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WHY DO OLDER ADULTS SEEK EMERGENCY CARE? THE IMPACT OF CONTEXTUAL FACTORS, CARE, HEALTH, AND SOCIAL RELATIONS

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Why do older adults seek emergency care? The impact of contextual factors, care, health, and social relations

THESIS FOR DOCTORAL DEGREE (Ph.D.)

By

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This thesis is dedicated to my parents: Naseer Ahmed and Ummat-Rasool.

POPULAR SCIENCE SUMMARY OF THE THESIS

Emergency department visits are increasing worldwide, with older adults accounting for a disproportionate share of these visits (e.g., adults ≥ 65 years constitute 20% of Sweden's population and account for 45% of emergency department visits). Emergency departments rarely adapt to the needs of older adults with multiple health problems and diffuse symptoms. Reasons for poor adjustment are the absence of comprehensive geriatric assessments in the emergency department, lack of interdisciplinary teams with specific skills in the care of older adults, long waiting times, and poor continuity of care. All these reasons entail the risk of adverse health outcomes. We need to identify factors that explain emergency care use in older adults to improve health-related outcomes and the most effective use of emergency care. These factors could be at the aggregate level (e.g., municipal level) or individual level (e.g., health status) or related to previous health care and social care use.

This thesis examined the factors explaining emergency care use in older adults. Large datasets were used, including administrative data/registers covering the entire population of two Swedish regions and survey data with representative samples of older adults from two regions.

Results of this thesis show that context contributes to explaining emergency care use in older adults. A higher proportion of adults aged ≥ 80 years in the total population and shorter distance to the emergency department were the contextual factors associated with emergency care use in older-old adults (defined as persons ≥ 80 years). Emergency care was explained by older adults' poor health status, indicating emergency care use is driven by the need for care. However, emergency care use for chronic conditions could indicate unmet primary health care needs. Surprisingly, our findings showed that more primary care visits were associated with the utilisation of emergency care. Greater use of primary health care is an indicator of poor health status. However, primary care visits do not ensure that primary health care needs are met. Thus, further research on unmet primary care needs is warranted. Another finding was that older-old adults admitted to inpatient care from the emergency department were less likely to revisit emergency care within 30 days of the initial visit. These results suggest the health care and post-discharge care needs of those older-old patients discharged home from the emergency department were unmet.

Extensive home help receipt and lower levels of social support were associated with higher emergency care use. These findings indicate poor health status and could be an indication that social care needs for older adults living in their homes are unmet. The proportion of adults aged 80 years or older in Sweden's population is expected to double by 2040 and this group will to a large extent age in place. To meet the needs of older adults, greater continuity in social care and collaboration between social care and health care providers are required. Improvements in care should be based on older adults' views and care should be flexible to individual preferences.

ABSTRACT

Background: Emergency department (ED) visits are becoming more prevalent globally. EDs provide care for acute health conditions, but some of these visits are driven by needs unmet by primary health care and social care for older adults, indicating ineffective social care and healthcare systems. The ED is often an inappropriate setting for older adults because of the lack of interdisciplinary teams with clinical competence in the care of an increasingly ageing population and because of poor continuity of care which entails the risk of adverse health outcomes. The Andersen model of health services use proposes contextual and individual factors to understand health care utilisation better. However, there are knowledge gaps in research on ED care in relation to contextual factors, home help receipt, and aspects related to inadequate informal care. Moreover, selection bias often limits previous research on ED care. **Aim:** The overall aim was to study factors associated with ED care use in older adults.

Design: Prospective cohort study

Study sample: All adults ≥ 65 years with ED visits in 2014 living in two Swedish regions (Dalarna, $N=16\,688$ and Stockholm, $N=101\,017$) participated in study I. The study population in study II was all community-living older-old adults (≥ 80 years) who were registered residents of Dalarna on 31 December 2014, excluding those who moved into residential care facilities during 2015 ($N=16\,543$). In study III, the participants were adults ≥ 60 years who participated in the Swedish National Study on Aging and Care-Kungsholmen (SNAC-K). The data were pooled from three waves (W) of SNAC: W1= 2001-2003, W3=2007-2009, and W5=2013-2015. Persons living in residential care facilities were excluded from study III providing an analytical sample of $N=3\,066$ at W1, $N=1\,885$ at W3, and $N=1\,208$ at W5. In study IV, adults ≥ 66 years who participated in the SNAC-Blekinge study (W3: 2007-2009) and who provided information on the exposure variable were included ($N=673$).

Data sources: The four studies of this thesis were based on national and regional registers and survey data. The registers were the Longitudinal Integration Database for Health Insurance and Labour Market, the Social Services Register, the Swedish Prescribed Drug Register, the National Patient Register, and the health care databases of Region Blekinge, Dalarna, and Stockholm. Municipal-level data were accessed from Kolada, a publicly accessible, comprehensive national database. Survey data were based on the Swedish National study on Aging and Care in Blekinge and Kungsholmen.

Dependent variables: The dependent variables were ED visits, at least one ED revisit within 30 days of an initial ED visit, and frequent ED use.

Independent variables: The independent variables included contextual factors (the proportion of adults aged ≥ 80 years in the total population, annual social care expenditures per person aged ≥ 80 years, home help quality, median days in residential care, and distance to the ED), individual-level predisposing factors (age, gender, and education), individual-level enabling resources (living arrangements, social connections, social support, and informal care), individual-level need factors (subjective and objective health status), and health care and social care use (primary health care visits, specialist care visits, hospital admissions, ED visits in the previous year, disposition at initial ED visit (admission to inpatient care/discharged home), residential care receipt, and home help receipt).

Data analyses: Logistic regression models were used to analyse the associations between independent variables and dichotomous dependent variables (ED visits, ED revisits, frequent ED use). Cox regression models were computed to determine the association between independent variables and time to the first ED visit. Associations between independent variables and the number of ED visits were assessed using generalised estimating equations with negative binomial regressions. In studies III and IV, all analyses were stratified by age group (Study III: younger-old, <78 years, older-old, ≥ 78 years; Study IV: younger-old, ≤ 80 years, older-old >80 years).

Results: Analysis of contextual factors showed that the proportion of adults aged ≥ 80 years in the total population and shorter distance to the ED were associated with ED visits in older-old adults (Study II). There were mixed findings on age, gender, and education level for individual-level predisposing factors. Regarding individual-level enabling resources, higher levels of social support were negatively associated with ED visits but only in older-old adults (Study III). In relation to the need for care factors, poor health status was associated with ED visits (Studies II-IV), ED revisits (Study I), and frequent ED use (Study IV). Concerning the utilisation of care, primary health care visits in the previous 12 months were associated with ED visits (Study II) and ED revisits (Study I). Hospital admissions and ED visits 12 months before the initial ED visit were associated with ED revisits (Studies I & II). Older-old adults admitted to inpatient care at the initial ED visits were 29% less likely to revisit an ED within 30 days of the initial ED visit than those discharged home (Study II). Older-old adults receiving home help for instrumental services and personal care were 148% more likely to visit an ED compared to those not receiving home help. This group with intensive home help also had a 30% higher likelihood of an ED revisit within 30 days of the initial ED visit (Study II).

Conclusions: Contextual factors contribute to understanding ED care use in older adults. Our findings on poor health status suggest that the need for care determines ED care use in older adults. However, factors other than health status also explain the use of ED care. For example, social support indicates inequalities and suggests investing in public health resources to address these risk factors. Discharge to home from the ED and risk of an ED revisit could indicate that health care and post-discharge care are not meeting the needs of older patients. Findings on the home help receipt and ED care use illustrate the vulnerability of this group and highlight the importance of future research on self-reported unmet needs of home help and the effect of unmet needs on the use of ED care.

SAMMANFATTNING

Bakgrund: Besök till akutmottagningar ökar i Sverige såväl som i stora delar av världen. Akutmottagningar ger vård vid akuta besvär, men en del av dessa besök avser behov som inte har tillgodosetts av primärvården och äldreomsorgen, vilket tyder på brister inom regionernas hälso- och sjukvård och den kommunala äldreomsorgen, samt i samarbetet organisationerna emellan. Äldre personer har ofta komplexa behov av både vård och omsorg och behöver därför mötas av tvärdisciplinära team. Akutmottagningar är sällan anpassade till äldre personers behov, exempelvis saknas tillräckligt med personal som har specifik kompetens rörande vård av äldre personer. Därtill präglas akutmottagningar av långa väntetider och dålig kontinuitet, vilket ökar risken för vårdskador och försämrade hälsotillstånd. Andersens modell för 'health services use' föreslår att kontextuella och individuella faktorer ska tas i beaktande för att bättre förstå hälso- och sjukvårdskonsumtion. Det finns kunskapsluckor när det gäller sambandet mellan kontextuella faktorer, hemtjänst, informell omsorg och besök till akutmottagningar. Dessutom har tidigare forskning om akutsjukvård sällan baserats på registerdata och har därför begränsningar rörande representativitet.

Syfte: Det övergripande syftet var att studera faktorer som har samband med äldre personers besök på sjukhusbaserade akutmottagningar.

Design: Prospektiv kohortstudiedesign.

Deltagare: Alla personer ≥ 65 år som har besökt akutmottagningar under 2014 och bosatta i två svenska regioner (Dalarna, $N=16\ 688$ och Stockholm, $N=101\ 017$) deltog i studie I. Alla äldre-äldre personer (≥ 80 år) som var folkbokförda invånare i Dalarna den 31 december 2014 som bodde i ordinärt boende ($N=16\ 543$) var deltagare i studie II. I studie III var deltagarna personer ≥ 60 år som deltog i den svenska nationella studien om åldrande och omsorg- Kungsholmen (SNAC-K). Data från tre undersökningsomgångar av SNAC-K slogs samman: 2001-2003, 2007-2009 och 2013-2015. Personer som bodde i särskilt boende exkluderades från studie III, vilket gav analytiska urval om $N=3\ 066$, $N=1\ 885$ och $N=1\ 208$ för de tre datainsamlingsomgångarna. I studie IV inkluderades personer ≥ 66 år som deltog i SNAC-Blekinge-studien (W3: 2007-2009) och som gav information om hälsorelaterad livskvalitet ($N=673$).

Data: De fyra studier som ingår i denna avhandling är baserade på Longitudinell Integrationsdatabas för Sjukförsäkrings- och Arbetsmarknadsstudier (LISA), Socialtjänstregistret, Läkemiddelsregistret, Patientregistret, regionala register över hälso- och sjukvård i Region Blekinge, Dalarna och Stockholm, den nationella databasen Kolada, samt befolkningsstudien 'The Swedish National Study on Aging and Care' i Blekinge och på Kungsholmen.

Beroende variabler: De beroende variablerna var akutbesök, minst ett förnyat akutbesök inom 30 dygn efter ett initialt besök, och frekventa akutbesök.

Oberoende variabler: Kontextuella faktorer (andel personer ≥ 80 år i befolkningen, kostnad för äldreomsorg i kronor per invånare ≥ 80 år, brukarbedömning av hemtjänst, boendetid (median) i särskilt boende (antal dagar), och avstånd till närmaste akutmottagning), individuella predisponerande faktorer (ålder, kön, och utbildning), individuella möjliggörande resurser (ensam/samboende, sociala kontakter och socialt stöd), individuella behovsfaktorer (hälsotillstånd), och vård och omsorg (primärvårdsbesök, specialistvårdsbesök, sjukhusinläggningar, akutbesök i de senaste 12 månaderna, inskrivning i slutenvård vid akutbesök eller utskrivning till hemmet, mottagare av äldreomsorg).

Dataanalys: Logistiska regressionsmodeller har använts för att analysera sambanden mellan oberoende variabler och dikotoma beroende variabler (akutbesök, förnyat akutbesök, frekvent besök till akutmottagningar). För att analysera sambandet mellan oberoende variabler och tid till det första akutbesöket användes cox regressionsmodeller. Samband mellan oberoende variabler och antalet akutbesök analyserades med hjälp av 'generalised estimating equation' med negativa binomialregressioner. I studie III och IV stratifierades samtliga analyser efter åldersgrupp (Studie III: yngre-äldre, < 78 år, äldre-äldre, ≥ 78 år; Studie IV: yngre-äldre, ≤ 80 år, äldre-äldre > 80 år).

Resultat: De kontextuella faktorer som hade samband med akutmottagningsbesök var: andelen personer som är 80 år eller äldre i den totala befolkningen i kommunen samt kortare avstånd till akutmottagningen (Delstudie II). Analyserna av individuella predisponerande faktorer visade på blandade resultat. Vad gäller individuella möjliggörande resurser hade högre nivåer av socialt stöd ett negativt samband med akutbesök, men endast hos äldre-äldre personer (Delstudie III). Rörande individuella behovsfaktorer hade sämre hälsotillstånd samband med akutbesök (Delstudier II, III och IV), förnyat akutbesök inom 30 dagar (Delstudie I) och frekventa akutbesök (Delstudie IV). Ett högre antal primärvårdsbesök under 12 månader före akutbesöket hade samband med akutbesök (Delstudie II) och förnyat akutbesök inom 30 dagar (Delstudie I). Sjukhusinläggningar och akutbesök under 12 månader före akutbesök ökade risken för förnyat akutbesök (Delstudie II). Äldre-äldre personer som blev inskrivna i slutenvården vid första akutbesöket hade 29 % lägre sannolikhet för förnyat akutbesök inom 30 dagar än de som skrevs ut till hemmet (Delstudie II). Äldre-äldre personer i ordinärt boende som fick hemtjänst både för service och personlig omvårdnad hade 148% större risk för akutbesök än personer utan hemtjänst. Sannolikheten för förnyat akutbesök inom 30 dagar var 30% högre i denna grupp av äldre-äldre personer med mer omfattande hemtjänst (Delstudie II).

Slutsatser: Kontextuella faktorer är viktiga för förståelsen av akutbesök bland äldre personer. Att personer med sämre hälsotillstånd hade en större risk för akutbesök visar att akutbesök hos äldre personer drivs av vårdbehov. Dock hade andra faktorer än hälsotillstånd, såsom bristande socialt stöd, också samband med akutbesök, vilket indikerar att det finns ojämlikheter och att resurser bör satsas på att minska dessa. Att utskrivning till hemmet från akuten ökade risken för förnyat akutbesök kan vara ett tecken på att behov av sjukvård och eftervård inte helt tillgodoses för äldre personer. Sambandet mellan hemtjänstinsatser och

besök till akutmottagningar illustrerar sårbarheten hos denna grupp och belyser vikten av att inkludera äldre personers perspektiv och behov i framtida forskning och praktik

LIST OF SCIENTIFIC PAPERS

- I. **Naseer M**, Agerholm J, Fastbom J, Schön P, Ehrenberg A, Dahlberg L. Factors associated with emergency department revisits among older adults in two Swedish regions: A prospective cohort study. *Archives of Gerontology and Geriatrics*. 2020; 86:103960
- II. **Naseer M**, J McKee K, Ehrenberg A, Schön P, Dahlberg L. Individual and contextual predictors of emergency department visits among community-living older adults: A register-based prospective cohort study. *BMJ Open*. 2022; 12(2): e055484
- III. **Naseer M**, Dahlberg L, Ehrenberg A, Schön P, Calderón-Larrañaga A. The role of social connections and support in the use of emergency care in older adults. *Submitted*
- IV. **Naseer M**, Dahlberg L, Fagerström C. Health-related quality of life and emergency department visits in adults of age ≥ 66 years: A prospective cohort study. *Health and Quality of Life Outcomes*. 2018; 16(1): 144

TABLE OF CONTENTS

1	INTRODUCTION.....	1
2	BACKGROUND.....	3
2.1	Older adults and care use	3
2.2	The Swedish social care and healthcare systems	3
2.2.1	Health care.....	4
2.2.2	Social care for older adults.....	4
2.3	Changes in social care and healthcare systems	4
2.3.1	Ageing in place and deinstitutionalisation	4
2.3.2	Marketisation, privatisation, and user choice reforms	6
2.3.3	Recent reforms	7
2.4	Interplay between social care and health care	7
2.5	Emergency department care.....	8
2.5.1	ED revisits	8
2.5.2	Frequent use of ED care.....	9
3	CONCEPTUAL FRAMEWORK.....	11
3.1	Andersen’s model of health services use.....	11
3.1.1	Contextual factors in Andersen’s model	12
3.1.2	Individual factors in Andersen’s model.....	12
3.2	Gruneir’s model of ED care use by older adults	12
3.3	What affects ED care use by older adults?	12
3.3.1	Contextual factors	12
3.3.2	Individual factors.....	13
3.3.3	Care use	13
3.3.4	ED care use.....	13
3.4	Equitable access to ED care	13
4	PREVIOUS RESEARCH ON PREDICTORS OF ED CARE USE	15
4.1	Contextual factors.....	15
4.2	Individual-level predisposing and enabling factors.....	15
4.3	Need for care factors	16
4.4	Use of health care and social care	17
4.5	Knowledge gaps	17
5	RESEARCH AIMS.....	19
6	MATERIALS AND METHODS	21
6.1	Study design	21
6.2	Study population and study sample	21
6.3	Settings.....	23
6.4	Data sources.....	24
6.4.1	Registers	24
6.4.2	Survey data	26
6.4.3	Kolada.....	26
6.5	Variables	26

6.5.1	Dependent variables	26
6.5.2	Independent variables	27
6.6	Data analyses	34
6.6.1	Descriptive and bivariate analyses	34
6.6.2	Logistic regression	34
6.6.3	Generalised linear mixed models	35
6.6.4	Generalised estimating equations (GEEs).....	35
6.6.5	Cox proportional hazard model	35
6.7	Ethical considerations	36
7	RESULTS.....	37
7.1	Reasons for seeking ED care and diagnosis at the initial ED visit	37
7.1.1	Reasons for seeking ED care (Study I).....	37
7.1.2	Diagnoses at the initial ED visit (Study I).....	38
7.2	Contextual factors associated with ED care use (Study II).....	39
7.3	Individual-level factors associated with ED care use.....	40
7.3.1	Predisposing factors (Studies I-IV)	40
7.3.2	Enabling resources (Studies I, III, & IV)	41
7.3.3	Need for care factors (Studies I-IV)	43
7.4	Use of care and ED care	45
7.4.1	Health care use (Studies I & II)	45
7.4.2	Social care for older adults and ED care use (Studies I, II & IV)	46
8	DISCUSSION	49
8.1	Main findings.....	49
8.1.1	Impact of contextual factors on ED care use.....	50
8.1.2	Individual-level predisposing factors	50
8.1.3	Enabling resources: the role of social support in ED care use.....	51
8.1.4	Need for care and use of care.....	52
8.1.5	Social care for older adults and ED care use.....	53
8.1.6	Admission to inpatient care at initial ED visit and ED revisit.....	54
8.2	Methodological considerations	55
8.2.1	Internal validity [Systematic error].....	55
8.2.2	External validity [Generalisability]	57
9	CONCLUSIONS.....	59
10	POINTS OF PERSPECTIVE	61
10.1	Implications of the findings	61
10.2	Future research	62
11	ACKNOWLEDGEMENTS.....	63
12	REFERENCES.....	65

LIST OF ABBREVIATIONS

ADL	Activities of Daily Living
CI	Confidence Interval
ED	Emergency Department
GEE	Generalised Estimating Equations
GP	General Practitioner
HAT	Health Assessment Tool
HR	Hazard Ratio
HRQoL	Health-Related Quality of Life
IADL	Instrumental Activities of Daily Living
ICD	International Classification of Diseases
IRR	Incidence Rate Ratio
LISA	Longitudinal Integrated Database for Health Insurance and Labour Market Studies
MADRS	Montgomery-Åsberg Depression Rating Scale
OR	Odds Ratio
SF-12	Short Form Health Survey-12
SNAC	Swedish National Study on Aging and Care
SNAC-B	Swedish National Study on Aging and Care-Blekinge
SNAC-K	Swedish National Study on Aging and Care-Kungsholmen
W	Wave

SPECIFICATION OF TERMS

Older adults refer to adults aged ≥ 65 years. Study III in this thesis included another age cut-off (≥ 60 years) due to the original design of the Swedish National Study on Aging and Care-Kungsholmen. However, sensitivity analyses were performed by excluding age cohort < 66 years and did not find any systematic differences.

