

From the Department of Clinical Neuroscience  
Karolinska Institutet, Stockholm, Sweden

# **SUICIDE AND VIOLENCE IN PARENTS**

## **RISK FACTORS AND CONSEQUENCES**

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# SUICIDE AND VIOLENCE IN PARENTS

## THESIS FOR DOCTORAL DEGREE (Ph.D.)

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*Till Erika, Isak och Nathan. Ni är de viktigaste i mitt liv.*



## **ABSTRACT**

Suicide and deadly violence directed towards other people are two different expressions of aggression. In family life, lethal violent behaviour may have devastating consequences, obviously for the victims but also for the surviving and bereaved children.

In this thesis, focus is on violent behaviour related to parenthood; violence in the form of suicide as well as violent behaviour directed towards others. The aim has been to identify risk factors of violent expression, for possible use in prevention.

Study I is a matched cohort study of all cases of filicide, the killing of one's child, in Sweden 1973–2008. Perpetrators of filicide were matched to population controls and further compared to other homicide perpetrators. In 42% of the cases, the perpetrator committed suicide in connection with the offence. Risk factors of filicide were major mental disorder, previous suicide attempt and previous violent offending. No independent effect of substance use disorder was found.

Study II is a nested case-control study of men who killed women with whom they had children. The study includes all cases in Sweden 1973–2009. Children who were bereaved of their mother were followed over time and the risk of adverse events were measured. The association of perpetrator status and major mental disorder was found to be substantial. Similar to Study I, no effect of substance use disorder was found. The children who were bereaved below the age of 18, more often developed mental disorder and substance use disorder and engaged in violent crime and self-harm, compared to controls.

Study III is a nested case-control study, including all mothers aged below 40 who committed suicide in Sweden 1974–2009. When calculating risk of suicide during the first year after giving birth compared to later, a minor decrease in the suicide rate was found. Suicides that occurred during the first year after delivery showed an association to current mental disorder and also to a history of self-harm.

Mental disorder was associated with violence against others (Study I & II) and with suicide (Study III). Previous self-harm was considered a risk factor for both suicidal and violent behaviour and, on the other hand, exposure to violence seems to affect the risk of later mental disorder and suicidal behaviour.

The associations found in these studies cannot be interpreted in terms of causality. This limitation primarily derives from the use of register data. However, the large samples in the presented studies have yielded reliable estimates that could lead to improved detection of individuals at risk.

## LIST OF SCIENTIFIC PAPERS

- I. Lysell H, Runeson B, Lichtenstein P, Långström N. Risk Factors for Filicide and Homicide: 36-Year National Matched Cohort Study  
*Journal of Clinical Psychiatry 2014;75: 127-132*
  
- II. Lysell H, Dahlin M, Långström N, Lichtenstein P, Runeson B. Killing the Mother of One's Child: Psychiatric Risk Factors Among Male Perpetrators and Offspring Health Consequences  
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- III. Lysell H, Dahlin M, Viktorin A, Ljungberg E, Almqvist C, D'Onofrio BM, Dickman P, Runeson B. Maternal Suicide – Register Based Study of All Suicides Occurring After Delivery in Sweden 1974–2009  
*Manuscript*

# CONTENTS

1	Background .....	1
1.1	Introduction.....	1
1.2	Suicide.....	2
1.3	Violent behaviour .....	6
1.4	Suicide and violence .....	7
1.5	Suicidal and violent behaviour in parents .....	8
1.6	Epidemiological studies.....	11
2	Aims .....	15
3	Materials and measures.....	16
3.1	Data sources.....	16
3.2	Measures .....	18
4	Method.....	20
4.1	Overall method .....	20
5	Results .....	25
6	Discussion .....	29
6.1	Methodological concerns.....	29
6.2	Ethical considerations.....	33
6.3	General discussion .....	34
6.4	Findings and clinical implication .....	38
6.5	Future studies.....	40
7	Svensk sammanfattning .....	42
7.1	Bakgrund.....	42
7.2	Metod .....	42
7.3	Resultat.....	42
7.4	Sammanfattning.....	43
8	Acknowledgments.....	44
9	References .....	45

## LIST OF ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
CDR	Cause of Death Register
CI	Confidence Interval
HIV	Human Immunodeficiency Virus
HR	Hazard Ratio
ICD	International Classification of Diseases
IPF	Intimate Partner Femicide
IR	Incidence Rate
MBR	Medical Birth Register
MGR	Multi-Generation Register
NCR	National Crime Register
NPR	National Patient Register
NSSI	Non-Suicidal Self-Injury
OR	Odds Ratio
PIN	Personal Identity Number
RR	Rate Ratio

# 1 BACKGROUND

## 1.1 INTRODUCTION

*In May 2008, a young man is killed in a small village in the western part of Sweden. The offender, Kevin, a 19-year old man, is a former friend of the victim, Magnus. Kevin and Magnus were both part of the neo-Nazi movement, and on the night of the murder they visited the same party at a mutual friend's house.*

*Later that evening, an argument between Kevin and Magnus escalates, and Magnus is severely beaten and drowned in the small pond that lies in the garden. People attending the party, all friends of the offender, help Kevin in destroying Magnus's personal belongings and the body is transported from the house in the trunk of a car. After some thoughts of where to hide the body, someone has the idea of dumping it in a pit filled with manure, convinced that this will decompose the body and leave no trace. In the press, the murder becomes known as "Gödselbrunnsmordet" ["The Shurry Pit Murder"] because of the manner in which the body was dumped. After the trial, Kevin is sentenced to seven years in prison for homicide.*

*The episode at the party is not the only time Kevin has been in contact with violence. He is known among his friends for his ability to "shut off" when in a fight and is used to receive physical violence. Some years before the devastating incident, Kevin's stepfather is sentenced to ten years in prison. The stepfather was convicted of aggravated rape, sexual abuse and possession of child pornography. During the inquiry it became known that both Kevin and his one-year-older biological brother had been raped on a weekly basis. Kevin thinks it all started when they moved back to the mother and her new husband, when Kevin was six years old. It also became apparent that Kevin had been beaten on several occasions by his mother, many times with bruises that he had to hide or try to make excuse for at school.*

*Four years after the trial when the stepfather was convicted, Kevin is on trial, accused of murder. