Suicide. Risk factors and health care utilization in individuals with suicidal behavior

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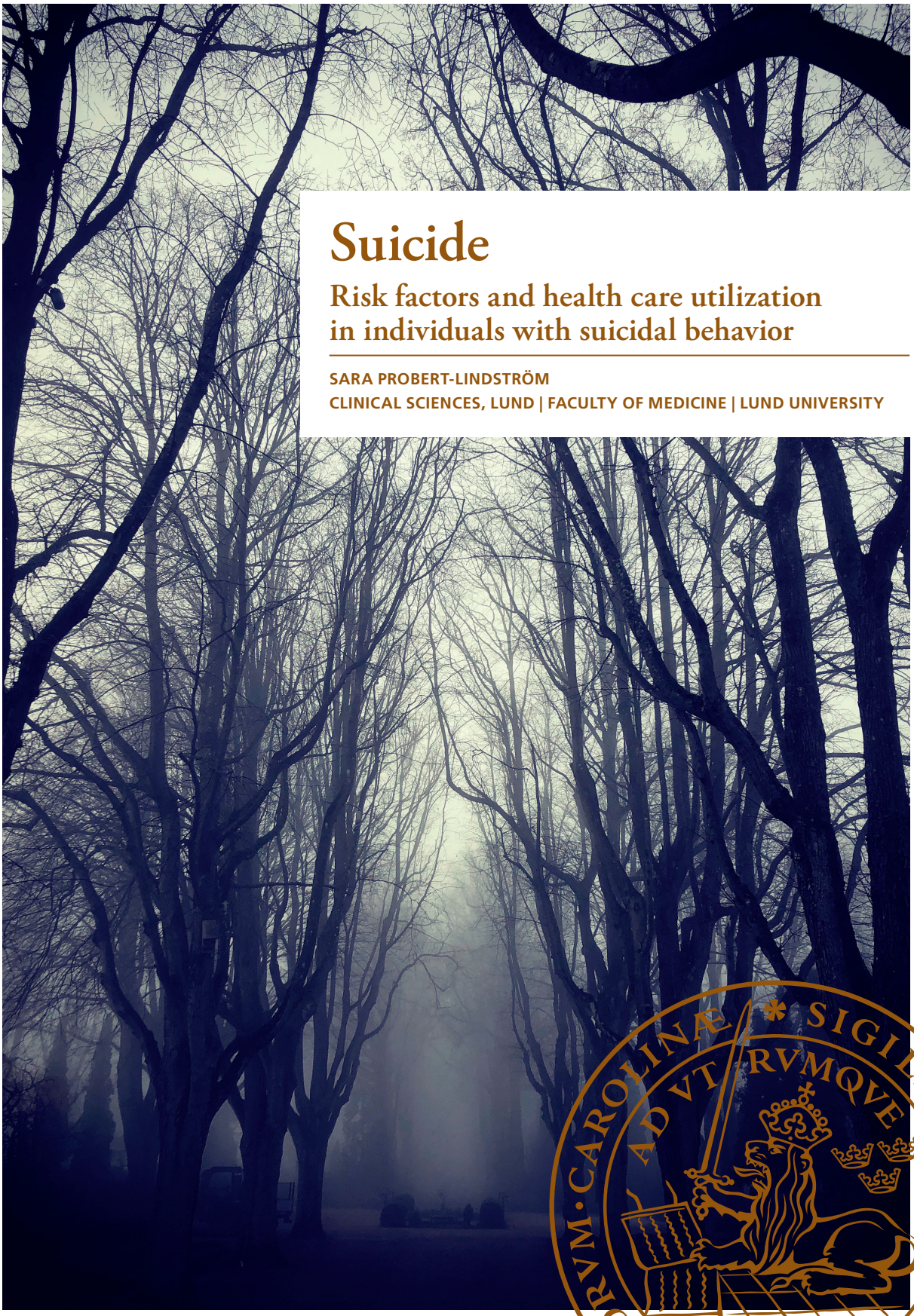

Suicide

Risk factors and health care utilization in individuals with suicidal behavior

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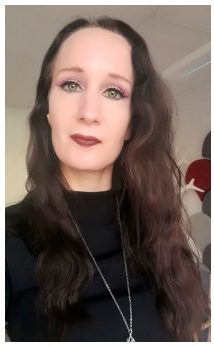

The problem of suicidality is multifaceted, and interventions are needed in many different domains of society, including a need for new health care strategies. This thesis contributes to the existing literature by providing knowledge of risk factors and suicide mortality in the very long term in a large group of suicide attempters with access to clinical baseline data. Further, the studies contribute to the knowledge of the overall health care utilization in Sweden in individuals who died by suicide. The differences in utilization of psychiatric services between individuals with or without previous suicide attempts are investigated.

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Sara Probert-Lindström

LUND
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Co-supervisors: Anna Ehnvall and Livia Ambrus

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Suicide- Risk factors and health care utilization in individuals with suicidal behavior

Abstract

Background and aims

The problem of suicidality is multifaceted, and interventions are needed in many different domains of society, including a need for new healthcare strategies. This thesis aimed to increase knowledge of risk factors for suicide mortality among suicide attempters, and healthcare utilization prior to death by suicide.

Method and results

Study I and II (N=1,044 and N=1,039) covered clinical baseline data on suicide attempters followed by register-based data after up to 32 years. The patients were included when admitted to a medical emergency inpatient unit after a suicide attempt in 1987-1998. At follow-up, 7.2% of the suicide attempters, had died by suicide. Psychosis, major depression, and a history of attempted suicide before the index attempt were identified as long-term risk factors. The suicide intent, measured by the Suicide Intent Scale, was a risk factor within 5 years. The overall excess mortality by suicide was elevated by 23,5 times compared to the general population and highest among violent suicide attempters.

Study III and IV (N=984 and N=484) are parts of a large national project that examine health care prior to death for individuals who died by suicide in Sweden in 2015. It was shown that 90.3% had been in contact with healthcare and 51% with psychiatric services within two years before suicide. Half of the individuals in contact with psychiatric services had made previous suicide attempts. They were more likely to have received a psychiatric diagnosis, psychopharmacological treatment, and to have been absent from appointments than those without previous attempts.

Conclusion

Healthcare units compose promising domains for improved suicide prevention. Evaluation of earlier suicide attempts may aid clinicians in suicide risk assessment, even decades after the attempt. Improvements of suicide preventive interventions are warranted including psychiatric diagnostics and strategies to prevent and handle absence from appointments.

keywords: suicide, suicide attempt, psychiatry, healthcare utilization, risk factors, mortality, excess mortality, psychiatric disorders, violent method, suicidal intent, repeated suicide attempts, long-term follow-up, retrospective, prospective

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I dedicate this dissertation to all who are struggling
to stay alive. In the words of John Milton:
"They also serve who only stand and wait".
The hard work of enduring through dark
suicidal periods is a heroic effort.

From the poem "On his blindness"

Table of Contents

Abstract

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The problem of suicidality is multifaceted, and interventions are needed in many different domains of society, including a need for new health care strategies. This thesis aimed to increase knowledge of risk factors for suicide mortality among suicide attempters, and health care utilization prior to death by suicide.

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Study I and II (N=1,044 and N=1,039) covered clinical baseline data on suicide attempters followed by register-based data after up to 32 years. The patients were included when admitted to a medical emergency inpatient unit after a suicide attempt in 1987-1998. At follow-up, 7.2% of the suicide attempters, had died by suicide. Psychosis, major depression, and a history of attempted suicide before the index attempt were identified as long-term risk factors. The suicide intent, measured by the Suicide Intent Scale, was a risk factor within 5 years. The overall excess mortality by suicide was elevated by 23.5 times compared to the general population and highest among violent suicide attempters.

Study III and IV (N=984 and N=484) examine health care two years prior to death for individuals who died by suicide, in 20 of the 21 regions of Sweden in 2015. It was shown that 90.3% had been in contact with health care and 51% with psychiatric services. Differences in utilization regarding sex and age were identified. Half of the individuals in contact with psychiatric services had made previous suicide attempts. They were more likely to have received a psychiatric diagnosis, psychopharmacological treatment, and to have been absent from appointments than those without previous attempts.

Conclusion

Health care units compose promising domains for improved suicide prevention. Evaluation of earlier suicide attempts may aid clinicians in suicide risk assessment, even decades after the attempt. Improvements of suicide preventive interventions are warranted including psychiatric diagnostics and strategies to prevent and handle absence from appointments.

List of studies

Study I

Probert-Lindström S, Berge J, Westrin Å, Öjehagen A, Skogman Pavulans K. Long-term risk factors for suicide in suicide attempters examined at a medical emergency inpatient unit: results from a 32-year follow-up study. BMJ Open. 2020 Oct 31;10(10):e038794. DOI: 10.1136/bmjopen-2020-038794. PMID: 33130567.

Study II

Probert-Lindström S, Öjehagen A, Ambrus L, Skogman Pavulans K Berge J. Excess suicide mortality in suicide attempters examined at an emergency unit- the role of violent method, repeated attempts and high suicidal intent at long-term follow-up. BMJ Open, manuscript submitted 28th of June 2021. Under review.

Study III

Bergqvist E, Probert-Lindström S, Fröding E, Palmqvist-Öberg N, Ehnvall A, Sunnqvist C, Sellin T, Vaez M, Waern M & Westrin Å. Health Care Utilization Two Years Prior to Suicide and Subsequent Reports to the Supervisory Authority in Sweden- A Retrospective Explorative Study Based on Medical Records. Under review.

Study IV

Probert-Lindström S, Vaez M, Fröding E, Ehnvall A, Sellin T, Ambrus L, Bergqvist E, Palmqvist-Öberg N, Waern M & Westrin Å. Utilization of psychiatric services prior to suicide- a retrospective comparison of users with and without previous suicide attempts. Archives of Suicide Research. 2021 DOI: 10.1080/13811118.2021.2006101

Preface

In the Attempted Suicide Short Intervention Program (ASSIP) project I have learned to ask my patients to tell me the story behind their suicide attempt. In the spirit of this, I will tell you the story behind my choice of subject for this dissertation.

In my twenties, working my first years as a social counsellor in psychiatric services, I experienced the death of a patient by suicide. She was a middle-aged woman with a history of several suicide attempts who came to me for counselling. We saw each other every week for several months and little by little I felt I was earning her trust. One day she did not show up for her appointment. I tried to call her but there was no answer. The next day I found out that she had died by suicide.

This experience affected me deeply. I felt grief, guilt, and bewilderment. I dealt with these emotions the same way I have always dealt with difficult things in life; by trying to understand. I wanted to understand how this could have happened and what I could have done, if anything, to have prevented it from happening. This included a lot of reading, training to become a licensed psychotherapist, learning various forms of cognitive behavioural therapy, and seeing many patients. However, over the years I often felt that what I offered patients was not enough. Some patients got better but others did not. In my clinical setting, patients died by suicide even though they were in ongoing treatment. My impression was that neither I nor my co-workers fully knew how to deal with the phenomenon of suicidality; who is at risk and how should we prevent suicide in the context of healthcare? I then turned toward research. I sought out Professor Åsa Westrin who I knew was conducting suicide research in the clinical setting affiliated with the University. After many discussions of suitable projects, she agreed to take me on as a doctoral student. Four years later, in collaboration with the research group, I have written this dissertation with the title: “Suicide- risk factors and healthcare utilization in individuals with suicidal behaviour”.

I am still trying to understand. As a psychotherapist and researcher, I hope to develop a platform to keep learning and test new suicide preventive approaches in close collaboration with other researchers, The University psychiatric clinic, and the true experts, the suicidal individuals.

Populärvetenskaplig sammanfattning på svenska

Bakgrund

Varje år dör mer än 700 000 personer i världen i suicid, varav ungefär 1 500 i Sverige, inräknat både säkra och s.k. osäkra suicid. Att en person tar sitt liv är en personlig tragedi och representerar dessutom en omfattande samhällelig förlust. Det är känt från studier från bland annat USA att personer som senare dör i suicid ofta har haft någon form av kontakt med vården i nära anslutning till dödsfallet. Det indikerar att vården har potential att utgöra är en viktig kontaktyta för suicidprevention.

Ett eller flera tidigare suicidförsök utgör den mest väletablerade riskfaktorn för suicid. Individer som kommer i kontakt med vården och har gjort suicidförsök utgör alltså en riskgrupp som man bör vara särskilt observant på vid suicidriskbedömning och som utgör en viktig målgrupp för suicidpreventiva åtgärder. Inom gruppen av personer som tidigare har gjort suicidförsök är det av värde att kunna bedöma vilka som löper särskilt förhöjd risk för suicid. Flera studier har undersökt risken för suicid upp till 5 år efter ett suicidförsök, men endast ett fåtal studier har undersökt risken för suicid och överdödlighet (jämfört med normalbefolkningen) i suicid under längre uppföljningstider, dvs 20 år eller längre. Utöver det är kunskapen bristande kring eventuell överdödlighet hos subgrupper av personer som gör suicidförsök, nämligen de som:

1: gör upprepade suicidförsök

2: gör våldsamma suicidförsök

3: har hög suicidal intention.

Sådan kunskap kan vara till hjälp för kliniker i den svåra uppgiften att bedöma suicidrisken hos personer som gjort suicidförsök och ge möjlig vägledning för lämpliga åtgärder.

