the results.

The studies had different purposes and comparison of findings between studies was thus difficult due to considerable variation in study designs, data sources, study populations and clinical settings. The clinical and methodological heterogeneity did thus not allow for a statistical combination of study results and to conduct a meta-analysis based on the quantitative findings. However, the systematic review process and detailed data extraction facilitated a further investigation of the various types of exposure variables as well as differences and similarities of the results, which substantiated the synthesis of the quantitative findings through the narrative summary.

Even though the synthesis of existing evidence on risk factors for readmission did not allow a conclusion of any substantial clinical implications, it indicated the multifaceted array of potential risk factors that should be considered in Study II.

Study II

The main strength of study II was the large dataset and the availability of population-based and individual-level linkable data sources allowing tracking of each individual over time and across health care systems. Based on these data it was possible to develop the OPRA database providing a unique opportunity for exploring the complexity of various risk factors and determinants pertaining to hospital readmission.

There are several methodological questions to be considered when conducting research based on complex and comprehensive secondary data and different forms of knowledge and expertise are necessary (71). *Health system knowledge* is essential for deciding the scope and the specific questions to be addressed and must be supplemented with the understanding of the possibilities and limitations of register-based information. *Clinical knowledge* is needed in appraising the details of data. *Epidemiological*, *statistical* and *data-mining* expertise is required to ensure that the methodology is appropriate and to cross validate data between registries. All of these types of expertise were represented in the research team collaborating during the pre-modelling phase as well as in the subsequent cohort study. This interdisciplinary collaboration during the entire research process was invaluable and strengthened the rigour, reliability and findings in Study II. The multicomponent and interdisciplinary approach and the possibility to link and reshape data on life- and health-events of the individual with the hospitalisation data was a major strength in this study.

The utility of secondary data analysis and the overall strengths, limitations, and challenges of regist-based research have been discussed previously (70,113,114), and relate to the representativeness of the study population, data quality and availability as well as the possibility to link data between different registries. We chose a general approach and included all admissions of patients over 65 years admitted to a Danish public hospital and allowed the individual to contribute with several index admissions. The inclusion criteria were broad, and the study population included in the OPRA database is thus representative in a Danish context and for the objectives of Study II. Variation in coding practices is an inherent limitation of all register-based research and it was not possible to control data collection, quality of data, validity and completeness of data (70,113). However, due to administrative procedures and previous validation studies the validity of Danish register-based data is generally accepted to be high (115-118).

Another limitation in register-based research is that the information is collected for other purposes than research and the availability of data is restricted by the information that is already available; this might introduce information bias and risk of misclassification (70,113). As the data on exposure variables was collected prospectively, without knowing the outcome, any potential misclassification in the cohort study would be non-differential, with minor impact on the observed associations. The lack of data on functional level (93), health conditions (96), social support (97) and subjective health outcome (119) was a major challenge. In an attempt to remedy these shortcomings, we defined a number of proxy variables to compensate for non-available information. The accuracy and validity of these proxy variables need further validation and therefore interpretation based on these results needs to be cautious.

We did not intend to develop a predictive model centered on specific patient populations, pathways or clinical settings and combined an explanatory and

predictive approach in the statistical modelling (76,77). The predictive performance of the model was moderate and inclusion of interactions in the analysis would probably improve the predictive performance. However, in this general and heterogeneous population of hospitalised patients, we would expect a huge amount of different pathways postdischarge leading to readmission (42). Thus, including interactions would only be feasible when analysing specific smaller subgroups and focusing selected pathways. In addition, this general and complex model should be further developed an validated through subgroup analyses and validated in different settings and patient populations.

Study III

The sampling strategy for Study III was purposive and the inclusion criteria were based on the preliminary findings from Study I and Study II. The inclusion criteria were few and restricted to facts and basic information obtainable through the administrative system. The main advantage of these inclusion criteria was that it was easy for the gatekeeper to identify potential eligible participants without disruptions in patient care and furthermore to ensure patient confidentiality. Furthermore, it indicates that the future development of a clinically meaningful and feasible indicator to identify high-risk patients might be possible based on easy obtainable information.

According the CIT literature (52,53), efforts must be taken to include a heterogeneous group of respondents capable of reporting diverse and exhaustive descriptions (85). The sample was selected specifically to include older males and the focus in Study III was on the male experiences of hospital readmission. As gender differences have been reported according to health behaviour (100), health outcomes as well as health care use (11), potential gender differences between experiences of life conditions and critical incidents related to hospital readmission need to be further explored. All four participants were community dwelling males in their seventies; they were all married and their wives had a key role as caregivers. Thus, at first hand, the participants seemed very homogenous. However, during the interview and later in the analysis it appeared that the narratives of critical incidents were closely linked with the life story and current life conditions of the individual. A potential threat to transferability of the findings might be that the participants were recruited from a single hospital and two medical wards. However, by focusing on life and health events over time, the descriptions of life conditions and critical incidents by these four male participants revealed a range of care episodes, crossing organisational boundaries within and between hospital and community care settings.