Emergency department (ED) care use: This thesis has focused on the visits conducted at the hospital-based EDs that are available around the clock. ED care use is an umbrella term for ED visits, revisits, and frequent ED visits.

Social care for older adults: Municipalities are responsible for providing social care to those older adults who need assistance, based on formal need assessment, with daily living in their ordinary homes or care homes (SFS 2001:453).

Residential care (according to the 5 chapter 5 § Social Services Act) entails social care provided to older adults in care homes.

Home help is services provided in the ordinary homes of older adults based on formal need assessments. These services mainly include personal care (e.g., hygiene, dressing, eating) and instrumental care (e.g., cleaning, cooking, shopping).

1 INTRODUCTION

In many countries (e.g., Sweden), emergency department (ED) care use has been the focus of media, political debates, and policy discussions. Examples of headlines from media in Sweden are: Kaos på akutmottagning-patienter fick ligga på golvet [Chaos at ED: patients had to lie on the floor] (1); Fullt på akuten [ED is full] (2); Patient väntade 44 timmar på akuten [Patient waited 44 hours in the ED] (3); Akutvården har blivit allt sämre för äldre] ED care has become even worse for older adults (4). Even though an increase in ED care use has been under debate for several years, it is still an important public health problem and in the headlines of media reports.

An increase in ED care use contributes to crowding at the ED that could lead to delays in treatment and unplanned revisits (5, 6) and raises concerns about the appropriateness of such visits, particularly in older adults (7). EDs provide care for acute health conditions but act as a safety net when primary health care is unavailable (7-9). Policymakers, health system managers, and researchers argue that ED care use for needs unmet by primary health care and social care or due to lack of social connections indicates inefficiency in social care and healthcare systems and is an inappropriate use of health care resources (9-11).

The ED is often an inappropriate setting for older adults with diffuse symptoms because of the lack of interdisciplinary teams with specific competence in the care of older adults (12, 13), the extended length of stay at an ED, and poor continuity of care, which entails the risk of being affected by adverse outcomes such as delirium, functional decline, and mortality (13-15). Furthermore, unplanned hospitalisation following an ED visit is stressful for the care receiver (16). Therefore, ED care use should be avoided when primary health care can efficiently fulfill the required care needs (17, 18).

ED care use could be influenced by community characteristics and regional variations in access to primary health care and social care for older adults (17). Moreover, social care and healthcare systems vary across countries and within countries in funding, patient fees, staffing, and delivery of care. For example, in Sweden, the provision of health care is the responsibility of 21 regions and the provision of social care is the responsibility of 290 municipalities. Therefore, it is crucial to consider the impact of contextual factors on ED care use (19). Identifying individual-level factors explaining ED care use helps identify risk groups to which public health interventions for improving health-related outcomes should be targeted. Therefore, this thesis aims to study the impact of contextual factors, care-related factors, health status, and social relations on ED care use in older adults.

2 BACKGROUND

This section provides a context on the care used by older adults (age ≥ 65 years), a brief introduction to Swedish social care and healthcare systems, ongoing changes in the care systems, and ED care use.

2.1 OLDER ADULTS AND CARE USE

Older adults are increasing in absolute terms and as a percentage of the whole population worldwide. Adults aged ≥ 80 constitute 5% of the Swedish population, which is expected to increase to 8% in 2040 (20). In Sweden, adults ≥ 65 years make up 20% of the total population and account for 45% of ED care use and 55% of inpatient care use in adults ≥ 19 years (21).

Older adults often have multiple health problems that may require frequent medical attention and social care services (9, 22). Moreover, geriatric syndrome, an ageing-related group of conditions across organs such as insomnia, functional decline, urinary incontinence, depressive symptoms, and vision impairment, also increases health care use in older adults (23). A recent Swedish report on patients ≥ 65 years has shown that the risk of unplanned hospitalisations within 30 days of discharge is almost double in frail older adults with multimorbidity compared to other adults of comparable age (24, 25).

The ageing population makes it increasingly necessary to adapt the social care and healthcare systems according to the needs of older adults and have adequate staff with special competence in the care of older adults (26). However, the number of geriatricians in Swedish healthcare has reduced from 28 to 24 per 100 000 persons ≥ 65 years between 2014 and 2019. One possible explanation is that the number of geriatricians in healthcare has not increased given the increasing proportions of older adults in the population. The number of nurses has also shown a decline in healthcare and social care for older adults since 2015. In Sweden, the proportion of registered nurses in municipal care for older adults is lower than in neighbouring Norway (9% vs. 31%) (27), while currently, a person receiving home help meets an average of 16 different carers during a 14-day period (25). Poor continuity or inadequate outpatient or social care delivery may increase ED care use (10, 17, 22).

2.2 THE SWEDISH SOCIAL CARE AND HEALTHCARE SYSTEMS

Sweden has a universal and mainly tax-financed healthcare system where users pay a small fraction of the total costs. A fundamental principle in Swedish health care provision, explicitly supported by legislation, is good health care on equal terms and priority should be given to those with greater needs (SFS 2017:30) (28). Similarly, social care provision for older adults is based on formal need assessments (29). In Sweden, healthcare and social care responsibility is divided into three levels. The national government sets directives for legislation and policies (30). The provision of health care, including hospital care, outpatient care, and advanced level home care, is the responsibility of 21 regions. The municipalities (n=290) are responsible for social care. Provision of basic home care (up to nurse level) is the

responsibility of municipalities, except in Region Stockholm, where the region is responsible for basic home care. Social and health care costs are primarily covered by local taxes (30, 31).

2.2.1 Health care

Primary health care serves as the first line of contact in healthcare systems. All residents of Sweden are assigned to a primary health care clinic, and have the right to choose their preferred primary health care provider (32). The Swedish healthcare system offers out-of-hours primary health care for urgent primary health care-related problems. Telephone service is also available 24/7 for medical advice (33). There is no formal requirement for general practitioners' (GPs) referral for seeking specialist care. A person can request an appointment at a specialist care unit by self-referral. Hospitalisation/inpatient care could be planned or unplanned. An ED visit largely follows unplanned hospitalisation. In the hospital-based ED, appointments cannot be made and no referrals are required.

2.2.2 Social care for older adults

In Sweden, care for older adults is a public responsibility, and families do not have legal obligations to care for their relatives/parents (34). A fundamental value in social care for older adults is to ensure that they live an independent, dignified life, including good mental health and wellbeing (5 chapter 4 § Social Services Act) (29). In Sweden and internationally, social care for older adults can be divided into two main categories: residential care and home help services (35). Residential care (according to the 5 chapter 5 § Social Services Act) is social care provided in care homes. Home help services include personal care (e.g., hygiene, dressing, eating) and instrumental services (e.g., cleaning, cooking, shopping). Municipalities also offer services (e.g., meals-on-wheels, transportation, and safety alarms) (36). Older adults in need of care can apply for social care services from the municipality where they live (35, 37). There are no national guidelines on the eligibility of social care. Instead, municipalities decide on the eligibility, range, and intensity of social care services based on formal need assessments (29, 36). The eligibility threshold for residential care has become stricter and approximately 5% of adults ≥ 65 years receive residential care. This figure can be compared to about 11% who receive home help services (38). Both public and private providers can offer social care, albeit publicly funded (31).

2.3 CHANGES IN SOCIAL CARE AND HEALTHCARE SYSTEMS

International social care and healthcare systems have substantially changed over the past few decades (31, 39). These changes have also occurred in Sweden. This section describes notable changes in the Swedish social care and healthcare systems.

2.3.1 Ageing in place and deinstitutionalisation

For decades, Swedish and international policy and practice regarding the care of older adults have been guided by the goal of supporting older adults to age in place, i.e., in the community rather than in institutions. Older adults appreciate age in place regarding a sense of

attachment, independence, friends, and familiarity with the neighbourhood (40, 41). Concerns are raised when i) older adults do not know about the services available to support ageing in place, ii) older adults are reluctant to seek needed care, or iii) do not receive the care required to meet their needs, which increases the risk of adverse health outcomes (40, 41).

2.3.1.1 Cutbacks in hospital care

In 1992, the Community Care Reform was implemented in Sweden, reinforcing the age-in-place policy and establishing the current structure of long-term care. The community care reform transferred responsibility for all types of long-term care of older adults from regions to municipalities, including basic health care in residential facilities (42). Provision of health care does not include medical care provided by physicians, which is still the responsibility of regions. Municipalities can take on basic home health care (up to nurse level) after a formal agreement is reached with the regions. Municipalities were also given the financial responsibility of 'bed blockers' in hospital care (a patient ready to discharge after medical treatment and blocking beds while waiting for care to be arranged after hospital stay).

Transfer of responsibility for long-term care of older adults and fewer beds occupied by bed blockers contributed to the reduction in the hospital-bed rate by more than half since the 1990s (30, 42). Sweden has the lowest per capita hospital-bed rate (2.1 per 1000 inhabitants) in Europe and the seventh lowest of all Organisation for Economic Cooperation and Development countries (39). In addition to policy reforms, hospital-based care in Sweden also suffered from financial cutbacks of the 1990s (42).

However, if the reduction in hospital-bed rate is not concurrent with improvements in outpatient care access, it might increase the need for hospital-based care. An increase in hospital patient flow could result in high hospital-bed occupancy and shorter hospital stay (32, 39). High hospital-bed occupancy contributes to a more extended stay in an ED, a decline in admissions to inpatient care (32, 43), and a 2-4% higher risk of an ED revisit within 7 days after ED discharge (32). Early discharge increases the risk of readmissions and adverse health outcomes (39).

2.3.1.2 Deinstitutionalisation

Deinstitutionalisation in the care of older adults has been further intensified with a 33% reduction in municipal residential care beds since 2000 (30). Reduction in municipal residential care contributed to the stricter eligibility threshold for residential care contributing to shorter length of stay in residential care facilities and risk of mortality shortly after their transfer to the residential care facility. According to a national report, approximately 20% of those admitted to residential care deceased within 6 months after their transfer to the residential care facility (26). Deinstitutionalisation has increased the demand for home help services. However, the provision of home help has not advanced to the same extent as the reduction in residential care. Instead, there has been an increase in informal care receipt (unpaid care for people with disabilities or older adults with care and support needs),

particularly in older adults with lower education (34) and women (34, 44). A recent report shows that 70% of those receiving formal care also receive informal care in Stockholm (45).

2.3.2 Marketisation, privatisation, and user choice reforms

Another notable Swedish reform in the 1990s was the introduction of marketisation and privatisation in social care and healthcare. This reform aimed to enhance the efficiency of care services and give users freedom of choice (30, 31). Choice reform was further strengthened by introducing a tax subsidy for purchased home help services in 2007 (30). In 2009, the act on System of Choice in the Public Sector was implemented in social care for older adults, allowing municipalities to contract out social care provisions to private providers, including for-profit companies (30, 31). Social care services are still publicly financed, whether the provider is public or private (31). The implementation of choice reform is optional for municipalities. In 2022, there were 290 municipalities, of which 158 implemented choice model, 111 have not implemented choice model, and 21 cancelled the contracts (46). Underlying reasons attributed to the cancellation of contracts observed in previous years are poor quality care, lack of staff, missed visits to the care receiver, and few clients (46, 47).

Market-oriented changes have contributed to an increase in the share of private provision of social care in neighbouring Finland and Denmark and even more in Sweden (31). The argument behind choice reform was empowering users to make active choices and enhance the quality of care through competition, leading to the responsibility at an individual level for making choices regarding their care. However, critical voices have questioned the capacity of those older adults with complex care needs to make active choices (48, 49). With respect to the enhancement of quality of care, a study based on national survey data from 2011 has shown that privately provided residential care was not better than municipal residential care in structural quality indicators, such as staffing level and accommodation facilities (50). However, privately provided residential care was better in terms of screening for malnutrition and care planning than municipal residential care (50).

Choice reform also allowed private providers to offer top up services to their customers. This change permitted older adults eligible for home help services after need assessment to top up their services (e.g., the purchase of additional services or frequency of service via tax rebate) (31). Customers can claim a tax rebate for purchasing top up services. However, municipal providers are not allowed to offer top up services to their customers. This challenges the idea of equitable access to social care services and may lead to inequalities based on the user's purchasing power and the range of services (31, 34).

2.3.2.1 Choice reform in primary health care

In 2010, a law on choice was also enacted in primary health care and implementation was mandatory for the regions (51). In addition to allowing users to choose their primary health care clinic, choice reform also enables private providers to establish primary health care clinics at the location of their choice. If they attract users, they get reimbursement from the

regions (51). This means that for-profit reasons could influence the choice of location. A study on the geographical equity of primary health care found that private primary health care clinics established after choice reform are less likely to be in areas with a high share of older adults living alone, possibly with greater health care needs. However, minor differences were found regarding socio-economic factors (52). Integrated/coordinated care is often perceived as an important component of the care of older adults where primary health care plays a significant role (53). However, market-oriented changes and choice reform have contributed to the fragmentation of primary health care and partly complicated the coordination of care for older adults (53, 54). A scoping review on primary health care after choice reform has shown that access to primary health care has increased in the number of primary health care visits, but mainly among those with lesser health care needs (54). Unavailability of primary health care or unmet needs of primary health care may have consequences for ED care use (7, 10). An increase in ED care use could be indicative of inadequate primary health care.

2.3.3 Recent reforms

In 2018, a law on coordinated discharge from inpatient care was implemented to optimise care for patients who need social care, home care, or primary health care after discharge from inpatient care (55). This law regulates the coordination between social and health care providers and early care planning for safe release from inpatient care.

Good quality local health care reform (God och nära vård) was enacted in 2019, which proposed that primary care must be strengthened, a link to specialist care should be enhanced (53), and access to care should be improved (56). To strengthen primary health care, sufficient resources are needed to ensure continuity and good quality care. For example, enough GPs are required to assign a fixed GP to the patient to ensure continuity. In an international comparison, Swedish health care is well equipped with physicians, but there are too few GPs in primary health care (57). Therefore, many patients do not receive a fixed GP despite expressing a need for such care, particularly adults ≥ 65 years (56). Implementing good quality reform will likely reduce ED care use for unmet primary health care needs.

2.4 INTERPLAY BETWEEN SOCIAL CARE AND HEALTH CARE

Given their health status and living arrangements, the needs of older adults are often complex. Accordingly, older adults with severe health problems will likely need help from social and health care providers. Social care and healthcare systems worldwide are often fragmented, unbalanced (dominated by either healthcare or social care), and poorly coordinated (58-60). Unbalanced and poor care coordination may lead to an increased risk of adverse health outcomes for patients and costly and inefficient care systems (58).

Previous international research has shown that the supply and use of social care services have the potential to reduce the number of unmet social care needs (60), ED care use (17), and hospital admissions in older adults (61). Thus, the availability of social care can adequately meet various care needs of older adults and prevent worsening health status, reducing overall health care use (61). Similarly, the availability of primary health care reduces ED care use (7)

and ED revisits (62). Therefore, adequate coordination between care systems has the potential to serve the needs of older adults better. However, fragmented financing structures, poor communication across systems, and misalignment of goals and incentives prevent effective collaboration between social services organisations, public health agencies, and the healthcare system (58).

Sweden has decentralised social care and healthcare systems that may pose challenges to the care coordination for persons who need care from both providers (e.g., older adults with multiple health problems) (53). In Sweden, as in many other developed countries, the fragmentation and lack of coordination between social care and healthcare have become more visible during the COVID-19 pandemic (63, 64). The pandemic also contributed to the build-up of unmet care needs, mostly because of the unavailability of health care due to the pandemic, followed by waiting times or people not seeking health care or social care because of fear of virus spread (65, 66). In Sweden, the share of new users of home help saw a reduction during the pandemic compared to previous years. The decline was most pronounced between March and May 2020 from 324 to 209 per 100,000 inhabitants (26). The build-up of care needs because of people not receiving or seeking social and health care during the pandemic may affect future social and health care use.

2.5 EMERGENCY DEPARTMENT CARE

Hospital-based EDs are often available 24-7, 7 days a week. EDs provide care for acute health problems, some of which are life-threatening (7). Management and delivery of ED care can vary between healthcare systems. Unlike Norway (67), in Sweden, no referrals are required, and patients are free to visit an ED in case of perceived need. In a critical acute condition, the telephone emergency service 112 is contacted, which manages ambulance resources to the ED (68). Pathways to the ED in non-critical acute conditions could be self-referral to the ED or referral by the health care provider. A recent study has shown that self-referrals were the most common mode of arrival to ED care in Sweden (34%), followed by ambulance (24%) in adults ≥ 18 years (68). However, ambulance was the common mode of arrival to the ED among adults ≥ 65 years (68). Because ED care is unplanned, a triage system is used to assess the severity of health problems to decide the order of treatment of patients with urgent needs.