Det saknas också kunskap om hur vårdsökandemönster före suicid ser ut i Sverige och om det skiljer sig mellan olika åldersgrupper samt i relation till kön. Vidare finns ingen information om huruvida personer med tidigare suicidförsök haft vårdkontakter som skiljer sig från de som avlider vid sitt första suicidförsök

Övergripande syften med denna avhandling är att öka kunskapen om överdödlighet och riskfaktorer för suicid över lång tid hos personer som gjort suicidförsök och hur kontakter med sjukvården sett ut före suicid.

De specifika syftena var följande:

1. Att undersöka dödlighet, förekomsten av suicid och riskfaktorer för suicid i ett långtidsperspektiv efter ett suicidförsök samt eventuella skillnader mellan riskfaktorer för suicid nära försöket och efter längre tidsintervall.
2. Att undersöka den långsiktiga överdödligheten i suicid jämfört med normalbefolkningen hos personer som gjort suicidförsök samt i undergrupper av dessa; de som gjort upprepade suicidförsök, de som använt av en våldsam metod under försöket och de som haft hög suicidal avsikt.
3. Att undersöka vårdkontakterna bland individer som har avlidit i suicid i Sverige, eventuella ålders- och könsskillnader och andelen individer som rapporterades till Socialstyrelsen i enlighet med lex Maria.
4. Att jämföra psykiatrisk vård två år före suicid bland individer med och utan tidigare suicidförsök.

Material och metoder

Avhandlingen inkluderar fyra delstudier som utgår från två olika populationer i större forskningsprojekt. Forskning om suicid inkluderar ibland både säkra och osäkra (det vill säga där intentionen är oklar) suicid. I den här avhandlingen har vi valt att enbart undersöka säkra suicid.

I Studie I, N=1 044, och II, N=1 039, ingår personer som inkommit till medicinsk akutvårdsavdelning vid Lunds universitetssjukhus efter ett suicidförsök mellan åren 1987 och 1998. De bedömdes där av psykiater och kurator med ett strukturerat bedömningsmaterial inklusive skattningsskalor och diagnostisk bedömning. Vi begärde ut datum för dödsfall och eventuellt utlandsflytt från Skatteverket för alla personer i studien samt uppgifter om dödsorsaker för alla de personer som fanns i Socialstyrelsens dödsorsaksregister för perioden 1 januari 1987 till 31 december 2018. Detta möjliggjorde att vi kunde beräkna samband mellan faktorer vid suicidförsöket såsom psykiatriska diagnoser, resultat från skattningsskalor och huruvida de dog i suicid upp till 32 år efter suicidförsöket. För att undersöka eventuella skillnader avseende riskfaktorer för suicid gjorde vi också en separat analys om det fanns skillnader i riskfaktorer för suicid inom fem år och efter fem år från suicidförsöket. För att kunna se om personerna i Studie I verkligen hade en högre dödlighet i suicid jämfört med normalbefolkningen, begärde vi uppgifter om dödsfall genom suicid i den svenska befolkningen för samma tidsperiod. Undergrupper av personer som gjort suicidförsök analyserades separat.

Studie III och IV: I de här två studierna granskades journalanteckningar för personer som avled i suicid i Sverige 2015 och som hade haft kontakt med vården inom de två år som föregick dödsfallet. Stockholmsregionen ingick inte i studierna eftersom datainsamlingen ännu inte var klar vid tidpunkten för analyserna. I Studie III

granskades all typ av vård och i Studie IV enbart den psykiatriska vården. Granskningen utfördes med hjälp av granskare runt om i landet enligt en särskilt utarbetad mall. Mallen innehöll totalt 622 frågor som gällde bland annat vilken vård personerna fått, hur de bedömdes avseende suicidrisk och huruvida de gjort tidigare suicidförsök. Ett begränsat antal av de frågorna användes till delstudierna i den här avhandlingen.

Resultat

Av personer som gjort suicidförsök i Studie I var 7,2% döda i suicid vid uppföljningen. Över hälften av dessa dog inom 5 år efter suicidförsöket som ledde till inklusion i studien (indexförsöket) och den totala andelen som dött under denna period, oavsett dödsorsak, var 37,6%. En diagnostiserad psykos vid suicidförsöket representerade den mest kraftfulla riskfaktorn följt av depressionsdiagnos vid suicidförsöket eller upprepade suicidförsök. Suicidal intention visade sig vara en riskfaktor inom de första fem åren efter suicidförsöket men inte i ett långtidsperspektiv.

I Studie II fann vi att dödligheten i suicid i den undersökta gruppen av personer som gjort suicidförsök var 23,5 gånger så hög som dödligheten i suicid i hela den svenska under samma period. Överdödligheten var högre bland kvinnor än bland män och högre under de första fem åren efter det suicidförsök som ledde till inklusion i studien än senare. Den undergrupp som hade högst överdödlighet var de individer som gjort ett våldsamt suicidförsök.

90,3 % av de personer som dog i suicid i Sverige 2015 i Studie III hade haft kontakt med sjukvården under de två år som föregick dödsfallet och 60 % inom de senaste fyra veckorna. En högre andel yngre personer hade haft kontakt med psykiatrisk vård och en högre andel äldre personer hade haft kontakt med primärvården samt specialiserad somatisk vård.

Av de personer som haft kontakt med psykiatrin inom två år innan dödsfallet i suicid i Studie IV hade hälften gjort tidigare suicidförsök. Den psykiatriska vården före suicid skiljde sig mellan personer med tidigare suicidförsök och de utan tidigare suicidförsök. Individer med tidigare försök hade varit i kontakt med psykiatrin längre och hade oftare bedömts ha en förhöjd suicidrisk. De hade också oftare fått psykofarmakologisk behandling, hade oftare en psykiatrisk diagnos, hade oftare planerad kontakt med socialpsykiatrin och hade oftare uteblivit från planerade besök nära dödsfallet, jämfört med de patienter som inte hade gjort tidigare suicidförsök.

Diskussion

Resultaten i denna avhandling visar att förekomsten av tidigare suicidförsök har en påverkan på risken för död i suicid, även om försöket/försöken kan ha inträffat för många år sedan. Psykiatrisk diagnos med särskilt fokus på psykos och depression, och omständigheterna vid tidigare suicidförsök såsom våldsam metod, upprepade försök och hög suicidal intention är faktorer som kan bidra till ökad risk. Sådan kunskap kan komma att gynna kliniker i den prövande utmaningen att bedöma suicidrisk.

Vidare visade den här avhandlingen att en mycket hög andel, 90,3%, av individer som dör i suicid har haft kontakt vården inom de senaste två åren. Det indikerar att vården utgör en viktig kontaktyta för förbättrad och ökad suicidriskbedömning samt suicidpreventiva åtgärder. Att så många som hälften av alla hade haft kontakt med psykiatrisk vård före suicid är, visar att psykiatrin är en viktig arena för att intervenera. Den större andelen uteblivande från vårdbesök hos personer med tidigare suicidförsök tyda på ett behov av tydlig behandlingsplan bland annat avseende kontakt vid uteblivande och en förbättrad allians mellan psykiatriska vårdgivare och denna grupp av individer samt kontakt med deras anhöriga. Den här avhandlingen visar också på ett behov av att implementera suicidpreventiva strategier inom all svensk hälso- och sjukvård eftersom personer som dog i suicid även i hög grad varit i kontakt med primärvården och somatisk specialistvård. Förbättrad bedömning av suicidrisk, bedömning av psykiatrisk problematik samt strategier för att hantera uteblivande kan vara utvecklingsområden.

Resultaten måste tolkas i ljuset av studiernas begräsningar. Studie I och II bygger på standardiserad klinisk intervju vid starten av studien och uppföljning via nationella register. Vi har därför ingen information om personerna utöver huruvida de lever och dödsorsak. Studierna har enbart information från ett sjukhus och personerna som ingår har gjort suicidförsök som var så pass allvarliga att de tarvade medicinsk akutvård. Dessa aspekter påverkar generaliserbarheten av resultaten till den större gruppen av alla personer som gör suicidförsök. Vidare ställdes diagnoserna vid bedömningen av en psykiater under de omständigheter som råder vid medicinsk akutvård, vilket kan ha påverkat den diagnostiska träffsäkerheten och lett till att man missat diagnoser som kräver mer omfattande observation såsom bipolär sjukdom och personlighetssyndrom. Studierna III och IV bygger uteslutande på uppgifter som samlats in från journaler. Vi kan inte uttala oss om huruvida vården skilt sig mellan personer som dog i suicid jämfört med personer som överlevde eftersom vi inte jämfört med någon matchad kontrollgrupp av patienter som inte dog i suicid. Studiepopulationen omfattar endast dödsfall som klassificerats som suicid. Dödsfall till följd av osäkra suicid ingick inte, varför en del faktiska suicid kan ha missats och därmed inte ingått i analysen. Ingen systematisk testning av att alla granskare samlade in data på samma sätt gjordes.

Slutsatser

Genom avhandlingen kan vi bättre förstå riskfaktorer över lång tid hos personer som gjort suicidförsök, och dessutom få en mer detaljerad bild av överdödligheten hos personer som gjort suicidförsök utifrån kliniska omständigheter vid suicidförsöket. Vidare har studierna kunnat beskriva vårdkontakterna i Sverige hos individer som dog i suicid, och skillnaderna i vårdkontakterna inom psykiatrin mellan individer med och utan tidigare suicidförsök. Resultaten måste tolkas mot bakgrund av begränsningar i generaliserbarheten till alla personer som gör suicidförsök och till alla individer som dör genom suicid.

Problematiken är mångfacetterad och insatser behövs inom många olika domäner i samhället, bland annat finns ett stort behov av nya hälso- och sjukvårdsstrategier för att minska dödsfallen i suicid. Med ökad kunskap om de mönster av vård, som de som dör i suicid fått och vad som utmärker dem som gjort suicidförsök och senare dör i suicid, kan vi få bättre uppslag till hur vi framgent skulle kunna förbättra suicidpreventionen ytterligare och i förlängningen få en förbättrad chans att minska antalet dödsfall i suicid.

Kliniska implikationer av studierna

Det är viktigt vid bedömning av suicidrisk inom vården att ta en noggrann anamnes avseende suicidförsök, även om försöket eller försöken kan ha inträffat för många år sedan. Det är av vikt att uppmärksamma upprepade försök och om suicidförsöket/en gjordes med hög suicidal avsikt eller om våldsamma metoder hade använts, eftersom dessa kliniska aspekter är kopplade till högre risk för död genom suicid.

Eftervård och uppföljning av alla som gjort suicidförsök är viktig. I program för suicidprevention kan man uppmärksamma identifierade undergrupper av personer som gör suicidförsök. Det är viktigt att ha strategier för uteblivna besök och att erbjuda effektiva behandlingsinsatser inom ett brett spektrum av behov över tid.

Suicidpreventiva insatser inom alla delar av hälso- och sjukvården är av yttersta vikt, eftersom en stor majoritet av personer som dör genom suicid har varit i kontakt med primärvård, psykiatri eller somatisk specialistvård. Förbättrade strategier för bedömning av suicidrisk, screening av och ökad uppmärksamhet över lång tid på dem som gjort tidigare suicidförsök kan sannolikt rädda liv.

Framtida forskning

I framtida forskning skulle det vara intressant att inkludera händelser efter indexförsöket i långtidsuppföljningar, till exempel utveckling av psykiatriska problematik och ytterligare suicidförsök. Det skulle också vara intressant att genomföra intervjuer med dem som fortfarande lever.

När det gäller vårdkontakter före suicid skulle det vara av värde att testa resultaten av denna studie mot en kontrollgrupp av personer som hade kontakt med vårdenheter och som inte dog genom suicid.

Att utebli från besök under de tre sista månaderna före suicid var vanligare bland individer med PSA än bland individer med NSA. I denna avhandling analyserades inte om några strategier användes för att nå patienten eller närstående när möten missades. Vikten av att göra överenskommelser om hur man hanterar frånvaro från möten skulle vara av intresse att undersöka.

I alla långtidsstudier är det viktigt att ta hänsyn till skillnaderna i de perioder som omfattas mellan studierna. I framtida forskning skulle det vara av vikt att ytterligare undersöka om riskfaktorerna har förändrats över tid.

Eftersom riskfaktorer bland och undergrupper av personer som gjort suicidförsök med förhöjd suiciddödlighet har identifierats, skulle det vara av intresse att testa förbättrad uppföljning av personer med suicidförsök och undersöka om och hur det långsiktiga förloppet för dessa personer kan påverkas.

Acknowledgments

First of all, I would like to thank the individuals seeking psychiatric services that I have met during my 20 years working in psychiatric units as a psychotherapist and social counsellor. You have been my most important teachers in the subject of suicidality and the depths of human experience. Thank you for sharing your life stories with me and for helping me understand the wide range of pathways that may lead up to suicidal behaviour.

I would like to sincerely thank Åsa Westrin, main supervisor and co-author of three of my papers and initiator of the national medical record project that led up to Study III and IV, for opening the door to the opportunity to learn the ways of the scientific community. I have been sharpened by the many discussions we have had on research methodology and on how to conduct large-scale research projects, from study design to the publishing process. We share the vision of doing research in close collaboration with the clinic, with a focus on helping the patients. Thank you for believing in me and supporting my continued work within suicide research.

