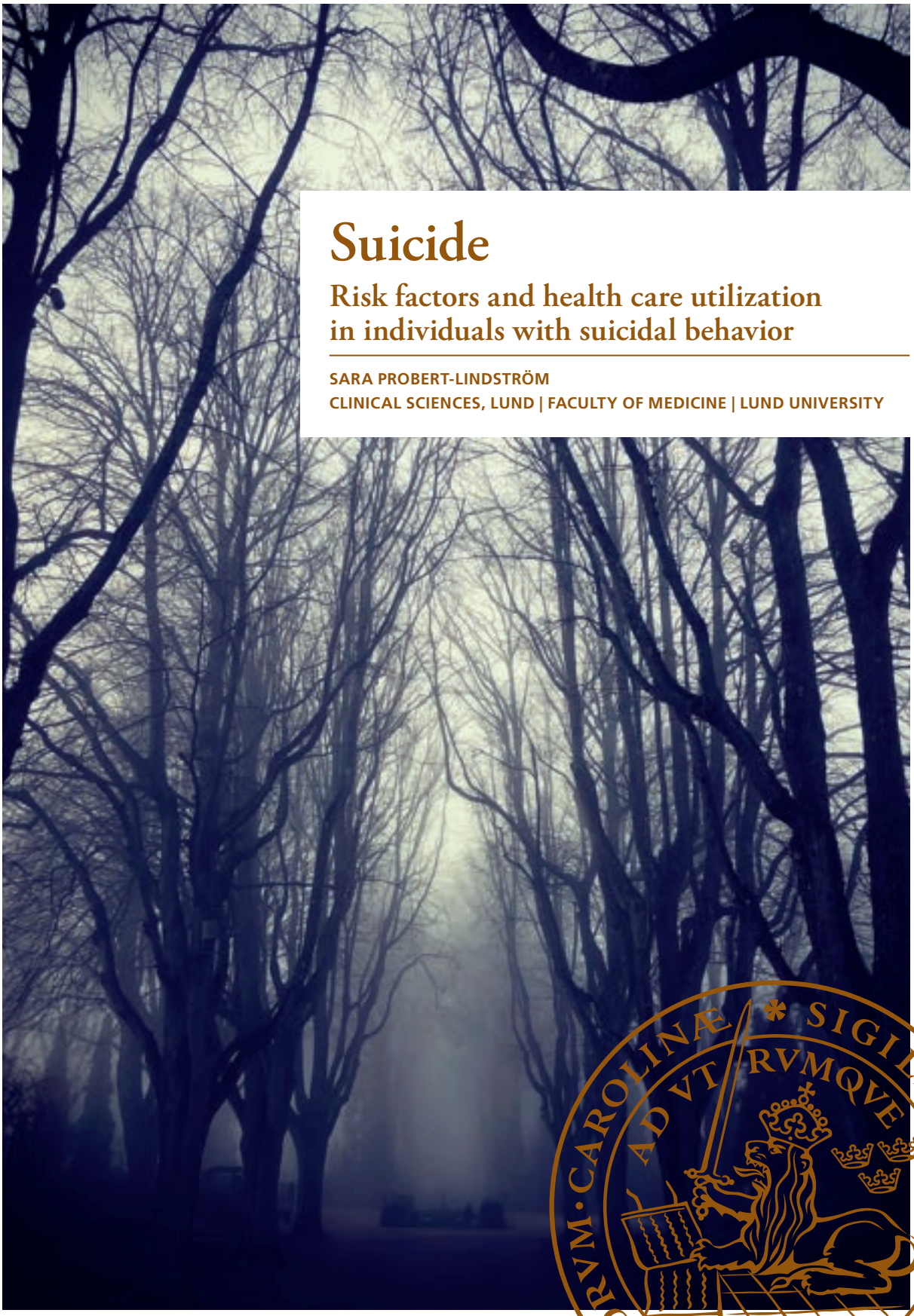

Suicide

Risk factors and health care utilization in individuals with suicidal behavior

SARA PROBERT-LINDSTRÖM
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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
UNIVERSITY

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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 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.

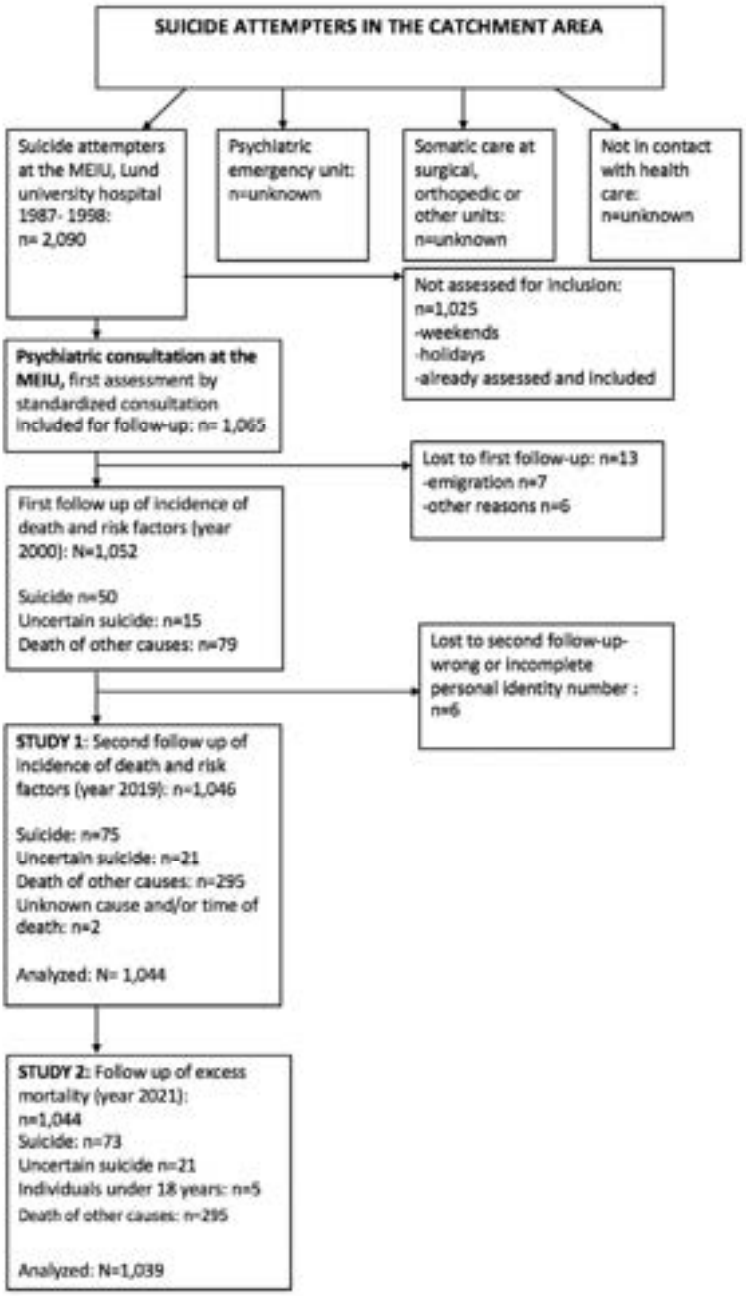

Figure 1: Flow chart of participants in Study I and II

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.

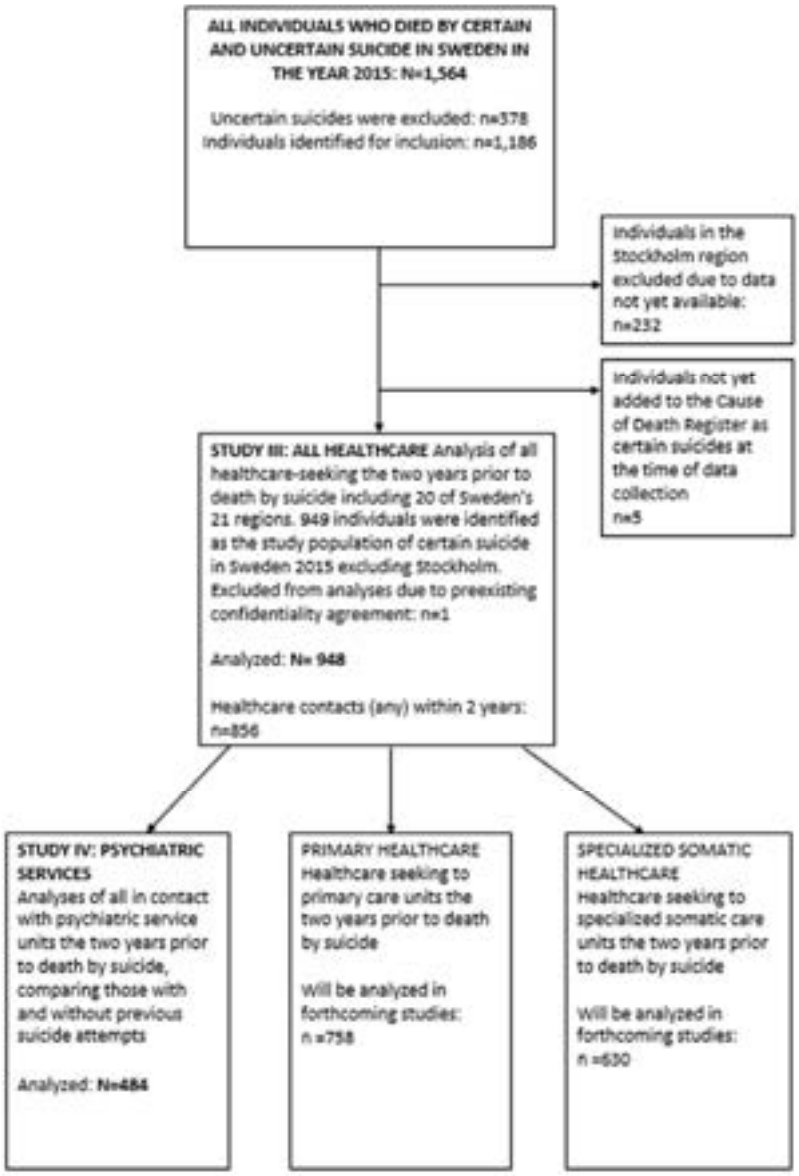

Figure 2: Flowchart of the participants in Studies III and IV

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.

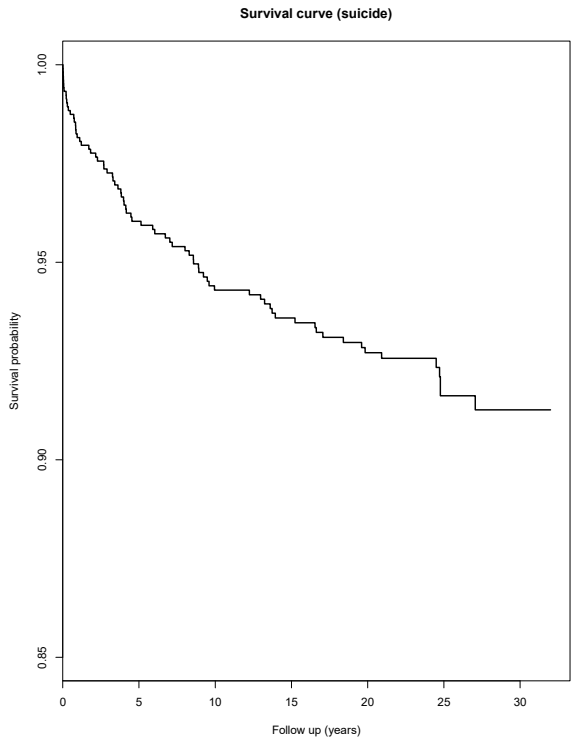

Figure 3: Survival curve of death by suicide in the study population

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.

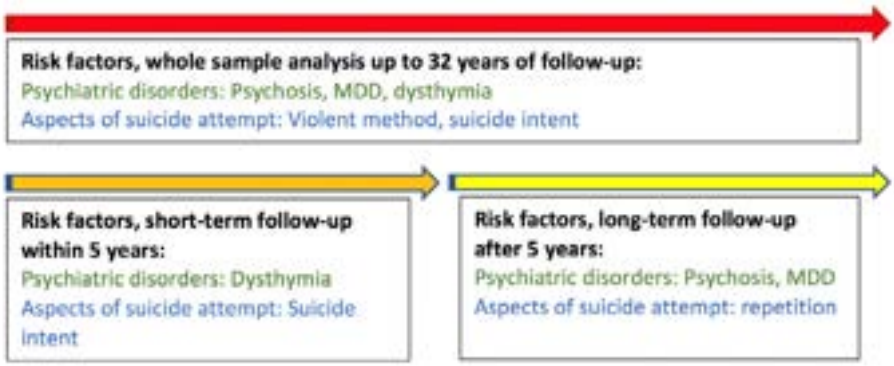

Figure 4: Risk factors for suicide among suicide attempters, an overview of the whole period, short-term follow-up, and long-term follow-up

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.

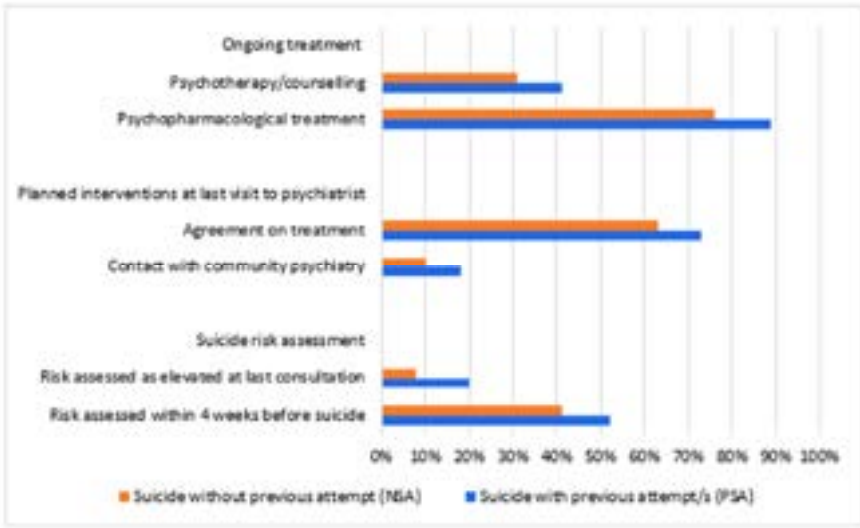

Figure 5: Proportions (%) with ongoing and planned psychiatric interventions and suicide risk assessment by suicide attempt history.

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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Original papers

Study I

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Long-term risk factors for suicide in suicide attempters examined at a medical emergency in patient unit: results from a 32-year follow-up study

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ABSTRACT

Objectives The overall aim of this study is to gain greater knowledge about the risk of suicide among suicide attempters in a very long-term perspective. Specifically, to investigate possible differences in clinical risk factors at short (≤5 years) versus long term (>5 years), with the hypothesis that risk factors differ in the shorter and longer perspective.

Design Prospective study with register-based follow-up for 21–32 years.

Setting Medical emergency inpatient unit in the south of Sweden.

Participants 1044 individuals assessed by psychiatric consultation when admitted to medical inpatient care for attempted suicide during 1987–1998.

Outcome measures Suicide and all-cause mortality.

Results At follow-up, 37.6% of the participants had died, 7.2% by suicide and 53% of these within 5 years of the suicide attempt. A diagnosis of psychosis at baseline represented the risk factor with the highest HR at long-term follow-up, that is, >5 years, followed by major depression and a history of attempted suicide before the index attempt. The severity of a suicide attempt as measured by SIS (Suicide Intent Scale) showed a non-proportional association with the hazard for suicide over time and was a relevant risk factor for suicide only within the first 5 years after an attempted suicide.

Conclusions The risk of suicide after a suicide attempt persists for up to 32 years after the index attempt. A baseline diagnosis of psychosis or major depression or earlier suicide attempts continued to be relevant risk factors in the very long term. The SIS score is a better predictor of suicide risk at short term, that is, within 5 years than at long term. This should be considered in the assessment of suicide risk and the implementation of care for these individuals.

Strengths and limitations of this study

- The observation time of up to 32 years enabled a long-term investigation of suicide risk.
- A large clinical population (n=1044) provided sufficient statistical power for subgroup comparisons.
- The total number of suicides (n=75) limited the number of variables that could be included in the analyses, thereby risking the omission of potentially important variables.
- Access to a broad set of clinically relevant baseline data that were collected in a standardised manner was a strength, but the reliability of psychiatric diagnoses was limited by the emergency setting and single diagnostic assessor.
- The follow-up data were limited to register data of survival and cause of death.