Qualitative samples are usually small (82) and the sample size of four participants (n=4) in Study III contrasts with the sample sizes in Study I (n=280,690) and Study II (n=479,854). Within the CIT literature, there are no fixed rules on the number of participants and there is a big variation in the number of incidents generated from different sample sizes (87). As the analytical unit is the critical incident, the question

of sample size concerns the number of critical incidents more than the number of participants (52). The excact number of critical incidents will not be known until a preliminary analysis is commenced and the quality of the data is ascertained (53). In Study III, the interviews were double interviews and the analysis of eight interviews contributed with 52 narratives of critical incidents. This number is, according to Schluter et al. (2008) (53), sufficient to ensure an adequate amount and quality of usable data. Furthermore, due to the limited time and the vulnerable situation of potential participants, the sample size (n=4) was acceptable. Each participant contributed with between eight and twenty-two narratives of critical incidents and the four main areas of critical incidents were based on the narratives of all four participants. Analysis of additional interviews might have contributed with further critical incidents or have replicated earlier data and it was not possible to assess if saturation had been reached.

Through double interviews with the same individuals, we derived an image of the temporal sequencing of critical incidents. The number of days between the first and second interview ranged between 15 and 22 days. The critical incident chart and notes offered an opportunity to ask deeper, and allowed for further reflection and deeper mutual understanding during the second interview (86).

Credibility in the analysis was ensured through iterative reading and rereading of transcripts, codes and categories based on segments of text. The categories including direct quotations were discussed in the team of researchers and themes and areas of critical incidents were revised until a final classification emerged.

CHAPTER 6. CONCLUSION

This thesis provides insight into the multifaceted and complex pattern of individual-level and healthcare related determinants associated with readmission in older persons. Moreover, it elaborates on how complex determinants of readmission interact and constitute the conditions for the course of care of the individual.

Based on the purpose and aims of this thesis, it is concluded that:

Existing evidence on risk factors for acute readmission comprises demographic and social factors such as higher age, male gender, ethnic disparities and living in deprived areas. Indicators of poor health, functional disability and prior admissions as well as illness severity and prolonged hospitalisation further increase the risk of readmission. The existing evidence lacks comparability concerning study design, study population and clinical setting and does not reach any substantial level for clinical implications.

Older persons at increased risk of future readmission suffer from comorbid illnesses, consume more drugs and are frequent users of in- and out-patient health services. Sociodemographic characteristics and pre-index factors were found to be dominant contributors to readmission. Furthermore, older persons at increased risk of acute readmission could be identified based on information accessible at the time of admission.

Researching the perspective of older persons readmitted for medical reasons, highlights the interconnectedness, dynamics and complexity surrounding risk factors for readmission in older persons. Critical incidents concerned the period prior to admission, during admission as well as post-discharge. Critical incidents arose in everyday life, in face-to-face encounters between older persons and health care professionals and in finding ways to navigate within and between health care system(s). For older persons at risk of readmission, critical incidents became tipping points, either increasing or decreasing the life demands, health capacity and burden of illness and treatment in every-day life.

The thesis also provides a discussion of how the mixed methods approach expands and strengthens the evidence-based knowledge of patterns of risk factors pertaining to readmission in older persons. The multistage mixed methods approach was useful to gain a deeper understanding of the complexity and dynamics of risk factors and circumstances associated with readmission.

The key finding is that readmissions in older persons comprised the course of care rather than specific illnesses and distinct care episodes and readmissions should be considered as events in a complex, longitudional and cyclic pattern of life and health

events of the individual rather than endpoints and adverse health outcomes in distinct and demarcated acute care episodes.

CHAPTER 7. PERSPECTIVES

This thesis reflects the multifaceted and complex pattern of individual-level and healthcare related determinants associated with readmission in older persons that comprised the course of care rather than specific illnesses and distinct acute care episodes. There is a need to enhance the understanding of the complex mechanisms and interrelatedness between individual-level and healthcare related determinants of readmission and to investigate the role of current practices and organisational conditions to improve the course of care and health outcomes in a high-risk population of older persons.

To improve the course of care and support for older persons there is a need to identify "high-risk individuals" in time to prevent further deterioration of health status and self-care capacity (120). The results of this thesis form the basis of the development of a clinically manageable indicator based on clustered data and related to the course of care. However, this thesis exposed some of the weaknesses in Danish health data and emphasised the necessity of joint efforts by researchers and health professionals to develop, validate and implement an indicator of general risk (120) or patient complexity (104,106) that could be useable within and across various health care settings involved in care for older persons.