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Abbreviations

AHR	Adjusted hazard ratio
ASSIP	Attempted Suicide Short Intervention Program
CI	Confidence interval
CBT	Cognitive behavioural therapy
DSM	Diagnostic and Statistical Manual of Mental Disorders
HR	Hazard ratio
HS	High suicidal intent
ICD	International Classification of Diseases
MEIU	Medical Emergency In-patient Unit
NSA	No previous suicide attempts
OR	Odds ratio
PSA	Previous suicide attempts
RA	Repeated suicide attempts
RR	Risk ratio
SCB	Statistiska centralbyrån (Statistics Sweden)
SIS	Suicide intent scale
SMR	Standardized mortality ratio
SPSS	Statistical package for social sciences
TAU	Treatment as usual
UHR	Unadjusted hazard ratio
VA	Violent suicide attempt method
WHO	World Health Organization

Introduction

The problem of suicidality is multifaceted. Interventions are needed in many different domains of society, including a great need for new health care strategies to reduce death by suicide (1). Despite decades of intensive research on many aspects of suicide, much remains to be better understood. This is partly because suicides, fortunately, are rare events. Large populations are needed to draw conclusions about their frequency, risk factors, and effective prevention. The biggest challenge in suicide prevention is determining those at the highest risk as well as the timing when that risk is present (2).

This thesis addresses two major aspects of suicidality. The first is long-term suicide mortality and the risk factors for suicide among suicide attempters. The other aspect concerns what health care has been offered to individuals who die by suicide prior to death, with a specific focus on individuals who belonged to the well-known risk group of suicide attempters (3).

Epidemiology of suicide and suicide attempts

Every year, more than 700, 000 individuals die by suicide worldwide (4) about 1,500 in Sweden, counting both certain and uncertain suicides. In 2019, the global age-standardized suicide rate was 9.0 per 100,000 in the population. The corresponding rate in Sweden was 12.4, somewhat above the global average. Suicide rates in 2019 were also higher in Africa, Europe, and South-East Asia compared to the global average, but lower in the Eastern Mediterranean region. The overall rate of deaths by suicide has declined globally during the last two decades, except in the American region where rates instead are rising (4). In the US, during 1999-2016, 25 of the states experienced an increase in suicide rates over 30%, and half of those did not have a known mental health disorder (5) The most common method used globally was pesticide, followed by hanging and firearms (6). In Sweden, the most commonly used method among men was hanging and in women poisoning (7).

For every suicide, there are approximately 20 suicide attempts (4) adding up to about 14 million suicide attempts globally every year. In 2020 in Sweden, nearly 7,000 individuals attempted suicide or engaged in a serious act of self-harm that involves emergency services for at least one night in the hospital, corresponding to 73 individuals per 100, 000 (7). Far from all suicide attempts come to the attention of health care. It is estimated that suicide attempts that lead to hospital care represent about half of the true number of suicide attempts each year in Sweden (8). Globally, the national systems for reporting the number of suicide attempts vary greatly. Accordingly, it is difficult to compare rates between countries. Nock et al (9) reported an overall lifetime prevalence of suicide attempts of 2.7% in 17 investigated countries.

Terminology and concepts of suicidal behaviour

Non-stigmatizing terminology

In recent years, the importance of respectful use of language regarding suicide-related concepts has been increasingly recognized. In this thesis, efforts have been made to avoid stigmatizing language concerning suicidal behaviour. Instead, neutral terms are utilized, as suggested by among others Padmanathan et al (10). It has been recommended the use of the term "to die by suicide" and avoiding "to commit/complete suicide"(11), using "a fatal suicide attempt" avoiding "a successful suicide attempt" and using "those who died by suicide" and avoid "suicide victims/cases". Although some cultural differences regarding the acceptability of the concepts exist, the suggested terms have been rated high in acceptability in most cultural contexts (10). It has been suggested that terms like "die by suicide" remove the agency from an individual (10) which raises the question of how much agency one has over one's state of mental health or illness, amongst other considerations. A more thorough exploration of these concepts is beyond the scope of this thesis.

Suicidality and suicidal behavior

Suicide comes from the Latin word suicidium and is composed of sui meaning self and caedere meaning to kill. Suicidality and the synonymous concept of suicidal behaviours refer to a wide range of behaviours with suicidal intent such as death by suicide and suicide attempts (12). For the purposes of this thesis, suicidal behaviour refers to both suicide attempts with fatal and without fatal outcomes. Suicidal ideation refers to thoughts of suicide but without any action.

Certain and uncertain suicides

In Sweden, when a person dies, a *Cause of Death* certificate is issued by a physician based on the available information. Regarding death by suicide, we separate certain and uncertain diagnoses. In accordance with the International Classification of Diseases (ICD), certain suicides are those in which there is no doubt that the intention was to die. This could be confirmed for example by a suicide note. The term "uncertain suicide" is used when there is uncertainty about the intention behind the death. This could for example be the case for overdoses and certain car accidents. In Sweden, the proportion of uncertain suicides represents about 20% of certain and uncertain suicides with no significant sex differences (8). In a study investigating possible misclassification of suicide deaths in Denmark, Norway, and Sweden, 21% of events of undetermined intent in Sweden were re-classified as suicides (13). In

suicide research, the inclusion or exclusion of deaths of undetermined intent potentially has a great impact on results. It is important to clarify whether the study includes only certain suicides- thereby possibly underreporting the actual suicides or includes both certain and uncertain suicides- thereby also including deaths that have been accidents. In the four studies in this thesis, only certain suicides have been included.

Suicide attempt, deliberate self-harm (DSH), and non-suicidal self-injury (NSSI)

Suicide attempts have been defined in several different ways over the years. In Studies I and II, the definition formulated by Beck is employed: "a situation in which a person has performed an actually or seemingly life-threatening behaviour with the intent of jeopardizing their life or give the appearance of such an intent, but which has not resulted in death" (14). Some researchers advocate the use of the term deliberate self-harm (DSH) that includes intentional self-injury or self-poisoning, irrespective of the type of motivation or degree of suicidal intent (15). Parasuicide is a synonymous term that also refers to self-injury with or without suicidal intent (16, 17). The motive for the use of this broader definition is the often mixed and ambivalent nature of the intention behind an episode of self-harm (18). Further, the reporting of intent can also be influenced by the phenomenon of stigma (12). Non-suicidal self-injury (NSSI) is defined as the deliberate, direct, socially unacceptable destruction or alteration of body tissue that occurs in the absence of suicidal intent (19). There has been some controversy as to whether suicide attempts and NSSI should be studied jointly or not. Nock and co-workers argue that NSSI differs from suicidal behaviour in that it occurs mainly in young people, the low lethality and chronic pattern of the behaviour, the sense of relief after the behaviour as the main function, and use of different methods used by the same person (19). Silverman et al (20, 21) are also among the advocates of studying suicide attempts separate from self-injurious behaviour without suicidal intent. For the purposes of this thesis, suicide attempts have been analysed as a phenomenon separate from NSSI based on the tradition of data collection in the studies that this thesis builds on.

Models of suicidality

The reasons why an individual considers suicide may vary considerably depending upon a wide array of factors that are biological, psychological, social, and environmental. However central to our understanding of why many people die by suicide is that the individual has decided that they can no longer tolerate the distressing circumstances in which they find themselves. Vulnerability to suicidal acts has been conceptualized in multiple ways. Several models have been proposed to explain suicidal behaviour. One of the more well-known is the stress-diathesis model introduced by Mann and Arango (22) which argues how biopsychosocial

vulnerability factors interact with the environment and when external stressors exceed what the individual vulnerability can tolerate suicidal behaviour is expressed.

From a learning theory perspective, models from the cognitive-behavioural theory have contributed to the understanding of how cognitive processes in interaction with individual vulnerability contribute to maintaining and causing psychiatric distress (23). Rudd et al (24) have shown how the emergence of suicidal modes can help to explain the state that can prompt individuals to move from suicidal thoughts to suicidal acts. Here Schneidman's psychache (25) contributes here to understanding how psychological pain can contribute by causing a person to become suicidal when suffering exceeds what the individual can cope with.

An evolutionary psychological theory of the development of psychopathology was proposed by Gilbert and Allen (26), suggesting that depression can result from perceptions of defeat and entrapment. Defeat refers to the feeling of failed social struggle while entrapment refers to the feeling of being trapped in a situation from which there is no escape. It has been proposed that perceptions of defeat and entrapment in humans increase the risk of psychopathology. Perceptions of defeat and entrapment were found in a review study to be strongly associated with depression, anxiety, PTSD, and suicidality (27).

Ideation-to-action models of suicidal behaviour

The ideation-to-action framework aims to explain the pathway from suicidal thoughts to suicidal acts. Joiner has made important contributions with his Interpersonal Theory of Suicidal Behaviour (ITS) (28). The ITS model has introduced concepts such as thwarted belongingness and perceived burdensomeness as background to how suicidal thoughts develop in a social interpersonal context. Furthermore, Joiner argues that the factors that explain whether a person acts on these thoughts are determined by the so-called capability for suicide. This capability means that you learn to go against the natural survival instinct due to painful experiences.

Another model that has received considerable attention is the integrated motivational and volitional model (IMV) (29), which also attempts to explain what factors that cause a person to develop suicidal thoughts and what factors then lead to suicide attempts and suicide. Here, O'Connor argues that concepts such as defeat and entrapment, borrowed from the arrested flight model, explain suicidal ideation in combination with biopsychosocial vulnerability. Suicidal acts are then explained by the so-called volitional factors that go one step further than Joiner's ITS model. Here, in addition to previous suicide attempts, acquired volition is also explained by other biopsychosocial factors such as access to resources, suicide in the family, etc. It also explains, via the associative network theory, how each new suicide attempt increases the tendency for suicidal thoughts and actions in a negative self-reinforcing spiral.

The most recently presented model within the ideation-to-action framework is the Three-Step Theory (3ST) introduced by Klonsky and co-workers (30). The 3ST model explains suicidal desire and suicidal attempts with four factors: pain, hopelessness, connectedness, and capability for suicide. The model posits that in the presence of pain and hopelessness, suicidal desire can occur. If the pain is overwhelming the sense of connectedness to others, the suicidal desire can become strong. Even with strong suicidal desire, the individual will not, according to this theory, act if the capability for suicide is not present. The ideation-to-action models have received criticism for being overly simplistic in explaining the complex phenomenon of suicidal behaviour (31) However, it is important to note that while the above-mentioned theories cannot be used to accurately predict suicide, they may aid the understanding of suicidal behaviour and help guide prevention efforts (32).

Risk factors for suicide

Research of risk factors for suicide has identified several factors associated with suicide death. The risk factors can be of an individual and or environmental nature. Individual risk factors include, among others, psychiatric illness (35, 82, 97, 98) family history of suicide or loss of someone close to suicide (33-35), and physical health problems (36-40). Psychological autopsy is often used to post-mortem retrospectively assess the presence of any psychopathology by retrieving information through interviews and any medical records available. Employing this method, psychiatric disorders are estimated to be present in about 87% of those who die by suicide, especially affective disorders (43%) and substance disorders (23%) (41). A meta-review of psychiatric disorders found bipolar disorder, borderline personality, and anorexia nervosa to be risk factors for suicide (42). However, the majority of individuals with a psychiatric diagnosis do neither present with suicidal ideation nor do they ever attempt or die by suicide. It is also true that suicidal behaviours occur in individuals without obvious signs of (or a diagnosis of) any psychiatric illness. Factors such as economic problems (78, 88, 114), stressful life events (88, 92, 100) including adverse childhood events (113) is associated with the risk of suicide. Further, heredity, effects of media, access to lethal means, and previous suicide attempts have also been shown in a review by Fazel and Runeson to have an impact on suicide risk (43). Examples of risk factors for suicide and risk factors for suicide among suicide attempters are presented in Table 1. The overview does not aim to be comprehensive of all known risk factors or all studies investigating the presented risk factors. Note that the studies included in the overview have different populations (clinical as well as the general population) both certain and uncertain suicide or only certain, suicide attempt by several different definitions, suicidal intent and, violent method by various definitions.

Risk factors for suicide and suicide mortality among suicide attempters

One or several previous suicide attempts is one of the most well-established risk factors for suicide (3). The incidence of suicide is highest within the first years of the attempt but previous literature points at continued risk of suicide for many years after the suicide attempt (44-52). The few studies of investigation of the incidence of suicide at long-term, over 20 years have found between 2 and 13% have died by suicide at follow-up (51-55). Such results may be somewhat inflated since suicide attempts often are analysed among those that have been serious enough to lead to hospitalization.

Previous research has most often examined the risk factors for suicide in the first few years following a suicide attempt (see Table 1, short-term risk factors). Studies investigating long-term risk factors are far scarcer. Studies with a total observation time of 10–19 years report mostly the same risk factors as shorter-term studies (see Table 1, long-term risk factors). To the best of my knowledge at the time of writing this, there are only four previous prospective studies of suicide risk factors among suicide attempters with follow-up periods of 20 or more years. These report male sex (52), a baseline diagnosis of schizophrenia, bipolar/unipolar depressive disorder, other depression (51), and an index suicide attempt involving hanging, strangulation, or suffocation (55). Only a few studies have compared risk factors in the short-term and long-term. Soukas et al (56) found male sex, previous suicide attempt, somatic disease, a motive for the suicide attempts of "wish to die" and previous psychiatric treatment in the long term, while the short-term risk factors were male sex, previous suicide attempt, and a non-impulsive index suicide attempt. Tidemalm et al (48) showed that violent methods at index attempt and psychiatric disorder increase the suicide risk at short-term risk in young males while repeated self-harm may increase the long-term (2-9 years) risk in young patients. Maser et al (57) showed that, among patients with mood disorders, the short-term risk for suicide was symptoms of panic attacks. A risk factor beyond one year after the suicide attempt was impulsivity (57). Holley et al (58) identified male sex, violent method, and living in a low-income area to be risk factors at 1 year, 5 years and 10 years follow up. Zahl and Hawton investigated repeated DSH and found it to be a risk factor for suicide in the short term (5 years) and after (10 and 15 years) (59).