INTRODUCTION

Suicide is a preventable cause of premature death and is highly associated with mental distress (for a recent review see[1]). The most well-documented risk factor for suicide is a history of attempted suicide.[2 3] The incidence of suicide is highest within the first years of the attempt but the risk of suicide seems to persist for many years after a suicide attempt.[4–12] Long-term studies of mortality among suicide attempters have found that between 2% and 13% have died by suicide after 20–37 years after the index suicide attempt.[10–14]

Several studies have examined the risk factors for suicide in the first few years following a suicide attempt and have among other variables identified: male sex and older age,[3 15–18] mental disorder,[19] substance abuse,[16 19 20] previous psychiatric care,[20 21] earlier suicide attempts,[4 16 21] violent method[21 22] and suicidal intent[23] as relevant variables. Studies assessing long-term risk factors for suicide among suicide attempters are far more scarce. Studies with a total observation time of 10–19 years[5 7 8 24–27] report mostly the same risk factors as shorter-term studies. To our knowledge, there are only three previous prospective studies (two of mainly the same sample,[11 14] including uncertain suicide) of suicide risk factors among suicide attempters with follow-up periods of 20 or more years, reporting male sex,[12] a baseline

diagnosis of schizophrenia, bipolar/unipolar depressive disorder, other depression[11] and an index suicide attempt involving hanging, strangulation or suffocation.[14] One of these was based on a small clinical sample (n=98),[12] and the other two were register studies with very large samples (n=39 685, n=48 649),[11 14] but without evaluation of clinical risk factors other than the method used during the index suicide attempt and diagnosis at discharge from inpatient care following the suicide attempt.

As previous studies of mortality rates among suicide attempters point at a sustained elevated risk for suicide over many years after attempted suicide,[4–12] there is a need for more knowledge on long-term risk factors and whether they differ from short-term risk factors. Only two previous studies[8 27] involved subgroup comparisons of risk factors for those who died by suicide within the first years after the index attempt and those who committed suicide after that. Tidemalm *et al*,[8] including both certain and uncertain cases of suicide, indicated that violent method at index attempt and mental disorder increase the suicide risk within the first year in young men and that repeated self-harm may increase the long-term (2–9 years) risk in young patients. Maser *et al*[27] found that, in a sample of affectively ill patients, suicide within a year was best predicted by clinical variables such as symptoms of panic attacks, whereas suicide beyond 1 year was better predicted by personality variables such as impulsivity. None of these studies investigated risk factors at the very long term (over 20 years).

The overall aim of the present study is to investigate the occurrence of suicide and all-cause mortality, and risk factors for suicide, over an interval lasting up to 32 years after the index attempt. A further aim is to investigate the possible differences between risk factors for suicide in the proximal (≤5 years) and the distant (>5 years) intervals, with the hypothesis that different risk factors are important in a shorter and longer perspective.

Research questions:

- What proportion of the suicide attempters had died by suicide at long-term follow-up?
- What are the risk factors for suicide at long-term follow-up?
- Are the clinical factors associated with risk of suicide at short term following attempted suicide the same as those associated with risk of suicide at long term? If not, what differences can be found?

Patient and public involvement

Patients or the public were not involved in this study.

METHOD

Study design and cohort collection

The present study is a second follow-up of a population previously studied[28] and consists of clinical interview and register data from a large population (n=1044) of suicide attempters admitted to a medical emergency inpatient unit (MEIU), where they were thoroughly interviewed by a psychiatrist and social worker and followed up after 21–32 years.

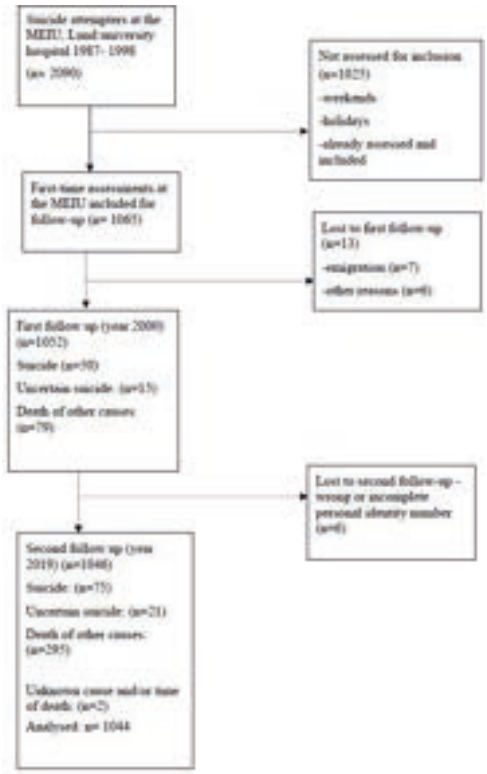

Figure 1 Flowchart of subjects through the study. MEIU, medical emergency inpatient unit.

The sample was collected between 1987 and 1998 at a MEIU in southern Sweden, and represent approximately half of all individuals who were admitted to the MEIU following an attempted suicide during those years (estimated 1065/2000[23]). Individuals who were admitted on weekends or holidays were not assessed for inclusion, alongside individuals already included who reattempted (see figure 1). On weekdays, everyone who attempted suicide was assessed in a standardised manner with specific assessment measures (for more detailed description, see[28 29]). Since most of the individuals were admitted on weekdays, a subsample of consecutive cases admitted also on weekends (n=251) was compared with the rest of the sample. No statistically significant differences were found between the two groups for the frequency of suicide and overall mortality in either the previous follow-up study[28] or in this sample.

Information about whether the study participant had died (date of death) or emigrated from Sweden (date of

emigration) was obtained from the Swedish Tax until July 2019. Information about the causes of death was obtained from the Swedish Cause of Death Register, National Board of Health, the information in the register covered the time from the study start in January 1987 until 31 December 2018.

The previous follow-up by Skogman *et al*[28] identified male gender, age of 50 years or more at the time of index assessment, being a repeater, violent index method, total Suicide Intent Scale (SIS) score and major depression to be important risk factors for suicide. Furthermore, major depression was found a risk factor for both genders while violent method was a risk factor for men only, and older age as well as suicidal intention for women only.

We intended to include the 1052 individuals from the previous follow-up study.[28] However, 8 individuals were lost to a second follow-up (2019), leaving 1044 participants for the present analyses (see figure 1). The mean observation time was 20 years (range=0–32 years) and the median was 22 years and 10 months. The total observation time was 20 926 person-years. The mean age at index attempt was 40 years (range=15–96 years). At baseline, 42% were married or living with a partner and 55% were employed or studying. At discharge from the MEIU, 57% were referred to an inpatient psychiatric ward. Frequency of risk factors in the total sample and in suicide are presented in table 1. In line with the previous follow-up of this population,[28] we chose not to include uncertain suicides in the analysis of risk factors, due to the uncertain nature of these deaths.

The Strengthening the Reporting of Observational Studies in Epidemiology cohort reporting guidelines was used.[30]

Baseline investigation

Baseline data were collected at emergency psychiatric consultations, that are always requested by the MEIU of patients who have attempted suicide. During the years 1987–1998, a semistructured interview that had been developed at the Suicide Research Centre based in the Department of Psychiatry at Lund University was in use.[29] The assessment protocol was introduced to improve the procedure for treatment referral by ensuring a broad and standardised manner of assessment, including sociodemographic data, method of the suicide attempt, occurrence of previous attempts, suicidal intent and so on. The

Table 1 Risk factors for suicide after 0–32 years—whole sample analysis (Cox regression)

Baseline variable	Total sample % (n)/ median (IQR)*	Suicide % (n)/ median (IQR)†	UHR (CI 95%)	AHR (CI 95%)	P value (AHR)
Sex	n=1044	n=75			
Men	**39** (411)	**47** (35)	1.50 (0.95–2.37)	–	–
Women (reference)	**61** (633)	**53** (40)			
Age	**37** (23)	**40** (22)			
Per 10 years			**1.25 (1.09–1.43)**	1.16 (0.99–1.36)	0.061
Occurrence of previous attempts	n=970				
Repeater	**43** (415)	**62** (42)	**2.24 (1.37–3.65)**	1.62 (0.97–2.70)	0.068
Non-repeater (reference)	**57** (555)	**38** (26)			
Suicide attempt method	n=1044				
Violent method	**5** (55)	**15** (11)	**3.78 (1.99–7.17)**	**2.53 (1.26–5.09)**	0.009
Non-violent method (reference)	**95** (989)	**85** (64)			
Diagnosis	n=1044				
Adjustment disorder (reference)	**32** (330)	**15** (11)			
Major depression	**16** (171)	**33** (25)	**5.15 (2.54–10.48)**	**2.63 (1.18–5.85)**	0.018
Dysthymia	**5** (47)	**9** (7)	**5.35 (2.07–13.79)**	**4.09 (1.52–10.99)**	0.005
Psychosis	**7** (69)	**16** (12)	**5.61 (2.48–12.72)**	**4.18 (1.73–10.09)**	0.001
Other	**41** (427)	**27** (20)	1.50 (0.72–3.13)	**1.12 (0.49–2.54)**	0.795
SIS score	n=957				
	13 (12)	**18** (9)	**1.09 (1.05–1.12)**	**1.06 (1.02–1.10)**	0.004

The boldfaced entries mark statistically significant results.
*Percentage of the total sample of each category within the variable and number of individuals within each category, median and IQR are presented for the continuous variables age and SIS score.
†Percentage and number of all individuals who died by suicide within the category of the variable, and median and IQR are presented for the continuous variables age and SIS score.
AHR, adjusted HR; SIS, Suicide Intent Scale; UHR, unadjusted HR.

assessments were carried out by a psychiatrist and a social worker. The psychiatrist diagnosed psychiatric disorders in accordance with Third Revised Edition of the Diagnostic and Statistical Manual for Mental Disorders (DSM-III-R) by clinical interviewing, but no structured interview was carried out for diagnostics. The evaluations were carried out in the emergency setting of the MIEU usually within 24 hours of the suicide attempt. Baseline in this study refers to the time of assessment at MEIU after the index suicide attempt.

Variables

With the exception of suicide, uncertain suicide and other causes of mortality, all other variables were assessed at the time of admission to the MEIU (baseline).

Suicide was defined as classified in the Cause of Death Register[31]; external cause of morbidity and mortality; intentional self-harm in accordance to ICD-10,[32] codes X60–X84 and ICD-9[33] codes starting with E95. *Uncertain suicide* was defined as classified in the Cause of Death Register[31]; external cause of morbidity and mortality; event of undetermined intent in accordance to ICD-10[32] codes Y10–Y34 and ICD-9[33] codes starting with E98. *Suicide attempt* was defined as a situation in which a person has performed an actually or seemingly life-threatening behaviour with the intent of jeopardising their life or give the appearance of such an intent, but which has not resulted in death.[34] *Index suicide attempt* refers to the suicide attempt that led to inclusion in this study. *Repeaters* refer to individuals who had made at least one such suicide attempt before the index suicide attempt. *Violent method* refers to the method of attempted suicide; either a method other than drug overdose or single wrist-cut, or a combination of different methods.[35]

SIS[36] is a 20-item, clinician-completed measure of the severity of suicidal intent of a suicide attempt. A total score is computed based on the sum of the 0–2 severity ratings for the first 15 items.[36] Missing data at the item level for the SIS were low with 905 of 1044 (86.7%) of participants providing full data. To be included in the analyses, participants had to be missing a maximum of 3 items from the SIS (n=52). In such cases, missing items were replaced by the mean of that individual's responses to the SIS. Cases with more than 3 values (n=87) were excluded from further analysis of this variable.

Age was analysed as a numerical variable but divided into decades to facilitate interpretation. *Psychiatric disorders* were diagnosed according to the DSM-III-R.[37] Only the main diagnosis was used for the purposes of the study. Secondary diagnoses, if any, were not used in the analyses due to very high rate of missing data. Psychosis, dysthymia, major depression and adjustment disorder were analysed separately in the regression analyses. The category 'other' includes substance abuse disorder (11%), depression not otherwise specified (9%), anxiety disorder (2%), other axis I-diagnosis (4%), no diagnosis (3%), axis II diagnosis (but not an axis I diagnosis) (1%) and cases with missing data for diagnosis (12%). *Observation time* refers to the time patients were followed from the index date (time of assessment at the MEIU) until death, emigration or the study end.

Data analysis

Cox regression models were used to identify associations between baseline variables and time to suicide. The recommendations of Vittinghof *et al*[24] of at least 5–9 outcome events per covariate were followed by focusing on the clinically relevant variables identified at the earlier follow-up of this population.[28] With these statistical limits we excluded variables viewed as more descriptive of the healthcare system than of the study participants, such as previous or current psychiatric contact and referral to psychiatric inpatient treatment.

All diagnostic groups (see the Variables section) were investigated by Kaplan-Meier survival analysis to plot temporal patterns of suicide after a suicide attempt. Three diagnoses were identified as possible risk factors for completed suicide, that is, major depression, dysthymia and psychosis. These were selected for further analysis. Substance abuse disorder, depression not otherwise specified, anxiety disorder, other axis I diagnosis or axis II diagnosis only were not identified as individual risk factors and were not included in further analysis. Adjustment disorder, the most common diagnosis (32%), was chosen as the reference group. The HR for each of the selected diagnoses was analysed in relation to adjustment disorder using Cox regression.

To assess whether the risk factors for suicide differ over time, an analysis of Schoenfeld residuals was first performed to test the assumption of proportional hazards for each covariate separately. Separate Cox regression models were carried out for the first 5 years after the index attempt and for the remainder of the study period (>5 years after index attempt). This 5-year cut-off was chosen pragmatically because approximately half of the suicides occurred in each of the two time spans (40 suicides in the first 5 years, 35 in the remaining years). HRs were calculated for each variable independently to identify possible risk factors. As a second step, variables that were found to be independently statistically significant in a regression model were included, thereby adjusting for the effect of these variables. Results were considered statistically significant when $p<0.05$.

We performed three sets of sensitivity analyses. Each set consisted of unadjusted Cox regression analyses for all covariates in both the short-term and the long-term analysis, but instead of using 5 years as the cut-off between short term and long term, the cut-off values used for the three sets were 3, 7 and 10 years, respectively. Altering the cut-off values changed the number of suicides in the short-term and long-term analyses, and we expected that fewer suicides would increase p values and vice versa, while the HRs should remain approximately the same. Overall, HRs in the models were similar to the results in the main models, and the p values were comparable and overall effected in the expected direction.

All analyses were performed using V.25 of SPSS.[38]

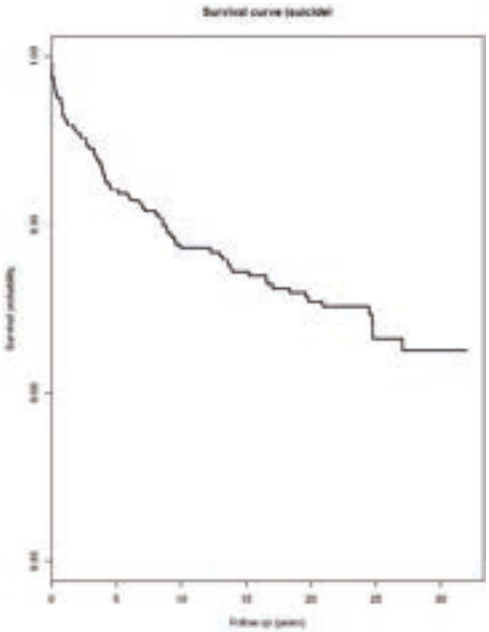

Figure 2 Survival curve of death by suicide in the study population.

RESULTS

Suicide and all-cause mortality

At follow-up, 393 individuals had died (37.6%); 75 (7.2%) by suicide, 21 (2.0%) by deaths labelled as uncertain suicide, 295 (28.3%) from other causes and two could not be analysed. The most common other cause of death was diseases of the circulatory system. The mean observation time in months was 88 (range=3–325 months) for those who died by suicide, 110 months for uncertain suicide (range=3–242 months) and 302 months for those who died of other causes (range=0–384 months).

As can be seen in figure 2, the incidence of suicide was higher in the first years after baseline. In the first year, 19 of the total 75 suicides occurred (25.3%), and the following 2–5 years, another 21 (28.0 %). Within 10 years, another 16 deaths by suicide occurred (21.3%). The remaining 19 suicides (25.3%) were evenly distributed over the rest of the observation time. Regarding the overall mortality (391 individuals), 29% died within 5 years of baseline. The mean age at death for all causes was 63 years (range=22–100 years, median=64 years) and for those who died by suicide, the mean age was 50 years (range=22–81 years, median=48 years). There were equal proportions of men (47%) and women (53%) among those who committed suicide, while the proportions who died by uncertain suicide was higher among men (71%) than women (29%) (p<0.01).

Risk factors for suicide after 0–32 years: whole sample analysis

As can be seen in table 1, the risk factors identified in the adjusted model for the total sample were violent method at index attempt, a diagnosis of major depression, dysthymia or psychosis, and the SIS score. Variables used to calculate the adjusted HR were age, occurrence of previous attempts, suicide attempt method, diagnosis and SIS score. For every increase of one point of the total SIS score the hazard for suicide increased by 6%. Being diagnosed with psychosis at baseline was the risk factor with the highest HR. Age and being a repeater were found statistically significant as independent risk factors but no longer when included in the adjusted regression model. Analysis of the Schoenfeld residuals indicated a statistically significant violation of the assumption of proportional hazards for SIS score (p=0.043), indicating that the HR for SIS was not consistent over the observation time. The Schoenfeld residual analysis was not significant for any of the other variables in the model, indicating that the proportional hazard assumption was not violated to a statistically significant degree.