However, the usability of risk stratification and risk markers to identify older persons at risk of future readmission are not neccesarily modifiable and feasible risk adjusters. Risk stratification needs to be followed by strategies to assess the care needs of the individual and next, followed by individualised, comprehensive and integrated interventions (25,111). The adequate care and support for these older persons must be based on knowledge of the specific life conditions and care needs of the individual. The narrative approach and dialogue with older persons identified as risk-patients focusing circumstances and critical incidents related to the course of care was a manageable, clinically meaningful and person-centred approach to explore the fundamental care needs of the individual (51). These narratives of critical incidents and life conditions of the individual revealed a number of missing opportunities to support and intervene optimally. In addition, they illustrated how a depersonalised and "task and time driven" culture within health care (51) can be experienced as disruptive and fragmented and thereby increasing the patient complexity and burden of illness and treatment in older persons (106).

To provide personalised care and support in a proactive and need-based approach, requires a comprehensive and continuous collaboration between health professionals across organisational boundaries, including medical and social services. To determine the benefits of personalised care models and interventions there is a need to include more care- and case-sensitive outcomes to identify small changes over time.

Prospective studies with longer follow-up are needed to develop personalised and multicomponent interventions.

As patients and caregivers have intimate knowledge of the circumstances of their readmission, qualitative studies are needed to enhance the understanding of readmission from a patient perspective and to explore the experiences and impact of patient preferences regarding use of in- and out-patient health care services. The finding that male gender is associated with increased risk of readmission needs to be investigated in gender-specific studies and/or gender-separated analyses.

Health care professionals are involved in a range of activities and interventions that are predominately of a complex nature (60,121) and different types of evidence is needed depending on the nature of this activity and purpose (62,122). To capture the complexity in the care for older perons and to address the concerns and questions raised by clinicians and patients (54) regarding health and care needs, there is a need for a dynamic, contextualised and active research programme involving researchers and practitioners working closely together throughout the entire research process (7).

An ideal study design would be a prospective multi-stage, mixed methods study based on participatory and interdisciplinary approaches focusing on subgroups of older perons identified as a high-risk population and exploring potential barriers related to administrative and structural boundaries within healthcare. The overall purpose would be to develop, evaluate and implement personalised interventions to improve the care and support for older persons with complex care needs and address the course of care across primary and secondary health care settings. To substantiate the findings and implications, such a study would need to involve both older persons and caregivers, professionals from in- and out-patient health care and social services.

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LITERATURE LIST

APPENDICES

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Appendix A. List of abbreviations

Registers:

CPR - The Central Person Registry

DNPR - The Danish National Prescription Registry

DNRP - The Danish National Registry of Patients

IDA - The Integral Database for the Danish Labor Market

ISR - The Income Statistics Register

NHSR - The National Health Service Registry

PER - The Population's Education Register

Classification:

ACSC - Ambulatory Care Sensitive Conditions

ATC - Anatomical Therapeutic Clinical Classification

DRG - Diagnosis Related Group

ICD - World Health Organization International Classification of Diseases

Acts:

APPD - The Act of Processing of Personal Data

Statistics:

AUC - Area Under the Curve

CI - Confidence Interval

ROC - Reciever Operating Characteristic

SD Standard Deviation

Other:

ADL - Activities of daily living

IADL - Instrumental activities of daily living

CIT – Critical Incident Technique

CPR (number) - Central Personal Registry number

ED - Emergency Department

GP - General Practitioner

ICU - Intensive Care Unit

LOS - Length of stay

Appendix B. Approval by the Danish Data Protection Agency

Anmeldelse af sundhedsvidenskabelig forskning i Region Nordjylland Journalnr.: 2008-58-0028

Nedenstående projekt vurderes at være omfattet af Region Nordjyllands anmeldelse af **"Sundhedsvidenskabelig forskning i Region Nordjylland"** til Datatilsynet.