Individuals who have a history of suicide attempts represent a risk group to which particular attention should be paid in suicide risk assessment, as well as an important target group for suicide prevention interventions (3). However, far from everyone who has attempted suicide will attempt suicide again and/or die by suicide, just as not everyone who dies by suicide has a history of (known) suicide attempts. It is therefore of value to be able to assess, within the group of individuals with a history of suicide attempts, which individuals are at the highest risk.

While several studies provide knowledge about rates of suicide and risk factors among suicide attempters, they often do not always knowledge about the degree of

increased suicide mortality risk as compared to the total population. Excess suicide mortality among suicide attempters has been previously identified, (60-68) , but rarely with a long observation time of several decades (69). Suicide attempters (by DSH definition) do not only have elevated mortality due to suicide but also from other causes of death such as respiratory disease, neurological disorders, etc (69).

Violent suicide attempt

Individuals who make violent suicide attempts have been repeatedly identified as a risk group among individuals who attempt suicide (55, 58). Since violent methods in previous suicide attempts may be associated with higher mortality than for instance poisoning, it is important to include the method of the previous attempt in the analysis. Furthermore, high suicidal intent in people who attempt suicide has been linked to the use of violent methods (70).

Suicide intent

Suicide intent is in this thesis defined as the seriousness or intensity of the individual's wish to terminate their life (71) measured by Beck´s Suicide Intent Scale (SIS) (71). SIS has been extensively used in research and several researchers have linked high scores to suicide risk (45, 56, 68, 72, 73) including the previous follow-up of the study population (Studies I and II) by Skogman and co-workers (73). However, the results of other previous studies have been inconsistent. A review from 2008 (74) found a positive association between high scores on SIS and suicide in 6 of 13 included studies, with follow-ups ranging from under one year to over 20 years.

Repeaters

Evidence suggests that suicide attempters who make two or more attempts at suicide, sometimes referred to as repeaters have a significantly higher risk of subsequent suicide compared to those who do not repeat suicide attempts (47, 48, 56, 59, 62, 73, 75). Several studies comparing repeaters and individuals who make one suicide attempt have reported that repeaters may have specific clinical and sociodemographic characteristics (76-80). Particularly, repeaters are younger, are more often single (80), have a family history of suicide (76, 78, 80), have experienced childhood sexual or emotional abuse (77, 78), and have a poorer social and interpersonal function (78, 80). Repeaters have been reported to have higher rates of psychiatric disorders (80) including depression, substance use disorder, or personality disorder (77, 78, 81), and higher levels of hopelessness compared to suicide attempters with only one attempt (76, 82).

Table 1: Examples of risk factors for suicide and risk factors for suicide among suicide attempters in the short and long-term**.** The numbers in the bracket refer to references noted in the reference list.

Type of risk factor	Risk factors for suicide	Suicide attempters up to 5 years	Suicide attempters over 5 years
Socio-demographic			
Male sex	(36, 83, 84)	(56, 58, 85-90)	(52, 56, 58, 73, 91, 92)
Older age	(37, 93)	(86-88, 90, 94, 95)	(62, 73, 91, 92)
Psychiatric problems			
Psychiatric disorder (generally)	(36, 38, 96-98)	(48, 88)	(47, 48)
Major depression/more severe depressive symptoms	(33, 37, 83, 84, 93, 96-99)	(57, 100, 101)	(51, 73)
Bipolar disorder	(93, 98)	(102)	(51)
Psychosis	(37, 98, 99)	(102)	(51)
Substance use disorders/misuse	(37, 96, 97, 99, 103)	(85, 86, 94, 101, 104)	(47)
EUPD/Cluster B personality disorder*			(75)
Comorbidity	(99)	,	(75)
Family member/someone close died by suicide	(33-35)	(95)	
Somatic illness	(36-40)	(89, 101, 104)	(56)
Environmental			
Living alone/not with close relative	(36, 38)	(104)	
Stressful life events	(33, 37, 97)	(89)	
Problems with economy/living in a low-income area	(36, 37)	(58)	(58)
Previous suicide attempt/s	(33, 83, 93, 96, 105)	-	
Aspects of suicide attempts in suicide attempters			
Violent method	-	(48, 58, 90, 102)	(55, 58, 73)
High suicide intent/motive	-	(88, 100, 106)	(45, 56, 68, 73, 107)
Repeater	-	(56, 85, 88, 95)	(47, 48, 56, 59, 62, 73, 75)

* Emotionally unstable personality disorder/Borderline Personality Disorder

Health care utilization prior to suicide and suicide preventive interventions in health care

It is known from international research that people who die by suicide have often sought some form of health care in close proximity to their death (108-116). One review reported that 80% of the individuals who died by suicide were in contact with primary health care within one year of death, and 44% within one month of death. A total of 31% sought psychiatric services within one year prior to suicide, 21% of which was accessed one month prior to death (117). Another review and meta-analysis study found a rate of 25.7% of individuals who died by suicide had been in contact with out-or in-patient psychiatric care (118), though the studies focus mostly on in-patient care in Northern America and Western Europe. Such data indicate that health care services represent an important interface for improving suicide risk assessment and suicide prevention.

Suicide prevention efforts identified in a recent review as effective in health care include education of primary care physicians in treatment management, active outreach to discharged or suicidal patients, means restriction, and CBT treatment (2). Lithium has been repeatedly shown to be an effective suicide pharmacological intervention (119, 120). Though suicidal individuals are encouraged to seek help, health care units have often been lacking in providing an efficient response (121) Post-discharge suicides after in-patient psychiatric care was called a nightmare and disgrace by Nordentoft et al (122). A study from the US reported that of individuals who had attempted suicide within 12 months, 56% had been in contact with psychiatric services but half of those perceived unmet treatment needs (123)

Given that suicide attempters have been identified as a risk group with an elevated risk of suicide (3), thorough assessment, treatment, and follow-up should be a high priority after a suicide attempt. “Postvention”- i.e. interventions after a suicide attempt was identified as an important component of suicide prevention by the WHO (121). Psychiatric treatment is an important protective factor for suicide (124). A very recent review (125) of 18 studies regarding psychotherapeutic interventions for suicide attempters found CBT-related and potentially psychodynamic approaches to be efficacious in preventing new suicide attempts. This confirms the results of a previous review (126). Both reviews emphasize that the focus of the intervention should lie directly on the suicidal behaviors/episode.

In 2006 in Sweden, the Swedish National Board of Health and Welfare introduced regulations requiring mandatory reports from health care providers of all suicides occurring within four weeks of a health care contact (127) following the lex Maria legislation. Lex Maria concerned reporting events involving severe patient harm or risk of such events, that could have been prevented (128). This mandatory reporting continued until 2017 when the regulation was updated to state that only suicides regarded as ‘severe patient harm’ (i.e. preventable) must be reported to the

supervisory authority (129). Two recent analyses have been published regarding the outcomes of post-suicide audits in Sweden (130, 131).

Assessment of suicide risk

The prediction of all human behaviours is by nature a very challenging task, and suicide risk assessment is no exception. The prediction of suicide is fundamentally difficult since even individuals assessed as high-risk patients rarely die by suicide and those assessed as low-risk patients are still at risk of dying by suicide (132). Risk factors identified at the group level do not necessarily apply to a specific individual. The suicide risk level is a complex combination of a wide range of factors, further, it varies over time. Another problem is that individuals seeking health care in close proximity to death by suicide do not necessarily communicate their suicide intentions. Isometsä et al investigated the last appointment before death by suicide in 571 individuals who were in contact with health care within 28 days before death. Only 22% had reported suicide intentions even though as many as 100 were in contact the day of death (133). To facilitate and improve the clinical assessment of suicide risk, researchers have developed interview and assessment instruments. It has been shown that suicide risk assessment scales, in general, do not perform well enough to use for the prediction of suicide in routine clinical care (134, 135). Clinicians often weigh in their ”gut feeling” when assessing suicide risk (136). Indeed, the clinician prediction of death by suicide within one year among suicide attempters was shown to perform equally well to the SIS scale also studied in this thesis (137). It is unclear whether estimation instruments can improve the prediction of suicidal acts when the instruments are used as an adjunct to clinical assessment, as studies of this are currently lacking.

Sex and age differences related to suicidality

Sex

Globally, the age-standardized suicide rate is 2.3 times higher in males (12.6 per 100, 000) than in females (5.4 per 100, 000) (4). Sex differences exist for both suicide and attempted suicide, but with the opposite relationship. The gender paradox refers to the puzzling phenomenon in the epidemiology of suicidal behaviour that in many western countries where the prevalence of suicidality has been studied, females have higher rates of suicide attempts than males, yet rates of death by suicide are typically higher among males. In Sweden, two-thirds of all who die by suicide are men (7). The majority of suicide attempts in all age groups in Sweden can be attributed to women, although the difference between the sexes decreases with age and is quite marginal above the age of 65 (138). In the Swedish national self-reported health survey in 2020, 5.2% of the women reported a lifetime suicide attempt and 3.0% of the men (7). Several theories have been proposed to

explain the gender paradox. Four theories have been presented by Moscicki (139) and reviewed by Canetto and Sakinofsky (140): lethality, recall bias, differential rates of depression and alcohol abuse, and socialization. Lethality refers to the explanation that method differs between the sexes and that male suicide attempters often use more lethal methods and therefore more often die as a result of the suicide attempt. In this view, there are no differences regarding suicidal intent. The recall bias theory posits that women have better recall of health history compared to men and therefore give a more accurate report of previous suicide attempt/s. The differential rate of depression and alcohol abuse theory suggests that women are more often in treatment for depression and that alcohol abuse is more common among men. The fourth suggested theory of explanations for the gender paradox is differences in socialization where femininity is more associated with non-lethal suicidal behaviour while masculinity is more associated with death by suicide. The authors (140) conclude that among the reviewed theories, the socialization theory best explains the available data of the gender paradox (mostly from the United States and Canada). The cultural scrips of femininity and masculinity seem to affect the choice of method, reporting bias, and classification biases (140). Previous research of gender differences in health care utilization has shown that while men, in general, are at higher risk of suicide, women more often contact health care (any) in the year before the suicide and the portion of women who had a diagnosis of a psychiatric disorder was higher (141).

Age

Globally, more than half of all suicides occurred before the age of 50 years and suicide was the fourth leading cause of death in ages between 15–29 years (4). In Sweden, the highest suicide numbers are noted among men in the age group 85 or older while the largest portion of all deaths was seen among the youngest age group 15-29 years old (7). Yearly, on average 22 children under the age of 18 die by suicide in Sweden and a third of those had visited psychiatric services for children during the year before death (7). In the Swedish national self-reported health survey in 2020, the highest proportion, 6.3%, of respondents who said they had made a lifetime suicide attempt was in the youngest age group (16-29 years), and the lowest proportion, 1.9%, was in the oldest age group (65-84 years) (7). A previous study investigating health care-seeking patterns showed that older individuals more often seek health care for chronic somatic disease in the year before suicide, while younger individuals seek psychiatric services (141).

Knowledge gaps in the literature

None of the identified earlier studies on suicide attempters investigating differences in short-term and long-term risk factors for suicide (48, 56-59), have investigated risk factors in the very long term (over 20 years). Previous studies of suicide rates among suicide attempters indicate a sustained elevated risk for suicide over many years after attempted suicide (44-52). There is still a need for more knowledge on long-term risk factors and whether they differ from short-term risk factors.

Excess mortality in suicide attempters has been found in previous studies (60, 61, 63-67, 142-144), but very few investigations (69, 143) involved observation times as long as in Study II (up to 32 years). Study II builds on the findings of Study I by comparing excess mortality by suicide in the cohort versus the general population and re-examining the risk based on transdiagnostic clinical aspects of the suicide attempt. These include repeated attempts, the type of method used, and suicidal intent in suicide attempts. To the best of my knowledge, no previous studies have investigated whether suicide mortality is elevated among the subgroups of suicide attempters, repeaters, those using more violent methods, or those with higher suicidal intent.

Regarding health care before suicide, there is a lack of knowledge of overall health care utilization in Sweden. Prior international studies state that older adults are less likely to seek psychiatric services than younger persons (145, 146), and that male utilization of psychiatric services is lower than female utilization (147, 148). More knowledge is also needed regarding sex or age differences regarding health care contacts before death by suicide in Sweden. Further, it is unknown to what extent the health care providers have been aware of and have complied with the Swedish National Board of Health and Welfare's demand to report all individuals with a health care contact who died by suicide within four weeks before death.

The literature on psychiatric care utilization before death by suicide specifically in individuals with and without previous suicide attempts is scarce. There is a lack of knowledge of whether previous suicide attempts, a powerful risk factor, lead to specific care interventions in terms of frequency, content, and suicide risk assessments among these individuals. To the best of my knowledge, no previous studies have been conducted in the context of psychiatric health care services, comparing individuals with previous suicide attempts and those without. More knowledge about the psychiatric health care utilization of those who attempt and later die by suicide may shed light on aspects of health care that represent possible areas of improvement, toward the overall goal of improved suicide prevention.