Risk factors for suicide at short term

The significant risk factors for suicide at short term, that is, within 5 years of baseline, in the adjusted model, were a diagnosis of dysthymia and the SIS score (table 2). Variables used to calculate the adjusted HR were age, method of suicide attempt, diagnosis and the SIS score. The risk factor with the highest (adjusted) HR was being diagnosed with dysthymia. The SIS score was the most statistically significant predictor at short term. For every additional point increase on the SIS, the hazard for suicide increased by 10%. Psychosis, major depression, age and violent method were statistically significant independent risk factors but no longer when included in the adjusted model.

Risk factors at long term

Long-term risk factors for suicide, that is, over 5 years after the index attempt (table 3), were being a repeater and having a diagnosis of major depression or psychosis. A diagnosis of psychosis at baseline, represented the risk factor with the highest (adjusted) HR at long-term follow-up, followed by major depression. Variables used to calculate the adjusted HR were occurrence of previous attempts, method of suicide attempt and diagnosis. The SIS score was not a statistically significant risk factor at long-term follow-up and was not included in the adjusted regression model.

DISCUSSION

Risk for suicide was found more than two decades after a suicide attempt that led to hospital admission in this large sample of Swedish adults. 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

Table 2 Risk factors for suicide at short-term follow-up (Cox regression), n=1044

Baseline variable	UHR (CI 95%)	AHR (CI 95%)	P value (AHR)
Sex	1.77 (0.95–3.29)	–	–
Reference: women (n=1044)			
Age per 10 years (n=1044)	**1.30 (1.10–1.53)**	1.16 (0.96–1.40)	0.118
Repeater	1.67 (0.87–3.23)	–	–
Reference: non-repeater (n=970)			
Violent method	**4.10 (1.82–9.28)**	2.36 (0.96–5.81)	0.061
Reference: non-violent method (n=1044)			
Diagnosis			
Reference: Adjustment disorder			
Major depression	**5.43 (2.12–13.87)**	2.32 (0.85–6.35)	0.101
Dysthymia	**6.72 (2.05–22.02)**	**5.09 (1.51–17.10)**	0.009
Psychosis	**4.02 (1.23–13.19)**	2.16 (0.59–7.88)	0.242
Other (n=1044)	1.04 (0.36–3.00)	0.58 (0.18–1.93)	0.377
SIS score (n=957)	**1.13 (1.07–1.20)**	**1.11 (1.04–1.17)**	0.001

The boldfaced entries mark statistically significant results.
AHR, adjusted HR; SIS, Suicide Intent Scale; UHR, unadjusted HR.

index attempt. The risk factors at short-term and long-term follow-up differed. Risk factors for suicide at short term, that is, within 5 years, were violent method at index attempt, dysthymia and a higher SIS score. Analyses indicated that a higher SIS score was less relevant as a risk factor for suicides that occurred more than 5 years after the index attempt. The long-term risk factors for suicide, that is, over 5 years after the index attempt, were being a repeater and being diagnosed with major depression or psychosis. The presence of earlier suicide attempts before the index attempt proved to still be an important risk factor in a very long-term perspective.

This study has several strengths. A thorough, standardised assessment provided a broad set of clinical baseline data on a large clinical sample (n=1044) of suicide attempters. Furthermore, these were followed up for a very long time (mean=20 years, range 0–32 years). To our knowledge, this is the largest population of suicide

Table 3 Risk factors for suicide at long-term follow-up (Cox regression), n=927

Baseline variable	UHR (CI 95%)	AHR (CI 95%)	P value (AHR)
Sex	1.24 (0.63–2.44)	–	–
Reference: women (n=927)			
Age per 10 years (n=927)	1.16 (0.92–1.50)	–	–
Repeater	**3.18 (1.50–6.71)**	**2.68 (1.24–5.78)**	0.012
Reference: non-repeater (n=863)			
Violent method	**3.33 (1.17–9.43)**	2.83 (0.95–8.36)	0.061
Reference: non-violent method (n=927)			
Diagnosis			
Reference: adjustment disorder			
Major depression	**4.64 (1.54–13.76)**	**4.57 (1.38–15.14)**	0.013
Dysthymia	3.51 (0.68–18.01)	3.21 (0.58–17.75)	0.182
Psychosis	**7.70 (2.44–24.26)**	**7.61 (2.18–26.54)**	0.001
Other (n=927)	2.10 (0.74–5.95)	2.14 (0.67–6.86)	0.200
SIS score (n=853)	1.04 (0.99–1.10)	–	–

The boldfaced entries mark statistically significant results.
AHR, adjusted HR; SIS, Suicide Intent Scale; UHR, unadjusted HR.

attempters to be followed for this length of time with baseline data from an extensive clinical interview. This enabled statistical analysis of both short-term and long-term risk factors measured at baseline and comparisons of differences between these. Such comparisons have very rarely been done before,[8 27] and never before with a follow-up time as long as in the present study. Nevertheless, generalisability to the wider population of individuals who attempt suicide is limited as this sample consists of individuals who were admitted to an MEIU as a consequence of attempted suicide, indicating a certain medical severity of the attempt.

Even though a standardised psychiatric assessment was carried out at the MEIU by a psychiatrist, the emergency context of the assessment can create difficulties in obtaining a full psychiatric history. This difficulty may help explain why no individuals in the present sample were diagnosed with bipolar disorder and quite few with personality disorders. It is likely that some of the patients among those diagnosed with major depression in fact suffered from bipolar depression. Indeed, it has been suggested that it is quite common in clinical practice that bipolar depression is misdiagnosed, often as major depression.[39] Furthermore, suicide attempts in bipolar disorder often occur during depressive episodes.[40] As only the main diagnoses could be used in the analysis, it is also possible that individuals could meet the criteria for other diagnoses than investigated in this study. Results must be interpreted in light of this limitation.

In comparison to the register-based population study by Tidemalm *et al*,[11] who specifically studied psychiatric diagnoses as risk factors for suicide, the present sample was much smaller and could not investigate as many diagnoses separately. However, diagnoses could be assessed in relation to other types of risk factors. As with most longitudinal studies, there were missing data for some variables, though efforts were made to statistically compensate for this in the case of the SIS. For statistical reasons, only a limited number of variables could be included in the regression models, thereby risking omission of potentially important variables, such as past psychiatric history and family history of mental illness. A limitation regarding the differential analysis in the short-term and long-term subgroups was that the number of outcome events was further reduced, thereby diminishing statistical power to detect true associations. Finally, it is important to consider that there are some potentially important clinical variables that were not assessed at baseline and therefore not included in analysis. Also, some factors that were indeed assessed at baseline, would have been valuable to reassess during the follow-up period, for example, repeated attempts.[9] Suicide risk is multifactorial, and complex interactions between different factors are probable. Furthermore, suicide risk is unlikely to be static over time and should be assessed at repeated intervals during an individual's lifetime.

The results of the present study that the risk of suicide after a suicide attempt persists at very long term confirm the results of four previous long-term follow-ups.[10–13] The finding that 7.2% of the individuals had died by suicide is in line with the previous studies, similar to ours, that found that between 2% and 13% had died by suicide.[10–13] Among these, a very early long-term follow-up of suicide attempters by Dahlgren published in 1977,[13] set in the same catchment area as the present study, found that 11% had died by suicide at follow-up after 35 years. Our finding that 53% of suicides occurred within 5 years and as much as 25% within the first year, is in agreement with earlier long-term follow-ups of suicide attempters that the risk of suicide persists for many years after a suicide attempt, though the incidence of suicide is highest within the first years.[4–12]

The results of the present study are to some extent in line with the findings of previous studies regarding mental disorder[8 27 41] and violent method.[8 14 21] SIS has been extensively used in research and high scores on the scale have repeatedly, but inconsistently, been linked to the risk of completed suicide[5 42 43] including the previous follow-up by Skogman *et al*[28] who found SIS score to be a relevant risk factor for women only at 6.5 years follow-up. A review from 2008[42] found a positive association between high scores on SIS and suicide in 6 of 13 included studies, with follow-ups ranging from under 1 year to over 20 years. The present study found the SIS score highly statistically significant in the analysis of short-term risk factors but not in the long-term analysis, a finding which is also validated by the fact that the analysis revealed that the assumption of proportional hazards was violated for this variable. The finding that psychosis was the risk factor with the highest HR at long term is in line with previous findings that psychosis is a risk factor for suicide[11] although its more evident importance at long term as compared with at short term has not previously been described. Furthermore, this study confirms the findings of previous studies that major depression is an important risk factor for suicide, which has been found both in the earlier follow-up of this population[29] and in another sample of suicide attempters.[11] Repeated suicide attempts have previously been identified as a risk factor for completed suicide at 2–9 years,[8] 4 years[11] and 10 years[25] follow-up. The present study found that previous suicide attempts before baseline remained a risk factor even decades after the attempt.

The differences in short-term and long-term risk factors found in this study are to some extent in line with the findings of previous studies investigating such differences.[8 27] The finding of the present study that violent method seems a relevant short-term factor confirmed the results of Tidemalm *et al*.[8] Maser *et al*[27] found symptoms of anxiety and affective states to be a relevant risk factor at short term (within 1 year). This is partially in line with our finding that the affective disorders (dysthymia and major depression) were relevant risk factors within the first 5 years, although we found that major depression continued to be a relevant risk factor at long term also. Furthermore, the present study identified suicidal intent

as a relevant short-term risk factor. A possible explanation could be that suicidal intent, like affective and clinical symptoms of anxiety, may be more reflective of a state condition, the effect of which passes over time. On the other hand, when it comes to long-term factors these seem to be more trait-like and long-lasting, as impulsivity, which was found to be an important long-term risk factor (up to 14 years) by Maser *et al*[27] and, as found in the present study, that psychosis (often a chronic disorder) was a significant long-term risk factor.

CONCLUSIONS

The risk of suicide after a suicide attempt persists for up to 32 years after the index attempt. A baseline diagnosis of psychosis or major depression or earlier suicide attempts continued to be relevant risk factors at very long term, and the SIS score is a relevant risk factor within the first 5 years.

Implications for clinicians and policymakers

This study implies that individuals who have attempted suicide have a risk of suicide over several decades, with a particularly high risk within the first year after an attempted suicide. An earlier suicide attempt should be considered a risk factor for completed suicide regardless of when the attempt occurred. The severity of intent and the use of a violent method is important to consider at least the first 5 years following the attempt. It seems important to take on a very long-term—perhaps even a lifetime—perspective when it comes to secondary suicide preventive interventions for suicide attempters, especially those with repeated suicide attempts, and/or major depression and/or a psychotic disorder.

Unanswered questions and future research

Many possible risk factors, not included in this study, remain to be further investigated at long term, for example, life events after index attempt, heritability and so on. Future research would also benefit from follow-ups with assessment interviews of those still living.

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Contributors AÖ initiated the clinical baseline investigation and the present follow-up, acquired and registered the follow-up data and made revisions of the manuscript. JB initiated the follow-up, acquired the data, prepared the data set, designed the statistical strategy, made significant contributions to the statistical analysis and made revisions of the manuscript. AÖ, JB, SP-L and KSP contributed to designing the study and interpretation of the data. SP-L drafted the manuscript and made the statistical analysis. KSP made revisions of the manuscript. ÅW interpreted the data and made revisions of the manuscript. All authors also read and approved the final manuscript.

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Study II

Excess suicide mortality in suicide attempters examined at a medical emergency unit

The role of violent method, repeated attempts, and high suicidal intent at long-term follow-up

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Attempted suicide, suicide, repeater, violent method, Suicide Intent Scale, mortality

ABSTRACT

Objectives: The primary aim of the present study was to investigate the putative excess mortality by suicide in suicide attempters. As a secondary aim, we investigate excess mortality in specific, clinically relevant subgroups: individuals with repeated suicide attempts (RA); individuals who used violent methods at the attempt (VA); and those who scored high on the Suicide Intent Scale (HS) at the time of the baseline attempt. Finally, we investigate excess mortality in men and women separately and within five years and five years after hospital admission for attempted suicide.

Design: Prospective register-based follow-up for 21-32 years. Standardized mortality ratio (SMR) was calculated for suicide using national census data. Clinically relevant subgroups were investigated separately.

Setting: Medical emergency in-patient unit in the south of Sweden.

Participants: 1,039 individuals who were psychiatrically assessed at admission to medical in-patient care for attempted suicide between 1987 and 1998.

Outcome measure: Suicide.

Results: The overall SMR for suicide was 23.50 (CI 95% 18-68-29.56); significantly higher ($p<.001$) 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 5 or more years after the index attempt ($p<.001$) [14.74 (10.53-20.63)]. The highest independent SMR was found for VA [70.22 (CI 95% 38.89-126.80)]. A regression model including RA, VA, and HS all contributed significantly to excess suicide mortality.

Conclusions: A severe risk of premature death by suicide was found in suicide attempters compared to the general population. A thorough assessment of the history of previous suicide attempts is important, even though the attempt/s may have occurred many years ago. When assessing suicide risk, clinicians should consider repeated attempts and whether the attempts involved high suicidal intent and violent methods. Aftercare and follow-up of all suicide attempters is vital. Suicide prevention programs may benefit from targeting identified subgroups of attempters with specific interventions.

ARTICLE SUMMARY

- Access to annual general population death rates for the study period within gender and age subgroups permitted generation of accurate estimates of expected numbers of deaths
- The structured psychiatric assessment at baseline provided a broad set of clinically relevant data
- The large clinical population (N =1,039) provided sufficient statistical power for subgroup comparisons.
- An observation time of up to 32 years enabled a long-term investigation of suicide mortality.
- Participants were only recruited from one hospital, limiting generalisability.

INTRODUCTION

A suicide attempt is widely recognized as one of the most robust predictors of suicide (1-10), especially within the first years of the attempt and over the long-term (7-9, 11-16). Long-term follow-ups of suicide attempters have found suicide rates between 2 and 13% (15-20). Studies investigating risk factors for suicide among suicide attempters have for instance identified male sex (though inconsistently) and older age (3, 21-24), mental disorder (15, 25) substance abuse (22, 25, 26), previous psychiatric care (26, 27), earlier suicide attempts (11, 22, 27), violent method (19, 27, 28), and suicidal intent (29).

While these studies provide knowledge about crude death rates and risk factors among the high-risk group of suicide attempters, they do not provide knowledge about the degree of increased suicide mortality risk as compared to the total population. Knowledge about the degree of increased risk associated with different clinical factors could aid clinicians in the challenging task of assessing suicide risk in suicide attempters, especially if these clinical factors are easy to identify in a clinical emergency setting. Further, knowledge about the degree of excess mortality for different sub-groups of suicide attempters as compared to the general population adds to the theoretical basis on suicidology, which in turn may guide policy- and decision-makers in mental health and society in suicide prevention.

Excess mortality in suicide attempters has been found in several studies (30-39), but very few investigations (34, 40) involved observation times as long as the current study (32 years). In a previous study employing the same cohort as here (20), we reported on the role played by repeated attempts, scores on the Suicide Intent Scale (SIS), and diagnosis at emergency hospital admission for a suicide attempt, on short- and long-term risk for completed suicide. The present study extends these findings by comparing excess mortality by suicide in the cohort versus the general population and re-examining risk based on transdiagnostic, presumed important clinical aspects of the behavior of the suicide attempt, that could easily be identified at an emergency consultation. Specifically, we examine repeated attempts, as well as the type of method and suicidal intent involved in suicide attempts. In relation to these risk factors, there is evidence that individuals who had made repeated suicide attempts, sometimes referred to as repeaters, have an increased suicide risk (41-45). Scoring high on the SIS scale has also been linked to the risk of suicide (8, 29, 46-48), though inconsistently. A review from 2008 found higher SIS scores to be a risk factor for suicide in 6 of the 13 included studies (46). Suicide attempters who use a violent method have been identified as a risk group for

suicide among suicide attempters (19, 27, 28), though other research indicates that the choice of attempt method is not associated with subsequent suicidal behavior (49). High suicidal intent in suicide attempters has also been linked to the use of violent methods (50). To the best of our knowledge, no previous studies have investigated whether suicide mortality is elevated among these clinically relevant subgroups of suicide attempters (repeaters, use of more violent methods, higher SIS scores).

The primary aim of the present study is to investigate the putative long-term excess mortality by suicide in suicide attempters assessed at a medical emergency in-patient unit in southern Sweden over a 32-year period. The secondary aim is to investigate the level of excess suicide mortality in clinically relevant subgroups defined by repeated suicide attempts, use of a violent method during the attempt, and high scorers on the Suicide Intent Scale. Finally, as previous studies have found an association between suicide mortality and time since the index suicide attempt, we investigate suicide mortality within and five or more years after the index attempts, as well as separately for men and women.