Projektets navn:
Elderly Care – a Mixed Methods Study on Elderly Medical Ward Patients in risk for Early Rehospitalisation

Indgår der biobank i projektet:

[X] Nej [ ] Ja

Projektansvarlig inkl. kontaktoplysninger:
Mona Kyndi Pedersen, sygeplejerske, Cand. Cur., Cand. pæd. og PhD.studerende ved Medicinsk Center, Ålborg Sygehus er projektansvarlig
Mail: mokyp@rn.dk
Mobil: 21911413 (privat)

Projektets formål:
Formålet er at identificere den gruppe af ældre, medicinske patienter, der er i særlig risiko for tidlige genindlæggelser. Hensigten er dels at udvikle og verificere en prædiktionsmodel, der kan anvendes til at udpege den gruppe, der har behov for en særlig indsats for at forebygge tidlige genindlæggelser, dels at målrette indsatsen for forebyggelse af tidlige genindlæggelser

Projektet indeholder tre delstudier:
- Del 1: Et systematisk litteratur review
- Del 2: En registerundersøgelse
- Del 3: En kvalitativ interviewundersøgelse

Følgende materialer er vedlagt:
- Kort beskrivelse af hele projektet
- Uddybet beskrivelse af Del 2.
- Udtræksbeskrivelse
- Indstilling om godkendelse af projekt Elderly Care

Oplysningerne opbevares hos – angiv evt. databehandlere (navn og adresse):
Dataudtrækket foregår via forskerservice ved Danmarks Statistik. Der anvendes anonymiserede mikrodata, hvor CPR-nr. er erstattet af et løbenummer. Databearbejdningen foregår via online adgang til forskningsserver på Danmarks Statistik. Både projektansvarlig og databehandler har logon og password og kan derfor arbejde med data.

Databehandler er:
Søren Lundbye Christensen, MSc, PhD, Biostatistiker ved Kardiovaskulært Forskningscenter, Ålborg Sygehus

Overholder projektet reglerne i Sikkerhedsbekendtgørelsen (Bekg. nr. 528 af 15. juni 2000):

[ ] Nej [x] Ja

Appendix C. Contract Statistics Denmark

AFTALE

Mellem Danmarks Statistik og

Mona Kyndi Pedersen

er indgået aftale om etablering af ekstern elektronisk adgang til udvalgte datasæt.

Adgangen gives i henhold til den autorisation Danmarks Statistik i særlig aftale af ***28. februar 2007*** har givet ***Kardiovaskulært Forskningscenter ved Aalborg Sygehus***.

Det enkelte projekt skal godkendes af Danmarks Statistik for at være omfattet af nærværende aftale, jf. autorisationsaftalens pkt. 1 og 2.

Der gælder i øvrigt følgende bestemmelser:

1. De datasæt, der gives adgang til, er fortrolige i henhold til Forvaltningslovens §27, stk. 3 og Straffelovens §152.
2. Edb-kørsler må kun afvikles fra forskningsmiljø, som er tildelt autorisation, eller via det autoriserede forsknings-/analysemiljø viderestilles til en hjemmearbejdsplads i overensstemmelse med retningslinier fastsat af Danmarks Statistik.
3. En pc, der er opkoblet til Danmarks Statistik, må ikke overlades til andre personer og forbindelsen skal, når pc'en forlades enten være lukket helt ned eller "disconnected", dvs. beskyttet mod uautoriseret brug.
4. De af Danmarks Statistik udleverede passwords er personlige og må ikke udlånes eller meddeles til andre.
5. Grunddata såvel som afledte datasæt må ikke downloades hverken direkte eller indirekte.
6. Alle overførsler af output (tabeller, analyseresultater mv.) til udprintning eller til videre statistisk bearbejdning må kun ske i overensstemmelse med de af Danmarks Statistik fastsatte retningslinier og metoder. Danmarks Statistik foretager en logning af disse overførsler.
7. Der må ikke udprintes fortrolige data, herunder data på individ- eller virksomhedsniveau og alt output skal være aggregeret i en sådan grad, at der ikke er fare for direkte eller indirekte identifikation af personer eller virksomheder. Der må ikke foretages forsøg på en sådan identifikation.
8. Adgangen til data gives for perioden: ***2 år med mulighed for forlængelse.***
9. Publiceringer fra projektet må ikke indeholde oplysninger, der kan identificere enkeltpersoner eller enkeltvirksomheder
10. Danmarks Statistik skal have tilsendt alle publiceringer fra projektet til orientering

Særligt vedrørende tilknyttede forskere.

11. Den ansvarlige person, som har underskrevet autorisationsaftalen på den autoriserede danske institution, godkender og tager ansvaret for at den tilknyttede forsker overholder alle gældende regler for omgang med mikrodata.
12. Det pålægges den danske autoriserede institution at orientere den tilknyttede forsker om reglerne for brug af mikrodata, herunder de gældende diskretionsregler, samt reglerne vedrørende hjemtagelse af data.
13. Den tilknyttede forskers adgang til mikrodata skal gå gennem den danske autoriserede institution og viderestilles i overensstemmelse med reglerne for hjemmearbejdsplads.
14. Den autoriserede danske institution udpeger en kontaktperson, der varetager al kontakt mellem den tilknyttede forsker og Danmarks Statistik.
15. Alle faktura vedrørende den tilknyttede forsker sendes til og betales af den pågældende autoriserede danske institution på de faktureringsvilkår, som i øvrigt gælder for institutionen.