Aims of the dissertation

The overall aim of this Ph.D. thesis was to increase the knowledge of risk factors for suicide and excess mortality of suicide attempters in a long-term trajectory and to increase knowledge of the health care utilization prior to death by suicide. The specific aims were:

1. To investigate the occurrence of suicide and all-cause mortality, risk factors for suicide after a suicide attempt in a long-term trajectory, and possible differences between risk factors for suicide in the proximal and the distant intervals.
2. To investigate the long-term excess mortality by suicide in suicide attempters and subgroups defined by repeated suicide attempts, use of a violent method at the attempt, and high suicidal intent.
3. To examine health care utilization among individuals who died by suicide, possible age and sex differences, and the proportion of the individuals that were reported to The National Health and Social Care Inspectorate.
4. To compare psychiatric health care utilization two years before suicide among individuals with and without previous suicide attempts.

Materials and methods

Data criteria and definitions

Suicide

Suicide was defined as classified in the Cause of Death Register (149); external cause of morbidity and mortality; intentional self-harm in accordance to ICD-10 (150), codes X60-X84, and ICD-9 (151) codes starting with E95.

Uncertain suicide

Uncertain suicide was defined as classified in the Cause of Death Register (149); external cause of morbidity and mortality; event of undetermined intent in accordance to ICD-10 (150) codes Y10-Y34 and ICD-9 (151) codes starting with E98.

Suicide attempt

A suicide attempt was defined in Studies I and II as a situation in which a person has performed an actual or seemingly life-threatening behaviour with the intent of jeopardizing their life or giving the appearance of such an intent, but which has not resulted in death (14). As for Study III and IV, a suicide attempt was defined as any mention of any lifetime suicide attempts in the medical chart.

Index suicide attempt

Index suicide attempt refers to the suicide attempt (the first assessed) that led to inclusion in Studies I and II.

Repeater

Repeater in Studies I and II refers to individuals who had made at least one suicide attempt before the index suicide attempt.

Violent method

A violent method in Studies I and II refers to the specific method used in the attempted suicide; either a method other than drug overdose or single wrist-cut, or a combination of different methods (152).

Ethical considerations

Studies I and II were approved by The Swedish Ethical Review Authority, No 2019-02602 (Study I) and No 2020-01939 (Study II). Informed consent was given by the participants at baseline. There are always risks involved when asking individuals in a vulnerable state to participate in a study. They may be apprehensive of negative consequences for the health care if they say no and they may have a reduced judgment due to intoxication soon after a suicide attempt. Still, there are important gains by collecting data when individuals recently made the suicide attempt because they may have a better recollection of the state that they were in before the attempt. Further, from a clinical perspective, it has been noted that suicide attempters often are more open to talking about the attempt close in time afterward (153).

For the follow-up collection of register data, The Swedish Ethical Review Authority approved that we did not need to collect informed consent. The information we requested about study subjects who have died related to their causes of death and those could for natural reasons not be asked to participate in the study. For those who were still alive but no longer living in Sweden, the only information we requested was the date on which they (last) ceased to be registered in Sweden, and since we had no way of contacting these people, they too could not be informed of and consent to participation in the study. The persons who could have been asked to participate in the study were, therefore, those who were still alive and still registered in Sweden. However, we did not intend to request any new information about this group other than the indirect information that they were alive and still registered in Sweden. We, therefore, consider that the circumstances of these studies are such that the usual principle of informed consent should be set aside so that we could collect the above data without asking the study subjects who are still living and registered in Sweden. Further, we assessed that there were no additional risks for the people included in our studies as a result of this, as the data requested was at an aggregate level and not at an individual level. We assessed that the overall benefit of the projects was high as we would be able to study long-term suicide risks in a way that is relatively little studied in the scientific literature.

The national retrospective medical record study that Studies III and IV are part of, was exempt from ethical review as it did not include living human participants, following the Swedish Act Concerning the Ethical Review of Research Involving Humans (2003:460). Instead, we received an advisory opinion from the Regional Ethical Review Board (no. 2017/234).

High standards of data handling and high data security were employed at all times. Only researchers directly involved with the analysis had access to the data files in all four studies. Only medical record reviewers who had signed confidentiality agreements and had received training had access to the medical records investigated in Study III and IV. To ensure the objectivity of the reviewer, it was decided that if reviewers in data collection came across a participant, where they had been involved

in the health care, the data collection was made by another reviewer. All participants were de-identified and all data is presented on group-level to ensure anonymity and integrity of the participants. In cases of subgroup analysis including very few participants, the choice was made not to present the data in order to protect the integrity of the participants. Even though all participants were dead in Study III and IV, the possibility that significant others of the deceased may recognize reports of a specific individual must be considered.

The overall assessment we made in all four studies was that by high standards of data handling, the benefits of generating important knowledge regarding risk factors and mortality of suicide attempters and health care use of individuals who later died by suicide, exceeded the potential risks for the participants.

Cause of death register

Information about deaths in all four studies was obtained from the Swedish Cause of Death Register (149), currently maintained by the National Board of Health. The Cause of Death Register is a high-quality source of data suitable for research purposes (154). The strengths of the Cause of death register are the completeness of information of deaths in the nation as well as its long history of use in Sweden, facilitating comparisons with other countries. The decision to start documenting causes of death was taken in the Swedish parliament in 1749. Data is available electronically for research from 1952 and onward. Weaknesses of the register include some missing and incorrect data from the earlier years of the register (1952-1960) (154). This weakness should not impact the results of this thesis as data retrieved for the included studies was made between the period 1st January 1987 until December 31st, 2018

Table 2: Overview of the four studies in the thesis

	Study I	Study II	Study III	Study IV
Design	Prospective cohort study with clinical baseline data and 21-32 years follow up by register data	See Study I plus national census data	Retrospective population-based cohort study using medical records	See Study III
Inclusion	Individuals who were psychiatrically assessed at admission to medical in-patient care for attempted suicide between 1987 and 1998.	See Study I.but only adults aged 18 and over	Individuals who died by certain suicide in Sweden in 2015 in 20 of 21 regions	See Study III but only including those with psychiatric services within two years before death
N	1,044	1,039	984	484
Data sources	Clinical assessment, Cause of death register, Statistics Sweden	See Study I plus, national census data	Cause of death register, all medical records of the two years preceding death by suicide, Reports conducted by health care providers to the Health and Social Care Inspectorate	See Study III but only including psychiatric services
Outcome	Certain suicide and all-cause mortality	Certain suicide	Health care contacts (%) in psychiatric services, primary care and specialized somatic care and number of reports to the supervisory authority	Binary dependent variable: at least one previous suicide attempt during the individual's lifetime/no previous suicide attempt
Statistical methods used	Descriptive with chi², Kaplan Meyer analysis, Cox regression	Descriptive with chi², standardized mortality ratios were calculated by Poisson regression models	Descriptive with chi², Mann-Whitney U test. Kruskal Wallis H test	Descriptive with chi², binary regression models

Clinical setting and sample: Study I and II

Setting

Between the years 1987 and 1998, approximately half of all suicide attempters admitted to the medical emergency unit, MEIU, at Lund University hospital were included in this thesis. The other half were suicide attempters whose suicide attempts occurred during weekends and holidays; these individuals were not included in the study. An overview of the inclusion of participants in the study including the previous follow-up is presented in Fig. 1. During weekdays, a suicide research team evaluated patients in a standardized manner, using a special form and particular ratings (155). The evaluations were carried out at the MEIU, generally within 24 hours after the attempt. If an individual attempted suicide again, the first evaluation was included in the study. The suicide attempt that led to inclusion in the study is referred to as the index attempt in this study. Since most of the individuals were admitted on weekdays, a subsample of consecutive cases admitted also on weekends (n=251) was compared to the rest of the sample. No statistically significant clinical differences were found between the two groups in the frequency of suicide and overall mortality in neither the previous follow-up study (73) nor in this sample. In Study, I 1,044 participants of all ages was included, while in Study II 1,039 individuals from the age of 18 and above were included.

Table 2 describes the sample divided by certain suicide, uncertain suicide, death of other causes, and being alive. Those categories as uncertain suicide compared to certain suicide were more often men, more often diagnosed with substance use disorder or adjustment disorder, and less often diagnosed with major depression.

Table 3: Overview of baseline characteristics divided by cause of death or living, N=1044, in % (column).

Baseline variable	Suicide (n=75)	Uncertain suicide (n=21)	Death by other causes (n=295)	Alive (n=653)
Sex				
Men	47%	71%	48%	33%
Women	53%	29%	52%	67%
Working or studying	47%	61%	30%	68%
Married or in a relationship	50%	28%	48%	39%
Children < 18 years	33%	39%	25%	39%
Psychiatric disorder				
Major depression	35%	11%	22%	15%
Dysthymia	10%	-	7%	4%
Substance use disorder	6%	26%	19%	9%
Adjustment disorder	15%	37%	24%	44%
Anxiety disorder	4%	5%	2%	2%
Psychosis	17%	-	8%	7%
Depression UNS	10%	5%	12%	10%
Other Axis I disorder	1%	-	3%	5%
Axis II disorder	-	-	1%	1%
Repeater	62%	56%	42%	40%
Violent method at attempt	15%	10%	5%	4%
SIS score ≥ 19	44%	20%	28%	20%

Follow-up

Information about whether a study participant had died (date of death) or emigrated from Sweden (date of emigration) was obtained from the Swedish Tax Authority until July 2019. Data on causes of death were obtained for the period 1st January 1987 until December 31st, 2018, from the Swedish Cause of Death Register. Uncertain suicide was not included in the analyses, as in the previous follow-up (73).

Data collection and measures: Study I and II

A psychiatrist and a social worker from the Lund suicide research team conducted semi-structured interviews and ratings. The psychiatrist (not the same one for all patients) diagnosed psychiatric disorders according to the Diagnostic and Statistical Manual of Mental Disorders, Third Edition-Revised (DSM-III-R) (156), but no structured interviews were carried out for diagnostics. The interviews at the MEIU covered the following parameters: socio-demographic data, the method used at the suicide attempt (violent vs. non-violent methods), the occurrence of previous suicide attempts, current or previous contact with psychiatry, and suicidal intent

assessed by using the Beck Suicidal Intent Scale (SIS) (71). Suicide attempters who were assessed as high-risk patients were admitted to psychiatric in-patient treatment after their medical condition had been treated at the MEIU, others were referred to outpatient psychiatric care.

Psychiatric diagnosis

Psychiatric diagnosis was assessed at the emergency psychiatric consultations, which were always requested by the MEIU after a suicide attempt. Only the primary diagnosis was used for Study I. The amount of missing data on secondary diagnoses was very high. For this reason, it was chosen not to include any secondary diagnoses in the analyses.

Suicidal intent

Suicide Intent Scale (SIS) (71) is a 20-item, clinician-completed measure of the severity of suicidal intent of a suicide attempt. The total score is calculated based on the sum of the 0-2 ratings for the first 15 items (71). The questions concern aspects of a recent suicide attempt in terms of the risk of being found, the planning involved, the perceived lethality of the method, and the wish to die from the attempt.

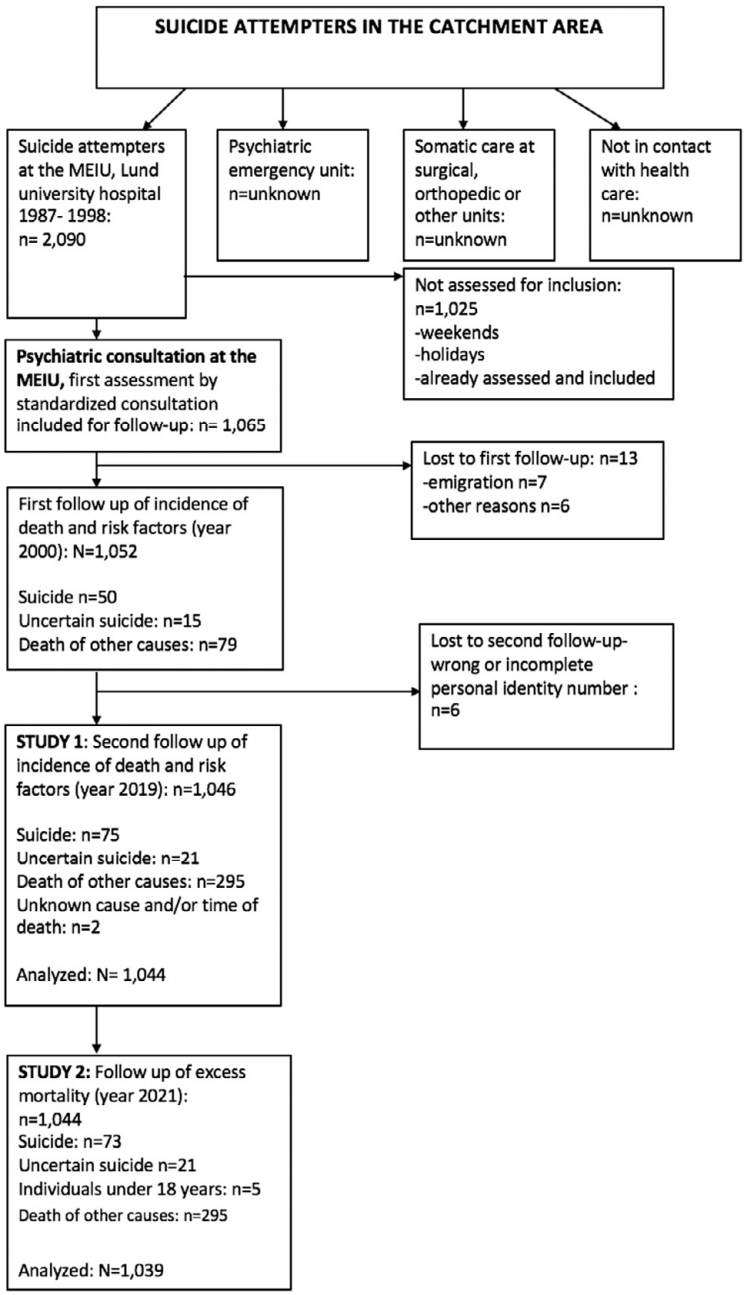

Figure 1: Flow chart of participants in Study I and II

Statistical analyses: Study I and II

All analyses were performed using Version 25, 26, and 27 of SPSS (157). As per convention, a significance threshold of 0.05 was set throughout the thesis.