2.5.1 ED revisits

ED revisits are considered unfavourable because each ED discharge is associated with a potential risk of adverse health outcomes among older adults (13, 15). According to a Swedish report, 24% of patients ≥ 65 years have an ED revisit within 30 days of the initial ED visit in Stockholm (69). International studies have shown that 10-15% of older patients revisit an ED within 30 days of the initial ED visit (15, 70, 71). According to the subjective views of older adults in international studies, ambiguous information on diagnosis, not remembering discharge details, stress (72), and unresolved health problems at the initial ED visit are contributing factors to the ED revisit (9). Sometimes, an ED revisit also indicates inadequate

post-discharge care (70). Primary health care or specialist care visits within 10-11 days after discharge from an ED lower the risk of ED revisits within 30 days. However, this effect has not been seen in delayed (>30 days) post-discharge primary health care or specialist care visits (62). In Sweden, a referral from an ED can accelerate the post-discharge follow-up at primary health care but usually entails a waiting time of 2-3 weeks (32). A report on hospital care in the Stockholm region has shown that older adults discharged home at the initial ED visit present with declining health status at the ED revisit within 30 days, suggesting post-discharge care needs are unmet (69).

2.5.2 Frequent use of ED care

In previous research, a varying number of visits (ranging from 2 to 12 per year) are used to define the frequent use of ED care (73). A Swedish register-based study on older adults identified that 2.5% of the patients were frequent users of ED care (≥ 4 visits a year) (74). A scoping review of international studies identified 3.5 to 29% of the adult patients as frequent ED users (≥ 4 visits a year) (75). These findings indicate that a small portion of patients is heavy users of ED care resources. Therefore, identifying the risk factors of frequent ED use is important to plan interventions to improve health outcomes and efficiently use ED care resources.

3 CONCEPTUAL FRAMEWORK

The conceptual framework of this thesis is based on the behavioural model of health services use by Andersen (19) and Gruneir et al.'s (10) model of ED care use by older adults. The model by Gruneir et al. (10) is adapted from Andersen's model, which was expanded further for ED care use by older adults.

3.1 ANDERSEN'S MODEL OF HEALTH SERVICES USE

Andersen's model was initially developed in the 1960s to understand health care use by individual predisposing factors, enabling resources, and the need for care factors (76). The model has been revised to emphasize the importance of contextual and individual-level factors for a better understanding of health care use (19).

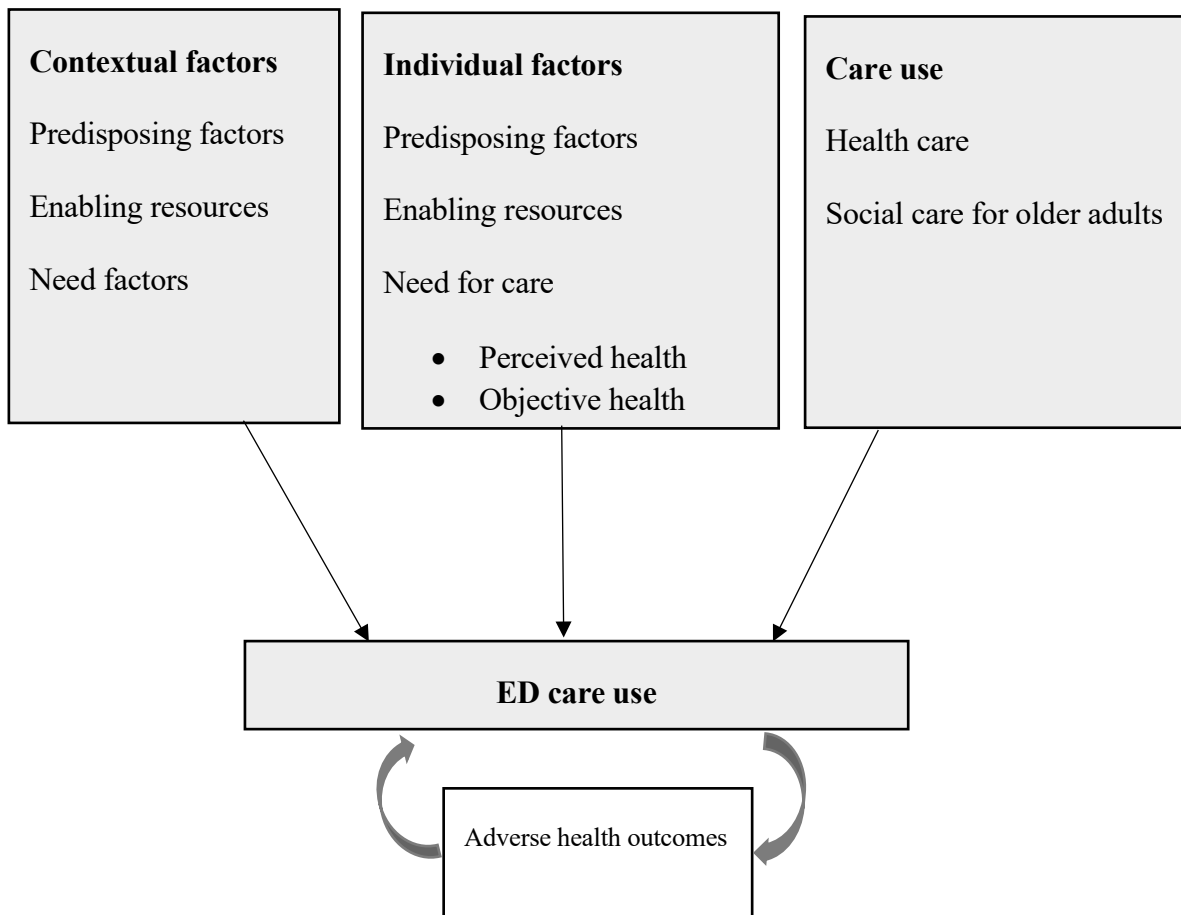


Figure 1. Conceptual framework based on Andersen's model (2008) and the adapted model by Gruneir et al., (2011)

3.1.1 Contextual factors in Andersen's model

Contextual factors include community characteristics and provider-related factors measured at an aggregate level (19). Contextual characteristics are divided into 1) predisposing factors, including aggregated sociodemographic factors (e.g., the age structure of the community), 2) enabling resources, including policies, legislations, financing, supply of care, location of service, and hours of service availability (e.g., local variations in the hospital bed rate or distance to health care services), and 3) need factors indicating the health profile of the community that may or may not be associated with the physical environment or living standards (e.g., disability rate in a community) (77).

3.1.2 Individual factors in Andersen's model

Individual factors are also divided into 1) predisposing factors, including demographics (e.g., age, gender), social structure (e.g., education, ethnicity), and health beliefs, 2) enabling resources that may facilitate or impede health care use (e.g., income, insurance, quality of social relations), and 3) need for care (77). Need for care could be based on perceived health and objective health measures (e.g., multimorbidity).

Andersen's model is a generic model for health services use. McCusker et al. (78) argued that ED care use explains acute health care needs, but the unavailability of primary health care explains some ED visits. This contention suggests including the aspects of care use in the model and the influence of these aspects on ED care use.

3.2 GRUNEIR'S MODEL OF ED CARE USE BY OLDER ADULTS

Gruneir et al. (10) modified Andersen's general model to explain ED care use by older adults by including the impact of unmet needs of primary health care and social care on ED care. The argument justifying this modification was that older adults often have multiple health problems and health care needs, but it does not inevitably imply a greater need for ED care. Primary health care can potentially prevent complications/exacerbations of the underlying medical problem by monitoring and control. Similarly, social care services for older adults can address functional limitations to prevent adverse health outcomes (e.g., falls) (10). Thus, unavailability or inadequate primary health care and social care services for older adults may increase the risk of exacerbating health problems, implying the need for ED care.

3.3 WHAT AFFECTS ED CARE USE BY OLDER ADULTS?

Figure 1 provides an overview of concepts and factors considered throughout this work to explain ED care use by older adults. In the figure, coloured boxes are the main components of the conceptual framework studied in this thesis.

3.3.1 Contextual factors

In this thesis, consideration was taken regarding context (such as decentralised social care and healthcare system). Therefore, the pooling of data from different regions was avoided and

separate statistical models were developed for each region. The association between contextual factors and ED care use was explored in study II.

3.3.2 Individual factors

Individual factors were classified into 1) predisposing factors, including demographics (e.g., age) and social structure (e.g., education), 2) enabling resources (e.g., social support), and 3) need for care (76). Perceived and objective health measures were used as proxy indicators of need factors. Need for care affects ED care use in two ways: an acute health problem that needs ED care (e.g., heart attack) or the need for a health care provider other than ED, but the unavailability of that health care provider is compensated by visiting an ED unit (10, 78).

3.3.3 Care use

Primary health care is the first line of contact in health care and provides services ranging from diagnosis, monitoring of health problems, and rehabilitation. Therefore, availability and continuity of primary health care can prevent complications of health problems that may lead to ED visits (7, 10, 79). Similarly, continuity of specialist care potentially reduces ED care use (79). Social care services for older adults address functional limitations to prevent adverse health outcomes that may imply the need for ED care (10).

3.3.4 ED care use

In the conceptual framework, ED care use is considered an outcome influenced by contextual factors, individual factors, and care use. ED care use is an umbrella term for at least one visit in the study period, the number of ED visits, ED revisits, and frequent use of ED care. Unmet needs at an initial ED visit or unmet needs of post-discharge care contribute to adverse health outcomes, which increase the risk for ED revisits or frequent use of ED care (10).

3.4 EQUITABLE ACCESS TO ED CARE

The assessment of equitable access to ED care is beyond the scope of this thesis but is still relevant in the interpretation of findings and for suggesting possible policy implications. Equitable access in health care use is based on factors explaining greater variance in the outcome (19). Access to care can be regarded as equitable when need is the predictor of health care use. In contrast, inequitable access is when social structure, health beliefs, and enabling resources are the explanatory factors of health care use. Equitable health care access reflects a policy's impact, distribution of health services, or suggests further policy implications. (19, 77). Health care includes a broad array of services and Andersen's model suggests that the predictive ability of explanatory factors can differ depending on the type of health service. For example, hospital care use (ED care and hospital admission) would be explained by demographic characteristics and need factors (19). Thus, need factors contributing to the greater variance in ED care use indicate equitable access. EDs provide care for acute medical conditions; therefore, further elaborations on the type and severity of health problems are needed to explain equitable access. ED care use explained by enabling resources provides evidence for planning public health interventions to modify these factors

for the appropriate use of ED care and for improving health-related outcomes in older adults. The use of ED care due to the unavailability or inadequate primary health care and social care raises concerns about the functioning of social care and healthcare systems.

4 PREVIOUS RESEARCH ON PREDICTORS OF ED CARE USE

This section overviews previous research on factors explaining ED care use and is divided into sections addressing contextual factors, individual-level predisposing and enabling factors, individual-level need for care factors, and care use.

4.1 CONTEXTUAL FACTORS

ED care use can be influenced by community characteristics in which older adults live or by features of the social care and healthcare systems. Therefore, it is essential to consider contextual factors for a better understanding of ED care use. In this section, information on country/place is also provided, as well as previous research on contextual factors for understanding context in relation to the healthcare system. A French study identified that ED care use was higher in municipalities with a high mortality rate, a greater proportion of older adults with chronic diseases, and a higher average age after 65 (7). However, a population-based study in Italy did not find an association between individuals aged ≥ 75 in the population and ED care use (17). Two French studies identified low median income and socio-economic deprivation at the municipality level as risk factors for ED care use (7, 80). In an Italian study, an inverse association was observed between economic deprivation and ED care use in adults < 75 . In the same study, no association was observed between economic deprivation and ED care use in adults ≥ 75 years (17).

A French study showed that out-of-hours availability of primary health care clinics and a high number of full-time employed GPs reduced ED care use in adults ≥ 65 (7). However, in Paris and the USA (North Carolina), no associations were noted for GP density, primary health care provider per 100 adults with ED care use (18, 80). Considerable evidence suggests that geographic proximity to the ED, mainly within 10 km, increases the likelihood of ED care use in older adults (7, 18, 22, 73).

Regarding social care supply, greater availability of residential care was associated with fewer ED visits (17), ED readmissions, reduced length of hospital stay, and hospital care expenditures (81). These findings contradict a study in the USA where a number of residential care beds were associated with higher ED care use (18). A systematic review on social care supply identified a literature gap on the impact of home help services and health care use (81).

4.2 INDIVIDUAL-LEVEL PREDISPOSING AND ENABLING FACTORS

The increased risk of multiple health problems in old age implies that advanced age increases the need for social and health care services. A systematic review identified a significant association between age and frequent use of ED care in three of eight studies (73). Studies on ED revisits have shown an inverse association between higher age and ED revisits (15, 70). In addition, several studies have found a positive association between male gender and ED care use in older adults (8, 11, 15, 22, 82). In contrast, other studies reported no or limited

evidence of an association between gender and ED care use (70, 73). A systematic review identified ethnic minority as a risk factor for ED care use towards the end of life (82); however, no association was observed between the country of birth and frequent use of ED care in a population-based study in Sweden (74).

A systematic review demonstrated no association between income, education, and ED care use towards the end of life (82). However, some studies found a significant association between lower income and frequent ED care use (73, 74). Several studies have also identified mixed findings regarding living alone and ED care use in older adults (17, 70, 74).

Enabling resources, such as social relations, particularly in old age, are important for providing emotional and physical support during a stressful event (9, 83, 84) and after hospital discharge (35). A study in Italy identified a positive association between limited social networks and nonurgent ED care use (11). A Canadian study found that loneliness explains self-reported ED care use in older adults (83). Conversely, an Irish study did not observe such an association (85). A systematic review concluded no association between social support and ED care use in older adults (86).

Previous research suggests that a trend towards receiving informal care, either alone or in combination with social care services, is increasing among older adults (44, 45, 87). However, there are few studies on informal care receipt and health outcomes in care recipients (87, 88). For example, a Canadian study found no association between informal care support and ED care use (88).

4.3 NEED FOR CARE FACTORS

Research has identified positive associations between elevated levels of multimorbidity, high levels of frailty and ED care use in older adults (11, 74, 89, 90). In comparison, an inverse association was observed between high levels of multimorbidity and ED revisits in older adults receiving residential care (91). A systematic review of ED care use identified cardiovascular diseases, mental health problems, musculoskeletal problems, abdominal pain, respiratory, neurological, dermatological problems, and accidents as the principal reasons for ED care use in older adults (92). Pain (e.g., abdominal pain, headache, back pain) was a common reason for nonurgent ED visits and ED revisits in home-living older adults (70, 93). Previous research has shown that the number of drugs/polypharmacy, an indicator of health status, was associated with increased ED care use (15, 22, 73).

Subjective health status assessment is vital in seeking health care (77). Low self-rated health and low physical health-related quality of life (HRQoL) increase ED care use in older adults (89, 94). However, a study on ED revisits did not find associations between self-rated health and functional status and ED revisits (70).

4.4 USE OF HEALTH CARE AND SOCIAL CARE

Health care use indicates poor health status and need for care. Inadequate care received in primary health care (10, 95) and social care leads to ED care use in older adults (10). A Swedish study found positive associations between outpatient visits (primary and specialist care), home health care, and frequent use of ED care (74). The number of hospital admissions and ED visits in the previous year increased the risk of frequent use of ED care (22, 73) and ED revisits (70).

A population-based study in Sweden on social care use found a higher likelihood of frequent use of ED care in adults ≥ 65 years living in residential care facilities (74). A systematic review on the impact of social care receipt on health care use reported mixed evidence on the duration of stay in residential facilities and ED care use (61). For home help services, a Swedish study revealed an inverse association between home help receipt and unplanned hospitalisations in older adults (96). A register-based Danish study detected a positive association between an increasing amount of home help services (minutes per week) and a higher risk of ED revisits (97).

4.5 KNOWLEDGE GAPS

Attention to contextual factors in studies on ED care use has increased in recent years (7, 17, 80). Mixed findings could be interpreted in terms of different operationalisations of exposures and outcomes but also highlight the impact of contextual factors in various settings. Still, knowledge gaps need to be addressed in future studies, including contextual factors on the availability of home help services and their impact on ED care use (81). A growing proportion of the older population is ageing in place and many depend on the supply and quality of home help services. Studies on the correlations between supply and quality of home help services and ED care use could help improve older adults' care. The organisation and financing of social care and healthcare systems vary across countries and within single countries. For example, Sweden has highly decentralised social care and healthcare systems. Local autonomy means that local variations may exist in the eligibility threshold, coverage rate, and spending on social care for older adults (30, 34, 98, 99). Moreover, the proportion of older adults (≥ 65 years) is increasing in all Swedish regions but can vary somewhat between regions (20). However, no studies have been identified focusing on the association between contextual factors and ED care use in Sweden.

Methodological limitations of previous studies include self-reported ED care use (11, 83, 94), recruitment of patients at specific days or times, exclusion of persons with critical medical conditions (15, 70), language barriers (15, 72), exclusion of persons living at residential care facilities (8, 70, 93), and the inclusion of only one hospital (70, 72, 93). These limitations increase the risk of selection bias, which can be avoided in register-based studies covering the entire population and all regions.

A systematic review on health care use found limited evidence on the impact of home help services, particularly the amount and levels of care and ED care use (61). Only a few studies

examined informal care receipt and ED care use (e.g., (88)). Furthermore, adequate informal care and social support required to sufficiently meet the care recipient's needs have not received attention in studies on ED care use.

In summary, there are knowledge gaps regarding the impact of contextual factors on ED care use among older adults in Sweden. Internationally, there are few studies on the association between home help services (amount, quality, levels of care) and ED care use. Moreover, knowledge is lacking on the effect of good informal care receipt on ED care use. Moreover, previous research has seldom differentiated between younger-old and older-old adults, which might dilute possible associations relevant to specific age groups. Previous research on ED care use is often limited as regards selection bias. Therefore, register-based studies are needed to mitigate these issues.