En overtrædelse af reglerne i denne aftale vil medføre, at adgangen til data ophører omgående. Endvidere udelukkes underskriveren af aftalen fra at anvende nogen af Danmarks Statistiks forskerordninger i fremtiden. I mildere tilfælde vil der blive tale om en midlertidig udelukkelse fra Danmarks Statistiks forskerordninger i en periode på ikke under 3 år.

Aftalen kan i øvrigt opsiges af begge parter med 3 måneders varsel. Dersom forsknings-/analysemiljøets autorisation bortfalder eller ændres ophæves nærværende aftale samtidig.

Underskrifter og datering:

København, den

_____
Danmarks Statistik
Ivan Thaulow

Ålborg, den 3/7 2012

Mona Kyndi Pedersen
Mona Kyndi Pedersen

Ålborg, den 3/7 2012

Forskningsleder Erik Berg Schmidt
(der har underskrevet autorisationsaftalen)

KARDIOVASKULÆRT FORSKNINGSCENTER
Forskningens Hus
Søndre Skovvej 15
DK-9000 Aalborg
Tlf.: +45 99326860

Appendix D. Consent form

I gode hænder hos
AALBORG UNIVERSITETSHOSPITAL

Informeret samtykke til at deltage i forskningsprojekt

Projektets titel: Risikofaktorer for genindlæggelse hos personer over 65 år

Erklæring fra deltageren i projektet:

Jeg har fået skriftlig og mundtlig information og ved nok om formål og metode til at sige ja til at deltage.

Jeg ved, at det er frivilligt at deltage, og at jeg altid kan trække mit samtykke tilbage, uden at det påvirker min behandling og pleje.

Jeg er informeret om, at materialet behandles fortroligt.

Jeg giver samtykke til at deltage i projektet og har fået en kopi af dette samtykke-ark samt skriftlig information om projektet til eget brug.

Deltagerens navn: _____

Dato:_____ Underskrift: _____

Erklæring fra den, der afgiver information

Jeg erklærer, at der er givet skriftlig og mundtlig information om projektet.
Efter min overbevisning er der givet tilstrækkelig skriftlig og mundtlig information til, at der kan tages beslutning om deltagelse.

Navn på den, der har givet informationen: _____

Dato: _____ Underskrift: _____

Projekt-ID nr: Journal 2008-58-0028

Appendix E. Review of full-text papers

INCLUSION/EXCLUSION CRITERIA FOR REVIEW OF FULL-TEXT ARTICLES

Publication (Author, title, journal, publication year):

Publication ID:

1. Is the full text of the article in English, German, French, Swedish, Norwegian, Danish?

Yes:

No:

2. Is the Publication period between 1 January 2004 to 31 December 2013?

Yes:

No:

3. Does the study population include persons aged 60 and over?

Yes:

No:

4. Is the study population from a western country? (North America, Australia, New Zeeland and Europe)?

Yes:

No:

5. Is the study population persons admitted as inpatients and discharged home/to residential care facilities

(not to palliative or psychiatric care)

Yes:

No:

6. Are the risk factors considering demographics, socioeconomics, health illness, healthcare utilization or pathway related factors?

Yes:

No:

7. Is the primary or secondary outcome readmission to acute care hospital within one month (28-31 days) after discharge?

Yes:

No:

8. Is the outcome of interest based on measures of risk (frequencies/rates or relative measures)?

Yes:

No:

9. Is it possible to determine measures of risk related to persons 60+?

Yes:

No:

10. Is the study a primary study?

Yes:

No:

If yes - what is the study-type:

11. Should the study be included for critical appraisal (answered yes to question 1-10)

Yes:

No:

Reasons for exclusion:

If not included for critical appraisal:

12. Is the article a systematic review or meta-analysis of risk factors of hospital readmission?

Yes:

No:

13. If the article meets none of the above criteria would it be useful?

(Citation, Background/Discussion)

Appendix F. Data-extraction instrument

DATA EXTRACTION FORM (VERS 3_05.03.2014)

REWIEW*

Reviewer Acronym	
Date	

REFERENCE*

Author	
Year	
Journal	
Record number	

DATA EXTRACTION

STUDY METHOD

Study type*	Cohort prospective: Cohort retrospective: Secondary Data Analysis: Case Control Study: Case Series: Individual Case Report: Cross Sectional Study: Other study types (which): _____
Purpose, objective or research question	
Data sources (E.g. administrative data, clinical data, national registers, local registers, surveys)	
Data collection period	
Outcome(s)	
Setting* (Where the study took place)	
Country* (Study population)	
Participants* -inclusion and exclusion criteria -sample technique -sample characteristics (e.g. age, gender, cultural background)	
Number of participants* (Sample size)	