Study I

Associations between baseline variables and time to suicide were identified using Cox regression models. Clinically relevant variables identified at the earlier follow-up of this population (73) were chosen to investigate for further analysis. By using Kaplan-Meier survival analysis, all diagnostic groups were investigated. Three diagnoses were identified as possible risk factors for suicide, i.e., major depressive episode, dysthymia, and psychosis, these were therefore selected for further analysis. The most common diagnosis was adjustment disorder (32%) and for this reason, it was chosen as the reference group. The hazard ratio for the selected diagnoses was calculated in relation to the reference group (adjustment disorder) using Cox regression.

In order to investigate if the risk factors for suicide varied over time, Schoenfeld residuals were analysed to test the assumption of proportional hazards for each covariate separately. Separate Cox regression models were carried out for the first five years after the index attempt and the remainder of the study period (> 5 years after the index attempt). This 5-year cut-off was chosen since approximately half of the suicides occurred in each of the two-time spans (40 suicides in the first five years, 35 in the remaining years). Firstly, hazard ratios were calculated for each variable independently to identify possible risk factors. Secondly, in order to adjust for the effect of the variables on each other, the variables found to be independently statistically significant were included in a regression model.

Study II

The standardized mortality ratio (SMR) can be used to investigate the excess mortality in a study population. Differences in age and sex distribution compared to the total population can this way be controlled for, and the analysis allows information about the level of excess mortality in the study population compared with the expected level, based on the mortality of the chosen total population. Our baseline data set was restructured to match the census data on sex, age, and year, all combinations of the years 1987-2018, both sexes and 1-year age intervals of 18-100 years. As a next step, it was differentiated in all 16 combinations of the dichotomous variables: repeaters, violent attempt, suicide intent scale ≥ 19 p, and time. The total number of suicide deaths in the study population for each row of data was considered observed suicide deaths, and by using the total observation time per row from the study population and the incidence of suicide death for each row of data

from the census data, we could calculate expected suicide deaths for each row of the data. Poisson regression models were used to calculate standardized mortality ratios (SMR) and rate ratios (RR). Observed suicide deaths were the dependent variable and the offset variable was the logarithm of expected suicide deaths. The covariates were included as independent variables in the regression models for subgroup analysis purposes. Tests of the statistical significance of the SMR were based on the Poisson distribution using 95% confidence intervals. Analyses of the SMR of several subgroups were performed, and the difference between levels of covariates was assessed by confidence intervals of the RR and p-values.

Firstly, all investigated variables were analysed separately, category by category. Secondly, the variables were investigated with the categories within the variable about each other. Thirdly, the investigated subgroups repeater, violent method, and a high score on SIS were included jointly in a regression model. This way they were adjusted for the effect of one another. To control for the possible interaction between the subgroup variables, a regression model also including interaction terms was calculated. Comparing the interaction model to the model without interaction terms, by assessment of Akaike Information Criterion, the model without interaction terms was preferred.

Clinical setting and sample: Study III and IV

Study III and Study IV were carried out as parts of an ongoing nationwide research project titled Retrospective investigation of health care utilization of individuals who died by suicide in Sweden 2015. Using the Swedish Cause of Death Register (149), which comprises data on all deaths of people registered in Sweden, identification of all individuals recorded with death by suicide from 1 January 2015 to 31 December 2015 was possible. The total number of certain suicides in Sweden in 2015 was 1,186. For this thesis, only certain suicides were included. The same year, 378 deaths were registered as deaths with unclear intent (uncertain suicides) and these were not included in these studies. Among the 1,186 certain suicides, the 232 individuals from Region Stockholm were not included because the data from Stockholm was not yet available when the analysis was performed. The project includes data for 20 of Sweden's 21 regions. A flowchart of participants in Studies III and IV is presented in Figure 2.

In Study III, 949 individuals died by certain suicide in Sweden in 2015 (except for the Stockholm Region as mentioned above) were identified as the study population. However, one individual was excluded due to a pre-existing confidentiality agreement. That left 948 individuals included. In Study IV, 484 individuals were included who had died by suicide in Sweden 2015 (except for the Stockholm Region) and were in contact with psychiatric health care services during their last two years of life, representing 51% of all suicides in the 20-county catchment area.

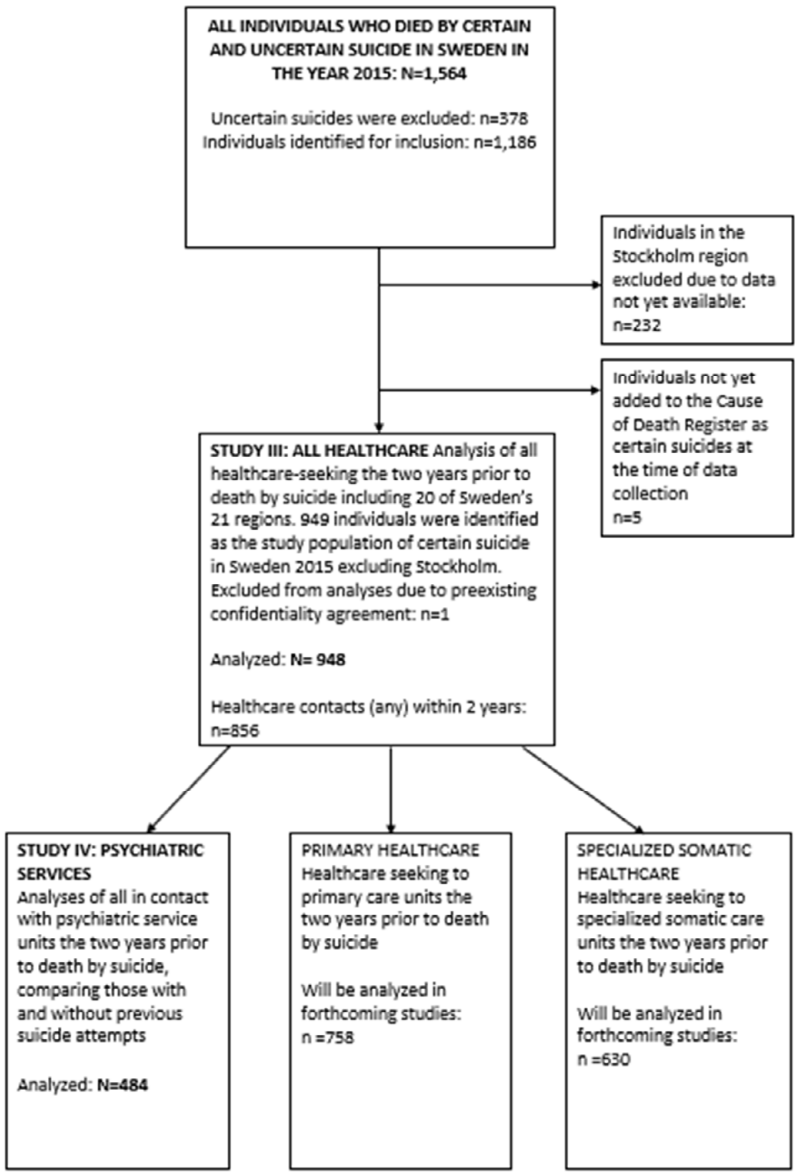

Figure 2: Flowchart of the participants in Studies III and IV

In Study III, among the 948 included individuals 72% were men (n= 681) and 27% were women (n=257). The mean age at death was 52 years. In Study IV, 65% (n=316) were men, 35% (n=168) were women and age ranged from 13-94 years, mean 47 years.

Table 4: Overview of sociodemographic information and health care contacts Study IV (N=484)

Variable	Previous suicide attempts (n=246)	No previous suicide attempts (n=238)
Gender		
Men	74%	57%
Women	26%	44%
Health care contacts 24 months:		
Psychiatric care	100%	100%
Primary care	84%	87%
Specialized somatic care	68%	79%
Age at death m/M (max-min)	48/50 (13-90)	46/45 (18-94)
Age divided into groups:		
Up to 19 years	6%	2%
20-29 years	12%	18%
30-39 years	12%	19%
40-49 years	19%	17%
50-59 years	24%	22%
60-69 years	18%	12%
70 years or older	9%	11%
Married/living with a partner	24%	25%
Employed full-time	29%	22%
Unemployed full-time	14%	20%
Sick leave full-time	28%	35%
Living with children under 18 years	15%	17%

Data collection and measures: Studies III and IV

The personal identification numbers were divided by region. Health care in Sweden is decentralized and managed by regional councils in each county. After establishing a confidentiality agreement based on the Swedish Law of Patient Confidentiality (158) with a representative in each county, personal identification numbers of individuals who died by suicide in 2015 in the specific county and corresponding de-identification codes were sent to the representative by registered post. Access was granted regionally to electronic health record systems. In some regions, paper copies were requested.

Post-suicide reports

All suicide events during 2015 reported by health care providers to the National Health and Social Care Inspectorate (the supervisory authority) were included. Complete reports conducted by the health care providers and the subsequent evaluation by the supervisory authority were obtained, granted by a contract of secrecy. The unique personal identification number (de-identification codes) from the reports was coordinated with the data from the reviewed health care records to find the proportion of reported cases among health care users within four weeks before suicide.

Protocol for the investigation of medical records

The research group developed a data collection protocol inspired by the guidelines of the Swedish Psychiatric Organization (159). The protocol includes 622 questions regarding a wide range of aspects connected to health care utilization. Questions include demographic information, number of visits, diagnostic codes recorded, type of treatments received or planned, assessment of suicide risk, etc. A limited number of these questions were analysed in Study III and IV. Records from private psychiatric health care services were also included when possible but information of private health care contacts was not always available to the medical reviewers, likely causing missing data on an unknown number of individuals. Data regarding previous suicide attempts was collected from all available medical record information within two years, i.e., not only from psychiatric medical records. Visits to and telephone contacts to all kinds of health care units were taken included in analyses, outpatient clinics, inpatient wards, psychiatric emergency visits, psychiatric consultations, mobile team visits, private psychiatric care, and telephone contact. Contacts with all professions were included, such as a physician, psychologist, social counsellor, nurse, physiotherapist, and assistant nurse.

Medical records reviewers

Regional agreements were signed between the project leader of the overarching project where study III and IV are included and health care representatives regarding patient confidentiality documents, agreeing to adhere to the Swedish law of patient confidentiality (The Swedish Public Access to Information and Secrecy Act (SFS 2009:400) (158) when handling the research data. Following the agreement, they were granted access to personal identification numbers of the individuals who had resided in that specific regional area and who died by suicide in 2015. Investigators were chosen regionally and were primarily clinicians with experience in using the region's electronic record system The investigators were trained in how to use the protocol in groups by members of the research team. To assist reviewers in how to

collect data, the research team constructed a written data collection guide. Post training, the research group made sure to be available to reviewers if any question would arise and continuously sent out updates.

Statistical analyses: Studies III and IV

In Study III, for descriptive analysis, the Crosstabs' function was used to identify the proportion of individuals having a health care contact within 24 months, 12 months, three months and four weeks, one week and one day before death. Group differences between age groups (0-24, 25-44, 45-64, 65+) and sex were investigated using Chi^2 analyses. The number of reports from health care providers to supervisory authority among individuals with health care utilization within four weeks, one week, and one day was analysed. Group differences between age groups as defined above and sex were investigated using chi^2. Putative differences in the median time from last health care contact and death between sexes and age groups were tested using the Mann-Whitney U test. Kruskal-Wallis H test.

In Study IV, frequency distributions with the Chi^2 test were calculated. Crude and adjusted OR were investigated using logistic regressions were used in order to analyze associations between suicide with previous suicide attempt/s (PSA) versus without (NSA) and independent variables. The results were presented as crude and adjusted odds ratios (ORs) and 95% confidence intervals (95% CIs). ORs with 95% CIs were estimated for each independent variable. ORs were then adjusted for gender and age. As the last steps, we wanted to investigate the effect of sex, age, and psychiatric diagnoses on the clinical variables in the regression models. Firstly, for gender and age, secondly for all psychiatric disorders, and lastly for psychiatric comorbidity. thereby adjusting also for the effect of these variables.

Results

Study I

At follow-up, 7.2% of the individuals had died by suicide and of these, 53% had died within 5 years and 25% in the first year after the index attempt. The overall mortality was 37.6% of the study population.