5 RESEARCH AIMS

The overarching aim of this thesis was to study the impact of contextual factors, use of health care and social care, health status, and social relations on ED care use in older adults.

RESEARCH QUESTIONS

1. Which of the baseline characteristics of older adults at the initial ED visit are associated with ED revisits within 30 days of the initial ED visit in two Swedish regions? (Study I)
2. To what extent can contextual characteristics improve the explanation of initial ED visits and ED revisits by community-living older adults compared to that provided by individual factors alone? (Study II)
3. Is there an association between social connections, social support, informal care receipt, and ED visits? (Study III)
4. Is HRQoL associated with time to first ED visit or frequent use of ED care in older adults during a 4-year period? (Study IV)

6 MATERIALS AND METHODS

This section includes a description of the study design, study population, setting, data sources, dependent and independent variables, statistical methods, and ethical considerations. Table 1 provides an overview of study designs, materials, and methods used in the four studies of this thesis.

6.1 STUDY DESIGN

This thesis is based on four studies that included a prospective cohort study design. In a prospective cohort design, individuals meeting the inclusion criterion are observed for a specific period for the incidence/occurrence of outcome (100). Because exposure occurs before the outcome, the temporal framework makes it advantageous to conclude the direction of association compared to studies with a cross-sectional design.

6.2 STUDY POPULATION AND STUDY SAMPLE

In study I, the study population comprised all adults ≥ 65 years living in residential care facilities or community-living in two Swedish regions (Dalarna and Stockholm). The inclusion criterion was older adults with ED visits between 1 January 2014 and 31 December 2014. The study included the total population of adults meeting the inclusion criteria, which provided analytical samples of $N=16\ 688$ in Dalarna and $N=101\ 017$ in Stockholm.

The study population in study II was all community-living adults aged ≥ 80 years who were registered residents of Dalarna on 31 December 2014, excluding those who were moved out of Dalarna or moved into residential care facilities during 2015. Study II included variables on the levels and quality of home help. Age ≥ 80 years was used because home help is more common in this age group than in younger age groups. The analytical sample was $N=16\ 543$.

Study III was based on data from The Swedish National Study on Aging and Care-Kungsholmen (SNAC-K). The target population in SNAC-K was adults ≥ 60 years. The national population register was used to randomly select persons of specific birth years to invite them to participate in the study. Participants were followed up every sixth year for younger age cohorts (60, 66, 72) and every third year for older cohorts (78, 81, 84, 87, 90, 93, 96, 99). In study III, data were pooled from three waves (W) using SNAC-K: $W1=2001-2003$, $W3=2007-2009$, and $W5=2013-2015$, excluding persons living in residential care facilities. This arrangement provided an analytical sample of $N=3066$ at $W1$, $N=1885$ at $W3$, and $N=1208$ at $W5$. In study III, age ≥ 60 was used due to the design of SNAC-K; however, sensitivity analyses were performed by excluding adults <66 years. No systematic differences were found when excluding persons <66 years.

Study IV was based on The Swedish National Study on Aging and Care-Blekinge (SNAC-B). The target population in SNAC-B was adults ≥ 60 years. Study IV had a similar procedure to SNAC-K, except for including all inhabitants of age cohorts 81, 84, 87, 90, 93, 96, and 99 due to the fewer persons in these age cohorts.

Table 1. An overview of the titles of studies included in this thesis, the materials, and the methods used

	Study I	Study II	Study III	Study IV
Title	Factors associated with ED revisits among older adults in two Swedish regions: A prospective cohort study	Individual and contextual predictors of ED visits among community-living older adults: A register-based prospective cohort study	The role of social connections and support in the use of ED care in older adults	HRQoL and ED visits in adults of age ≥ 66 years: A prospective cohort study
Design	Prospective cohort	Prospective cohort	Prospective cohort	Prospective cohort
Study sample	Adults aged ≥ 65 years with an ED visit in 2014 Dalarna (N=16 688) Stockholm (N=101 017)	Community-living adults aged ≥ 80 years living in Dalarna 2014 (N=16 543)	Adults ≥ 60 years participated in SNAC-K at baseline (N=3066)	Adults ≥ 66 years participated in the SNAC-B wave (2007-2009) and with information on HRQoL (N= 673)
Data source	LISA 2013-2014; Social Services register 2014; The Swedish Prescribed Drug Register 2013-2014; Health care databases in Dalarna and Stockholm 2013-2014	LISA 2014-2015; Social Services Register 2014, 2015; Health care databases in Dalarna 2014-2015; Kolada 2015	SNAC-K (2001-2003, 2007-2009, 2013-2015); National Patient Register 2001-2016	SNAC-B; Health care database in Blekinge 2007-2011
Dependent variables	ED revisit within 30 days of the initial ED visit	ED visit; ED revisit within 30 days of initial ED visit	Number of ED visits	ED visit; Frequent use of ED care
Independent variables	Age, gender, education, living arrangements, social care, last year of life, polypharmacy, number of primary health care visits and number of ED visits 12 months before the initial ED visit	Age, gender, number of chronic diseases, home help receipt, number of primary health care visits, specialist care visits and hospital admissions, disposition at ED visit, social care expenditures, home help quality, median days in residential care, distance to the nearest ED	Social connections, social support, informal care, age, gender, education, HAT, MADRS	HRQoL, age, gender, education, living arrangements, living situation, ADL, IADL, number of chronic diseases
Statistical methods	Logistic Regression	Multilevel linear mixed model; Sequential Logistic regression	GEE negative Binomial regression	Cox regression; Logistic regression

In study IV, adults ≥ 66 years who were participants of SNAC-B (W3: 2007-2009) and provided information on the exposure variable (HRQoL) were included. Study IV included participants living in residential care or community living, providing an analytical sample of $N=673$.

6.3 SETTINGS

Study I was conducted in two Swedish regions (Dalarna and Stockholm). Dalarna, located in central Sweden, has approximately 288 000 inhabitants, with adults ≥ 65 years making up 25.1% of the population. In Dalarna, 22.2% of adults aged ≥ 65 years have post-secondary education (101). There are four hospital EDs in Dalarna where approximately 57 400 visits are made annually by individuals ≥ 19 years; adults ≥ 65 account for 48.0% of these ED visits. The median length of stay at an ED is approximately 200 minutes for older adults (102). Dalarna has 0.18 geriatric hospital beds per 1000 inhabitants. In Dalarna, 12.2% of the home-living adults ≥ 65 receive home help and 5.0% live in residential care facilities (38).

Stockholm has approximately 2 415 000 inhabitants and adults aged ≥ 65 years constitute 16.0% of Stockholm's population. In Stockholm, 38.0% of adults aged ≥ 65 years have post-secondary education (101). Approximately 360 000 ED visits are made annually by individuals ≥ 19 years old in Stockholm; adults ≥ 65 years account for 41.6% of these visits. The median length of stay at an ED is approximately 270 minutes for older adults (102). Stockholm has 0.47 geriatric care beds per 1000 inhabitants. In Stockholm, 11.9% of the home-living adults ≥ 65 receive home help and 5.2% live in residential care facilities (38).

Thus, Stockholm and Dalarna have comparable proportions of older adults receiving home help and residential care but differ in terms of the proportion of older adults in the population, the proportion of older adults with post-secondary education, and the healthcare systems with geriatric hospital bed capacity and length of stay at EDs.

Study II was also conducted in Dalarna. There are 15 municipalities in Dalarna with population densities varying from 1.0 to 90.1 persons/km². Thus, sizeable geographical variation is expected in social and health care access across municipalities.

Study III was based on a sample of older adults living in Kungsholmen. Kungsholmen is located in central Stockholm, with approximately 71 000 inhabitants; adults ≥ 65 comprise 16.9% of the population. Kungsholmen has a higher proportion of older adults, a higher proportion of persons with post-secondary education, and higher income levels than many other areas of Stockholm and Sweden (103).

Study IV was based on a sample of older adults in Blekinge. Blekinge is a region located in the southeastern part of Sweden. The participants of SNAC-B were residents of Karlskrona, a municipality in Blekinge with approximately 66 700 inhabitants. Adults ≥ 65 make up 22.1% of Karlskrona's population. In Karlskrona, 27.0% of older adults have a post-secondary education (101). There is one hospital-based ED in Blekinge with approximately 24 700 annual visits by individuals ≥ 19 years; adults aged ≥ 65 account for 46.0% of these visits with

a median length of stay of 240 minutes (102). Blekinge has 0.13 geriatric care beds per 1000 inhabitants. In Karlskrona, 10.2% of home-living older adults receive home help and 5.8% live in residential care facilities (38). Karlskrona has similar characteristics to Blekinge (e.g., percentage of adults aged ≥ 65 years in the population, home help receipt, and percentage of adults living at residential care facilities), except for having a higher percentage of older adults with a post-secondary education (27.0 vs. 22.1%).

Thus, the settings included in the thesis differ regarding population characteristics, health care resources (e.g., geriatric care bed rate), and the rate of ED visits. In addition, Sweden has a decentralised social care and healthcare system, which means that local variations in the management, delivery, and use of social and health care are expected. Given the contextual differences between regions, associations between independent and dependent variables in this thesis were explored separately for Regions Blekinge, Dalarna, and Stockholm.

6.4 DATA SOURCES

Studies included in this thesis are based on registers and survey data. The literature uses register, registry, and administrative databases interchangeably. Register-based studies have the same critical approach as survey-based studies, such as defining hypotheses, study design, inclusion criteria, analysis, and results. The only difference is the source of data (104). In survey-based studies, researchers collect data; data in register studies are extracted from registers where information is collected and reported by administrators for purposes other than research (104). Registers include the whole population, limiting the risk of selection bias compared to survey studies based on a sample taken from the population.

6.4.1 Registers

This thesis is based on four national registers (Longitudinal Integrated Database for Health Insurance and Labour Market Studies, The Social Services Register, The Swedish Prescribed Drug Register, and the National Patient Register) and three regional registers (healthcare databases for regions Blekinge, Dalarna, and Stockholm).

6.4.1.1 Longitudinal Integrated Database for Health Insurance and Labour Market Studies (Swedish acronym: LISA)

The LISA register comprises data on a range of variables for all persons aged ≥ 16 (for persons ≥ 15 since 2010) registered in Sweden on 31 December each year since 1990. Statistics Sweden (SCB) is responsible for the LISA register and information in LISA is based on data from several population-based registers linked via encrypted personal numbers (105). In studies I and II, information on age, gender, education, living place, and date of death was taken from LISA from 2013-2015.

6.4.1.2 The Social Services Register

The Social Services Register was established in 2007 and contains data on municipal social care provided to older adults and persons with disabilities. The Swedish National Board of

Health and Welfare maintains the Social Services Register. Data are updated on the 15th of the following month. This update includes information on the status of social care receipts for older adults on the last day of each month. The register contains information about the living place (residential care or not), the type and extent of home help services provided to older adults, short-term housing, and social services other than home help provided to older adults (e.g., safety alarms, support to persons with psychological impairments). Variables on residential care and home help services in studies I and II were measured by using Social Services Register data for 2014 and 2015.

6.4.1.3 The Swedish Prescribed Drug Register

The Swedish Prescribed Drug Register started in 2005 and contains data on all prescribed drugs dispensed at pharmacies. Thus, drugs used in hospital settings are not included. It is obligatory for pharmacies, retailers, and wholesalers to report data to the Swedish eHealth Agency, which in turn reports data to the National Board of Health and Welfare. Thus, the Swedish eHealth Agency is the data source for the Swedish Prescribed Drug Register. This register is updated monthly. The Swedish Prescribed Drug Register contains information about the type of drug, date of prescription, date of dispense, prescribed dosage, and cost. In study I, the Swedish Prescribed Drug Register was used to compute variables on polypharmacy.

6.4.1.4 The National Patient Register

The National Patient Register was established in the 1960s to collect information on inpatient care at public hospitals. Initially, the participation rate in the National Patient Register was low: only six county councils were included and the register covered only 16% of somatic care. In 1984, participation in the National Patient Register became mandatory and since 1987, the National Patient Register contains data on all inpatient care in Sweden. The National Patient Register also has data on outpatient specialist care from 2001 and covers both public and private care providers. Primary care is still not included in the National Patient Register. The Swedish National Board of Health and Welfare is responsible for the National Patient Register; data are updated each month, and control checks are performed on the quality and validity of the submitted data. In study III, the number of ED visits and days spent in inpatient care were measured using the National Patient Register.

6.4.1.5 Health care databases

Electronic health care databases are maintained at the regional level and contain information on all outpatient and inpatient care provided by the respective regions. In this thesis, electronic healthcare databases of Region Blekinge, Region Dalarna, and Region Stockholm were used to assess health care use. These variables include information on primary health care visits, specialist care visits, ED care use, and disposition at ED visits (discharged home or admitted to inpatient care).

6.4.2 Survey data

In addition to the registers, this thesis is based on survey data from the Swedish National Study on Aging and Care.

6.4.2.1 *The Swedish National Study on Aging and Care (SNAC)*

SNAC is an ongoing population-based longitudinal cohort study that was started in 2001. SNAC is a multi-purpose study including capturing the ageing process, care use, and the interplay between the ageing process and care use. Therefore, SNAC comprises a broad range of variables, including measures of health status, living arrangements, social relations, and formal and informal care. The National population register was used to randomly select persons of specific age cohorts (60, 66, 72, 78, 81, 84, 87, 90, 93, 96, and 99) to participate in the study. Data were collected through postal questionnaires, interviews, clinical examinations, and laboratory testing by trained personnel (106).

This thesis used data from two of four sites of the SNAC (SNAC-K and SNAC-B). Study III is based on the data of SNAC-K from baseline (2001-2003), W3 (2007-2009), and W5 (2013-2015). The response rate was 73.3% at baseline. In study IV, data were obtained from SNAC-B of W3 (2007-2009), with a response rate of 60.6% at baseline and 85.9% at W3.

6.4.3 Kolada

Kolada is a publicly available database managed by the Council for the Promotion of Municipal Analyses (101). Although Kolada is a database, it contains information for administrative purposes and data collected through surveys (e.g., survey data on what older adults think about the social care they receive). Municipalities and regions report data in Kolada and information is updated monthly. Kolada contains a large number of variables, including data on the municipal level and the social care of older adults. Data on contextual factors used in study II were extracted from the Kolada.

6.5 VARIABLES

This section describes the variables included in this thesis. The presentation of variables is guided by the conceptual framework of the thesis.

6.5.1 Dependent variables

In all four studies, the use of ED care served as the dependent variable. This thesis has focused on the visits conducted at hospital-based EDs available around the clock.

ED visits: A dichotomous variable of ED visits (coded as no (0); yes (1)) was used in studies II and IV. An ED visit was defined as the first ED visit of older adults in 2015 in study II and as the first ED visit by a participant of study IV during a 4-year follow-up. Study III used a continuous variable on the number of ED visits during a 4-year follow-up. Regional health care databases were used to assess ED visits in studies II and IV, while the National Patient Register was the data source in study III.

ED revisits were defined as at least one ED visit within 30 days of the initial ED visit, a definition often used in research (70, 71). In studies I and II, ED revisits were used as a dependent variable and information was obtained from regional health care databases.

Frequent use of ED care: In previous research, a varying number of visits (≥ 4 - ≥ 6) over different periods have been used to define the frequent use of ED care (107, 108). In study IV, frequent use of ED care was operationalised as ≥ 4 visits during a four-year follow-up. The health care database of Region Blekinge was the source of data.

6.5.2 Independent variables

This section describes contextual factors, individual-level factors, care use measured at the individual level, and other explanatory variables included in this thesis. Table 2 presents an overview of the dependent and independent variables studied in this thesis.

6.5.2.1 Contextual factors

Contextual factors at the municipality level were analysed as independent variables in study II: the *proportion of persons aged ≥ 80 years in the total population*, *annual social care expenditures per person aged ≥ 80 years*, *positive home help quality*, *median days in residential care*, and *distance to the ED*. The proportion of persons aged 80+ was classified as a predisposing factor, while other contextual factors were defined as enabling resources. Information on municipal-level data was obtained from Kolada (101), except for distance to the ED, which was estimated using Google maps and measured in kilometers of the shortest route from the centre of the municipality of residence to the nearest ED (7). Because one of the EDs in Dalarna (Säter) is an exclusively psychiatric care facility, it was excluded from estimating the distance to the ED.

Positive home help quality: Two indicators were used to measure positive home help quality: 1) response, trust, and safety and 2) influence and adequate time. These indicators are included in an annual national survey distributed to adults aged ≥ 65 years receiving home help or residential care (109). The response rates for the survey varied from 48 to 66% across the Dalarna municipalities.

The first indicator is comprised of three questions:

- Do home help staff members usually respond well to you? (response alternatives: yes, always, often, sometimes, seldom, never, don't know)
- Do you trust the staff who come to your home? (response alternatives: yes, for all staff members, yes, for most, yes, for some, not anyone, don't know)
- Do you feel safe living in your home with the support of home help? (response alternatives: very safe, relatively safe, neither safe nor unsafe, relatively unsafe, very unsafe)

In the Kolada database, the proportion of individuals within each municipality who provided positive responses to all three questions (yes always; yes, for all or yes for most; very safe) is recorded.

Table 2. An overview of the independent and dependent variables used in this thesis

	ED visits	ED revisits	Frequent use of ED care
Contextual factors			
Proportion of persons aged ≥ 80 years in the total population	x	x	
Annual social care expenditures per person aged ≥ 80 years	x	x	
Positive home help quality	x	x	
Median days at residential care	x	x	
Distance to the nearest ED	x	x	
Individual factors			
<i>Predisposing factors</i>			
Age	x	x	x
Gender	x	x	x
Education	x	x	x
<i>Enabling resources</i>			
Living arrangements	x	x	x
Informal care receipt	x		
Social connections	x		
Social support	x		
<i>Need indicators</i>			
HRQoL	x		x
ADL	x		x
IADL	x		x
Number of diseases	x	x	x
Polypharmacy		x	
HAT	x		
MADRS	x		
Last year of life		x	
Care Use			
Primary health care visits in the previous year	x	x	
Specialist care visits in the previous year	x	x	
Hospital admissions in the previous year	x	x	
ED visits in the previous year		x	
Disposition at the initial ED-visit		x	
Social care receipt	x	x	x

The second indicator is comprised of three questions:

- Do home help staff members usually take account of your suggestions and wishes on how help should be provided?
- Can you usually influence the time at which home help staff come to your place?
- Do home help staff members usually have adequate time to perform all their tasks at your place?