METHOD

Study design and cohort collection

The present study is a follow-up of overall excess suicide mortality and mortality of risk groups within a population of suicide attempters previously studied (20, 48). It consists of a clinical interview and register data from a large population (n =1039) of suicide attempters. The participants were admitted to a medical emergency in-patient unit, MEIU, in southern Sweden. Data were collected in a standardized manner at the emergency psychiatric consultations that are routinely requested in cases of suicide attempts. A semi-structured interview that had been developed at the Suicide Research Centre based in the Department of Psychiatry at Lund University was used (51), including socio-demographic data, method of the suicide attempt, occurrence of previous attempts, suicidal intent, etc. The assessments were carried out by a psychiatrist and a social worker at the emergency setting of MIEU, usually within 24 hours of the suicide attempt. The psychiatrist diagnosed psychiatric disorders in accordance with DSM-III-R by clinical interviewing. The baseline in this study refers to the time of assessment at the MEIU after the index suicide

attempt. The study population constitutes approximately about half of all suicide attempters who were admitted to the MEIU during the years 1987 and 1998 (estimated 1,065/2,000 (29)). Individuals who were admitted on weekends or holidays were not assessed for inclusion, alongside individuals already included who re-attempted. For a more detailed description, see (51) and (48).

Information about deaths by suicide in the study population and the Swedish population was obtained from the Swedish Cause of Death Register, National Board of Health, covering the time from the study start in January 1987 until December 31st, 2018. The cause of death register has been found to be a high-quality source of data suitable for research purposes (52). The data regarding the Swedish population was divided into gender and age group by every year for the purpose of standardization, thus allowing for the comparison of mortality between the study population and the population in the nation during the same period. In line with the previous follow-ups of this population (20, 48), we chose not to include uncertain suicides as an outcome in the analysis of risk factors, due to the uncertain nature of these deaths.

There were 411 men (39.6%) and 628 women (60.4%) in the study population. The age group 18-39 years represented 55.1% (n=572), the age group 40-69 years represented 36.7% (n=381) and the group 70+ years 8.3% (n=86). The mean age at baseline was 40 years (range 18-96). At follow-up, 36.8% of the study population were dead (n=382) and 7% of all had died by suicide (n=73). Of all suicide attempters in the study, 47% had made previous suicide attempts before baseline (n=488), 5.3% had used a violent method at the baseline suicide attempt (n=55) and 22% had a SIS score $\geq$ 19 (n=230). The mean observation time was 20 years (range=0-32 years) and the median was 22 years and 10 months. The total observation time was 20,773 person-years. At baseline, 42% were married or living with a partner and 55% were employed or studying. Participants were diagnosed with adjustment disorder (32%), major depression (16%), substance abuse disorder (11%), depression not otherwise specified (9%), psychosis (7%), dysthymia (5%), anxiety disorder (2%), other axis I-diagnosis (4%), no diagnosis (3%), axis II diagnosis (but not an axis I diagnosis) (1%), and cases with missing data for diagnosis (12%). At discharge from the MEIU, 57% were referred to an in-patient psychiatric ward.

The STROBE cohort reporting guidelines were used (53).

Baseline variables

With the exception of suicide, all other variables were assessed at the time of admission to the MEIU (baseline).

A Suicide attempt was defined as a situation in which a person has performed an actual or seemingly life-threatening behavior with the intent of jeopardizing their life or give the appearance of such an intent, but which has not resulted in death (54). *Index suicide attempt* refers to the suicide attempt that led to inclusion in this study. *Repeaters* refer to individuals who had made at least one suicide attempt before the index suicide attempt. *Violent method* refers to the method of attempted suicide; either a method other than drug overdose or single wrist-cut, or a combination of different methods (55). *Suicide Intent Scale* (SIS) (56) is a 20-item, clinician-completed measure of the severity of suicidal intent of a suicide attempt. A total score is computed based on the sum of the 0-2 severity ratings for the first 15 items (56). Participants who were missing 3 items or more from the SIS were excluded from the analysis (n=87). In cases with 1-2 missing items were replaced by the mean of that individual's responses to the SIS (n=52). Cases with more than 3 values were excluded from further analysis of this variable. In a previous study by Niméus and co-workers (29) of a subgroup of this patient sample, an optimal cut-off at 19 points was identified in predicting suicide (five-year follow-up). The same cut-off was employed in this study to distinguish between low/high scores. *Age* was divided into three groups to facilitate interpretation. *Observation time* refers to the time patients were followed from the index date (time of assessment at the MEIU) until death, emigration, or the study end.

Individual-level register data

Information about the causes of death in the study population was obtained from the Cause of Death Register, National Board of Health, the information in the register covered the time from the study start in January 1987 until December 31st, 2018. Suicide was defined as classified in the Cause of Death Register (57); external cause of morbidity and mortality; intentional self-harm in accordance to ICD-10 (58), codes X60-X84, and ICD-9 (59) codes starting with E95.

Census data

An additional extraction from the Cause of Death Register (57) was requested. The data requested was at an aggregate level regarding all combinations of ages 18-100 years, men and women, during the years 1987-2018. Further, data on the size of the Swedish population for each cell (age/gender/year) was collected from Statistics Sweden. This way we received information of how many deaths by suicide occurred in the entire Swedish population for each year 1987-2018 broken down by gender and age group (1-year age groups).

Data analysis

A crude death rate of how many within a given population die within a specified time frame does not consider the study population's distribution of age and sex. Both age and sex distribution can be assumed to have an impact on mortality. One way to investigate the risk of excess mortality is to calculate the standardized mortality ratio (SMR). This way, differences in age and sex distribution compared to the total population are 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.

The baseline data set was matched to the census data on sex, age, and year, and differentiated in all 16 combinations of the dichotomous variables repeaters, violent attempt, suicide intent scale ≥ 19 p, and period. 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.

Standardized mortality ratios (SMR) and rate ratio (RR) were calculated using Poisson regression models with *observed suicide deaths* as the dependent variable and the logarithm of *expected suicide deaths* as an offset variable. In the subgroup analyses, the covariates were included as independent variables in the regression models. Tests of the statistical significance of the SMR were based on the Poisson distribution using 95% confidence intervals. The SMRs of several subgroups were investigated, and the difference between levels of covariates was assessed by confidence intervals of the RR and p-values.

Firstly, all investigated variables were analyzed separately, category by category. Secondly, the variables were investigated with the categories within

the variable in relation to each other. Thirdly, the investigated subgroups were included in a regression model, thereby adjusting for the effect of one another. As the last step, a regression model also including interaction terms was calculated, controlling for the possible interaction between the variables repeater, violent method, and a high score on SIS. In this way, the interaction model was used as a sensitivity analysis. The model with the interaction effect had a considerably worse Akaike Information Criterion value than the model without the interaction effects (965.2 vs. 962.5, and the p-value from the likelihood ratio test was 0.427, which means that the simpler model is preferred). We thus used the results from the model with the three covariates included, but not the interaction terms. As per convention, a significance threshold of 0.05 was set throughout. All analyses were performed using Version 25 of SPSS (60).

Ethical approval

The study received approval from The Swedish Ethical Review Authority, no 2019-02602 and 2020-01939. Patients provided informed consent at baseline.

Patient and public involvement

Patients or the public were not involved in this study.

RESULTS

As can be seen in Table 1, the overall suicide mortality in the study population was elevated compared to that of the total population. Further, Table 1 presents SMR for each category of the investigated variables independently. SMR for suicide was higher among women than among men. It was over 30 times the expected for women and over 18 times for men compared to the general population. The age group with the highest individual SMR was the individuals over 70 years of age who had suicide mortality just over 37 times the expected. Excess mortality for death by suicide was higher the first 5 years after the attempt compared to after more than 5 years (see Table 1), especially in the first year, illustrated in Figure 1. Individuals who had made suicide attempts prior to the index attempt had suicide mortality over 34 times the expected. The group of individuals who had made a violent suicide attempt represented

the group with the highest SMR with suicide mortality over 70 times the expected. In attempters who scored high on the Suicide Intent Scale, suicide mortality was 47 times the expected compared to the total population (Table 1).

Table 1: Unadjusted standardized mortality ratio (SMR) (95% CI), and adjusted models of rate ratio (RR) (95% CI), death by suicide.

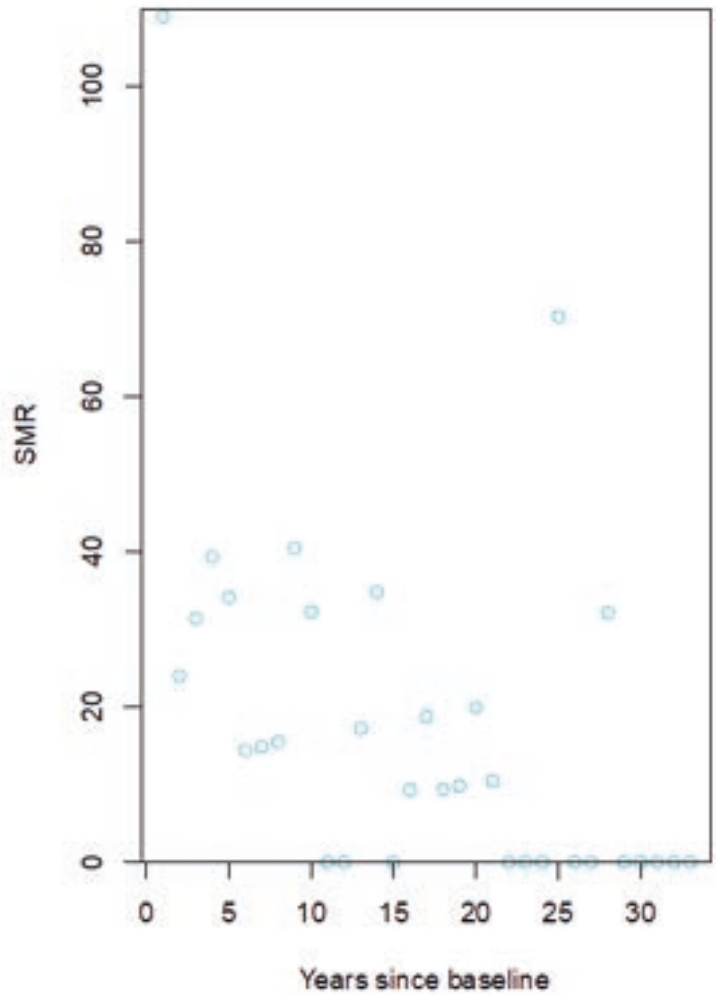
	Observed no. of deaths	Expected no. of deaths	UNADJUSTED SMR (95% CI)	ADJUSTED RR (95% CI)	*P**
Gender					
Men	39	1.28	**18.61** (13.30-26.05)	1	.035
Women	34	1.83	**30.49** (22.27-41.72)	**1.64** (1.03-2.59)	
Age groups (years)					
18-39	21	0.73	**28.79** (18.77-44.15)	0.77 (0.38-1.57)	.475
40-69	40	2.05	**19.47** (14.28-26.54)	**0.52** (0.27-1.00)	.048
70+	12	0.32	**37.27** (21.17-65.63)	1	
Time groups (years)					
≤ 5	39	0.80	**48.79** (35.64-66.77)	**3.31** (2.09-5.24)	<.001
> 5	34	2.31	**14.74** (10.53-20.63)	1	
Repeated suicide attempts at baseline					
Repeater	47	1.38	**34.14** (25.65-45.44)	**2.27** (1.41-3.67)	.001
Non-repeater	26	1.73	**15.03** (10.24-22.08)	1	
Method at baseline attempt					
Violent	11	0.16	**70.22** (38.89-126.80)	**3.34** (1.76-6.34)	<.001
Non-violent	62	2.95	**21.02** (16.39-26.96)	1	
SIS score**					
≥19 p	30	0.64	**46.90** (32.79-67.07)	**2.69** (1.69-4.28)	<.001
< 19 p	43	2.47	**17.43** (12.93-23.51)	1	

* p-value for the difference between categories within the variable

**Suicide Intent Scale

Unadjusted standardized mortality ratio (SMR) (95% CI), and adjusted models of rate ratio (RR) (95% CI), death by suicide. Unadjusted SMR investigate each category within the variable separately. Adjusted RR includes the categories within the variables, reference category marked as “1”.

Figure 1: Standardised suicide mortality per year of follow-up



Overview of the change of SMR over the course of follow up. The SMR is plotted for each year of follow-up.

In Poisson regression models including the three investigated clinical variables repeated attempts, violent method, and high SIS score, all were identified as statistically significant variables contributing to excess suicide mortality (Table 2). Violent method demonstrated the highest independent levels of SMR (Table 1) as well as the highest adjusted RR in the model (Table 2). In the last adjusted model, including interaction terms for sensitivity analysis purposes, the adjusted RR:s are similar to that of the main model, but the confidence intervals are wider. In this model, only violent method remained statistically significant.

Table 2: Unadjusted and adjusted models of standardized mortality ratio (SMR) and rate ratio (RR) (95% CI) including interaction variables, death by suicide

	UNADJUSTED MODEL		ADJUSTED MODEL 1		ADJUSTED MODEL 2	
	RR (95% CI)	*p*	RR	95% CI	RR	95% CI
Intercept (SMR)	**23.50 (18-68-29.56)**	<.001	**10.05**	**6.49 -15.57**	**11.50**	**6.98 -18.96**
Baseline variables						
Repeated attempts at baseline	**2.27 (1.41-3.67)**	.001	**2.39**	**1.48 -3.87**	1.80	0.95 -3.42
Violent	**3.34 (1.76-6.34)**	<.001	**3.28**	**1.71 -6.31**	**3.22**	**1.05 -9.86**
SIS score≥19 p	**2.69 (1.69-4.29)**	<.001	**2.42**	**1.51 -3.88**	1.66	0.60 -4.57
Interaction terms:						
Repeater *violent method					2.13	0.52-8.68
Repeater*SIS score≥19 p					1.66	0.60-4.57
Violent method*SIS score ≥19 p					0.41	0.11-1.61

Unadjusted and adjusted models of standardized mortality ratio (SMR) and rate ratio (RR) (95% CI) including interaction variables, death by suicide. The unadjusted model includes only the categories within the variable. Adjusted model 1 includes the three baseline variables. Adjusted model 2 includes the baseline variables and the interaction terms.

DISCUSSION

The present study aimed to fill a gap in the literature by examining excess mortality by suicide in hospitalized suicide attempters versus the general population and to examine clinically relevant risk factors for the same. We found substantial excess mortality by suicide among suicide attempters; higher among women than among men; and higher within the first five years than five years or more after the index attempt. The highest independent SMR was found for the subgroup of patients who engaged in a violent index attempt. In a regression model including repeated suicidal attempts (RA), more violent attempts (VA), and higher scores on a measure of suicidal intent (HS), all three clinical characteristics were significantly associated with excess suicide mortality.

Findings from the present study need to be considered within the context of several strengths and limitations. A standardized clinical assessment provided a broad set of baseline data on a large sample of suicide attempters who had been admitted to an emergency medical unit because of a suicide attempt. The generalizability of the study population to the wider group of suicide

attempters, in general, is limited by only including participants from one site and also by the fact that these participants were admitted to a medical emergency unit, indicating a certain severity of the suicide attempt. However, to our knowledge, this is the largest population of suicide attempters followed for this length of time, with baseline data available from a semi-structured clinical interview designed specifically for use with suicide attempters. The study also benefits from the inclusion of annual general population death rates for the study period, within gender and age subgroups, permitting the generation of a more accurate estimation of the expected numbers of deaths. This population data enabled computation of the overall excess mortality by suicide (SMR) in the study population as well as for clinically relevant subgroups defined by putative risk groups for suicide (RA, VA, and HS) within the group of suicide attempters. Still, further studies are needed employing similar designs, both in other countries and with individuals recruited from outside of inpatient (emergency) medical settings. In addition, future studies should attempt to assess the level of violence and suicidal intent involved in repeated suicide attempts that did not result in death.

The results of the present study confirm the conclusions of previous studies that suicide attempters have an elevated risk of suicide mortality. Previous studies have found SMRs of between 17-77, though these studies had different standard populations (30-38). The number of suicides in this study population of suicide attempters was approximately 23.5 times that which would be expected in the general Swedish population. The SMR was particularly high in females, mirroring the results of previous studies (30, 31, 33, 35, 40). The finding that the excess mortality was higher the first five years after the attempts compared to after that, is in line with the results of previous studies investigating the risk of death by suicide over time who found the highest risk the first year (22, 30) and the first three years (36) after the attempt.

RA, VA, and HS were all identified as statistically significant variables contributing to excess suicide mortality. Since VA was the only variable still statistically significant in the interaction model that was used as sensitivity analysis, it may indicate stronger support for this variable as an independent contributing factor. To the best of our knowledge, no previous studies have investigated the excess suicide mortality of these subgroups of suicide attempters although repeated suicidal behavior, violent method (19, 27, 28), and a high score on the SIS (8, 29, 46-48) have been identified as risk factors for suicide within the group of suicide attempters in several studies. The results of this study strengthen the suicide mortality risk associated with these subgroups and while they may be linked to each other, all three are independent

relevant risk groups. Further, this study clearly demonstrates the severe risk of premature death by suicide in suicide attempters compared to the general population, especially in the years following the attempt. The excess suicide mortality is especially high in women, and in those who have made repeated attempts, in those who made a violent suicide attempt, and among those who were high in suicidal intent.