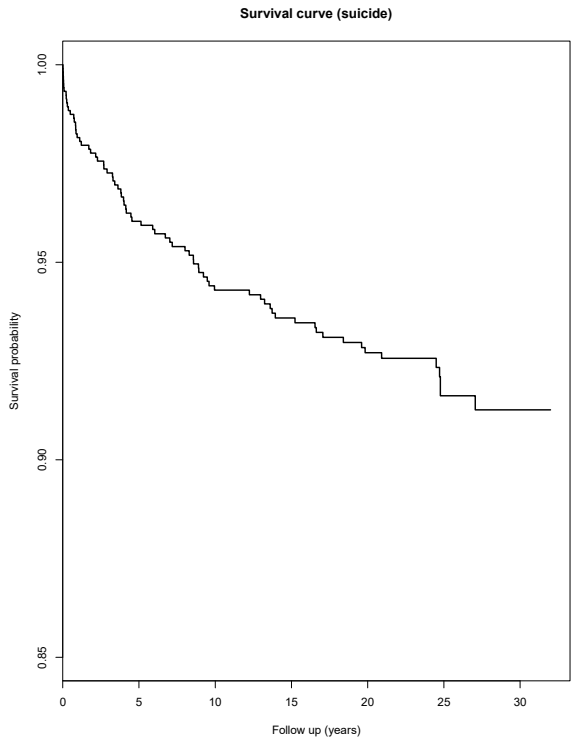

Figure 3: Survival curve of death by suicide in the study population

The survival curve can be viewed in Figure 3 (160). The risk factors in short-term and long-term follow-up differed as can be seen in Figure 4. A diagnosed dysthymia at baseline and high suicide intent (SIS score) were risk factors for suicide in short term, i.e., within 5 years. Analyses indicated that a higher SIS score was less relevant as a risk factor for suicides more than five years after the index attempt. The long-term risk factors for suicide, i.e., more than 5 years after the index attempt, were being a repeater or diagnosed with major depression or psychosis. Risk factors

for the whole period were being diagnosed with a psychosis, major depression or dysthymia, violent method, or higher SIS score. The most salient finding in this study was that suicide attempts that happened before the index attempt was a risk factor for suicide even decades after they occurred.

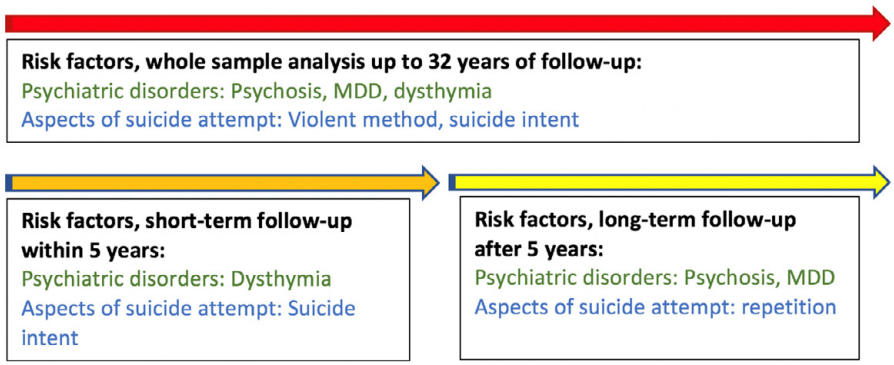

Figure 4: Risk factors for suicide among suicide attempters, an overview of the whole period, short-term follow-up, and long-term follow-up

Study II

Substantial excess mortality by suicide among suicide attempters was found. The overall SMR for suicide was 23.50 [CI 95% 18.68-29.56], higher among women [30.49 (CI 95% 22.27-41.72)] than men [18.61 (CI 95% 13.30-26.05)]. Mortality was highest during the first 5 years after the index suicide attempt [48.79 (CI 95% 35.64-66.77)] compared to those who died after more than 5 years after the index attempt [14.74 (10.53-20.63)]. The highest independent SMR was found for the subgroup of patients who engaged in a violent index attempt [70.22 (CI 95% 38.89-126.80)]. A regression model including measures of repeated suicidal attempts (RA), violent attempts (VA), and scores on a measure of suicidal intent (HS), showed that repeated attempts, violent methods, and a higher suicidal intent were significantly associated with excess suicide mortality. The most salient finding was the highly elevated mortality among those who had made a violent suicide attempt.

Study III

A large majority, 90.3%, were with a health care provider during the 24 months prior to suicide, and 60% within four weeks. The most common type of health care contact within two years to four weeks before suicide was with primary health care, while psychiatric health care was the most common type of health care within four weeks to one day before suicide. The utilization rate of primary care was 72% who were in contact within twelve months, 31% within one month, and 14% within one

week before death by suicide. In psychiatric services, the corresponding rates were 47% within twelve months, 31% within one month, and 19% within one week before death by suicide. A higher proportion of younger individuals (<65 years) were in contact with psychiatric services, and a higher proportion of older individuals (≥65 years) were in contact with primary and specialized somatic care. Men had fewer contacts than women across all investigated settings. Among health care users within four weeks before suicide, only 45% were reported to the supervisory authority. Reports were less likely to be filed after suicides in men and older adults. The most salient finding of this study was the age differences found in health care-seeking and the low portion of health care users who died by suicide that was reported to the supervisory authorities though this was mandatory at the time.

Study IV

Of the 484 individuals included, 51% had made previous suicide attempts. Those with previous suicide attempts, PSA, were more likely than those with no previous attempts; NSA, to have received a psychiatric diagnosis [OR 1.96 (CI 95% 1.17–3.30)], to have ongoing psychopharmacological medication [OR 1.96 (CI 95% 1.15–3.36)] and to have been absent from appointments during the last three months [OR 1.97 (CI 95% 1.25–3.13)]. In addition, elevated suicide risk was more often noted in the psychiatric case records in those with a PSA than in NSA [OR 2.17 (CI 95% 1.24–3.79)]. In individuals with PSA, suicide risk was assessed as elevated in 20% and less than 10% among those with NSA. As presented in Figure 5 (161), ongoing pharmacological-, and psychological treatments as well as planned contact with community psychiatry were more common in PSA. These results remained significant for psychopharmacological treatment after adjustment for sex, age, comorbidity, and psychological treatment. The most salient finding was that as many as half of the users of psychiatric services who died by suicide had known lifetime previous suicide attempts. They more often had missed appointments the last three months before suicide. NSA were more likely to not have been diagnosed with a psychiatric disorder, though all included subjects were in contact with psychiatric services.

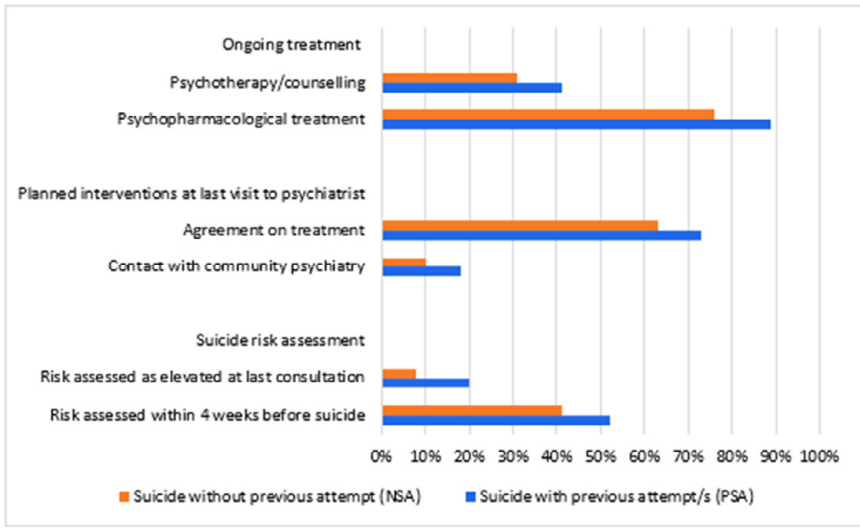

Figure 5: Proportions (%) with ongoing and planned psychiatric interventions and suicide risk assessment by suicide attempt history.

General discussion

Methodological considerations

Study I and II

To the best of my knowledge at the time of this writing, the cohort of suicide attempters in Study I and II is the largest followed for this length of time, i.e., over 20 years, which also has clinical baseline data from a standardized psychiatric assessment. The inclusion of a relatively large study population in combination with a very long observation time made analysis of both short-term and long-term risk factors possible. Such comparisons have rarely been done to date (48, 56-59), and never with a follow-up time as long as the duration in the present thesis. Another strength of Studies I and II was the collection of data from high-quality registers (154). Study II also benefits from the inclusion of annual general population death rates, divided into gender and age subgroups, for the study period permitting the generation of a more accurate estimation of the expected numbers of deaths.

One aspect of external validity concerns the generalisability of the study population to the wider target group (162), i.e. suicide attempters in the case of Study I and II. This sample consists of individuals who were admitted to a medical emergency in-patient unit associated with a suicide attempt, thus indicating a certain medical severity of the attempt. In general, the larger group of suicide attempts do for the most part not come to the attention of the health care system or do not require emergency care, thereby reducing the generalisability of the study sample. Further, the external validity of the study is limited by including only participants from one hospital, in one city with its catchment area. The population of the city where data collection was made may not be representative of other cities in Sweden and even less globally. Lund is a university city with a high portion of individuals with higher education and a high portion of younger individuals since many students come to Lund for university education. Another inherent problem of long-term follow-up studies is the fact that the characteristics of suicide attempters, as well as contextual factors, may have changed since baseline data were collected. The impact of these factors on the generalization to the wider group of suicide attempters must be considered.

Another limitation of Study I concerns the emergency unit diagnoses that were included in the analysis. The psychiatric assessment was carried out at the medical emergency in-patient unit (MEIU) by a consulting psychiatrist. It has been shown that clinical emergency consultation diagnostics are unreliable and often underestimate the overall psychopathology of suicide attempters compared to a

research diagnosis, especially in reference to depressive symptoms, alcohol use disorders, and psychiatric comorbidity (163). Thus, the emergency context at the assessment in Study I may have created difficulties in obtaining a full psychiatric history. This difficulty could possibly explain the surprising result that no cases of bipolar disorder, and very few cases of personality disorder, were identified within the study group. Previous research has shown that individuals with bipolar disorder often attempt suicide during depressive episodes (164), a fact contributing to bipolar disorder commonly being misdiagnosed as MDD. Likely, an unknown portion of the individuals diagnosed with MDD, psychosis, or other diagnoses would also fill the criteria for bipolar disorder, personality disorder, or other psychiatric diagnoses, if a more thorough diagnostic assessment had been possible. As only the primary diagnoses could be used in the analysis, it is also possible that certain individuals also filled the criteria for other diagnoses than those investigated in this thesis. Furthermore, the field of psychiatric research and diagnostic assessments is complex and the borders between different disorders are often not sharp. Thereby the validity in this sense can be considered as low(165)

Study III and IV

The population of studies III and IV provided nearly a national coverage of suicides among individuals with various types of health care contacts. Study III and IV contained detailed data on the type of contacts, treatments, and interventions, as well as the duration of the provided health care, which is rare in previous studies on the subject. A limitation of the two studies is that data from the Stockholm region could not be included since it was not yet available at the time of analysis. Stockholm is the largest city in Sweden. Approximately 19% of all suicides in Sweden are committed within this region and in 2015, there were specifically 232 deaths by suicide. Inclusion of the Stockholm region may have yielded a somewhat different result since it would have made the portion of suicides from a metropolitan area larger. Partially due to lower access to psychiatric services and stigmatizing beliefs about psychiatric treatment (166), suicides and suicide attempts have been shown to be more common in rural compared to urban areas (167). Further, in Sweden, metropolitan regions have lower unemployment, higher median income, and fewer people with low education compared to remote rural regions (7).

Apart from information about death by suicide from the *Cause of Death* register, the studies rely exclusively on the information noted in medical records. The only source of information on the occurrence of any lifetime suicide attempts was from the record. By this way of data collection, suicide attempts that did not require in-patient care were possible to include as opposed to information from national registers that only include suicide attempts that were serious enough to require patient care. However, the limitations of the data collection are important to consider. Generally, the use of data from medical charts could result in measurement

bias since reporting in medical records is not systematic and rely heavily on the individual reporting of health care professionals, a reporting that may vary in detail and extent. All cases of previous suicide attempts were likely not mentioned in the medical chart or known by health care staff. This suggests that the number of suicide attempters is likely higher than reported, posing a limitation to internal validity and a possible source of measurement bias. The psychiatric diagnoses reported in Study IV were accordingly also derived from the medical record and are therefore somewhat unreliable as they are clinical and not research diagnoses. Further, this study did not include information from any of the national registers apart from the *Cause of Death* Register. The addition of data from other national registers could have contributed to more information on the overall health-seeking patterns. Neither did Study III and IV include a matched control group of individuals in contact with health care at the same period but did not die by suicide, resulting in descriptive and hypothesis building results that require further testing.

Data were collected by numerous investigators all over the country, however, there was no testing of inter-rater reliability (IRR). Some of the questions in the protocol could involve a degree of assessment by the investigator, among them the categorization of PSA/NSA depending on how it was noted in the medical record. The absence of IRR testing could reduce the reliability of the data as could the fact that investigators came from different parts of the country. Because of confidentiality law, medical records could only be assessed within one region. Efforts to make sure investigators uniformly collected data included group training, written investigator guidelines, and a high level of support and availability from the research group. Another issue to consider is that there were regional differences in the organization of health care which made the protocol more challenging to use in some regions. These differences could also mean regional disparities in the care offered. Such data will be possible to analyse in forthcoming studies but was not investigated in this thesis.