*Participants (CAVE: RCT´s are excluded)	Group A	Group B
(If control group)		

METHODS FOR ANALYSIS

EXPOSURE/RISK FACTOR*

DEFINITIONS

Readmission - def	
Readmission - type	
Readmission - time frame	

OUTCOME MEASURES

Readmission rate	

RESULTS*

Continuous	**Results (%; range, mean (SD))**

Dichotomous	**Results (RR, OR, AUC, Cut off)**

CONCLUSIONS*

Authors conclusion	
Reviewers conclusion	

MISCELLANEOUS

Funding source	
Approval	
Notes	

CONTACT

Date	Contact	Text

NOTES

Date	Reviewer	Text

Items with * = items included in the standardized JBI-MAStARI data-extraction tool.

This data extraction tool is the adapted version of a data extraction tool developed and proven by Möhler et al. 2013

Appendix G. Information for gatekeepers

I gode hænder hos
AALBORG UNIVERSITETSHOSPITAL

Afsnitsledende sygeplejerske på Y Afdeling

Forespørgsel angående forskningsprojekt med inkludering af patienter indlagt i Y Afdeling

Klinik Medicin

Aalborg Universitetshospital

Forskningens Hus
Sdr. Skovvej 15
9000 Aalborg

Sygeplejerske og
ph.d. studerende
Mona Kyndi Pedersen

Telefon: 24748870

Mail: mokyp@rn.dk

18. November 2014

Jeg er i gang med et forskningsprojekt, der har som formål at identificere den gruppe af personer over 65 år, der er i særlig risiko for at blive genindlagt kort tid efter udskrivelse og at belyse faktorer, der øger risikoen for genindlæggelse.

Projektets titel: Risikofaktorer for genindlæggelse blandt personer over 65 år.

Projektet er godkendt som et regionalt sundhedsfagligt forskningsprojekt med projekt-ID nr: Journal 2008-58-0028. Vejledere på projektet er Postdoc Edith Mark, Biostatistiker Søren Lundbye-Christensen, Overlæge Gunnar Lauge Nielsen og Lektor Lisbeth Uhrenfeldt (hovedvejleder).

Studiet består af 3 delstudier;

i) En systematisk gennemgang af forskningsbaseret litteratur
ii) Et kohortestudie baseret op landsdækkende registerdata
iii) En kvalitativ interviewundersøgelse med patienter, indlagt og udskrevet fra medicinske afdelinger

Denne henvendelse drejer sig om det 3. delstudie, der har som formål at undersøge patienternes perspektiv og de forhold, som de oplever, har særlig betydning for, hvorvidt de bliver genindlagt eller ej.
Vi er i gang med at finde patienter, der vil deltage i projektet. Det er planlagt, at dataindsamlingen skal foregå som individuelle interviews. Deltagerne vil blive interviewet to gange; første interview foregår mens de fortsat er indlagt (ca. 30 minutter) og det efterfølgende interview foregår hjemme 1-2 uger efter udskrivelse (varighed 45-60 minutter).
Ud fra de foreløbige resultater fra de to første delstudier har vi valgt at interviewe 5-6 personer, med følgende karakteristika:

- Mænd i aldersgruppen 65-75 år.
- Der er planlagt udskrivelse til hjemmet (med eller uden hjælp)
- Har været indlagt en eller flere gange inden for de seneste 3 måneder
- Er i behandling med 5 eller flere præparater - optalt ift. det generiske stof
- Er ikke indlagt med henblik på palliativ pleje og behandling
- Er i stand til at deltage i et interview

REGION NORDJYLLAND

Jeg vil være meget taknemmelig, hvis du vil hjælpe med at rekruttere deltagere til disse kvalitative interviews. Begrundelsen for, at jeg har valgt ikke selv at kontakte mulige deltagere, skyldes flere forhold. Der kan være en risiko for, at patienten oplever, at jeg som forsker lægger et pres på dem, for at de skal deltage. Endvidere har jeg ikke adgang til de data, der skal til for at vurdere hvilke patienter, der er potentielle deltagere.

Jeg vil bede dig hjælpe mig med følgende:

- At kontakte 5-6 personer, der opfylder ovenstående kriterier og spørge vedkommende, om han er interesseret i at deltage i dette forskningsprojekt. Hvis vedkommende er interesseret i at deltage, vil det være en stor hjælp, hvis du vil kontakte mig snarest muligt, så jeg har mulighed for at kontakte vedkommende samme dag, eller senest den efterfølgende dag.
- At give de personer, du kontakter, et informationsbrev
- At orientere de potentielle deltagere om, at:
    - Det er frivilligt at deltage, og at de kan trække sig ud af projektet til enhver tid
    - Den information, de bidrager med, vil blive behandlet fortroligt
    - Interviewet på hospitalet vil vare 20-30 minutter, og interviewet hjemme vil vare ca. 45-60 minutter.
    - Interviewet vil blive optaget, og optagelsen vil blive slettet, når undersøgelsen er afsluttet.