The results of this study indicate the importance of a thorough assessment of the history of previous suicide attempts, even though the attempt/s may have occurred many years ago. In the psychiatric assessment of suicide attempters, clinicians could benefit from asking questions of previous suicide attempts, retrieving information about the method of the attempt, and gaining knowledge about the suicidal intent, for instance using the SIS scale. Clinicians may be aided by including these aspects in their suicide risk assessment of suicide attempters at both short- and long-term follow-up. By doing so they may have a be a better chance of identifying patients with a higher risk of suicide for many years after a suicide attempt.

Aftercare and follow-up of all suicide attempters is vital and suicide prevention programs may benefit from targeting the identified subgroups of attempters with specific interventions.

Suicide risk most likely changes over time and highly complex interactions between multiple factors are probable. Future research would benefit from repeated assessment over a life course to shed further light on the process of suicide risk over time. A follow-up assessment of those still living could provide information on possible sources of resilience.

Footnotes

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Competing interest statement

The authors declare no conflict of interest.

Author contribution

AÖ initiated the clinical baseline investigation and the present follow-up, acquired and registered the follow-up data, and made revisions of the manuscript. JB initiated the follow-up, acquired the data, prepared the data set, designed the statistical strategy, made significant contributions to the statistical analysis, and made revisions of the manuscript. AÖ, JB, SPL, KSP, and LA contributed to designing the study and interpretation of the data. SPL drafted the manuscript and made the statistical analysis and made revisions of the manuscript. All authors also read and approved the final manuscript.

Patient consent for publication

Not required.

Data availability statement

Data are available upon request.

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Study III

Health Care Utilisation Two Years Prior to Suicide and Subsequent Reports to the Supervisory Authority in Sweden: A Retrospective Explorative Study Based on Medical Records

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ABSTRACT

Objective

The overall aim of this study is to map health care utilisation among individuals in the two years prior to suicide in Sweden in 2015 and to examine possible age and gender differences. Further, for the subgroup with care contact during the final four weeks of life, we reviewed post-suicide reports filed at the Health and Social Care Inspectorate to determine whether gender and age might impact the tendency of reporting.

Methods

Design**:** A retrospective explorative study with a medical record review covering the two years preceding suicide.

Setting**:** All health care units located in 20 of Sweden's 21 regions.

Participants**:** All individuals residing in participating regions who died by suicide during 2015 (n=949).

Results

Over 90% were in contact with a health care provider during the 24 months prior to suicide, and 60% within four weeks. Overall health care utilisation during the last month of life did not differ between age groups. However, 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 specialised somatic health care. Among suicides with health care contacts within four weeks of suicide, only 45% were reported to the supervisory authority. Reports were less likely to be filed after suicides of men and older adults.

Conclusion

Care utilisation before suicide varied by gender and age. Despite regulations, less than half of the applicable cases were reported to the supervisory authority.

Keywords

Suicide, Health Services, Health Care Utilisation, Mandatory Reporting, Medical Records

INTRODUCTION

In 2008, the Swedish government passed a public health bill with a Vision Zero initiative for suicide prevention(1). The overall ambition of the legislation was that "No individual should find him- or herself in a situation in which they experience that the only solution is suicide". Yet about 1500 individuals, 1000 males, and 500 females die by suicide each year in Sweden. Approximately 300 of those are deaths due to events of undetermined intent (2).

In February 2006, two years before the Vision Zero public health bill, 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. The mandatory reports were requested following the lex Maria legislation (3), which concerned preventable severe patient harm incidents. In 2007, the Health and Social Care Inspectorate (IVO) published a report regarding reported suicide deaths in 2006 (4), followed by two aggregated analyses of the outcomes of post-suicide audits in Sweden (5, 6). Most of the reports came from psychiatric services.

Almost all mental disorders are associated with an increased risk of future suicide(7-9). In many countries, including Sweden, mental illnesses such as depression, anxiety, and substance abuse are primarily diagnosed and treated in primary health care and referred to psychiatric services when needed. Additionally, as stated in previous international research, many suicidal individuals are in treatment at primary health care before death by suicide. For example, a systematic review from 2002 covering studies mainly from the United Kingdom and the USA presented an approximate contact rate to primary health care within one month before death by suicide of 45% (range=20-76%), while the approximate contact rate to psychiatric services in the same period before suicide was 19% (range=7-28%) (10). A similar, more recent systematic review covering 15 countries in Europe, North America, Asia, and Australia described that 80% of the individuals who died by suicide were in contact with primary health care within one year and 44% within one month before death (11). The same review also presented data concerning psychiatric services: 31% received psychiatric care within one year before the suicide, 21% within one month, and only 10% during the final week of life. In addition, a large longitudinal study from the USA of over 5000 individuals who died by suicide from 2000 to 2010 reported that 84% had a health care contact within one year before suicide, but mainly with primary or specialised somatic secondary health care (12). A population-based case-controlled study from Wales, including all suicide cases 2000-2017, showed that 85% had contact with a general practice within one year, 68% within one month, and 26% within one week prior to death by suicide (13). A similar Norwegian study, comprising all suicide cases from 2006-2015, presented a higher consultation rate with general practitioners among female (89%) than male (80%) suicide decedents within one year before death (14). Corresponding rates one month prior to death were 35% among male and 46% among female suicide decedents. A meta-analysis of studies covering psychiatric utilisation before suicide from primarily Western European and Northern American countries with samples from 1980 to 2015 found a pooled prevalence for inpatient or outpatient psychiatric services within one year prior to death of 25.7% (95% CI=22.7%−28.9%)(15).

Few studies have focused on the health care utilisation prior to suicide in Sweden (16, 17). A register-based study showed that 23% of male and 31% of female individuals who died by suicide in Sweden between 1991-2003 had been hospitalised with a psychiatric disorder during the year that preceded death, and 3% of male and 5% of female deaths had occurred either during hospitalisation or on the day after discharge (18).

Still, there is a lack of knowledge of overall health care utilisation, including inpatient and outpatient care, prior to death by suicide in Sweden. Prior international studies state that older adults are less likely to attend psychiatric services than younger (19, 20), and the male utilisation of psychiatric services is lower than female utilisation (21, 22). However, it is unknown if there are any age or gender differences regarding health care contacts before death by suicide in Sweden.

Aims of the study

The overall aim of this study is to map health care utilisation among individuals in the two years prior to suicide in Sweden in 2015 and to examine possible age and gender differences. Further, for the subgroup with care contact during the final four weeks of life, we reviewed post-suicide reports filed at the Health and Social Care Inspectorate to determine whether gender and age might impact the tendency to report patient suicides.

METHOD AND MATERIAL

We carried out a retrospective explorative study based on data collected from two sources: medical records of people who died by suicide in Sweden during 2015 and health care providers' post-suicide reports to the Health and Social Care Inspectorate (the government agency responsible for supervising health care in Sweden).

The present study was carried out within the ongoing nationwide research project titled *Retrospective investigation of health care utilisation of individuals who died by suicide in Sweden 2015*. The project includes data for 20 of Sweden's 21 regions (Stockholm data not currently available).

Study population

Using the Swedish Cause of Death Register(23) (held by the National Board of Health and Welfare), which comprises data on all dates and causes of death of residents in Sweden, identification of all individuals recorded with death by suicide from 1st of January 2015 to the 31 December 2015 was possible. Suicide was classified as intentional self-harm, coded as X60-X84 by the International Classification of Diseases, 10th revision (ICD-10)(24). Individuals were identified by the unique personal identification number assigned to all residents in Sweden. Each individual in the dataset was given a specific code for de-identification. The total number of suicides in Sweden in 2015 was 1186. Among those, 232 were excluded because data from Region Stockholm were missing.

Data collection

Health care in Sweden is decentralised and managed by regional councils in each county. After establishing a confidentiality agreement based on the Swedish Law of Patient Confidentiality (25) 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.

Medical records were obtained for the individuals with a health care contact within two years prior to death by suicide, most often by granting access to the regional electronic health record system. Some regions sent paper copies.

Medical record investigation protocol

This study's definition of health care contact was either a visit or a phone call to any health care provider noted in the medical record in any health care setting (including inpatient care, outpatient care, mobile teams).

A structured investigation protocol was used to review each patient's medical records. The research group developed the investigation protocol based on guidelines from the Swedish Psychiatric Organisation (26) and specific regional suicide prevention protocols (27). The investigation protocol contained questions regarding health care utilisation in psychiatric services, primary health care, and specialised somatic health care. Furthermore, questions about contact with authorities, psychosocial problems, and post-

suicide reports from health care providers to the supervisory authority were also included in the protocol.

Medical records from psychiatric services, primary health care, and specialised somatic health care dated from death and the previous 24 months were reviewed. All data were compiled into a master file for statistical analysis. The medical records were reviewed during 2016-2020 in all included counties.

Medical record reviewers

In each county, health care professionals were engaged as record reviewers after signing a confidentiality agreement with the representative in the county. The reviewers were of different professions within health care. However, all were familiar with the electronic health record system and its terminology.

All reviewers were given training sessions in using the investigation protocol. The training was held by members of the research group and was offered on several occasions since new reviewers were included continuously. After the training, the reviewers had access to continuous support and updates by the research group. In addition, a written guide was created to further assist reviewers in data collection. If a reviewer in the data collection came across an individual they had met as a clinician; someone else would investigate the records of this individual in order to maintain objectivity.

Post-suicide reports

All suicides during 2015 reported by health care providers to the 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 was obtained, granted by a contract of secrecy. The unique personal identification number from the reports was linked with the data from the medical records to determine the proportion of reported cases among health care users within four weeks before suicide.

Data analysis

The data were analysed by health care settings (primary care, psychiatric services, and specialised somatic health care). Firstly, descriptive analysis was used to estimate the proportion of individuals having a health care contact within different observation periods: 24 months, 12 months, three months, four

weeks, one week, and one day before death. Secondly, differences in health care contacts regarding age (0-24, 25-44, 45-64, 65+) and gender (male, female) were tested using chi² analysis. Thirdly, the number of reports from health care providers to the supervisory authority among individuals with health care utilisation within four weeks, one week, and one day before death was analysed. Group differences between age groups and gender as defined above were investigated using chi² analysis. Finally, the median time from last health care contact and death was compared regarding gender using the Mann-Whitney U test. Kruskal Wallis H test was used to compare age groups and the median time between last heath care contact and death. As per convention, results were considered statistically significant when two-sided P <.05. All analyses were carried out in IBM SPSS® version 26 and 27 (28).

RESULTS

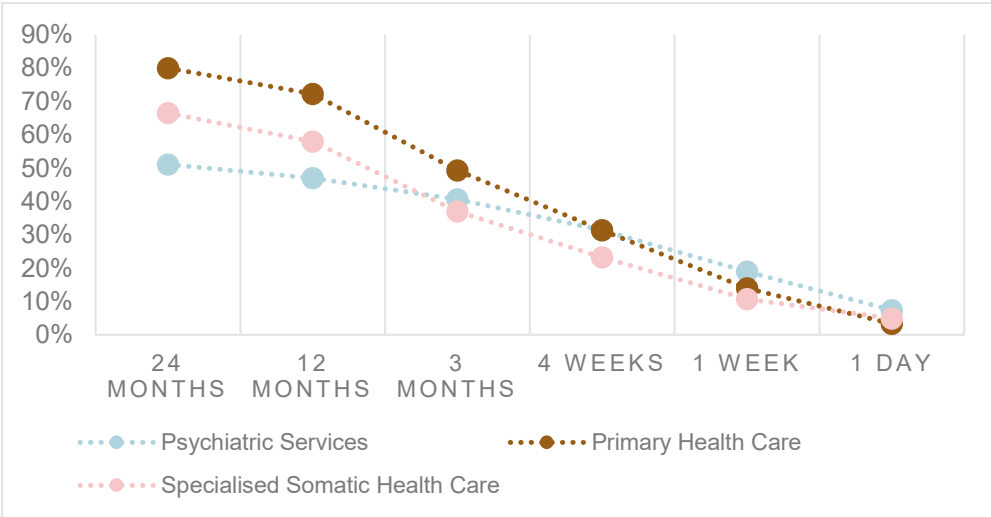
In all, 949 individuals were identified as the study population. However, one was excluded due to a pre-existing confidentiality agreement. The Swedish Cause of Death Register was updated after our data acquisition; five further suicides were identified, which were not included.

Table 1: Characteristics of the study population

	Total n (%, column)	Male n (%, row)	Female n (%, row)
Total	948 (100)	691 (72.9)	257 (27.1)
Age categories (years)			
0–24	86 (9.1)	56 (65.1)	30 (34.9)
25–44	254 (26.8)	183 (72.0)	71 (28.0)
45–64	352 (37.1)	266 (75.6)	86 (24.4)
65+	256 (27.0)	186 (72.7)	70 (27.3)
	Total n (%, column)	**Male n (%, column)**	**Female n (%, column)**
Marital status			
Married/ cohabitant	260 (27.4)	195 (28.2)	65 (25.3)
Unmarried/divorced/ widower	411 (43.4)	286 (41.4)	125 (48.6)
Unknown status	277 (29.2)	210 (30.4)	67 (26.1)
Occupation status			
In employment/school/ work training/age pension	507 (53.5)	344 (49.8)	163 (63.4)
In unemployment	139 (14.7)	103 (14.9)	36 (14.0)
Unknown status	302 (31.9)	244 (35.3)	58 (22.6)
Sick Leave			
Yes	201 (21.2)	132 (19.1)	69 (26.8)
No	441 (46.5)	309 (44.7)	132 (51.4)
Unknown status	306 (32.3)	250 (36.2)	56 (21.8)

Among the 948 included individuals (681 men, 257 women), the mean age was 51.65 years (SD: 19.12). Characteristics of the study population are presented in Table 1.

Figure 1: Total health care utilisation within 24 months to 1 day before death



Overview of the total health care utilisation to Psychiatric Services, Primary Health Care, and Specialised Somatic Health Care within 24 months to 1 day before death.

Contact with health care two years prior to suicide

As shown in Figure 1, the most common type of health care contact within two years to three months before suicide was primary health care. The utilisation rate of primary health care and psychiatric services was the same (31%) within the four weeks prior to death, while psychiatric services were the most common type of health care within one week to one day before suicide.

All health care

As shown in Table 2, over 90% of the study population had been in contact with a health care provider during the 24 months prior to suicide. Nearly 60% utilised health care within four weeks before suicide. Contact with any health care provider was more common in women than men. Older individuals (≥65 years) were in contact with any health care to a greater extent than younger within the 24 months, 12 months, and three months observation periods. No age group differences were identified from one month to one day prior to suicide.