Response alternatives for each question were: yes always, often, sometimes, seldom, never, and don't know (109). As per the previous indicator, this variable presents the proportion of individuals within each municipality with positive responses (yes always, often) on all three questions.

6.5.2.2 *Individual factors*

Individual-level factors were considered predisposing factors, enabling resources, and need for care factors.

6.5.2.2.1 Predisposing factors

This thesis chose age, gender, and education as the predisposing factors. *Age*, calculated from the date of birth, was used as an independent variable in all four studies. Information on the date of birth was obtained from LISA in studies I and II, while SNAC was the data source in studies III and IV. Changes in health status and living arrangements are common in adults ≥ 80 years that could impact social and health care use (e.g., a longer length of stay at EDs in the ≥ 80 age group compared to younger age groups) (110). Therefore, age groups were dichotomised where appropriate. In study I, age was used as a dichotomous variable (65-79 and ≥ 80). In study II, the target population was ≥ 80 and age served as a continuous variable. Age stratified analyses were performed in studies III (60-77 and ≥ 78) and IV (66-80 and > 80).

Gender was used as a dichotomous variable in regression models in studies I-IV. LISA was the data source in studies I and II and SNAC in studies III and IV.

Level of *education* was estimated from years of schooling. In study I, data on education were obtained from LISA and categorised into three groups: lower (primary and lower secondary), medium (upper secondary and post-secondary, < 2 years), and higher (post-secondary, ≥ 2 years). In study III, the SNAC-K was the data source, and education was categorised as primary, high (secondary, upper secondary, or vocational), and university (post-secondary, university degree). In study IV, the SNAC-B was the data source and education was a dichotomous variable ('primary' and 'upper,' including 'high' and 'university').

6.5.2.2.2 Enabling resources

Studies I, III, and IV included enabling resources as independent variables: living arrangements, informal care, social connections, and social support.

Living arrangements were used as a dichotomous variable and defined as ‘living alone’ or ‘cohabiting (living with spouse, children, or sibling).’ In study I, living arrangements was computed from the LISA database. In study IV, the question ‘who lives with the participant’ in SNAC-B was used to measure the variable on living arrangements.

In study III, *informal care* receipt and whether received assistance is sufficient were measured from four questions of the SNAC-K:

- i. In the previous month, did you receive any service assistance (e.g., cooking, grocery shopping, other purchases, cleaning, laundry, dishes, transportation) from relatives, friends, neighbours or volunteer/non-profit organisations? (response alternatives were: yes, no)
- ii. Did you receive enough assistance for instrumental services from friends/relatives/volunteer organisations? (response alternatives were: yes, no, don’t know)
- iii. In the past week, did you receive any assistance with personal care (e.g., eating, dressing, undressing, toilet need, bathing, washing, moving around) from relatives, friends, neighbours, or volunteer/non-profit organisations? (response alternatives were: yes, no)
- iv. Did you receive enough assistance with personal care from friends/relatives/volunteer organisations? (response alternatives were: yes, no, don’t know)

An index was developed based on these four questions and categorised into three categories: no informal care, received informal care and needs were met, and received informal care and needs were not met (response alternatives no and don’t know were regarded as needs are not met).

The *social connections* index in study III was comprised of:

- i. the number of living children (0, 1, 2, 3, 4, 5, ≥ 6)
- ii. marital status (married, widowed/divorced, unmarried)
- iii. living arrangement (residential care, alone, cohabiting)
- iv. the number of people do you feel you know well and can talk to about most things (0, 1-2, 3, 4-6, 7-9, 10-15, 16-30, >30).
- v. How often are you in touch with parents, children, son-in-law/daughter-in-law, grandchildren, siblings, other relatives, neighbours, or friends, either in person or remotely? (Daily, more than twice/week, weekly, more than twice/month, quarterly, more than once/year, less often, never).

Responses were standardised into z-scores based on the means and standard deviations of each SNAC-K wave and averaged into a single score (111). A three-category variable was developed based on the lowest, medium, and highest tertiles of social connections.

A *social support* index used in study III consisted of six questions:

- i. “Are you satisfied with your contacts? (“yes,” “no,” “don’t know,” “not applicable”)?”
- ii. “Could you get help from anyone in case of illness or other practical troubles?” Response options were “yes, without a doubt,” “yes, probably,” “no, probably not,” “no, not at all,” and “don’t know.”
- iii. “Do you know anyone who could a) help you write an official letter? b) give you proper personal/emotional support? c) accepts you for all your good and bad qualities?” Response options were “yes, without a doubt,” “yes, probably,” “no, probably not,” “no, not at all,” and “don’t know.”
- iv. “If you are part of an association, would you say you feel a strong sense of belonging to this group?” Response options were “to a high degree,” “to a certain degree,” “not especially,” “not at all,” “don’t know.”
- v. “Do you feel a strong sense of kinship with your a) relatives? b) neighborhood?” Response options were “to a high degree,” “to a certain degree,” “not especially,” “not at all,” “don’t know.”
- vi. “Are you part of a group of friends/acquaintances who have something in common or do some activity together?” Response options were: “yes,” “no,” “don’t know.”

Responses were standardised into z-scores based on the means and standard deviations of each SNAC-K wave and averaged into a single score (111). A three-category variable was developed based on the lowest, medium, and highest tertiles of social support.

6.5.2.2.3 Need for care factors

Variables on health status were included in studies I-IV as indicators of the need for care.

Perceived health

HRQoL was measured using a Short-Form Health Survey (SF-12) in SNAC-B. This validated instrument is widely used in older adults (112). The SF-12 measures two constructs of HRQoL: physical and mental. Physical HRQoL includes a subjective assessment of general health, difficulty performing moderate activities, climbing several flights of stairs, pain, and accomplishing less due to physical health. Mental HRQoL assessment is based on achieving less due to mental health, not being careful in daily activities, sadness, limited social interaction, feeling of calmness, energy level, and sadness. SF-12 scores were computed using Sullivan’s algorithm (113). The score of each dimension ranges from 0 (poor HRQoL) to 100 (good HRQoL). Dichotomous variables were constructed using the lowest quartile of each dimension of HRQoL in study IV.

Data on the *activity of daily living* (ADL) was obtained from SNAC-B. The Katz index was used to measure the ADL. The index was constructed from six items on ability: bath/shower, dress/undress, going to the bathroom, getting in and out of bed, continence, and feeding

(114). A dichotomous variable defined as ‘independent in all six items’ and ‘dependent in at least one ADL item’ was used in study IV.

The *instrumental activity of daily living* (IADL) index was based on four items in SNAC-B: cleaning, transportation, shopping, and cooking (115). Responses, used in study IV, were dichotomised as ‘independent in all four items’ and ‘dependent in at least one item.’

Objective health

The number of diseases: In study II, information on registered diagnosis (based on the ICD-10 classification) at inpatient and outpatient visits during 2014 was obtained from the regional database and converted using a measure of chronic multi-morbidity in older adults into number of diseases (116). The measure of multi-morbidity defined a disease or condition as chronic if it had a prolonged duration and either required a long period of care or is associated with adverse health outcomes such as functional decline or worsening quality of life (116). Self-reported diseases and illnesses in SNAC-B were used to define the number of diseases/illnesses in study IV.

Polypharmacy: The Swedish Prescribed Drug Register was the data source for measuring polypharmacy in study I. Drug use during the 3 months preceding the initial ED visits was estimated by using information about when the prescription was filled, the amount of drug dispensed, and the prescribed dosage (for details, see Wallerstedt et al., (117)). Polypharmacy was defined as no polypharmacy (0-4), polypharmacy ($\geq 5 < 10$), and excessive polypharmacy (≥ 10) (118).

The *Health Assessment Tool* (HAT) has been developed as an integrated measure of clinical and functional health. The HAT is based on five health indicators: the number of chronic diseases, physical function measured through gait speed whereby participants are required to walk 6 meters or 2.44 meters if they report walking quite slowly, cognitive function measured by the Mini-Mental State Examination, ADL, and IADL in SNAC-K. The HAT score ranges from 0 (poor health) to 10 (good health). The HAT is a reliable health assessment tool and a predictor of adverse health outcomes (119). In study III, HAT was used as an indicator of health status and an approximate measure of need for health care.

Montgomery-Åsberg Depression Rating Scale (MADRS) in SNAC-K was used as an indicator of mental health status in study III. The MADRS, a validated measure of depression symptoms, contains 10 items with scores ranging from 0 (good health) to 60 (poor health) (120).

Last year of life is a predictor of higher health care use and served as an independent variable in study I. The last year of life variable was measured as mortality within 365 days after the initial ED visit. Information on the date of mortality was obtained from the LISA database.

6.5.2.3 Care Use

The number of primary health care visits in the previous 12 months, an indicator of primary care availability, was measured from the regional health care database and used as an ordinal variable in study I (0, 1-4, 5-10, ≥ 11) and as a continuous variable in study II.

The number of specialist care visits 12 months before the initial ED visit (or during 2014 for those who did not visit the ED during the study period) was measured from the regional health care database and used as a continuous variable in study II.

The number of hospital admissions 12 months before the initial ED visit (or during 2014 for those who did not visit the ED during the study period) was measured from the regional health care database and used as a continuous variable in study II.

The number of ED visits 12 months before the initial ED visit was measured from the regional health care database and used as an ordinal variable (0, 1-4, 5-10, ≥ 11) in study I.

Disposition at the initial ED visit (discharged home, admitted to inpatient care) was measured from the regional health care database and used to explain variance in ED revisits within 30 days of the initial ED visit.

In study I, *social care status* was measured at the initial ED visit and defined as living at home with no home help, living at home with home help, and living in residential care. Study II focused on home-living older adults, and social care status was defined as receiving a) no home help, b) instrumental services, c) personal care, and d) both instrumental and personal care. The social services register was the source of data in studies I and II. Social care status in study IV was assessed from a question in SNAC-B: 'Where does the participant reside?' and used as a dichotomous variable ('residential care' and 'home-living').

6.5.2.4 Other variables

Time: In studies I and II, the number of days between initial ED visits and revisits was estimated from the dates of visits obtained from health care databases. Exposure time in study III was estimated in days from the interview date at W1, W3, and W5 of SNAC-K to the end-of-follow up, i.e., 4 years after the interview date at each time point or date of death. The number of days spent in inpatient care during the study period, obtained from the National Patient Register, was subtracted from exposure time. In study IV, time-to-event data were computed from the date of the interview in SNAC-B to the initial ED visit until 31 December 2011. Information on ED visits was obtained from the health care database.

Region and municipality of residence: Information on the region and municipality of residence in studies I and II was obtained from the LISA database. Persons who moved out from these regions during the study period were excluded from the study sample.

Reasons for seeking care and diagnosis at the ED visit: Information on reasons for ED visits and registered diagnosis (based on the ICD-10 classification system) at the ED visit was obtained from regional health care databases. This thesis is based on four study settings, and

two studies were based on Dalarna. Because study I was a register-based study on adults ≥ 65 years, including community-living and living at residential care facilities, reasons for ED visits and registered diagnosis at the initial ED visit were presented only for the Dalarna region.

6.6 DATA ANALYSES

This section describes the statistical methods used for data analyses.

6.6.1 Descriptive and bivariate analyses

In studies I-IV, descriptive analysis was performed: absolute frequencies, relative frequencies, mean, standard deviation, median, and range. In study IV, a chi-squared test for binary data and a t-test for interval data were performed to compare the characteristics of younger-old and older-old study participants.

6.6.2 Logistic regression

Logistic regression examines the relationship between a binary/dichotomous dependent variable and one or several independent variables that could be binary, ordinal, or continuous. The coefficient estimates of logistic regression explain the increase or decrease in the log-odds of outcome for a unit change in the explanatory variable. Odds ratios (ORs) are an easier way to interpret logistic regression because ORs don't require algorithmic transformations when interpreting results (121).

In study I, multivariable logistic regression analyses were performed to assess the association between explanatory variables and ED revisits within 30 days of the initial visit. Model 1 included variables on sociodemographic factors and living arrangements; model 2 included social care status and factors related to health status in addition to those in model 1; model 3 had all the variables in models 1 and 2 plus health care use. Results were presented as ORs and 95% confidence intervals (CIs). The Hosmer and Lemeshow goodness-of-fit test was performed to determine whether the regression models fit the data (122), where $p < 0.05$ indicates poor fit.

In study II, bivariate logistic regression was used to estimate the association between independent and dependent variables (initial ED visit and revisits). Variables significant at the bivariate level were included in the multivariable models. Sequential logistic regression was conducted in three model steps. Individual-level factors on demographic and health were entered in model 1. Model 2 included individual-level factors on home help receipt and health care use in addition to those contained in model 1. Contextual factors were entered in model 3 to determine whether there was a significant improvement in the models after entering all individual-level factors. The deviance statistic (-2LL), Cox and Snell's R^2_{CS} , and Nagelkerke R^2_N test were used for model fitting (121). The deviance describes the unexplained variance in the model, so the smaller the deviance value, the better the model fits the data. R^2_{CS} and R^2_N are approximations of the R^2 statistic for multiple linear regression, which describes the variance in the dependent variable explained by the model. R^2_{CS} and R^2_N are calculated

differently and may provide different estimates. Thus, both statistics were used for logistic regression.

6.6.3 Generalised linear mixed models

Generalised linear mixed models are models on repeated measures or multilevel modeling. Multilevel modelling separates the within-group from the between-group effects (123). Data in study II were nested within municipalities. Therefore, the relevance of nested models was considered by multilevel logistic regression. The variance estimate at the municipality level was 0.064 for the initial ED visit and 0.019 for the revisit, providing intraclass coefficients of 0.019 and 0.005. Thus, only 1.9% of the variance in the initial visit and 0.57% in the revisit could be explained by the municipality of residence, i.e., considerably below the conventional level, indicating a multilevel analysis is required (124). Therefore, simple logistic regression was used.

6.6.4 Generalised estimating equations (GEEs)

GEE is a statistical method for analysing repeated measures or clustered data. In repeated measures, observations are measured for the same participant at different time points, and there are multiple cases for a participant in the dataset. GEE assumes that cases are dependent within the subject and independent between subjects. In study III, data from three waves of a longitudinal study (SNAC-K) were pooled to increase the number of observations. The dependent variable was the number of ED visits that were not normally distributed; therefore, a GEE negative binomial regression was used, which accounts for over-dispersion in the outcome variable (i.e., most participants had no ED visit). The offset variable, a scale variable based on exposure time, was used to consider the exposure time for each participant in the observation period. Multivariable GEE negative binomial regression models were run whereby covariates were added to the models: model 1 only included the exposure variables; model 2 adjusted for age, gender, and education; and model 3 adjusted additionally for physical and mental health. Results were presented as incidence rate ratios (IRRs) with 95% CIs.

6.6.5 Cox proportional hazard model

Cox regression analysis models for survival-time (time-to-event data) and assume proportional hazards across different covariate values over time. The shape of the survival function and regression coefficients is based on all observed cases, including those with the outcome and censored cases at the follow-up. Independent variables could be categorical or continuous. In study IV, multivariable cox proportional hazard models were used to test the association between HRQoL and time to the ED visit. The model entered all the explanatory variables simultaneously at the first step, and a backward likelihood ratio selection method was used. The likelihood ratio accounts for the likelihood of a variable satisfactorily explaining the outcome (125). In the backward selection, variables are excluded from the models in steps, and the final model keeps only those variables that satisfactorily explain the

variance in the outcome variable. Results were presented as hazard ratios (HRs) with 95% CIs.

6.7 ETHICAL CONSIDERATIONS

Studies I and II were register-based studies. Stockholm's Regional Ethical Review Board has provided ethical approval for these studies (reg.no. 2016/299-31). Study III was based on the data from the SNAC-K and the National Patient Register. All waves of SNAC-K and the use of the National Patient Register have been approved by the Regional Ethical Board in Stockholm (reg.no. 01-114; 26-2007; 2013/3:6; 2022-03078-02). Study IV was based on the SNAC-B and Blekinge County Hospital's electronic health records. Study IV was approved by the Ethics Committee of Lund University (LU 128-00, LU 604-00).

National and regional registers used in this thesis cover the entire population and are linked to a unique personal identification number assigned to all residents of Sweden. The registers were linked via encrypted personal numbers to prevent the identification of individuals. Statistics Sweden SCB secured the key. The data are stored securely and only authorised persons can access the data.

Register studies do not require direct contact with participants; therefore, informed consent is not a pre-requisite in register studies and all individuals of a population are included.

Although informed consent is generally important in research studies, the argument that informed consent is not needed for register studies is based on the risk of selection bias in terms of low participation rate, low participation of vulnerable groups, difficulty in studying rare exposures or outcomes, cost, and time to obtain consent from large population groups (126).

In SNAC-K and SNACK-B, written informed consent was obtained from the participants. Next of kin were asked for consent for cognitively impaired participants. Information on the study context and purpose of the study was provided to the study participants. Participation in the study was voluntary; all participants were assured of confidentiality and could terminate their participation at any time. Older adults can be considered a vulnerable population. Interrupting the interview when the respondent complains of being tired could be a way to reduce the burden of participating in the interview. During the interviews, participants were asked if they were willing to proceed, and if a participant showed discomfort or fatigue, the interview was discontinued. Data on the personal identification were removed and assigned artificial identification numbers. The key for all the personal data is secured and only authorised persons have access to the key. The SNAC procedure complies with the ethical guidelines of the Declaration of Helsinki.

In summary, the guidelines of the Swedish Council for Research in the Humanities and Social Sciences and the Declaration of Helsinki were carefully followed in this thesis. The risk for integrity violation is minimal because all studies used pseudo-anonymous data. Moreover, the data are stored securely and the results are presented at the group level in each study.

7 RESULTS

This section describes the main results of this thesis. Reasons for and diagnosis at ED visits are summarised first, and then a conceptual framework is used to summarise factors associated with ED care use. In the tables, statistical significance is presented with colours: red shows higher ED care use, green lower ED care use, yellow mixed findings in four studies, grey no significant association, and white that the association is not explored for that specific dependent variable.