In the medical chart systems investigated in this study, private health care is not always automatically recorded and for this reason, data on some health care utilization may not have been included. The extent of missing data from private health care is not known, nor is understanding in what way inclusion of all private health care may have influenced the results.

Studies III and IV describe the health care utilization in one country only. The generalizability to other countries is limited. Further, it is important to note that both studies report on healthcare received by individuals who died by suicide and do not describe health care utilization in general. For instance, the reported differences between individuals with and without previous suicide attempts in Study IV cannot be applied to all individuals seeking psychiatric services with or without previous suicide attempts.

Main findings

The suicide mortality of suicide attempters

This thesis demonstrated in Study II a severe risk of premature death by suicide in suicide attempters compared to the general population. The number of suicides in this study population of suicide attempters was approximately 23.5 times the number of suicides in the general Swedish population for the same period, adjusted for sex, age, and year. This confirms the conclusions of previous studies that found SMRs of between 17-77 (58, 60, 61, 63-67, 142-144), though these studies had different standard populations. The finding in Study I that 7.2% of previous suicide attempters had died by suicide is in line with previous studies, which identified rates between 2 and 13% (51-54). More than half, 53% of all suicides occurred within 5 years after the index attempt and as much as 25% within the first year. These results are in line with earlier long-term follow-ups of suicide attempters that indicate that while the risk of suicide persists for many years after a suicide attempt, the incidence of suicide is highest within the first years (44-52). Additionally, results of Study II showed that excess mortality was higher the first five years after the attempts compared to the period after five years. The SMR was higher among women than among men, a finding others have previously made (60, 61, 63, 64, 69). The finding that female suicide attempters in this study had higher SMR than male suicide attempters, likely reflects that when compared to the general population, the risk in women is more clearly elevated than among men since the overall risk of suicide mortality is higher among men.

The long-term risk factors for suicide and subgroups with elevated suicide mortality

The present thesis found in Study I that having at least one suicide attempt before the index suicide at baseline was a risk factor for suicide even decades after the index attempt. Repeaters were also identified in Study II as a subgroup among suicide attempters with elevated suicide mortality. This is in line with the results of previous literature that repeated suicide attempts constitute a risk factor for suicide (48, 62) including Soukas et al (56), though they found previous suicide attempts to also be a short-term risk factor. A violent method was identified as a risk factor for suicide in Study I in this thesis, confirming the results of previous findings (55). Further, suicide attempters who used a violent method were shown to be the subgroup with the highest excess suicide mortality investigated in Study II in this thesis. The finding that psychosis was the risk factor with the highest hazard ratio in long term is in line with previous research (51). However, the importance in the long term as compared to in short term has not previously been described.

Differences in risk factors for suicide over time

The differences in short-term and long-term risk factors found in Study I are to some extent in line with the findings of previous studies investigating such differences (48, 56, 57). The finding of Study I that a violent method seems a relevant short-term factor confirmed the results of Tidemalm and co-workers (48). Anxiety and affective states were found by Maser et al (57) to be a risk factor in the short term, within one year. This is partially in line with our finding that dysthymia and major depression were relevant risk factors within the five first years, tough Study I identified depression as a risk factor for the whole observation period. The suicide intent as measured by the SIS score was highly statistically significant in the analysis of short-term risk factors but not in the long-term analysis in Study I. The subgroup of suicide attempters with high SIS scores was also shown in Study II to have excess mortality compared to the general population. An aspect worthy of consideration in Study I is that suicide intent (SIS score) was the only variable that violated the assumption of proportional hazards, therefore it could be argued that this variable had the strongest support for a differential effect over time. of varying of the investigated period.

Overall health care prior to suicide

As much as 90% of those who died by suicide were in contact with a health care provider over two years prior to suicide, with 60% within four weeks. Within one year, 86% had a health care contact, a result in line with the 84% reported by Ahmedani et al (108). In the utilization of primary care, 72% were in contact within one year, 31% within one month, and 14% within one week before death by suicide. Louma et al reported a contact rate within a month to be 45% and Stene-Larsen et al 44% (109, 168). This indicates that the utilization of primary care contacts was slightly lower in this study compared to previous literature The utilization of psychiatric services was 47% within a year, 31% within one month, and 19% within one week before death by suicide. These results demonstrate higher rates of contact than found in previous studies, Stene-Larsen et al found 31% and Walby et al 27.5% within a year (168, 169). Younger individuals were to a higher degree in contact with psychiatric services than older individuals, while older individuals were to a higher degree in contact with primary health care and specialized somatic health care. The identified patterns regarding age are in line with Louma et al.(109) and Liu et al (170). The reasons behind these variations need to be further investigated but lower levels of stigma regarding seeking help from psychiatric services in younger people could be a possible explanation. Less than half of the individuals with any health care utilization within four weeks before suicide was reported to the supervisory authority, although it was mandatory at the time of data collection. Possible explanations likely include low knowledge of the mandatory reporting and

the absence of an automatic feedback system to the clinician or the clinic when a patient dies soon after seeking health services.

Psychiatric services prior to suicide

Missed appointments

A finding with possibly important clinical implications was the result that being absent from appointments during the last three months before suicide was more common among individuals with previous suicide attempts (PSA) than those with no previous suicide attempts (NSA). Previous research has shown that ensuring treatment adherence to long-term psychological therapies among suicide attempters can be a clinical challenge (171). The relationship between clinician and patient can be described as a working alliance (172). Bordin described a good working alliance in terms of "(a) the patient and therapist arrive at a consensus about the goals and tasks of therapy and (b) the patient and therapist negotiate a shared affective and personal bond." A review from 2017 stressed the importance of building a strong alliance with suicidal individuals (173). Research shows that the working alliance is associated with treatment adherence and satisfaction (174). A recent study investigating the Attempted Suicide Short Intervention Program (ASSIP) showed that patient satisfaction with treatment outcome was associated with lower suicidal ideation in two years follow-ups (175). It is not known what strategies, if any, were used in Study IV to reach the patient when they missed an appointment and what role this aspect might play in the trajectory of prevention efforts.

To agree in the treatment plan on how to handle missed appointments could be a possible way of improvement within psychiatric services. It could for instance be agreed that clinicians reach out to patients the same day they miss appointments. Further, to discuss with the patient whether clinicians could include significant others in treatment planning. If patients agree that significant others may be included, clinicians will have to possibility to contact them in the case of absence from appointments. Further, the significant others could be informed of who they could contact if they were worried about the patient. Skogman et al (176) conducted interviews with individuals who had attempted suicide. The authors identified an overarching theme of wanting control. Alongside efficient treatment for psychiatric symptoms, the authors highlight the patients' needs for a better understanding of themselves, learning new skills to solve problems and seek help, and getting more help with social and economic problems. Such needs correspond to resources such as psychotherapeutic treatment, and multi-professional efforts. Another study explored the experiences and needs in a long-term trajectory of suicide attempters with severe depression (177). They identified a theme similar to that of Skogman et al: "taking care of oneself by regaining control" as important in overcoming suicidality over time. The interviewed suicide attempters reported that psychosocial

support was crucial for recovery in a longer trajectory, alongside recovering from depression. Support from a trusted person and openness for discussion about existential issues is helpful for patients. The identified need for psychosocial support may also be reflected in the finding in Study IV that patients with previous suicide attempts more often had planned contact with community psychiatry compared to individuals who died on their first attempt. A 1-year follow-up of a subsample of the participants in Study I and II investigated the needs of suicide attempters. Cedereke et (178) concluded that needs among suicide attempters after a suicide attempt include health aspects but also basic and social needs and that after a year, social needs are greater than psychiatric. Summarizing these findings by previous research and this thesis, it seems suicide attempters need a flexible long-term follow-up corresponding to a wide range of needs.

Suicide risk assessment

Within psychiatric services in Study IV, among the individuals who had PSA, it was more common that the suicide risk was assessed as elevated at the last consultation with a psychiatrist compared to among those with NSA. The reasons for this remain unanswered. It is possible that this finding reflects an awareness among clinicians of previous suicide attempts as a risk factor and this made the risk easier to detect compared to among patients with no previous suicide attempts. It has been described in a recent Korean study (179) that among individuals with PSA, the subject of suicide and death is more accessible to talk about. This could also be part of the reasons behind the differences identified in Study IV. Important to note among this group of individuals who all died by suicide in Sweden, including both PSA and NSA, and who were in contact with psychiatric services the last four weeks prior to death, is that suicide risk had not always been assessed. A very recent study from Norway (180) investigated clinicians' perceptions of suicide risk assessments in psychiatric services. The study showed that while the knowledge was generally good regarding the guidelines and requirements regarding suicide risk assessment, the practice can also be viewed as too time-consuming and focused on legal rather than clinical perspectives. Clinicians may experience that suicide risk assessment may conflict with time spent for treatment interventions. The finding of Study IV puts the spotlight on a possible area of improvement in psychiatric services in Sweden, perhaps by incorporating the suicide risk assessment as part of the treatment interventions.

Psychiatric diagnosis

Among individuals with PSA, being diagnosed with a psychiatric disorder (any) and psychiatric comorbidity (any) was more common than among those with NSA, a finding confirming the results of Yook et al (179). Overall, all investigated psychiatric diagnoses except schizophrenia were more common among individuals with PSA than those with NSA. The reason for this difference could not be explained by this thesis but it raises important questions as to whether individuals

with NSA are an underdiagnosed group. If this is the case, it may impact the chance of receiving effective treatments, longer care trajectories, and lowered overall prognoses in this group. Specifically, personality disorder and bipolar disorder were strongly associated with individuals with PSA, in line with previous research regarding personality disorder (81, 181) and bipolar disorder (182). Interestingly, these diagnoses were rare or absent in Study I, perhaps due to the emergency unit context or perhaps mirroring the fact that these diagnoses were not receiving enough attention in the late 1980s to 1990s.

Conclusions

In this thesis, the risk factors for suicide and excess mortality of suicide attempters in a long-term trajectory were examined, and a contribution to the knowledge of the health care utilization prior to death by suicide was made. Over a thousand suicide attempters were followed for up to 32 years in Study I and II and the health care utilization of the majority of individuals who died in 2015 in Sweden were analysed.

The following was found at long-term follow-up of suicide attempters:

- A severe risk of premature death by suicide compared to the general population.
- Psychosis or major depression at baseline or repeated suicide attempts were risk factors at very long term, while the suicide intent was a risk factor within the first five years.
- Those who had used a violent method had the highest excess suicide mortality.

Regarding the health care utilization during the two years prior to the death of individuals who later died by suicide the following was found:

- 90.3% of individuals who died by suicide were in contact with a health care provider during the 24 months prior to suicide, and 60% within four weeks.
- A higher proportion of younger individuals were in contact with psychiatric services, while a higher proportion of older individuals were in contact with primary and specialized somatic care.
- Among users of psychiatric services, suicide risk in individuals with previous suicide attempts was more often detected, they more often had a diagnosed psychiatric disorder and were more often in psychopharmacological treatment than individuals with no previous suicide attempts.
- A larger proportion of individuals with previous suicide attempts were absent from appointments the last three months before death by suicide.

This thesis contributed to the existing literature by providing knowledge of risk factors and suicide mortality in the very long term in a large group of suicide attempters with access to clinical baseline data. Further, the studies contributed to the knowledge of the overall health care utilization in Sweden in individuals who died by suicide. The differences in utilization of psychiatric services between individuals with or without previous suicide attempts were illuminated. The results need to be interpreted in the light of limitations to the generalisability to all suicide

attempters and to all individuals who die by suicide. The presented findings can contribute to improved suicide assessment and generate hypotheses regarding ways to improve the suicide preventive interventions in the health care system.

Implications for future research

In future research, it would be interesting to include events after the index attempt in long-term follow-ups such as the development of psychiatric disorders and additional suicide attempts. It would also be interesting to conduct interviews with those still living.

Regarding health care contacts before suicide, it would be of value to test the findings of this study against a control group of individuals in contact with health care units who did not die by suicide.

To be absent from appointments during the last three months before suicide was more common among individuals with PSA than among those with NSA. This thesis did not analyse whether any strategies were used to reach the patient or significant others when appointments were missed. The importance of making agreements on how to handle absence from appointments would be of interest to investigate.

In all long-term studies, it is important to consider the differences in periods covered between the studies. In future research, it would be of importance to further investigate whether risk factors have changed over time.

Since risk factors among and subgroups of suicide attempters with excess suicide mortality have been identified, it would be of interest to test improved follow-up of suicide attempters and investigate if the long-term trajectory of these individuals could be influenced.

Clinical implications

A thorough assessment of the history of previous suicide attempts is important, even though the attempt/s may have occurred many years ago. Aspects of suicide attempts such as high suicide intent in the short term and repeated attempts are indicators of a higher risk for suicide. Further, the group of suicide attempters who make violent attempts have highly elevated suicide mortality. This knowledge could inform clinicians in the challenging task of suicide risk assessment.

Aftercare and follow-up of all suicide attempters are vital. Suicide prevention programs may benefit from targeting identified subgroups of attempters with specific interventions. It is important to have strategies regarding missing appointments and to offer access to efficient treatment interventions within a wide range of needs over time.

Suicide preventive efforts in all areas of health care are of utmost importance as most individuals who die by suicide have been in contact with health care units prior to death. Raising awareness not only in psychiatry but also in primary care and specialized somatic care is warranted. Improved suicide risk assessment and screening strategies as well as attention to risk groups, would have the potential of saving lives.

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