Du er til enhver tid velkommen til at kontakte mig, hvis der er behov for yderligere oplysninger om projektet eller om rekrutteringen.

På forhånd stor tak for din assistance.

Venlig hilsen

Mona Kyndi Pedersen

Appendix H. Information for participants

I gode hænder hos
AALBORG UNIVERSITETSHOSPITAL

Information om forskningsprojekt

Vi vil spørge dig, om du vil deltage i en undersøgelse af grunde til genindlæggelser.

Om projektet:
Projektets titel er: Risikofaktorer for genindlæggelse blandt personer over 65 år.

Formålet er at få viden om patienternes opfattelse af de forhold der har betydning for, om man bliver genindlagt eller ej.
Det forventes, at undersøgelsen vil bidrage til, at sundhedsvæsenet i højere grad kan målrette indsatsen og forebygge nogle af disse genindlæggelser.

Hvis du vil deltage:
Hvis du siger ja til at deltage, vil du blive interviewet to gange.
Det første interview, der varer ca. 30 minutter, vil foregå, mens du stadig er indlagt. Det andet interview, der vil vare 45-60 minutter, vil foregå hjemme hos dig ca. 1-2 uger efter at du er udskrevet.
Under interviewene vil jeg spørge til konkrete situationer og oplevelser, som efter din opfattelse, har betydning for en genindlæggelse.
Når du er udskrevet vil jeg kontakte dig på telefon og vi kan aftale hvornår det passer dig bedst, at jeg kommer på besøg. Jeg forventer ingen servering under besøget, kun en samtale med dig.

Dine rettigheder:
Det er fuldstændig frivilligt at deltage, og du kan til enhver tid trække dit tilsagn om at deltage tilbage. Det vil ikke på nogen måde påvirke din behandling og pleje.
Interviewene vil blive optaget på en lille optager, og optagelsen vil blive slettet, når undersøgelsen er afsluttet.
Materialet vil blive opbevaret, så det er utilgængeligt for andre og informationer om dig vil blive behandlet strengt fortroligt.

Yderligere oplysninger:
Projektet er godkendt som et regionalt sundhedsfagligt forskningsprojekt med projekt-ID nr: Journal 2008-58-0028. Vejledere på projektet er klinisk forsker Edith Mark, statistiker Søren Lundbye-Christensen, overlæge Gunnar Lauge Nielsen og lektor Lisbeth Uhrenfeldt.

Du er til enhver tid velkommen til at kontakte mig, hvis der er behov for yderligere oplysninger om projektet og/eller om din eventuelle deltagelse projektet.

Venlig hilsen

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Appendix I. Interviewguide

Interview guide

Interview 1:

Fokus på den aktuelle indlæggelse og begivenheder det seneste år

Foregår på afdelingen, mens deltageren fortsat er indlagt. Varighed 20-30 minutter.

Tema/fokus	Interviewspørgsmål	Hjælpespørgsmål
Intro ift. projektet og indhentelse af informeret samtykke (5 minutter)	Tak for at du har vist interesse for undersøgelsen. • Årsagen til at du er blevet spurgt er.. • Har du spørgsmål til informationsbrevet? • Jeg vil specielt sikre mig, at du er opmærksom på, at der er tale om to interviews? Som deltager har du nogle rettigheder. Jeg vil lige kort gennemgå dem med dig. • Har du spørgsmål eller betænkeligheder? Er du fortsat interesseret i at deltage eller har du brug for yderligere betænkningstid?	
Situationen (15-20 minutter)	Aktuelle indlæggelse og forløbet op til indlæggelsen: Beskriv så konkret som muligt de begivenheder der ledte op til den seneste indlæggelse. Har du en ide om, hvad der skulle have været til, for at indlæggelsen kunne have været undgået. Prøv at beskrive ganske kort, hvad der er din vigtigste erfaring fra forløbet.	Flowdiagram over forløbet (tegner, mens deltageren fortæller) Spørgsmål for at få detaljer ift. "Critical incidents" frem: - Hvad skete der? - Hvordan påvirkede det dig? - Hvad gjorde du? - Hvordan reagerede dine omgivelser? - Hvordan reagerede "systemet" - Hvad endte det med? - Var der særlige begivenheder, der førte til indlæggelsen/genindlæggelsen
Planlægning af interview 2.	Når vi skal tale sammen næste gang vil vi gå mere i dybden med dine seneste indlæggelser. Og derfor har jeg valgt at jeg gerne vil snakke med dig igen 1-2 uger efter at du er udskrevet. Ved du allerede nu, hvornår du skal udskrives? a) Hvis ja → Er det i orden, hvis jeg ringer til dig? b) Hvis nej →Er det i orden for dig, hvis afdelingen orienterer mig?	Telefonnummer: Adresse: Tidspunkt, hvor du er nemmest at træffe? Form: Der er to muligheder: 1. Du og jeg fortsætter samtalen 2. Du kan vælge, at der er en med Hvad foretrækker du?