7.1 REASONS FOR SEEKING ED CARE AND DIAGNOSIS AT THE INITIAL ED VISIT

7.1.1 Reasons for seeking ED care (Study I)

There were 16 688 adults ≥ 65 years in Dalarna who had at least one ED visit during 2014 (Study I). Chest pain accounted for 11.5% of these ED visits in younger-old adults (65-79 years; N = 10 162), followed by abdominal pain, dyspnoea, extremities problem, dizziness, injuries to arm or hand, abnormal heart rhythm, infection, pain extremities, and stroke (Figure 2). In older-old adults (≥ 80 years; N = 6 526), dyspnoea was the most common reason for seeking ED care (10.8%) (Figure 3). Chest pain, abdominal pain, hip or thigh injuries, dizziness, head injuries, extremity problems, stroke, infection, and arm or hand injuries were the other common causes of seeking ED care in older-old adults.

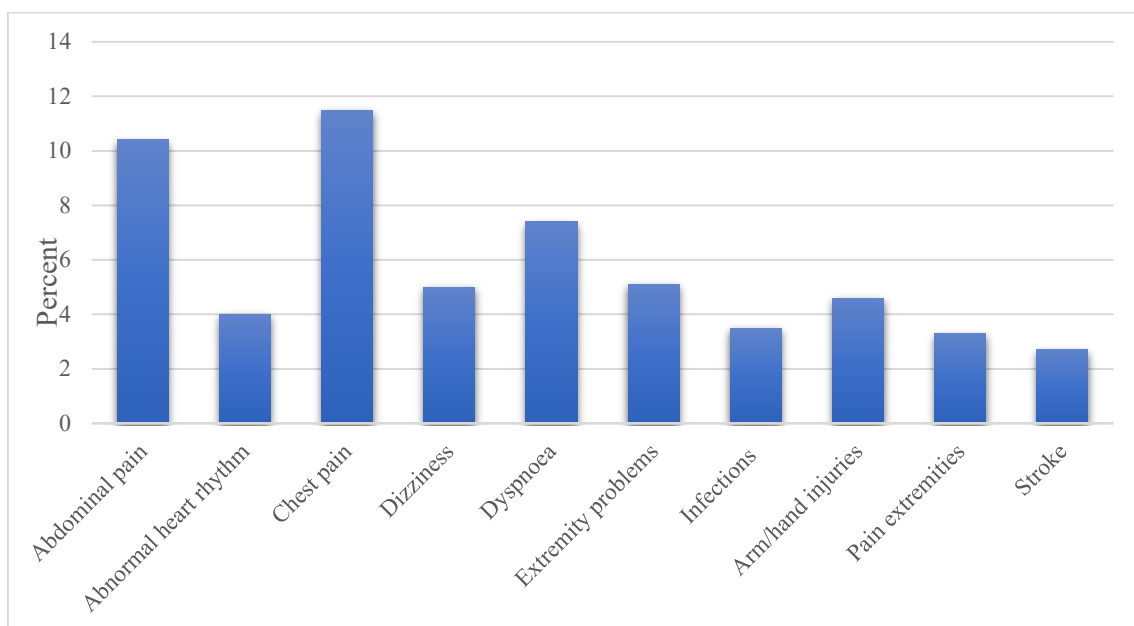


Figure 2. Top 10 reasons for younger-old adults (65-79 years; N = 10 162) to seek ED care in Dalarna in 2014 (Study I)

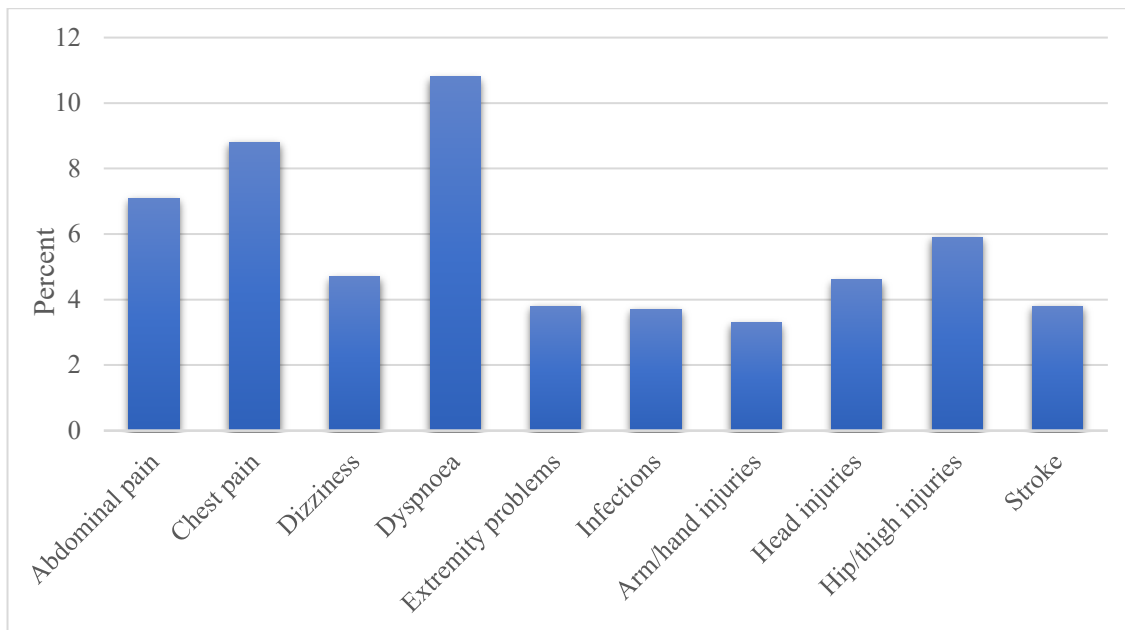


Figure 3. Top 10 reasons for seeking ED care of older-old adults (≥ 80 years; $N = 6\,526$) in Dalarna in 2014 (Study I)

7.1.2 Diagnoses at the initial ED visit (Study I)

Diagnoses at the initial ED visit were classified using the ICD-10 codes. Symptoms and abnormal lab findings without a precise disease specification accounted for 21.9% of the ED visits in younger-old adults (Figure 4). Injuries (15.2%), circulatory system-related diseases (15.0%), musculoskeletal problems (9.7%), and diseases of the digestive system (7.3%) were other common diagnoses at the ED. In older-old adults, circulatory system-related diseases (18.2%), symptoms and abnormal lab findings without a clear disease specification (18.1%), and injuries (17.6%) were the most common diagnoses at the initial ED visit (Figure 5).

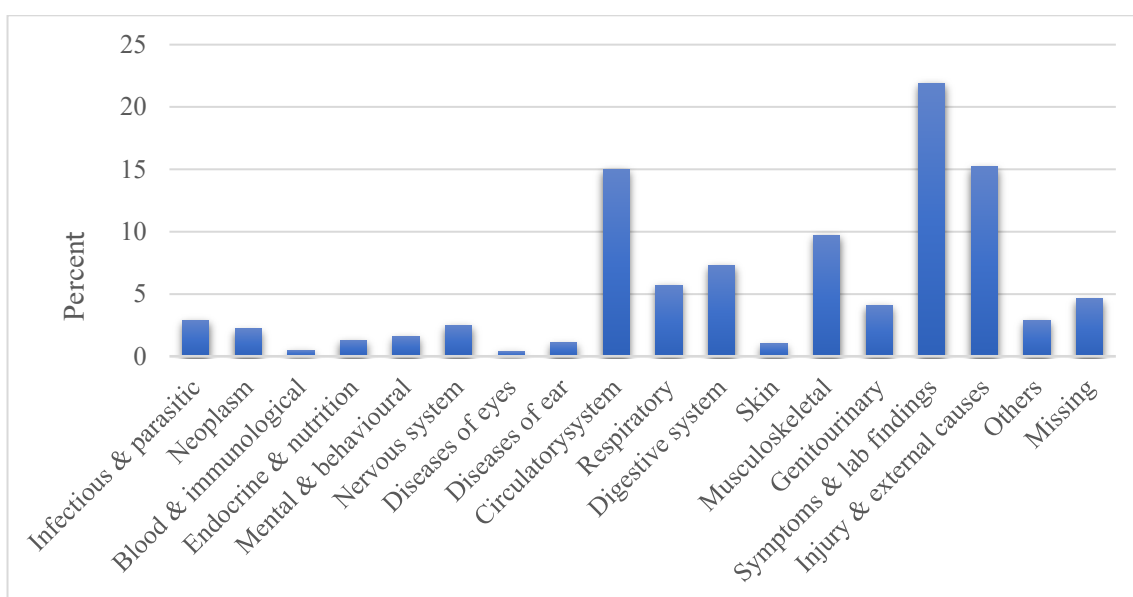


Figure 4. Diagnosis at the initial ED visit of younger-old adults (65-79 years; $N = 10\,162$) in Dalarna in 2014

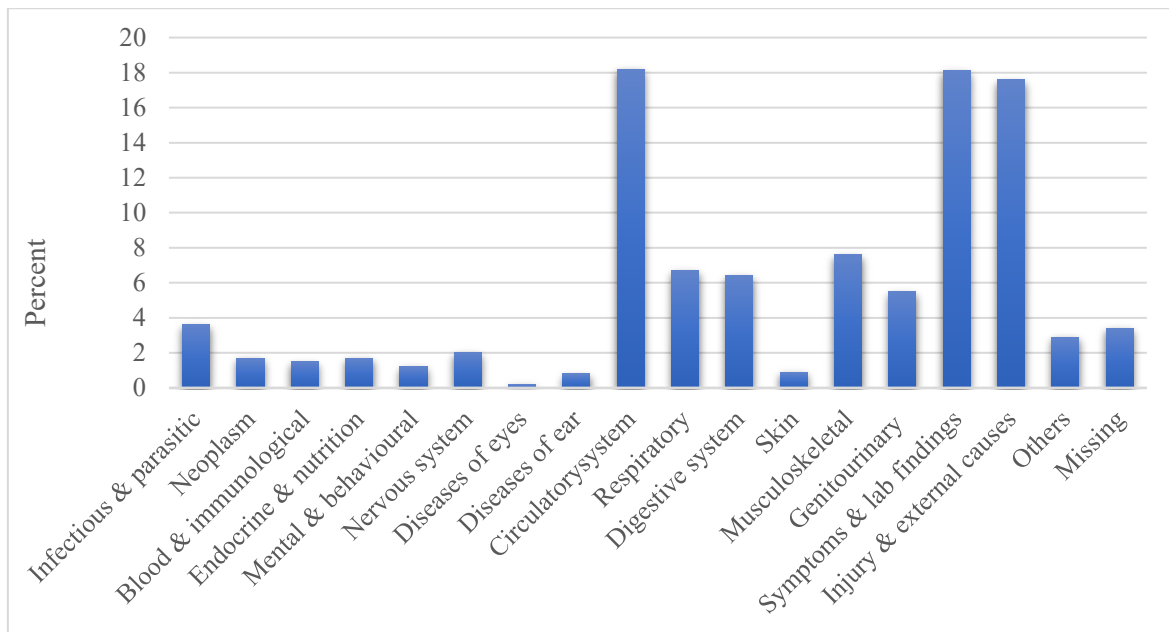


Figure 5. Diagnosis at the initial ED visit of older-old adults (≥ 80 years; $N = 6\,526$) in Dalarna in 2014

7.2 CONTEXTUAL FACTORS ASSOCIATED WITH ED CARE USE (STUDY II)

Contextual factors at the municipality level were analysed in study II. These factors included the proportion of persons aged ≥ 80 years in the total population, annual social care expenditures per person aged ≥ 80 years, positive home help quality, median days in residential care, and distance to the ED (Table 3).

Contextual factors improved the overall fit of the statistical model, explaining ED visits and ED revisits within 30 days of the initial ED visit. A higher proportion of persons ≥ 80 years in the total population was significantly associated with ED visits (OR 1.09; 95% CI 1.05-1.13). Farther distance to the nearest ED was significantly negatively associated with ED visits (OR 0.99; 95% CI 0.98-0.99). None of the contextual factors included in study II were statistically significant with ED revisits.

Table 3. Adjusted models for the association between contextual factors and ED care use in older-old adults (≥ 80 years) in study II

	ED visits	ED revisit	Frequent use of ED care
Contextual factors			
Higher proportion of persons aged ≥ 80 years in the total population			
Annual social care expenditures per person aged ≥ 80 years			
Positive home help quality			
Median days at residential care			
Distance to the nearest ED			

Note: The model of ED visits is adjusted for individual-level factors for age, number of diseases, home help receipt, primary health care visits, specialist care visits, and hospital admissions. The ED revisit model was adjusted for the number of diseases, home help receipt, primary health care visits, hospital admissions, and disposition at the initial ED visit.

- Statistically significant association with higher use of ED care
- Statistically significant association with lower use of ED care
- No statistical significance
- Not explored

7.3 INDIVIDUAL-LEVEL FACTORS ASSOCIATED WITH ED CARE USE

7.3.1 Predisposing factors (Studies I-IV)

Age, gender, and level of education were the predisposing factors included in this thesis (Table 4). Study I included adults ≥ 65 years. No statistical significance was observed between age and ED revisits (Study I). Study II included adults ≥ 80 years. The results showed that age was significantly associated with ED visits in older-old adults (OR 1.06; 95% CI 1.05-1.07). However, there was no significant association between age and ED revisits. Age-stratified analyses were conducted in studies III and IV. In study III, age was associated with ED visits, but only in younger-old adults (IRR 1.03; 95% CI 1.01-1.05). The risk of ED visits was significantly higher in older-old adults compared to younger-old adults in study IV (HR 1.74; 95% CI 1.34-2.25). No statistical significance was observed between age and the frequent use of ED care (Study IV).

A significant association was observed between male gender and higher odds of ED revisits among adults ≥ 65 years in study I (Dalarna: OR 1.14; 95% CI 1.05-1.24, Stockholm: OR 1.11; 95% CI 1.07-1.15). There was no statistically significant association between gender and ED revisits among older-old adults in study II. Gender was not significantly associated with ED visits (Studies II-IV) and the frequent use of ED care (Study IV).

No statistical significance was observed between levels of education and ED visits (Studies III & IV). A low level of education was associated with ED revisits in Stockholm (OR 1.05; 95% CI 1.00-1.09). This association was not seen in Dalarna among adults ≥ 65 years (Study

I). A low level of education was also associated with the frequent use of ED care in younger-old adults in study IV (OR 2.32; 95% CI 1.10-4.88).

Table 4. Adjusted models for the association between individual-level predisposing factors and ED care use

Individual-level predisposing factors	ED visits	ED revisit	Frequent use of ED care
Age group ≥ 65 (Studies I & IV)			
Age			
Younger-old	Ref.	Ref.	Ref.
Older-old			
Male gender			
Low-level education [#]			
Younger-old adults (Studies III & IV)*			
Age (continuous)			
Male gender			
Low-level education [#]			
Older-old adults (Studies II, III, & IV)[□]			
Age (continuous)			
Male gender			
Low-level education [#]			

Note: Study I adjusted for age, gender, education, living arrangements, social care receipt, health, and previous primary health care and ED visits. Study II adjusted for contextual factors, age, gender, number of diseases, home help receipt, and health care use in the previous year. Study III adjusted for social connections, social support, informal care, age, gender, education, and physical and mental health. Study IV adjusted for HRQoL, age, gender, education, living arrangements, living in residential care, ADL, and IADL. [#]Reference category was post-secondary/university education in studies I and II while secondary/post-secondary/university in study IV.

*Younger-old adults: 60<78 study III; 66-80 study IV

[□]Older-old adults: ≥ 78 years study III; ≥ 80 years study II; >80 years study IV

- Statistically significant association with higher use of ED care
- Mixed results
- No statistical significance
- Not explored

7.3.2 Enabling resources (Studies I, III, & IV)

Living arrangements, social connections, social support, and informal care were studied as enabling resources explaining ED care use (Table 5). Living arrangements was considered an independent variable in studies I and IV. No significant associations were observed between living alone and ED care use. Study III explored the association between informal care receipt and ED visits. This association proved significant at the bivariate level but not in the adjusted models.

Table 5. Adjusted models for the association between individual-level enabling resources and ED care use

	ED visits	ED revisit	Frequent use of ED care
Individual-level enabling resources			
<i>Age group ≥65 (Studies I & IV)</i>			
Living alone			
<i>Younger-old adults (Studies III & IV)*</i>			
Living alone			
Informal care receipt			
No informal care	Ref.		
Received and needs met			
Received and needs not met			
Social connections			
Low level	Ref.		
Medium level			
High level			
Social support			
Low level	Ref.		
Medium level			
High level			
<i>Older-old adults (Studies III, & IV)□</i>			
Living alone			
Informal care receipt			
No informal care	Ref.		
Received and needs met			
Received and needs not met			
Social connections			
Low level	Ref.		
Medium level			
High level			
Social support			
Low level	Ref.		
Medium level			
High level			

Note: Study I adjusted for age, gender, education, social care receipt, health, and previous primary health care and ED visits. Study III adjusted for age, gender, education, and physical and mental health. Study IV adjusted for HRQoL, age, gender, education, living arrangements, living in residential care, ADL, and IADL.

*Younger-old adults: 60<78 study III; 66-80 study IV

□Older-old adults: ≥78 years study III; ≥80 years study II; >80 years study IV

- Statistically significant association with lower use of ED care
- No statistical significance
- Not explored

No statistical significance was found between levels of social connections and ED visits. However, medium and higher levels of social support were associated with fewer ED visits, but only in older-old adults in study III (medium vs. low levels of social support IRR 0.77; 95% CI 0.59-0.99; high vs. low levels of social support IRR 0.77; 95% CI 0.56-0.99).

7.3.3 Need for care factors (Studies I-IV)

Health status, including perceived and objective health, was used to indicate the need for care. An overview of the results is presented in Table 6.

Perceived health status was measured by HRQoL and functional ability by dependence on ADL and IADL (Study IV). A low level of physical HRQoL was significantly associated with ED visits in adults aged ≥ 65 years (HR 1.68; 95% CI 1.29-2.20), younger-old adults (HR 1.97; 95% CI 1.34-2.88), and older-old adults (HR 1.46; 95% CI 1.02-2.10). There was no significant association between physical HRQoL and frequent use of ED care (Table 6). Low mental HRQoL was not associated with ED visits; however, there was a significant association between low level of mental HRQoL and frequent ED use in adults ≥ 65 years (OR 1.88; 95% CI 1.07-3.32). Dependence on ADL was not associated with ED visits, although we did find a significant association between dependence on ADL and frequent use of ED care in younger-old adults (OR 3.68; 95% CI 1.01-13.29). No statistically significant associations were detected between dependence on IADL and ED visits or frequent use of ED care.