Table 2: Distribution of the health care utilisation two years prior to suicide

ALL HEALTH CARE

Within	24 months		12 months		3 months		4 weeks		1 week		1 day	
	n (%)	p	n (%)	p	n (%)	p	n (%)	p	n (%)	p	n (%)	p
Total	856 (90.3)	-	816 (86.1)	-	698 (73.6)	-	565 (59.6)	-	338 (35.7)	-	137 (14.5)	-
Sex												
Male	611 (88.4[a])	0.001[c]	576 (83.4[a])	<0.001[c]	488 (70.6[a])	0.001[c]	389 (56.3[a])	0.001[c]	226 (32.7[a])	0.002[c]	86 (12.4[a])	0.004[c]
Female	245 (95.3[a])		240 (93.4[a])		210 (81.7[a])		176 (68.5[a])		112 (43.6[a])		51 (19.8[a])	
Age categories												
0–24	76 (88.4[a])		69 (80.2[a])		56 (65.1[a])		46 (53.3[a])		26 (30.2[a])		10 (11.6[a])	
25–44	223 (87.8[a])		209 (82.3[a])		183 (72.0[a])		152 (59.8[a])		91 (35.8[a])		44 (17.3[a])	
45–64	314 (89.2[a])	0.031[c]	300 (85.2[a])	0.001[c]	251 (71.3[a])	0.007[c]	203 (57.7[a])	0.261[c]	127 (36.1[a])	0.739[c]	44 (12.5[a])	0.326[c]
65+	243 (94.9[a])		238 (93.0[a])		208 (81.3[a])		164 (64.1[a])		94 (36.7[a])		39 (15.2[a])	

PSYCHIATRIC SERVICES

Within	24 months		12 months		3 months		4 weeks		1 week		1 day	
	n (%)	p	n (%)	p	n (%)	p	n (%)	p	n (%)	p	n (%)	p
Total	484 (51.1)	N/A	446 (47.0)	-	385 (40.6)	-	298 (31.4)	-	179 (18.9)	-	70 (7.4)	-
Sex												
Male	316 (45.7[a])	<0.001[c]	292 (42.3[a])	<0.001[c]	250 (36.2[a])	<0.001[c]	190 (27.5[a])	<0.001[c]	111 (16.1[a])	<0.001[c]	42 (6.1[a])	0.012[c]
Female	168 (65.4[a])		154 (59.9[a])		135 (52.5[a])		108 (42.0[a])		68 (26.5[a])		28 (10.9[a])	
Age categories												
0–24	51 (59.3[a])		40 (46.5[a])		36 (41.9[a])		31 (36.0[a])		19 (22.1[a])		8 (9.3[a])	
25–44	162 (63.8[a])		151 (59.4[a])		131 (51.6[a])		105 (41.3[a])		60 (23.6[a])		28 (11.0[a])	
45–64	189 (53.4[a])	<0.001[c]	177 (50.3[a])	<0.001[c]	147 (41.8[a])	<0.001[c]	108 (30.7[a])	<0.001[c]	70 (19.9[a])	0.004[c]	24 (6.8[a])	0.018[c]
65+	82 (32.0[a])		78 (30.5[a])		71 (27.7[a])		54 (21.1[a])		30 (11.7[a])		10 (3.9[a])	

PRIMARY HEALTH CARE

Within	24 months		12 months		3 months		4 weeks		1 week		1 day	
	n (%)	p	n (%)	p	n (%)	p	n (%)	p	n (%)	p	n (%)	p
Total	758 (80.0)	-	684 (72.2)	-	467 (49.3)	-	295 (31.3)	-	132 (13.9)	-	31 (3.3)	-
Sex												
Male	539 (78.0[a])	0.014[c]	483 (69.9[a])	0.011[c]	322 (46.4[a])	0.007[c]	209 (30.2[a])	0.342[c]	88 (12.7[a])	0.083[c]	19 (2.7[a])	0.140[c]
Female	219 (85.2[a])		201 (78.2[a])		145 (56.4[a])		86 (33.5[a])		44 (17.1[a])		12 (4.7[a])	
Age categories												
0–24	63 (73.3[a])		52 (60.5[a])		26 (30.2[a])		10 (11.6[a])		6 (7.0[a])		1 (1.2[a])	
25–44	182 (71.7[a])		151 (59.4[a])		91 35.8[a])		58 (22.8[a])		23 (9.1[a])		6 (2.4[a])	
45–64	286 (81.3[a])	<0.001[c]	263 (74.7[a])	<0.001[c]	180 (51.1[a])	<0.001[c]	115 (32.7[a])	<0.001[c]	53 (15.1[a])	0.001[c]	10 (2.8[a])	0.112[c]
65+	227 (88.7[a])		218 (85.2[a])		170 (66.4[a])		112 (43.8[a])		50 (19.5[a])		14 (5.5[a])	

SPECIALISED SOMATIC HEALTH CARE

Within	24 months		12 months		3 months		4 weeks		1 week		1 day	
	n (%)	p	n (%)	p	n (%)	p	n (%)	p	n (%)	p	n (%)	p
Total	630 (66.5)	-	550 (58.0)	-	351 (37.0)	-	220 (23.2)	-	101 (10.7)	-	46 (4.9)	-
Sex												
Male	437 (63.2[a])	0.001[c]	384 (55.6[a])	0.012[c]	247 (35.7[a])	0.181[c]	152 (22.0[a])	0.148[c]	73 (10.6[a])	0.883[c]	33 (4.8[a])	0.857[c]
Female	193 (75.1[a])		166 (64.6[a])		104 (40.5[a])		68 (26.5[a])		28 (10.9[a])		13 (5.1[a])	
Age categories												
0–24	48 (55.8[a])		40 (46.5[a])		21 (24.4[a])		16 (18.6[a])		5 (5.8[a])		3 (3.5[a])	
25–44	142 (55.9[a])		117 (46.1[a])		63 (24.8[a])		41 (16.1[a])		18 (7.1[a])		11 (4.3[a])	
45–64	232 (66.9[a])	<0.001[c]	199 (56.5[a])	<0.001[c]	126 (35.8[a])	<0.001[c]	75 (21.3[a])	<0.001[c]	40 (11.4[a])	0.015[c]	16 (4.5[a])	0.648[c]
65+	208 (81.3[a])		194 (75.8[a])		141 (55.1[a])		88 (34.4[a])		38 (14.8[a])		16 (6.3[a])	

a) % within sex

b) % within the age category

c) Pearson Chi-Square (2-sided)

Psychiatric services

Table 2 shows that slightly over half was in contact with psychiatric services within the 24-month observation period. Almost one-third was in contact with psychiatric services within the four weeks prior to suicide, almost one-fifth during the preceding week, and less than one-tenth within one day before

suicide. The proportion of women in contact with psychiatric services was higher than among men, and this difference remained for all observation periods.

A larger proportion of younger individuals (<65 years) was in contact with psychiatric services compared to older individuals (≥65 years). For example, nearly a quarter of all individuals aged 25 to 44 years had a psychiatric contact within one week before suicide. Twelve per cent of individuals over 65 years had a similar contact.

Primary health care

Eighty per cent of the study population were in contact with primary health care within 24 months, and almost a third were in contact with primary health care within four weeks before suicide. Women were in contact with primary health care more often than men within the 24 months, 12 months, and three-month observation period. No gender differences were found closer to suicide. Older individuals (≥65 years) were in contact with primary health care to a greater extent than younger individuals (<65 years) within all observation periods except the day before suicide.

Specialised somatic health care

Two-thirds were in contact with any specialised somatic health care within 24 months before suicide. Almost one-fourth were in contact with specialised somatic health care within four weeks and slightly over one in ten within one week before suicide. Paralleling primary care contacts, a larger proportion of women was in contact with somatic health care than men within 24 months and 12 months of observation. However, there was no difference between men and women closer to suicide. Likewise, older individuals (≥65 years) were in contact with specialised somatic health care to a greater extent than younger individuals (<65 years) within all observation periods, except for the final 24 hours.

Time since last health care contact

Among those with any health care contact within two years before suicide (n=856), the median time between the last health care contact and death by suicide was 12 days (IQR 3 to 53). Among those in contact with psychiatric services (n=484), the corresponding figures between the last contact and suicide were 16 (IQR 4 to 60) days. For those in contact with primary care

(n=758), the median time between the last contact in primary health care and suicide was 51 (IQR 12 to 165) days. Finally, for those in contact with specialised somatic care (n=630), the median time between the last contact in specialised somatic care and suicide was 70 days (IQR 16 to 223).

Overall, women had a lower median time between last health care contact (any) and suicide (women: 9 days, men: 14 days. Mann Whitney U test: p=.002), but no gender differences were identified when analysing psychiatric services, primary care, and specialised somatic care separately.

No difference between age groups was found when analysing median time between last health care contact and suicide in the whole group who were in contact with any health care or the subgroup of individuals who had been in contact with psychiatric services. However, older adults had a significantly shorter period between last non-psychiatric health care contact to suicide than younger people (Primary health care: age 0-24: 90 days, age 25-44: 90 days, age 45-64: 48.5 days, age 65+: 30 days. Kruskal Wallis Test: p<.001); (Specialised somatic health care: age 0-24: 156.5 days, age 25-44: 107.5 days, age 45-64: 72 days, age 65+: 40.5 days, Kruskal Wallis Test: p<.001).

Table 3: Distribution of the reports to the supervisory authority

	Health care utilisation within 4 weeks			Health care utilisation within 1 week			Health care utilisation within 1 day		
	Reported to supervisory authority?		p	Reported to supervisory authority?		p	Reported to supervisory authority?		p
	Yes, n (%)	No, n (%)		Yes, n (%)	No, n (%)		Yes, n (%)	No, n (%)	
Total	256 (45.3)	309 (54.7)	-	175 (51.8)	163 (48.2)	-	77 (56.2)	60 (43.8)	-
Sex									
Male	165 (42.4[a])	224 (57.6[a])	0.04[c]	111 (49.1[a])	115 (50.9[a])	0.164[c]	46 (53.5[a])	40 (46.5[a])	0,405[c]
Female	91 (51.7[a])	85 (48.3[a])		64 (57,1[a])	48 (42.9[a])		31 (60.8[a])	20 (39.2[a])	
Age categories									
0–24	22 (47.8[b])	24 (52.2[b])	0.022[c]	15 (57.7[b])	11 (42.3[b])	0.011[c]	7 (70.0[b])	3 (30.0[b])	0,105[c]
25–44	78 (51.3[b])	74 (48.7[b])		53 (58.2[b])	38 (41.8[b])		23 (52.3[b])	21 (47.7[b])	
45–64	98 (48.3[b])	105 (51.7[b])		72 (56.7[b])	55 (43.3[b])		30 (68.2[b])	14 (31.8[b])	
65+	58 (35.4[b])	106 (64.6[b])		35 (37.2[b])	59 (62.8[b])		17 (43.6[b])	22 (56.4[b])	

a) % within sex
b) % within the age category
c) Pearson Chi-Square (2-sided)

Distribution of the reports to the supervisory authority among individuals with health care utilisation within 4 weeks before suicide.

Post-suicide reports submitted to the Health and Social Care Inspectorate

In 2015, patient suicides that occurred within four weeks of a health care contact were to be reported to the Health and Social Care Inspectorate. There were 565 applicable suicides, and reports were submitted to the supervisory authority for 256 of these (45%). Table 3 shows an overview of the submitted post-suicide reports. For this subgroup, suicides among women were reported to a larger extent than suicides among men, and a smaller proportion of suicides among older individuals (≥65 years) were reported compared to suicide among younger (<65 years). The proportions of reported cases increased within subgroups with health care utilisation more adjacent to suicide, and gender and age group differences diminished.

DISCUSSION

Our study shows that over 90% of the study population was in contact with a health care provider during the 24 months prior to suicide, and nearly 60% had such contact during the last four weeks. Moreover, half of the care utilisers had

a health care contact within 12 days and a quarter within three days prior to suicide. Visits to primary health care were the most common type of care contact during the observation period, except for the final four weeks of life, where psychiatric care utilisation was more prevalent, although the utilisation varied by gender and age. Among those with health care utilisation within four weeks of suicide, only 45% were reported by the health care providers to the supervisory authority, although this was mandatory in 2015. Reports were less likely to be filed after suicides of men and older adults.

Within twelve months before death, 86% had a health care contact, and proportions with primary health care contacts and specialised somatic health care contacts were greater than the proportion with health care contacts at psychiatric services. This is in line with the results presented by Ahmedani et al. (12), who reported that 84% had a health care contact within twelve months before suicide, but mainly with primary or specialised somatic secondary health care.

As to primary health care utilisation, 72% were in contact within twelve months, 31% within one month, and 14% within one week before death by suicide. The results show a slightly lower consultation rate than corresponding numbers of Stene-Larsen et al. (11), Louma et al. (10), Hauge et al. (14), and John et al. (13). Hence, the primary health care utilisation before suicide in Sweden seems to be a bit lower than in the other investigated countries. However, the utilisation of primary health care before suicide was higher among Swedish suicide decedents than during the 1980s.

Regarding psychiatric health care, 47% utilised such services within twelve months, 31% within one month, and 19% within one week before death by suicide. These are higher contact rates than the average contact rates reported in the review article by Stene-Larsen et al. (11) and the meta-analysis by Valby et al. (15), illustrating a potentially greater utilisation of psychiatric services before suicide in Sweden than in the investigated countries in prior studies. The divergent prevalence of psychiatric utilisation could be due to different types of health care organisations in various countries. Proportions in contact with psychiatric services in our study were similar to those reported in a register-based study from Norway (30), which has a similar publicly financed health care system as Sweden.

Women were more often in contact with health care in general. The present study also elucidates a gender difference regarding contact with psychiatric services before suicide, where women were more likely to attend psychiatric services than men. Nevertheless, there was no gender difference regarding

contacts with either primary health care or specialised somatic health care in close in time to the death by suicide). Depressive disorders are more prevalent in women than men, especially in adolescents and younger adulthood(31), which could explain the gender differences in care utilisation. Moreover, men with depression may be less likely identified in health care than women due to different symptoms(32), resulting in inadequate diagnosis and undertreatment of male depression. Men experiencing depression are more likely than women to exhibit symptoms of irritability, anger, substance misuse, risk-taking, and impulsivity that could mask more typical internalising depressive symptoms (33). This is compatible with a prior older Swedish study where an educational program in depression diagnosis and treatment to primary care practitioners on the island of Gotland mainly affected the suicide rates of women (34). Another explanation for the gender differences could be the higher alcohol use disorder (AUD) rates among men(35). Although AUD is a potent risk factor for completed suicide in both women and men (36), alcohol-related problems are significantly more prevalent among men (35). Men with AUD are also more likely to develop secondary depressive disorders than women with AUD(37). Men are also more affected by the stigma associated with mental health services and are more prone to utilise health services not exclusively related to mental health(38).

This study also showed a minor but statistically significant difference between age groups. Older individuals had a higher contact rate than younger with any health care provider within the two years preceding suicide. This could be explained by considerable general morbidity, leading to increased health care utilisation among older adults. Closer in time to death by suicide, within four weeks before suicide, there was no age difference regarding any health care contacts. However, there were substantial age group differences within four weeks before suicide. Younger individuals were to a greater extent in contact with psychiatric services than older individuals. The pattern was inverted in contact with primary health care and specialised somatic health care. These findings are in accordance with the study by Louma et al. (10), which showed similar age-related variations in contacts with psychiatric services and primary health care services (within one year and one month before suicide, respectively). One way of understanding the observed phenomenon is that older individuals with depression or other psychiatric disorders may mainly attend primary health care or non-psychiatric specialist care when seeking help. Prior studies indicate that older adults with depressive disorders prefer to use the general health care system rather than mental health clinics(39). Regardless, this finding suggests a need for geropsychiatric competence within

these units, including suicide prevention programs suited for older patients. A recently published cohort study among suicide attempters at psychiatric emergency departments showed a lower prevalence of psychiatric disorders and a lower rate of symptomatology among older adults than young adults, even though the suicidal intent was higher among older than young adults(40). Further research is required to increase understanding of this issue, including analysing which symptoms are presented in health care among the different age groups before death by suicide. Possibly, older adults are less likely to present symptoms of psychopathology prior to suicide than younger adults, which could explain the age group differences in the type of care utilisation before death.

Even though post-suicide reviews were mandatory at the time for this review, less than half of the individuals with any health care utilisation within four weeks before suicide was reported to the supervisory authority. The causes for this low reporting rate are probably multiple; one primary explanation could be the absence of an automatic feedback system to the health care services when a former patient dies. In outpatient clinics with recurrent longitudinal contacts with patients, unexpected deaths are probably easier to detect than in emergency departments or inpatient clinics with no planned follow-up care. Another explanation could be a lack of continuity of care (COC). If the patient meets different physicians at each care visit prior to suicide, physicians are probably less likely to be aware of the suicide. Studies have shown lower COC-indices in primary care in Sweden than in Norway and England (41). A further explanation could be a lack of knowledge among health care providers about the regulatory reporting of applicable suicides.

In our study, women were reported to the supervisory authority to a greater extent compared to men, and a smaller proportion of older individuals (≥65 years) were reported compared to the younger (<65 years). Since both women and younger adults had a higher proportion of health care at psychiatric services than men and older adults, the reporting rate to the supervisory authority was probably higher in psychiatric services than in other clinics. However, additional analyses are needed to investigate this further.

Since many suicide decedents utilise health care shortly before death, our study highlights the importance of suicide prevention strategies within Swedish health care. Currently, suicide prevention interventions are mainly established in psychiatric health services in Sweden. As the rate of psychiatric service use before suicide is relatively high in Sweden, this study shows a need to improve existing prevention strategies (or increase the compliance to the strategies) within psychiatric services. However, this study also indicates a need to

implement suicide prevention strategies within all Swedish health care settings. Furthermore, specific strategies for older (42, 43) and male patients (44) may aid suicide prevention efforts in non-psychiatric health care settings.

Strengths and limitations

The study population provided nearly national coverage of suicide among individuals with all types of health care contacts. A limitation is that data from the Stockholm region were not yet available. The Stockholm region is the most populated in Sweden; approximately 20% of all suicides occur there.

By collecting data from medical records, the study provides detailed data on contacts with all professions in health care. However, all data in medical records are not systematically reported, resulting in relatively large proportions of missing data for some variables, such as marital status, occupation status, and sick leave. Including information from the National Patient Register would have yielded additional details of inpatient care and visits to physicians in psychiatric services and somatic care to the analysis, but not of visits to other care professionals nor visits to primary care.

Many investigators were involved in data collection. Efforts were made to ensure the investigators collected data uniformly. This included group training, investigator guidelines, and a high level of support from the research group. However, no systematic testing of inter-rater reliability (IRR) of the data scoring was performed.