Interview 2:

Fokus på seneste indlæggelse, udskrivelsen og tanker om det fremtidige forløb. Afsluttes med refleksion over det samlede forløb og hvad der har haft særlig betydning.

Foregår i hjemmet 1-2 uger efter udskrivelsen. Varighed 45-60 minutter.

Tema/Fokus	Interview spørgsmål	Hjælpespørgsmål
Indledning (5-10 minutter)	Tak for at jeg måtte komme. . Har du spørgsmål eller nogle kommentarer til den samtale, vi havde på sygehuset? Jeg har tænkt på noget af det, vi talte om sidste gang som jeg gerne kort vil vende tilbage til: .... Hvordan er det at være hjemme igen?	Samtalen i dag har fortsat fokus dine oplevelser og erfaringer med indlæggelser og genindlæggelser på sygehuset Hvis deltageren har valgt at have en "bisidder med.. Jeg kan se at ..... Det der er vigtigt for mig er at det er dine erfaringer og dit perspektiv, der kommer frem og derfor vil det mest forme sig som en samtale mellem dig og mig. Du fortalte mig sidste gang at ... (evt. inddrage flowdiagrammet)
Siden sidst (10-15 minutter)	Hvad er der sket siden vi talte sammen sidst? Kan du give konkrete eksempler på positive ting, der er sket i forbindelse med indlæggelsen og udskrivelsen Kan du givekonkrete eksempler på, hvad du har oplevet belastende i forbindelse med indlæggelsen og udskrivelsen Prøv at give et eller flere eksempler på hvad der var særligt vigtigt for dig, da du skulle udskrives. Er der noget, der har overrasket dig i forbindelse med at du er kommet hjem? Har du en ide om, hvad der skulle have været til, for at indlæggelsen kunne have været undgået. Hvad har været din vigtigste erfaring fra den seneste indlæggelse?	Spørgsmål for at få detaljer ift "Critical incidents" frem: - Hvad skete der? - Hvordan påvirkede det dig? - Hvad gjorde du? - Hvordan reagerede dine omgivelser? - Hvordan reagerede "systemet" - Hvad endte det med? - Var der særlige begivenheder, der førte til indlæggelsen -
Nu og fremover 10-15 minutter	Hvordan vil du have det, hvis du bliver indlagt igen? Er der noget, der gør, at du oplever at du er særlig udsat for at blive indlagt igen/genindlagt? Er der noget, du i særlig grad oplever at der kan "vippe balancen" så du bliver indlagt igen?	Spørgsmål for at få detaljer ift "Critical incidents" frem: - Hvad skete der? - Hvordan påvirkede det dig? - Hvad gjorde du? - Hvordan reagerede dine omgivelser? - Hvordan reagerede "systemet" - Hvad endte det med?

Appendix J. Critical Incident Chart

Critical Incident Chart and Time Line					
Time line Month/Year	Course of care (outpatient encounters)	Course of care (inpatient encounters)	Events and circumstances	Critical Incidents	Notes

Inspired by Miles and Huberman 1984 (Miles MB, Huberman AM. Qualitative data analysis: A sourcebook of new methods. Second ed. California: SAGE; 1984. p. 110-122)

SUMMARY

Hospital readmission is common and considered an adverse health outcome in older persons. Acute readmission of recently discharged patients puts additional pressure on clinical resources within health care services and support. Despite the frequency of readmissions, affecting health and wellbeing of older persons, there is still a relatively incomplete understanding of the broader array of factors pertaining to hospital readmission.

The current evidence on risk factors for hospital readmission is not adequate to identify person at risk of readmission in a heterogeneous population of older persons. Few studies have explored patients' experiences of circumstances and incidents leading to readmission.

This thesis uses a mixed methods approach and combines quantitative as well as qualitative data to explore and identify risk factors and predictors of hospital readmission.

Use of health care services is the point where patients' needs meet the professional system. There is a need to enhance our understanding of the complex pattern of risk factors associated with hospital readmission and to investigate the role of current practices and organisational determinants to improve the health outcomes in older persons.

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