Objective health status: There was no significant association between the number of diseases and ED care use in adults ≥ 65 years in study IV (Table 6). In younger-old adults, the number of diseases was significantly associated with ED visits (HR 1.15; 95% CI 1.02-1.29) but not with frequent use of ED care (Study IV). In older-old adults, there was a significant association between the number of diseases and ED visits in study II (OR 1.12; 95% CI 1.10-1.15) but not in study IV. Regarding ED revisits and frequent use of ED care, no significant associations were observed with the number of diseases in older-old adults (Studies II & IV).

Polypharmacy ($\geq 5 < 10$ drugs) in adults ≥ 65 years was significantly associated with ED revisits in Stockholm (OR 1.21; 95% CI 1.16-1.26) but not in Dalarna (Study I). A significant association was observed between excessive polypharmacy (≥ 10 drugs) and ED revisits in Dalarna (OR 1.38; 95% CI 1.17-1.63) and Stockholm (OR 1.32; 95% CI 1.24-1.40). Being in the last year of life was significantly associated with a higher odds of ED revisits in adults ≥ 65 years (Dalarna: OR 1.53; 95% CI 1.36-1.71; Stockholm: OR 1.23; 95% CI 1.13-1.34) (Study I). In study III, poor physical health status (as measured by HAT) was significantly associated with higher ED visits in younger-old (IRR 0.81; 95% CI 0.75-0.88) and older-old adults (IRR 0.86; 95% CI 0.82-0.91). A significant association was seen between poor mental health measured by MADRS and higher ED visits in younger-old adults (IRR 1.04; 95% CI 1.01-1.06), whereas associations between MADRS and ED visits were inconsistent in models with older-old adults (Study III).

Table 6. Adjusted models for the association between need for care and ED care use

	ED visits	ED revisit	Frequent use of ED care
Individual-level need factors			
<i>Age group ≥65 (Studies I & IV)</i>			
Low level of physical HRQoL [#]	Red		Grey
Low level of mental HRQoL [#]	Grey		Red
Dependent on ADL (≥1)	Grey		Grey
Dependent on IADL (≥1)	Grey		Grey
Higher number of diseases	Grey		Grey
Polypharmacy (≥5<10 drugs)		Yellow	
Excessive polypharmacy (≥10 drugs)		Red	
Last year of life		Red	
HAT			
MADRS			
<i>Younger-old (Studies III & IV)*</i>			
Low levels of physical HRQoL [#]	Red		Grey
Low levels of mental HRQoL [#]	Grey		Grey
Dependent on ADL (≥1)	Grey		Red
Dependent on IADL (≥1)	Grey		Grey
Higher number of diseases	Red		Grey
Polypharmacy (≥5<10 drugs)			
Excessive polypharmacy (≥10 drugs)			
Last year of life			
HAT	Red		
MADRS	Red		
<i>Older-old (Studies II, III, & IV)□</i>			
Low level of physical HRQoL [#]	Red		Grey
Low level of mental HRQoL [#]	Grey		Grey
Dependent on ADL (≥1)	Grey		Grey
Dependent on IADL (≥1)	Grey		Grey
Higher number of diseases	Yellow	Grey	Grey
Polypharmacy (≥5<10 drugs)			
Excessive polypharmacy (≥10 drugs)			
Last year of life			
HAT	Red		
MADRS	Yellow		

Note: Study I adjusted for age, gender, education, livings arrangements, social care receipt, primary health care, and ED visits. Study II adjusted for contextual factors, age, gender, home help receipt, and health care use. Study III adjusted for social connections, social support, informal care, age, gender, education, and physical and mental health. Study IV adjusted for age, gender, education, living arrangements, living in residential care, HRQoL, ADL, and IADL. [#]Lowest quartile of the total score.

*Younger-old adults: 60<78 study III; 66-80 study IV

□Older-old adults: ≥78 years study III; ≥80 years study II; >80 years study IV

Statistically significant association with higher use of ED care
 Mixed results
 No statistical significance
 Not explored

7.4 USE OF CARE AND ED CARE

7.4.1 Health care use (Studies I & II)

Twelve months before the initial ED visit, health care use included primary health care, specialist care, hospital admissions, and ED visits (Table 7). In study I, primary health care visits (≥ 11) 12 months before the initial ED visit was significantly associated with ED revisits in adults aged ≥ 65 years (Dalarna: OR 1.23; 95% CI 1.06-1.42; Stockholm: OR 1.10; 95% CI 1.02-1.18).

Table 7. Adjusted models for the association between the use of health care and ED care use

	ED visits	ED revisit	Frequent use of ED care
Health care use			
<i>Age group ≥ 65 (Study I)</i>			
Primary care visits in the previous 12 months (≥ 11) [#]			
Specialist care visits in the previous 12 months			
Hospital admissions in the previous 12 months			
ED visits in previous 12 months			
Admission to inpatient care at initial ED-visit			
<i>Younger-old*</i>			
Primary care visits in the previous 12 months			
Specialist care visits in the previous 12 months			
Hospital admissions in the previous 12 months			
ED visits in the previous 12 months			
Admission to inpatient care at the initial ED-visit			
<i>Older-old (Study II)[□]</i>			
Primary care visits in the previous 12 months (continuous)			
Specialist care visits in the previous 12 months			
Hospital admissions in the previous 12 months			
ED visits in the previous 12 months			
Admission to inpatient care at the initial ED-visit			

Note: Study I adjusted for age, gender, education, livings arrangements, social care receipt, and health. Study II adjusted for contextual factors, age, gender, number of diseases, and home help receipt. Study IV adjusted for HRQoL, age, gender, education, living arrangements, number of diseases, residential care, ADL, and IADL.

[#] Reference category was no primary care visit in previous 12 months before the initial ED visit.

*Younger-old adults: 60<78 study III; 66-80 study IV

[□]Older-old adults: ≥ 78 years study III; ≥ 80 years study II; >80 years study IV

	Statistically significant association with higher use of ED care
	Statistically significant association with lower use of ED care
	No statistical significance
	Not explored

In older-old adults, greater use of primary health care was associated with ED visits (OR 1.03; 95% CI 1.03-1.04) but not with ED revisits (Study II). The association between specialist care visits and ED visits or revisits was not statistically significant in older-old adults (Study II). In the same age group, hospital admissions in the previous 12 months were not associated with ED visits; however, a significant association was found between hospital admissions and ED revisits (OR 1.15; 95% CI 1.08-1.23; Study II). In study I, ED visits 12 months before an initial ED visit were associated with ED revisits within 30 days of an initial ED visit in adults ≥ 65 years (Dalarna: OR 4.90; 95% CI 2.28-10.52; Stockholm: OR 5.57; 95% CI 4.33-7.17). Concerning disposition at the initial ED visit, older-old patients admitted to inpatient care at the initial ED visit had significantly lower odds of ED revisits (OR 0.71; 95% CI 0.62-0.81) (Study II).

7.4.2 Social care for older adults and ED care use (Studies I, II & IV)

Residential care and home help are two main social care categories for older adults and are included as independent variables in this thesis. In study I, a significant association was revealed between residential care receipt and lower odds of ED revisits among adults aged ≥ 65 years in Stockholm (OR 0.70; 95% CI 0.63-0.77). In contrast, a statistically significant association was not detected between residential care and ED revisits in Dalarna (Table 8). In study IV, residential care receipt was not significantly associated with ED care use, except for frequent use of ED care in younger-old adults, though with a wide confidence interval (OR 11.69; 95% CI 1.04-131.62), suggesting the sample size was too small.

A significant association was found between home help receipt and ED revisits among adults ≥ 65 years of age in Dalarna (OR 1.25; 95% CI 1.12-1.39). No statistically significant association was found between home help and ED revisits in Stockholm (Study I). In study II, associations were explored between levels of home help, ED visits, and revisits in older-old adults. Compared to not receiving home help, levels of home help receipt were significantly associated with ED visits (instrumental services vs. no home help: OR 1.26; 95% CI 1.08-1.46; Personal care vs. no home help: OR 1.55; 95% CI 1.31-1.83; instrumental services & personal care vs. no home help: OR 2.48; 95% CI 2.26-2.73). Compared to not receiving home help, greater use of home help receipt (both instrumental services and personal care) was associated with ED revisits (OR 1.30; 95% CI 1.12-1.51).

Table 8. Adjusted models for the association between the use of social care for older adults and ED care use

	ED visits	ED revisit	Frequent use of ED care
Use of social for older adults			
<i>Age group ≥65 (Studies I & IV)</i>			
Residential care receipt [#]			
Home help receipt [♦]			
Home help, instrumental services			
Home help, personal care			
Home help, instrumental & personal care			
<i>Younger-old (Study IV)*</i>			
Residential care receipt [#]			
Home help receipt [♦]			
Home help, instrumental services			
Home help, personal care			
Home help, instrumental & personal care			
<i>Older-old (Studies II & IV)□</i>			
Residential care receipt [#]			
Home help receipt [♦]			
Home help, instrumental services			
Home help, personal care			
Home help, instrumental & personal care			

Note: Study I adjusted for age, gender, education, living arrangements, health, primary health care, and ED visits. Study II adjusted for contextual factors, age, gender, number of diseases, and health care use. Study IV adjusted for HRQOL, age, gender, education, living arrangements, number of diseases, ADL, and IADL.

[#]The reference category in study I was older adults living in ordinary homes without home help. In study IV, the reference category was older adults living in ordinary homes with or without home help.

[♦]The reference category was older adults living in ordinary homes without home help.

*Younger-old adults: 60<78 study III; 66-80 study IV

□Older-old adults: ≥78 years study III; ≥80 years study II; >80 years study IV

- Statistically significant association with higher use of ED care
- Mixed results
- No statistical significance
- Not explored

8 DISCUSSION

This thesis aimed to study the extent to which contextual factors, social care, health care use, health status, and social relations explain ED care use in older adults. A conceptual framework based on the models of Andersen (19) and Gruneir (10) was used to group independent variables into three main categories: contextual factors, individual-level factors, and care use. In this section, the main findings are summarised and discussed in relation to the conceptual framework and previous research, followed by a description of the strengths and limitations of the current methods.

8.1 MAIN FINDINGS

Previous research on ED care use has primarily focused on individual-level factors. In line with Andersen's model, this thesis (Study II) shows that ED care use in older-old adults can be further explained by contextual factors, which states that contextual factors are important for a better understanding of health care use (19). A higher proportion of individuals ≥ 80 in the population and a shorter distance to the nearest ED were the contextual factors associated with ED visits in older-old adults.

There were mixed findings on age, gender, and education level in individual-level predisposing factors based on statistical significance. However, there were no inconsistencies in the direction of associations between these independent factors and ED care use.

In individual-level enabling resources, higher levels of social support were associated with a lower number of ED visits, but only in older-old adults (Study III). The impact of adequate informal care on ED care use has rarely been considered in previous research. In this thesis, while not statistically significant in the adjusted model, a bivariate effect was observed regarding unmet needs for informal care and ED visits in older-old adults (Study III).

For the individual-level need for care factors, perceived (Study IV) and objective health status factors (Studies I-IV) explained ED care use in older adults. This finding implies that ED care use is driven by the need for care.

The number of primary health care visits for previous care use was associated with ED visits in older-old adults (Study II). Higher use of primary health care (≥ 11 visits), ED care (Study I), and hospital admissions (Study II) 12 months before the initial ED visit were associated with ED revisits. Of note, older-old adults admitted to the hospital at the initial ED visit were 29% less likely to revisit an ED within 30 days of the initial ED visit (Study II).

Older-old adults receiving home help for instrumental services and personal care were 148% more likely to visit an ED than those not receiving home help. The group with intensive home help also had a 30% higher likelihood of an ED revisit within 30 days of the initial ED visit (Study II).

8.1.1 Impact of contextual factors on ED care use

The Andersen model of health services use suggests that consideration of contextual and individual-level factors is essential for better understanding the use of health services (19). This thesis explored the role of contextual factors for ED care use in older-old adults by including municipal-level data on sociodemographic characteristics of the community (proportion of persons aged ≥ 80 years in the population) and enabling resources, including information on annual social care cost per person ≥ 80 years, the median length of stay at residential care, home help quality, and distance to the nearest ED (Study II). Previous research has shown that ED visits are higher in municipalities with higher proportions of older adults with chronic diseases and higher average age (7). Older adults often have multiple health problems and complex care needs. Rapid changes in health status and inadequate receipt of care services increase the risk of critical events that require ED care (10, 22). These events may explain the association between the contextual factor a higher proportion of adults aged ≥ 80 years in the population and ED visits (Study II). Evidence suggests that greater accessibility of primary health care services, home health care, home help services (7), and residential care considerably reduce ED visits (17). Thus, adequate access to social and health care services according to the needs of the local population could potentially mitigate avoidable ED visits.

The association between shorter distances to the nearest ED and ED visits is in line with previous studies (7, 18, 22, 73). This association may be partly explained by the "decay effect," that those living further from health care clinics have lower use than those living closer (18). To ensure equitable access to health care services, the use of health care should be explained by the need for care factors (19) rather than the place of residence. Therefore, future research on the access and geographical proximity of primary health care clinics in areas with and without hospital-based ED care could help understand the decision-making processes of older adults and their caregivers regarding when and where to seek health care (18).

For ED revisits, including contextual factors significantly improved the model fit statistics and variance explained by the statistical model (Study II). The direction of association between exposure and ED revisit was the same as in the model on ED visits; however, it did not reach statistical significance in the revisit models. It is thus possible that ED revisits are related to contextual variables (e.g., hospital bed rate) that were not available in the registers accessed and therefore not included in the models.

8.1.2 Individual-level predisposing factors

The increased risk of multiple health problems in old age explains consistent positive associations between higher age and ED visits. All studies in this thesis included gender as an independent variable and did not show any associations with ED care use, except study I where men were more likely than women to revisit ED within 30 days of the initial ED visit. Previous research on gender differences in health care use has shown that women are more

likely to seek health care at primary health care clinics while men are more likely to seek hospital care (127, 128). Perhaps women are more sensitive than men to mild health status changes and respond actively by contacting primary health care clinics.

The association of low level of education with ED revisits among older adults in Stockholm (Study I) and frequent use of ED care in younger-old adults (Study IV) echo some research on ED care use in old age (129) but contradicts findings of a systematic review on ED care (82). This finding explains inequality in health with poor health among older adults with lower socio-economic status (e.g., educational attainment, income, financial security) (130, 131). A study in England (a country with a universal healthcare system) found that older adults with higher education seek more outpatient care and less ED care than those with a low level of education (129). The authors explain the results by arguing that persons with higher education may find it easier to navigate the healthcare system, are active in making appointments, and benefit from the choice reforms by actively choosing outpatient providers with less waiting times, reducing the likelihood of avoidable ED visits. If this assumption is valid, choice reforms most likely exacerbate these inequalities in health care use (129).

8.1.3 Enabling resources: the role of social support in ED care use

In this thesis, social support is related to informal care, which was only found to be significantly associated with ED care use at the bivariate level (Study III). This finding mirrors previous research showing no association between informal and ED care in multivariate models (88). Nonetheless, higher levels of social support were negatively associated with ED visits, but only in older-old adults (Study III). This finding contradicts studies on social support and ED care (86, 132), possibly because of inconsistent methodologies for operationalising and measuring social support across studies. Moreover, age-specific differences are expected regarding needs and resources of social support (133). Still, previous studies have rarely differentiated between younger-old and older-old adults, which may have attenuated possible associations.

Social support can be broadly described as assistance to and from others, including emotional attributes that provide a sense of belonging (133, 134). The emotional aspect of social support helps deal with stressful events (134), such as when an ED visit is avoidable (9, 83, 84). Higher social relations and support levels also affect behaviours that may encourage a healthy lifestyle, better health (133, 135, 136), and the need for health care. In Sweden, as in many other welfare states, families and relatives do not have any legal obligation to provide care; however, social support can be crucial in supporting older adults to continue living at home (e.g., assistance in shopping and preparation of food, transportation to medical care facilities) and navigating the healthcare system (9). Social support is also vital in instrumental and emotional support after hospital discharge (35). It has been suggested that omitting these preventive care tasks can explain the association between lack of social support and ED visits (9, 83, 84).

ED visits explained by enabling resources (e.g., social support) indicate that if social support cannot be obtained informally, support or preventive measures may be needed through the formal social care of older adults. Findings on social support and ED visits provide evidence for planning public health interventions to modify these factors to reduce preventable ED visits in older-old adults.

8.1.4 Need for care and use of care

The associations between health status and ED care use are consistent with the description of equitable access in Andersen's model; i.e., in an equal system, care use should be explained by a need for care factors (19). Nevertheless, Andersen's model is a generic model for health care use. Hence, there is no further elaboration in his model on the type of health problem and its impact on health care use.

Perceived health indicates people's views about their health and how their health status impacts their functional ability (77, 137) and mental health (138). It also includes the persons' responses to their illness, which can influence the decision-making process of seeking health care (76). It might explain the association between poor physical HRQoL and ED visits in study IV. In older adults, the mental aspects of HRQoL are often linked to worries related to medical health problems. Sometimes, the lack of follow-up visits after ED care contributes to the continuation of these concerns and a decline in mental HRQoL (138). This assertion could explain the association between poor mental HRQoL and frequent use of ED care in older adults (Study IV).

Findings on the number of chronic diseases (11, 89, 90), excessive polypharmacy (139), and health status measured by HAT (140) align with previous research on ED visits (11, 89, 90), ED revisits (139), and hospital admissions (90, 140). Primary health care is the first line of contact in health care. It can potentially reduce ED care use for chronic diseases by monitoring disease prognosis and continuity of care (8, 10, 79). In this thesis, positive associations were observed between visits to the primary health care clinics and ED visits (Study II) and ED revisits (Study I), which are consistent with previous findings (73, 95). This finding indicates deteriorated health status and higher care needs but also unmet primary health care needs (95).