In addition, this study did not access all data from the medical records of all private health caregivers. In the medical records systems investigated in this study, private health care is not always automatically recorded, and data may therefore have been omitted. In cases where information on private care was available in regional registers or medical records, efforts were made to obtain the medical records from the private clinic. The amount of missing data due to the lack of private care records is unknown. A survey was sent out to the record reviewers regarding experienced investigation problems. Overall, reviewers responded that problems accessing non-governmental health care were minimal, and the effect on the results was presumably negligible.

Another methodological consideration is that criteria for classifying deaths as suicides vary across cited studies. We did not include data on individuals who died due to self-harm events of undetermined intent. According to the National Centre for Suicide Research and Prevention, such events (“uncertain suicides”)

comprise an estimated 20% of the total number of certain and uncertain suicides in Sweden (45).

Our study lacks a population-based comparison group. However, it is known from prior US studies that those who die by suicide have more frequent health care usage before death across all settings compared to a matched control group (12, 46, 47).

The definition of health care contact has been either a visit or a phone call to a health care provider in this study. However, the lex Maria legislation (3) valid in 2015 did not define health care contact clearly. Hence, the health care providers could have done other definitions than ours when selecting individuals who died by suicide to report to the supervisory authority. In turn, this could partly be a potential explanation of the low reporting rate to the supervisory authority in our study.

Implications for future research

The present study depicts age and gender differences in health care contacts prior to suicide. In further planned studies, we will explore symptomatology, treatments, and actions taken by health care professionals in the different health care settings during the weeks and months prior to patient suicide. We will also further investigate the post-suicide reports submitted to the Health and Social Care Inspectorate with a more detailed analysis.

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Conflict of interest

The authors declare no conflict of interest.

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Author contribution

ÅW is the principal investigator, initiated and designed the study, and acquired the data from the Swedish Cause of Death Register. ÅW, EF, AE, and NPÖ developed the protocol used to extract medical record data. EB, SPL, EF, and NPÖ collected data, and SPL, EB, and NPÖ trained other medical record reviewers to collect data. EB designed the statistical strategy. EB and SPL contributed to the presentation of data in the tables. ÅW, EB, SPL, EF, AE, NPÖ, CS, MV, MW, and TS contributed to designing this study and interpreting the data. EB carried out the statistical analysis. EB and SPL drafted the manuscript. EB, SPL, EF, NPÖ, AE, CS, TS, MV, MW, and ÅW revised the manuscript. All authors read and approved the final manuscript.

Data availability statement

Data are available upon reasonable request.

Ethical considerations

According to the Swedish Act Concerning the Ethical Review of Research Involving Humans(48) (2003:460) and an advisory statement from the Regional Ethical Review Board in Lund, Sweden (2017/234), this study did not require ethical review as it did not include living human participants.

Abbreviations

CDC: Continuity of care

Patient consent for publication

Not required.

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Study IV

ARCHIVES OF SUICIDE RESEARCH
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Utilization of psychiatric services prior to suicide- a retrospective comparison of users with and without previous suicide attempts

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ABSTRACT

Introduction: The aim was to investigate psychiatric health care utilization two years before death by suicide among individuals with previous suicide attempts (PSA) compared with those without (NSA).

Method: A retrospective population-based cohort study was conducted including 484 individuals who died by suicide in Sweden in 2015 and were in contact with psychiatric services within the two years preceding death, identified through the Cause of Death register. Data on psychiatric health care two years before death, including suicide attempts according to notes in the medical record was used. Associations between having at least one PSA *vs.* NSA and health care utilization were estimated as odds ratios (OR) with 95% confidence intervals (CI) by logistic regression analyses.

Results: Of the 484 individuals included, 51% had PSA. Those with PSA were more likely than NSA to have received a psychiatric diagnosis [OR 1.96 (CI 95% 1.17–3.30)], to have ongoing psychotropic medication [OR 1.96 (CI 95% 1.15–3.36)] and to have been absent from appointments during the last three months [1.97 (1.25–3.13)]. In addition, elevated suicide risk was more often noted in the psychiatric case records of those with a PSA than those without [OR 2.17 (CI 95% 1.24–3.79)].

Conclusion: The results underline the importance of improved suicide risk assessment as well as thorough diagnostic assessment and when indicated, psychiatric treatment as suicide preventive interventions regardless of PSA. Furthermore, the larger proportion of absence from appointments in individuals with PSA may indicate a need of improved alliance between psychiatric care providers and individuals with PSA.

KEYWORDS

Medical records; psychiatric health care utilization; suicide; suicide attempts

HIGHLIGHTS

- Being assessed with elevated suicide risk was more common among those with previous attempt/s (PSA).
- One-fifth of all with no previous attempt (NSA) had no psychiatric diagnosis, compared to one in ten in those with PSA.
- Receiving psychotropic medication was more common among those with PSA.

This article has been corrected with minor changes. These changes do not impact the academic content of the article.

INTRODUCTION

Suicide is a multifaceted problem and efforts are needed in many different domains in society, including a need for effective health and medical care strategies to reduce deaths by suicide (Stanley & Mann, 2020). People who die by suicide have often sought health care in close proximity to death (Ahmedani et al., 2014; Luoma, Martin, & Pearson, 2002). For example, a recent systematic review of contact with primary and mental health care before suicide in men and women and across a range of age categories (Stene-Larsen & Reneflot, 2019) showed that 35% had been in contact with mental health services during the 3 months preceding death. Suicide is strongly associated with mental disorders (Harris & Barraclough, 1997). Studies have repeatedly shown that ~90% of all individuals who died by suicide in western countries had a mental disorder at the time of death (Cavanagh, Carson, Sharpe, & Lawrie, 2003; Nock et al., 2008). This indicates that to improve prevention efforts, specific attention to mental health issues is warranted. A recent Australian study (Wyder et al., 2021) investigated suicide victims who had been in contact with psychiatric services before death. They found that 70% had been formally assessed regarding suicide risk within a month before death but none of them had been assessed as being at high risk of suicide. Psychiatric services constitute an important domain for improved suicide risk assessment and suicide prevention measures.

Although a previous suicide attempt is a well-documented risk factor (Bostwick, Pabbati, Geske, & McKean, 2016), as many as 60% of people who die by suicide die on their first attempt (Bostwick et al., 2016). A lack of knowledge about these individuals has been identified (Buchman-Schmitt et al., 2017; Jordan & McNiel, 2020), even though they make up a significant proportion of all individuals who die by suicide. The few studies that exist indicate that they are, to a greater extent, men (Isometsä & Lönnqvist, 1998; Yook et al., 2021), who are older (Blow, Brockmann, & Barry, 2004; Yook et al., 2021) and are less often diagnosed with a psychiatric disorder (Yook et al., 2021) and have used firearms as suicide method (Anestis, 2016; Bostwick et al., 2016; Jamison & Bol, 2016). Furthermore, compared to people with previous suicide attempts, they seem to have experienced fewer stressful life events before death (Buchman-Schmitt et al., 2017). A recent Korean study (Yook et al., 2021) compared individuals who died by suicide with and without previous suicide attempts. They found that individuals with previous attempts were more likely to have talked about suicide and death before death by suicide, while those with no previous attempt were reported to have been troubled by relationship problems and somatic complaints. The knowledge of psychiatric care utilization before suicide regarding individuals with and without previous suicide attempts specifically is scarce. To the best of our knowledge, no previous studies have been conducted comparing these two groups in the context of psychiatric health care services.

Aims and Research Questions

The aim was to compare psychiatric health care utilization two years before suicide among individuals with and without previous suicide attempts. Specific areas of focus

include the length of psychiatric contact and proximity of contact before suicide, suicide risk assessment, ongoing and planned treatment interventions, and individual factors, such as gender, age, type of psychiatric diagnosis, and comorbidity. The study includes 484 individuals who died by suicide in Sweden in 2015 and had been in contact with psychiatric services within the two years preceding death.

METHOD AND MATERIAL

The present study was carried out within the ongoing nationwide research project titled Retrospective investigation of health care utilization of individuals who died by suicide in Sweden 2015. The project analyses the patterns of health care utilization and includes data for 20 of Sweden's 21 regions (Stockholm data not currently available). Data were retrieved from the Cause of Death Register (The National Board of Health & Welfare, 2021). Suicide was recorded in the CDR as the underlying cause of death according to the International Statistical Classification of Diseases and Related Health Problems (ICD, version 10) (World Health Organization, 1992) as suicide (ICD 10: X60–X84).

Medical Record Protocol

Medical records from psychiatric health care services were investigated using a structured protocol developed for this purpose. The research group developed a protocol following the recommendations of the Swedish Psychiatric Organization (Salander Renberg & Swedish Psychiatric Association, 2013), including questions regarding a range of aspects connected to health care utilization. Records from private psychiatric health care services were also included. In some cases, information could be retrieved from any of the medical records, i.e., also including primary care and somatic care. Data regarding previous suicide attempts were collected from any available medical record information within two years. All visits at psychiatric service units were taken into consideration; outpatient clinics, inpatient wards, psychiatric emergency visits, psychiatric consultations, mobile team visits, private psychiatric care. Data of visits/contacts to all professions were collected including psychiatrist, psychologist, social worker, nurse, physiotherapist, and assistant nurse.

Medical Records Reviewers

Regional health care representatives signed patient confidentiality documents with the research group project leader, agreeing to adhere to the Swedish law of patient confidentiality[1] when handling the research data. They were then given access to data on the individuals residing in their geographic region who died by suicide. The regional representatives made agreements with local investigators who also signed a confidentiality statement with the local representative and thus were assigned to the research project. Access to medical records was granted regionally. Investigators around the country were all invited to a day of training to use the investigation protocol. Members of the

[1]Swedish law of public access to information and secrecy, SFS 2009:400 C.F.R.

research group provided the training, which was offered on repeated occasions as new investigators were included. A written guide was created to further assist investigators in data collection. After the training, the investigators had access to continuous support and updates by the research group.

Investigators were primarily clinicians with experience in using the region's electronic record system. If an investigator came across an individual they had met as a clinician, that case was investigated by someone else to maintain objectivity. All data analyzed in this study were collected from medical records and were entered into excel files.

Included Variables

Based on medical record data for the two years before the suicide, a person with one or more notations of a suicide attempt at any point during lifetime was considered to have a previous attempt. A binary dependent variable was created (previous attempt (PSA)/ no previous attempt (NSA). The presence of previous suicide attempts was assessed according to notes of any lifetime attempts in the medical records.

Independent variables included: Gender was categorized as men and women. Age at time of suicide was categorized as $\leq$19, 20–29, 30–39, 40–49, 50–59, 60–69, $\geq$70. Psychiatric diagnoses refer to a diagnosis noted in the medical record at the last contact with psychiatric health care services, as ICD-10 codes in chapter F using three digits (e.g., F32.1) (World Health Organization, 1992). Comorbidity refers to two or more psychiatric diagnoses (any) noted in the medical record at the last contact with psychiatric health care services. The number of days between the last contact with psychiatric services and the suicide ("proximity of psychiatric care") was transformed into a categorical variable (one week, one-four weeks, over four weeks up to three months, over three months up to one year, more than one year). The total length of the psychiatric treatment was coded as the number of days between the first psychiatric health care contact and the suicide. If the contact exceeded two years, it was assigned a maximum of 730 days. The continuous variable was transformed into a categorical variable (up to three months, three months up to one year, one year up to two years, or two years or more). Psychiatric treatment includes interventions, such as pharmacological treatment, psychotherapy (any method, offered by a therapist with at least basic psychotherapy training), counseling (supportive talk therapy, without specific training), physiotherapy, electroconvulsive therapy (ECT), and daycare treatment. All interventions were analyzed as ongoing yes/no or planned yes/no. Community psychiatry refers to support offered by social services, typically including supportive interventions in the home environment. Assessments of suicide risk refer to whether suicide risk was assessed within four weeks before death (yes/no) and whether suicide risk was assessed as elevated at the last visit to a psychiatrist (yes/no).

Statistical Analysis

Frequency distributions with the chi-square test were calculated. Associations between suicide with previous suicide attempts (PSA) *vs.* without (NSA) and independent variables were estimated by crude and adjusted OR with 95% CI using logistic regressions.

The results are presented as crude and adjusted odds ratios (ORs) and 95% confidence intervals (95% CIs). As a first step, ORs with 95% CIs were estimated for each independent variable. As a second step, ORs were adjusted for gender and age. In the final regression models, all included variables were adjusted for gender, age, all psychiatric diagnoses, and any psychiatric comorbidity, in turn, thereby adjusting also for the effect of psychiatric diagnosis on the clinical variables. Results were considered statistically significant when $p < .05$. Statistical assumptions of the regression model: All variables were tested for possible collinearity. All analyses were performed by SPSS version 25 (20).

Ethical Considerations

According to the Swedish Act Concerning the Ethical Review of Research Involving Humans (2003:460) and an advisory opinion from the Regional Ethical Review Board (no. 2017/234), this study was exempt from ethical review as it did not include living human participants.

RESULTS

Sample Description

All 484 individuals were included who were in contact with psychiatric health care services during their last two years of life, representing 51% of all suicides in the 20-county

TABLE 1. Characteristics of individuals in contact with psychiatric services who died by suicide ($n = 484$), crude and adjusted odds ratio (OR) with 95% confidence interval (95% CI) for the association between gender, age, type of diagnosis, and having at least one known previous attempt/s (PSA) *vs.* without previous attempt/s (NSA).

	Total cohort % (column) (*n*)	PSA $n = 246$ % (column) (*n*)	NSA $n = 238$ % (column) (*n*)	Crude OR (95% CI)	Adjusted* OR (95% CI)
Gender					
Men	**65 (316)**	**57 (139)**	**74 (177)**	1	1
Women	**35 (168)**	**43 (107)**	**26 (61)**	**2.23 (1.52–3.28)**	**2.38 (1.59–3.55)**
Age** (years)					
≤19	**4 (20)**	**2 (5)**	**6 (15)**	**0.27 (0.08–0.86)**	**0.24 (0.07–0.79)**
20–29	**15 (73)**	**18 (45)**	**12 (28)**	1.30 (0.62–2.73)	1.52 (0.71–3.28)
30–39	**15 (75)**	**19 (46)**	**12 (29)**	1.28 (0.61–2.68)	1.40 (0.66–2.99)
40–49	**18 (88)**	**17 (42)**	**19 (46)**	0.74 (0.36–1.50)	0.89 (0.43–1.85)
50–59	**53 (110)**	**22 (53)**	**24 (57)**	0.75 (0.38–1.49)	0.87 (0.43–1.76)
60–69	**15 (71)**	**12 (29)**	**18 (42)**	0.56 (0.27–1.17)	0.62 (0.29–1.33)
≥70	**10 (47)**	**11 (26)**	**9 (21)**	1	1
Psychiatric diagnosis***					
No diagnosis	**17 (80)**	**11 (28)**	**22 (52)**	1	
Any psychiatric diagnosis	**83 (404)**	**89 (218)**	**78 (186)**	**2.18 (1.32–3.59)**	**1.96 (1.17–3.30)**
Any psychiatric comorbidity	**82 (395)**	**87 (214)**	**76 (181)**	**2.11 (1.31–3.39)**	**1.94 (1.18–3.20)**
Mood disorder	**39 (188)**	**44 (109)**	**33 (79)**	**1.60 (1.11–2.32)**	**1.64 (1.11–2.41)**
Bipolar affective disorder	**10 (49)**	**15 (36)**	**5 (13)**	**2.97 (1.53–5.75)**	**2.99 (1.50–5.96)**
Personality Disorder	**8 (39)**	**13 (33)**	**3 (6)**	**5.99 (2.46–14.58)**	**5.14 (2.06–12.82)**
Schizophrenia	**3 (16)**	**2 (4)**	**5 (12)**	**0.31 (0.10–0.98)**	0.38 (0.12–1.21)

Bold marks statistically significant results.
*Gender only adjusted for age, age only adjusted for gender. Psychiatric diagnoses adjusted for both age and gender.
**At the time of death.
***Last noted before suicide. Only diagnoses with statistically significant differences (in the crude model) between individuals with PA and NA are presented.

TABLE 2. Individuals in contact with psychiatric services who died by suicide ($n = 484$), crude and adjusted odds ratio (OR) with 95% confidence interval (95% CI) for the association between length and proximity of psychiatric contact, absence from appointment, and having at least one known previous attempt/s (PSA) *vs.* without previous attempt/s (NSA).