In Sweden, initiatives have been taken to improve the accessibility and supply of primary health care (e.g., privatisation and marketisation in primary health care, legislation on choice reform in 2010, and the policy initiative good quality local health care enacted in 2019) (53). The choice reform in primary health care has increased access to primary health care visits. However, this reform, leading to multiple providers, has complicated the coordination of care for older adults with complex care needs (45, 46). International research has shown that integrated care (i.e., coordination between different care providers) can reduce ED visits (47), hospital admissions (47, 120), and the duration of hospital stay (120). A recent Swedish study on integrated care in Norrtälje reported a modest decline in ED care use in older adults (121). A study in southern Sweden showed that "case management," an example of integrated care,

contributed to a reduction in ED visits leading to hospital admissions after 6-12 months of intervention in older adults with complex care needs (122).

EDs are rarely adapted to the complex needs of older adults (e.g., lack of interprofessional teams), and each ED visit increases the risk of adverse health outcomes (12). Therefore, alternative care options for acute needs (e.g., mobile care teams) may reduce avoidable ED visits and improve health outcomes among older adults. However, a systematic review has shown inconsistent findings on the effects of mobile care teams on ED care use and hospital care (141). Heterogeneity in the interventions, composition of mobile teams, operationalisation of outcome, and follow-up time can likely explain such divergent results. A mobile team project in Uppsala, Sweden was started in 2011 as a collaboration between municipalities and Region Uppsala. The mobile care team comprised physicians, nurses, and registered nurses in the municipality who performed home visits as per need. A physician of the mobile care team estimated that 75% of those who received care at home by the team would have had to visit an ED if the mobile team did not exist (142). Another possibility to elude the ED is direct admission to inpatient care when older adults need hospital care. In some Swedish regions and hospitals, older adults with acute symptoms can avoid the ED and get admitted directly to inpatient care (13). This practice is entirely possible.

There are indications that the good quality local health care reform, which is not yet fully implemented, has contributed to reducing inpatient care for chronic diseases (56). However, the impact of this reform on ED care use remains obscure.

8.1.5 Social care for older adults and ED care use

Social care for older adults mainly consists of residential care and home help services. The different findings on aspects of social care for older adults in Blekinge (Study IV), Dalarna, and Stockholm (Study I) should be understood in light of Sweden's decentralised social care system and by a methodological divergence in study IV based on survey data. In study IV, there was a positive association between residential care receipt and frequent use of ED care, but only in younger-old adults. This finding agrees with a study on routine use of ED care in adults ≥ 65 years in Stockholm (74). However, the result of study IV should be interpreted with reservation because of the wide confidence interval, which could be due to a low number of study participants. Regarding ED revisits, older adults living in residential care facilities in Stockholm were less likely to revisit an ED within 30 days of their initial ED visit (Study I). Residential care is an intensified form of social care for older adults with easy access to nurse practitioners that could reduce the likelihood of an ED revisit and explain this finding. A time series analysis in Italy has shown declining ED visits during 2012-2019 in older adults living in residential care facilities, even though these older adults often have severe functional and cognitive impairments (143).

In Dalarna, positive associations of home help receipt with ED visits (Study II) and ED revisits (Studies I & II) are consistent with research on ED revisits (97) and unplanned hospitalisations (96). Extensive home help provision implies the care recipient's poor

health/functional status. Higher ED care use in home help recipients also indicates that the provided services do not meet the recipient's care needs. Low competence of the care-providing staff, lack of care continuity, and limited hours of home help can lead to the risk of needs going unmet (144). There are ED visits where older adults seek ED care for social reasons, i.e., due to the unmet needs of formal social care or informal care (10, 84). For instance, withdrawal or inadequate receipt of formal home help services or informal care (84).

Marketisation and the choice reform in social care have contributed to an increase in the number of providers, but it has made it difficult for those with severe illnesses, cognitive decline, limited language skills, lower education, and without close relatives to access information and make active and informed choices (37, 49). A study on hospital admissions has shown that the higher ability to deal with public authorities correlates with lower unplanned admissions, albeit significant only at the bivariate level (96).

8.1.6 Admission to inpatient care at initial ED visit and ED revisit

In older-old adults, being admitted to inpatient care at the initial ED visit decreased the risk of ED revisits within 30 days from the initial ED visit (Study II), which is in accordance with previous research (71). Cutbacks in hospital care impact declining admissions to hospital care (42) and lead to early hospital discharges, increasing the risk of adverse health outcomes (39) and ED revisits. ED revisits are considered unfavourable given the risk of negative health outcomes associated with each ED visit (13, 70). Crowding in the ED, insufficient staffing, and a heavy workload are some factors that threaten patient safety. Other factors threatening patient safety are assessment delays, medication errors, and extended stays in the ED (5, 145, 146). Older-old adults (≥ 80 years) often have a longer stay in the ED than younger adults. According to the Swedish National Board of Health and Welfare, half of the ED visits by older-old adults are longer than 4 hours and every 10th ED visit is longer than 8 hours (110). In 2020, an investigation based on 8 513 randomly selected ED admissions in the somatic care for adults (≥ 18 years) showed that health care associated adverse outcomes were more common in adults ≥ 85 years compared to younger adults (147).

A report showed that patients who were sent home after an initial ED visit presented with declining health status at the ED revisit within 30 days from the initial ED visit, suggesting that their needs for post-discharge care were not met (69). A primary health care clinic follow-up within 10-12 days of an ED visit is protective against ED revisits within 30 days (62). In Sweden, a referral from the ED could reduce the waiting time for a follow-up visit at a primary health care facility, but the primary health care provider prioritises and usually takes 2-3 weeks (32).

Frail older adults may visit the ED with atypical symptoms requiring detailed multidimensional assessment and an interdisciplinary team of professionals for diagnosis and care management (148). A comprehensive geriatric assessment is an overall assessment of the older patient's situation by assessing the medicinal aspect, functional and cognitive status,

nutritional status, and living arrangements (13). In comprehensive geriatric assessments, interdisciplinary teams are responsible for the care of older adults (12, 13). Previous research suggests that using geriatric assessments in the ED reduces the probability of ED revisits and unplanned hospitalisations after initial discharge (149). In acute hospital admissions, comprehensive geriatric assessment with interdisciplinary teams contributes to preserving the physical functional ability of frail older adults and increases the possibility of remaining home after hospital discharge (12, 13). Implementing comprehensive geriatric assessments in the ED may help in clinical decisions and improve health outcomes in older adults (13, 149).

8.2 METHODOLOGICAL CONSIDERATIONS

This section discusses the strengths and limitations of the methods used in this thesis. This thesis is based on four quantitative studies which used a prospective cohort design. The temporal framework in prospective cohort study design is advantageous for drawing inferences on the direction of the association (100). The validity of quantitative studies can be assessed by internal validity/systematic error and external validity/generalisability (150).

8.2.1 Internal validity [Systematic error]

Internal validity refers to the extent to which inferences can be drawn that the independent variables accounted for the outcome apart from the systematic errors that might have affected the estimated effects. Internal validity is a prerequisite of external validity. Most of the conditions which threaten internal validity can be classified into three categories: selection bias, information bias, and confounding (150).

8.2.1.1 Selection bias

Selection bias can occur from the procedures used to select study participants and the factors that influence participation in the study (e.g., self-selection bias) (150). In self-selection bias, the reason for participation is affected by the exposure or outcome of the study. The results are biased when the participants systematically differ from the non-participants, and the association between exposure and outcome is different for those who participated in the study and those who did not.

A strength of this thesis is the use of high-quality population-based register data. Studies I and II were register-based, while survey data were linked to the registers in studies III and IV. Registers include the whole population and do not risk selection bias due to non-response, exclusion of patients with critical medical conditions, or loss to follow-up (104).

Survey studies have a risk of selection bias. In studies III and IV, information on independent variables was based on survey data (SNAC). In SNAC, persons of specific ages were randomly selected, which reduces the risk of section bias. Moreover, SNAC is a multi-purpose study. Thus, the risk of selection bias associated with the outcome under study is low. The response rate was high in SNAC: 73.3% in SNAC-K and 60.6% in SNAC-B at baseline (85.9% in W3, data source of study IV). The reasons for non-participation are not fully known; however, poor health status is one possibility for non-participation in SNAC-K

and SNAC-B (106), which might have led to underestimating the exposure effect on ED care use. This potential bias should be considered when interpreting the results of studies III and IV.

8.2.1.2 *Information bias*

Information bias can occur from measurement bias, misclassification of outcomes, and inaccurate information. These errors lead to misclassifying independent and/or dependent variables (150).

8.2.1.2.1 ED care use

Registers were used to obtain the information on ED care use, as they are known to provide reliable information on the use of the healthcare system. A strength of study III is the use of the National Patient Register which covers ED care use by the study participants throughout Sweden. However, regional health care databases were used in studies I, II, and IV, which are limited to record health care use in a specific region. Therefore, there is a possibility that participants in studies I, II, and IV had ED visits in other regions. However, this is not common, and thus the risk that such potential visits should influence the findings of these studies is small.

At least one ED visit within 30 days of an initial ED visit is a definition often used in investigations on ED revisits in older adults (70, 71). In the estimation of 30 days from the initial ED visit, patients admitted to the inpatient care did not have an equal opportunity to be included in the 30-day criterion compared to those discharged. The median length of stay in hospital was 4 days. With such a low duration of hospital stay, this problem is not serious.

When categorical variables are used, classification errors may appear. In previous research, varying the number of ED visits (≥ 4 to ≥ 6) over different periods has been used to define the frequent use of ED care, which limits comparisons across studies (106, 107). In study IV, the number of ED visits was categorised into frequent ED visits (≥ 4 visits during a 4-year follow-up) or not frequent ED visits. Study IV could be limited in not considering exposure time for each participant in the analysis of the frequent use of ED care.

8.2.1.2.2 Independent variables

In study I, the Swedish prescribed drug register was used to measure polypharmacy. The Swedish prescribed drug register does not include information on drug use in inpatient care but provides information on drugs prescribed and dispensed from the pharmacy. However, dispensing drugs does not ensure patient compliance with the prescription. Previous research defined polypharmacy and excessive polypharmacy (118, 139); however, cut-offs only show the number of drugs and do not consider appropriate or inappropriate polypharmacy.

There is a risk of recall bias in the self-reported independent variables (e.g., HRQoL, social contacts, social support, informal care). However, comprehensive measures were used to develop an index to reduce the risk of misclassification. HRQoL was measured using the SF-

12, a validated instrument widely used in older adults (112). Still, there is no consensus on the definition of poor HRQoL for comparing across studies. In study IV, a statistical approach (25th percentile) was used to develop a dichotomised variable. Self-reported data on diseases in study IV are susceptible to recall bias; therefore, these results should be interpreted cautiously.

In study II, the Kolada database was used for municipal level data on home help quality based on a survey response rate between 48 and 66% across municipalities. Furthermore, only 46% of the data were provided by care recipients, with the rest supplied by relatives or care providers. Therefore, there is a risk of information bias. Survey questionnaires and data collection methods are the same across municipalities, a strength of home help quality data.

8.2.1.3 *Confounding*

Confounding refers to the distortions caused by extraneous factors that could lead to the under- or overestimation of the effect of independent variables on the outcome measure (150). Confounding cannot be completely ruled out in observational studies but can be reduced by adjusted models and stratified analysis. This thesis used a theoretical framework and previous research to identify independent variables and potential confounders.

The present studies included health status indicators to estimate the need for care. Self-reported and objective health measures were used as proxy indicators of need, but need is a complex concept, and it is uncertain to what extent health indicators account for the need for care. Another factor that could impact translating the need for care to the decision to seek ED care is health literacy. Health literacy helps understand the information received at discharge and navigates the healthcare system. However, health literacy was not studied in this thesis.

8.2.2 **External validity [Generalisability]**

External validity implies the extent to which results can be generalised to other populations (150). Representativeness of the study sample, population characteristics, settings, social care, and healthcare systems are some factors that can affect external validity. The exclusion of patients with critical medical conditions is a common methodological limitation in studies on ED care use (14, 58). Such exclusions distort representativeness and external validity. Registers provide information covering the entire population, including patients with critical medical conditions and persons living in residential care facilities. A strength of this thesis is that studies I and II were register-based, providing high-quality information on social and health care use in the entire population. However, generalisability of the current findings could be affected by regional variations in the organisation, delivery, and resources of social and health care in Sweden and varying social care and healthcare systems worldwide.

Study III was based on a study sample from a community with a better socio-economic profile compared to other parts of Stockholm (103) and Sweden. Therefore, caution is recommended in comparing and generalising findings of study III in communities with lower socio-economic status. In SNAC-B, despite an oversampling in older cohorts, very older-old

age was the common cause for non-response (106). Therefore, it is reasonable to believe that participants were younger and had better health compared to non-participants, which may limit the generalisability of the findings of study IV.

9 CONCLUSIONS

By considering the within-country differences in population characteristics, social care and health care, this thesis shows that contextual factors help explain ED visits in older-old adults.

ED care use in older adults was driven by a need for care factors as indicated by positive associations with poor HRQoL and objective health measures. Generally, the need for care factors explaining health care use indicates equitable access; however, Andersen's model of health services use is limited to describing whether the type and severity of the medical problem have any role in explaining equitable access to ED care. Chest pain, breathlessness (Dyspnoea), and abdominal pain were common reasons for seeking ED care in older adults. These findings indicate acute medical conditions, but the severity and role of primary health care in treating these conditions were not explored.

Compared to not receiving home help, the likelihood of seeking ED care was considerably high among older-old adults living at home with home help receipt. Older adults with home help receipt were also at higher risk of ED revisits within 30 days of the initial ED visit. These findings show a worsened health status of care receivers, indicating unmet social care needs for older adults. Therefore, it is crucial to consider the needs of this group in ED care settings to ensure adequate post-discharge care.

The likelihood of an ED revisit within 30 days of the initial ED visit was 29% lower in those older-old adults admitted to the inpatient care from an ED than those discharged home from the ED. Excessive polypharmacy (≥ 10 drugs), being in the last year of life, higher use of primary health care (≥ 11 visits in a year) and ED care before the initial ED visits were associated with an ED revisit within 30 days after the initial ED visit in older adults.

As mentioned earlier in this thesis, in Sweden, families and relatives do not have any legal obligations to provide care. Nevertheless, study IV shows that higher levels of social support were associated with a decreased risk of ED visits in older-old adults.

10 POINTS OF PERSPECTIVE

10.1 IMPLICATIONS OF THE FINDINGS

Findings related to the contextual factor (*higher proportion of persons aged ≥ 80 years in the population*) raise concerns about whether primary and social care for older adults is adapted to the needs of the local population. Although the direct impact of these factors was not explored in this thesis, findings on contextual factors suggest that variations in the needs of the local population and geographical proximity to health care should be considered as a means to reduce avoidable ED care use in older-old adults.

Findings on home help receipt and ED care use illustrate this group's vulnerability. Internationally and in Sweden, the implementation of *age in place* policy and deinstitutionalisation has contributed to stricter eligibility criteria for residential care. Thus, frail older adults with complex care needs increasingly live at home with home help. Home help may not be sufficient to meet the needs of these older adults, and sometimes this gap is fulfilled by informal care receipt (30).

The share of older adults with residential care receipt is lower in Sweden than neighbouring Norway and Denmark. Conversely, Sweden has a higher proportion of older adults with home help receipt than Norway (151). In Sweden, adults ≥ 80 years are expected to increase from 510 000 to 900 000 in 2040 (25). In compliance to the *ageing-in-place* policy, a larger proportion of older adults will live in their ordinary home with home help services. The population increase and findings of thesis on home help suggest a need to improve home help services.

To meet the needs of older adults, greater continuity in social care and collaboration between social care and health care providers are required. Improvements in care should be based on older adults' views and care should be flexible to individual preferences. Continuity of care helps in improving patient safety by knowing the history of care recipients' health problems and establishing trust and social relations with the care recipients (25). These attributes of continuity can help in identifying changes in the health or social situation that requires attention. Moreover, the needs of this group should be considered in ED care settings that secure adequate post-discharge care (e.g., follow-up at primary health care, home visit by mobile care teams, or contact with home help providers).

Findings on the higher levels of social support and decreased risk of ED visits highlight the importance of identifying older-old adults who lack social support in social care and health care settings to mobilise local resources to offer help (133, 152). Home help services mainly provide help with instrumental tasks and personal care but are usually more limited in addressing needs of social support and social activities (37). As mentioned earlier, sufficient time and continuity of home help staff can facilitate establishing social relations with older adults. Some municipalities and non-profit organisations offer services e.g., safety calls and befriending services. A safety call is to keep check that a person is feeling fine. This practice

of safety calls or befriending services can be practiced entirely to meet social support needs of older-old adults.

Older-old adults discharged home after an initial ED visit and at risk of ED revisits within 30 days of the initial ED visit could indicate unmet health care needs and post-discharge care. Early follow-up at primary health care or home visits could reduce the risk of revisits (62, 153).

10.2 FUTURE RESEARCH

In this thesis, home help receipt and primary health care visits were included as explanatory variables; however, intensive home help receipt and greater use of primary health care do not ensure that needs are met. Moreover, previous research has rarely considered aspects of adequate care and the impact of unmet care needs on ED care use. In this thesis, consideration was taken regarding informal care receipt and met/unmet needs. However, further research is needed to confirm the present findings. The *age in place* policy and deinstitutionalisation underlines the importance of future research on self-reported unmet needs of informal care, home help receipt, and primary health care, as well as the impact of these unmet needs on ED care. Moreover, consideration of older adults' perspectives regarding their care needs and experiences is an important area of future research.

Continuity of primary health care and competence and continuity of home help staff are also important factors to explore in relation to ED care use. A policy initiative (*good quality local health care*) enacted in 2019 aims to strengthen primary health care. The effect of this policy initiative on ED care use in older-old adults is an essential future research direction.

Future research on local variations in social care provision, after-hours availability of primary health care, and geographical proximity of primary health care clinics in areas with and without hospital-based ED facilities could help in understanding the decision-making processes of older adults and their caregivers as to when (and under what conditions) and where to seek health care (18).

Social and health care use after discharge from ED care could help identify factors and gaps in the post-discharge period, increasing the risk of early revisits of older-old adults to ED care. Identifying gaps in the post-discharge care period could be another future research direction

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