	PSA $n = 246$ % (n)	NSA $n = 238$ % (n)	Crude OR (95% CI)	Adjusted for age and gender OR (95% CI)	Adjusted for gender, age, and comorbidity OR (95% CI)
Length of contact* (days)					
0–89	**37 (33)**	**63 (57)**	**0.41 (0.24–0.72)**	**0.43 (0.24–0.77)**	**0.47 (0.26–0.84)**
90–365	**64 (55)**	**36 (31)**	1.26 (0.72–2.21)	1.51 (0.83–2.75)	1.58 (0.86–2.90)
366–729	**48 (37)**	**52 (40)**	0.66 (0.37–1.16)	0.73 (0.40–1.33)	0.80 (0.43–1.47)
≥730	**59 (76)**	**42 (54)**	1	1	1
Proximity of contact** (days)					
0–7	**56 (101)**	**44 (78)**	1	1	1
8–28	**52 (62)**	**48 (57)**	0.84 (0.53–1.34)	0.85 (0.52–1.38)	0.89 (0.55–1.45)
29–90	**52 (45)**	**48 (42)**	0.83 (0.50–1.38)	0.88 (0.52–1.51)	0.92 (0.54–1.57)
90–365	**46 (28)**	**54 (33)**	0.66 (0.37–1.18)	0.68 (0.37–1.25)	0.79 (0.42–1.49)
≥366	**26 (10)**	**72 (28)**	**0.28 (0.13–0.60)**	**0.27 (0.12–0.61)**	**0.33 (0.14–0.77)**
Absent from appointment***	**64 (70)**	**36 (39)**	**2.00 (1.29–3.12)**	**1.98 (1.24–3.17)**	**1.97 (1.25–3.13)**

Bold marks statistically significant results.
*Number of days from first registered contact with psychiatry.
**Number of days from last psychiatric contact to suicide.
***During the last 3 months.

catchment area. As can be seen in Table 1, among those, 65% ($n = 316$) were men and 35% ($n = 168$) were women and age ranged from 13 to 94 years, mean 47 years (*SD* 17), median 48 years (*SD* 17).

Gender, Age, Psychiatric Diagnosis, and Comorbidity

Almost two-thirds of the women who were in contact with psychiatric services and who died by suicide had at least one previous suicide attempt (PSA) compared to 44% of the men. Bivariable associations revealed that women, those with psychiatric diagnoses (any), those with psychiatric comorbidity (any), those with a mood disorder, bipolar affective disorder, personality disorder had higher ORs of having at least one suicide attempt (PSA) compared to those with NSA.

Age differences between PSA and NSA were found, as presented in Table 1. Three-quarters of those who died by suicide before the age of 20 died at their first known attempt. Those who died at their first attempt in this age group were equally distributed between genders.

Being diagnosed with any psychiatric disorder was more common in individuals with PSA than in those with NSA. Of the 22% of individuals with NSA that did not have a psychiatric diagnosis, 24% had been in contact with psychiatry for two years (or more), 24% between one-two years, 21% between three months and a year, and 32% for three months or less. Comorbidity was high in both groups but significantly higher in individuals with PSA than in those without. A comparison between psychiatric diagnoses in individuals with PSA and NSA is presented in Table 1. Only diagnoses with statistically significant differences (in the crude model) between individuals with PSA and NSA are presented in Table 1. Except for schizophrenia, all diagnoses were more common in

TABLE 3. Crude and adjusted odds ratio (OR) with 95% confidence interval (95% CI) for associations between the ongoing and planned psychiatric interventions, suicide risk assessment, and having at least one known previous attempt/s (PSA) *vs.* without previous attempt/s (NSA).

	Crude OR (95% CI)	Adjusted for age and gender OR (95% CI)	Adjusted for gender, age, and comorbidity OR (95% CI)
Ongoing interventions			
Psycho-pharmacological	**2.45 (1.50–4.02)**	**2.20 (1.30–3.72)**	**1.96 (1.15–3.36)**
Psychotherapy/ counseling	**1.55 (1.06–2.25)**	1.31 (0.88–1.96)	1.20 (0.80–1.80)
Planned interventions*			
Agreement on treatment	1.64 (1.11–2.42)	1.63 (1.08–2.45)	1.48 (0.97–2.25)
Contact with community psychiatry for joint planning	**1.94 (1.14–3.31)**	**1.95 (1.12–3.42)**	**1.89 (1.07–3.32)**
Suicide risk assessment			
Suicide risk elevated at last visit to psychiatrist	**2.33 (1.37–3.96)**	**2.23 (1.28–3.88)**	**2.17 (1.24–3.79)**
Suicide risk assessed within 4 weeks before death	**1.58 (1.10–2.26)**	**1.49 (1.03–2.17)**	1.33 (0.90–1.96)

Bold marks statistically significant results.
*Planned at the last visit to psychiatrist.

PSA compared to NSA. Among the individuals diagnosed with schizophrenia ($n = 16$), half had been assessed regarding suicide risk within four weeks before death, suicide risk was rated as elevated in none. Diagnoses without significant differences include substance use disorders, anxiety, and stress disorders, eating disorders, and attention deficit disorders.

The Length and Proximity of Contact

As shown in Table 2, the duration of contact with psychiatric services was longer in individuals with PSA compared to those with NSA. Of all the individuals in contact with psychiatry within a week of the suicide, individuals with PSA represented more than half. Of all individuals with PSA, 41% had been in contact with psychiatric services within a week and the corresponding proportion in NSA was 33%. As opposed to individuals with PSA, individuals with NSA were more likely to have been in contact with psychiatric health care services within a year. Results were slightly attenuated when adjusted for gender, age, and comorbidity, but associations remained significant. As seen in Table 2 the OR of being absent from appointments during the final three months of life was twice as high in individuals with PSA than in those with NSA, a result that remained significant after controlling for age, gender, and comorbidity. Of all individuals with PSA, 28% were absent from at least one appointment during the last three months.

Suicide Risk Assessment

Table 3 as well as Figure 1 show an association between elevated suicide risk assessed at the last visit to a psychiatrist and having PSA in crude and adjusted models. After adjusting for gender, age and comorbidity, no difference was found between individuals

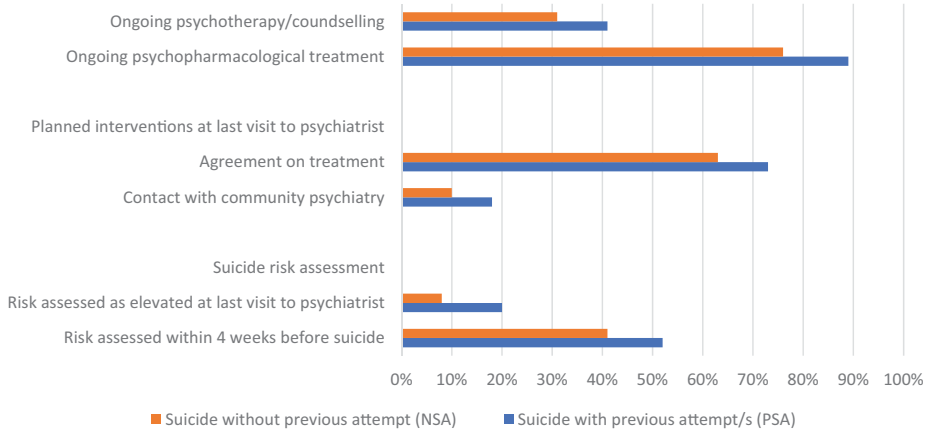

FIGURE 1. Proportions (%) with ongoing and planned psychiatric interventions and suicide risk assessment among patients who died by suicide, by suicide attempt history ($n = 238$).

with and without PSA regarding whether or not suicide risk had been assessed within the four weeks before suicide.

Ongoing and Planned Treatment Interventions

As presented in Figure 1 and Table 3, ongoing pharmacological treatment, psychological treatments as well as planned contact with social services were more common in those with PSA. These results remained significant for pharmacological treatment after adjustment for gender, age, comorbidity, and psychological treatment. The association of psychopharmacological and psychological treatment with having PSA was also controlled for each of the diagnoses, but the effect was negligible. Regarding all other treatment variables noted as ongoing at the time of death, no differences were found.

DISCUSSION

This study showed that the patterns of psychiatric health care utilization before suicide differed significantly between individuals with PSA and those with NSA. The results indicate that individuals with PSA had a longer duration of health care utilization. Further, they were more often assessed with elevated suicide risk. Individuals having PSA also had significant associations with psychotropic medication and planned interventions and a larger proportion of care contacts close to suicide, compared to patients with NSA.

The result that half of the study population had previous suicide attempts was in line with Bostwick et al. (2016) reporting that 60% of individuals who die by suicide die at their first attempt. The finding that individuals with PSA compared to those with NSA more often had ongoing psychotropic medication and planned interventions indicate an independent association between having a history of suicide attempt/s and treatment and planning of interventions. The planned support offered by social services points at

the clinicians having detected a wider range of needs than what could be met in the health care system.

Over 40% of the individuals with PSA, had been in contact with psychiatric services within one week before death. This can be compared to the 33% of individuals with NSA. Schaeffer et al. reported an overall percentage of contact with psychiatric services within a week before the suicide of 22% (Schaffer et al., 2016), but no comparison depending on previous suicide attempts was made. Further, being absent from appointments during the last three months before suicide was more common among individuals with PSA, 28% of individuals with PSA, and 16% of those with NSA. It is not known what strategies, if any, were used to reach the patient when they missed an appointment and what role this aspect might play in the trajectory of prevention efforts.

Individuals with PSA were more likely to be assessed with elevated suicide risk than those with NSA. Since previous suicide attempts are a well-known risk factor, this may point to suicide risk being more easily detected since the presence of earlier attempts can be weighed into the assessment. Yook et al. (2021) found that, as opposed to those with NSA, individuals with PSA are more likely to have talked about suicide and death, a factor that might help to explain the differences found in this study. For some of the individuals, the last contact with psychiatric services before death may have been in connection with a suicide attempt, though this was not analyzed specifically in this study.

Although the suicide risk was assessed in many cases and some were in contact with psychiatric services just days before death, suicide was not prevented in the individuals in this study. A suicide risk assessment is, by nature, a very challenging task for clinicians, just as the prediction of any human behavior. Risk factors on the group level do not necessarily apply to a specific individual, as the suicide risk level is a complex combination of contributing factors and varies over time. A problematic finding is that although the study analyzes psychiatric health care services, suicide risk was not always assessed—or at least was not always recorded in the medical chart. This indicates a possible area of improvement in psychiatric services in Sweden.

The majority of the women who died by suicide had at least one previous attempt while the majority of the men died at their first attempt, confirming the results of previous research (Isometsä & Lönnqvist, 1998; Kodaka et al., 2017; Yook et al., 2021). The first attempt was fatal in three-quarters of those in the youngest age band, a proportion similar to that reported by Gagnon et al. who investigated suicides in teens and young adults (Gagnon, Davidson, Cheifetz, Martineau, & Beauchamp, 2009). Cho et al. (2013), investigating age differences in health care utilization before suicide, stated that community-based prevention strategies may be necessary to prevent suicide in adolescents with psychiatric disorders as they may not seek the help they need in the health care system. However, the high proportion of the youngest individuals in this study who died in connection with their first suicide attempt can reflect the fact that the older a person gets, the more likely it is that previous suicide attempts have occurred.

Being diagnosed with a psychiatric disorder (any) and psychiatric comorbidity (any) was more common in individuals with PSA than in those with NSA. The finding regarding psychiatric disorders confirms the results of a recent Korean study (Yook et al., 2021). Further, each individual psychiatric diagnosis was more common among

individuals with PSA than those with NSA—except for schizophrenia. This finding raises important questions as to whether individuals with NSA are an underdiagnosed group, which in turn could have an impact on receiving the correct treatment as well as the overall prognoses. The difference may reflect that individuals with PSA as a group were in longer contact with psychiatric health care services, allowing a more thorough psychiatric assessment over time. It could also be explained by an effort to assess diagnosis after a suicide attempt. Personality disorder and bipolar disorder were markedly associated with individuals with PSA, paralleling the results of previous research (Benjamin et al., 2003; Christiansen & Jensen, 2007; Irigoyen et al., 2019; Isabel et al., 2017).

Three-quarters of the study population with a diagnosis of schizophrenia died on their first known suicide attempt. While suicide risk had been evaluated during the final month of life in half of the cases, none of the individuals with schizophrenia were assessed with elevated risk. Large and Ryan argue that since suicide mortality is 20–75 times higher in individuals with schizophrenia compared to the general population, all individuals with schizophrenia should be considered at risk of death by suicide and be targets of treatment efforts suited to the individual (Large & Ryan, 2014).

It is important to note that the current study focuses on individuals who had been in contact with psychiatric services. The portion of for example individuals with psychiatric disorders and psychiatric treatment must be interpreted in light of this. The results can therefore not be generalized to all individuals who die by suicide.

Strengths and Limitations

The present study has several strengths. It provides detailed data on the type of contacts, treatment, interventions as well as the duration of the provided psychiatric health care, something that is rare in the previous literature in the field. Further, the study population is large enough to allow for multivariate analyses and includes almost an entire nation.

The study relies exclusively on the information noted in medical records. It is possible that there were cases of previous suicide attempts that were not included in the chart, and these individuals would in such cases be incorrectly classified as having no previous suicide attempt/s (NSA). This would mean an underestimation of the number of PSA and an overestimation of NSA. Further, this study did not include information from any of the national registers. Doing so would have yielded more information that would have added to the analysis in several of the investigated areas.

As all subjects in this study died by suicide, no analyses of health care utilization effect on suicide as the outcome could be performed. The current study did not include a control group of individuals in contact with psychiatric services who are still alive, with or without previous suicide attempts, to allow for such an analysis.

Data from medical records were collected by numerous investigators and there was no testing of inter-rater reliability (IRR). Some of the questions in the protocol involve a level of assessment by the investigator, among them the categorization of PSA/NSA. The lack of inter-rater reliability testing could reduce the validity of the data. One aspect hindering IRR testing was that the investigators came from different parts of the

country. Due to the confidentiality law, medical records could only be assessed within one region. Efforts to make sure investigators uniformly collected data included group training, investigator guidelines, and a high level of support from the research group. Another issue is that there were regional differences in the organization of psychiatric services which made the protocol more challenging to use in some regions. Information could have been omitted as a result.

This study may not have gained access to data from psychiatric medical records of all private health care facilities. In Sweden, private healthcare represents about 19% of all psychiatric health care services nationwide, though with large regional differences (Vårdföretagarna, 2020). In the medical chart systems investigated in this study, private health care is not always automatically recorded and for this reason, data on some psychiatric health care may have been omitted. In cases where information on private care was available in regional registers or medical records, efforts were made to obtain the medical records from the private clinic. The amount of missing data due to the lack of private care records is not known. Further, any psychiatric disorder diagnosed in primary care settings would be omitted since this study only investigated records in psychiatric service settings.

Suicide risk, when assessed, was coded in the study protocol as a dichotomous variable (elevated yes/no). In a clinical setting, a more nuanced grading is usually employed. For this reason, levels of complexity may have been lost to the coding.

The wide confidence intervals seen in Table 1 in the crude and adjusted model regarding personality disorder suggest that there may be a power problem. The result, for this reason, should be interpreted with caution.

Conclusions

Suicide risk in the group of individuals with PSA was more often detected, they more often had a diagnosed psychiatric disorder and they were in pharmacological treatment more often than individuals with NSA. Still, suicide in these cases was not prevented, indicating a need for access to efficient treatment interventions. The larger proportion of absence from appointments in individuals with PSA may indicate a need for an improved alliance between psychiatric care providers and individuals with PSA. In individuals with NSA, suicide risk was less often detected, they were less often diagnosed with a psychiatric disorder and in pharmacological treatment compared with individuals with PSA. Improved suicide risk assessment strategies, as well as diagnostic assessment and psychiatric treatment, are important regardless of previous suicide attempts.

Implications for Future Research

The finding that individuals with PSA to a higher degree receive pharmacological treatment, even when adjusting for diagnosis, raises several questions. Could this be an expression of clinicians detecting a higher severity in these patients because of the earlier attempt/s and therefore a higher inclination to offer pharmacological treatment? Or is the difference better explained by individuals with PSA generally having been in contact with psychiatric health care services for a longer time and clinicians, therefore, had

time to assess the need for pharmacological treatment? These questions remain unanswered and need further investigation in future research.

Being absent from appointments during the last three months before suicide was more common among individuals with PSA than among those with NSA. This study did not analyze if any strategies were used to reach a patient when they missed an appointment. It would be an interesting focus of future studies to investigate this and in light of suicide prevention efforts.

In future research, the findings of this study would benefit from being tested against a control group of individuals with contact with psychiatric health care services but who did not die by suicide. Further, this study investigated the Swedish health care system, and future research might investigate if the results are similar in other contexts.

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DISCLOSURE STATEMENT

The authors declare no conflict of interest.

AUTHOR NOTES

ÅW is the principal investigator, initiated and designed the study, and acquired the data. ÅW, EF, AE, and NPÖ developed the protocol that was used to extract medical record data. SPL, EF, EB, NPÖ, and TS collected data, and SPL, EB, and NPÖ trained other investigators to collect data. SPL and MV designed the statistical strategy. SPL, MV, EF, MW, and ÅW contributed to the presentation of data in the tables. ÅW, SPL, MV, MW, EF, LA, AE, and TS contributed to designing the study and interpretation of the data. SPL drafted the manuscript and made the statistical analysis. ÅW, MW, MV, LA, AE, EF, TS, EB, and NPÖ revised the manuscript. All authors read and approved the final manuscript.

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DATA AVAILABILITY STATEMENT

Data are available upon reasonable request.

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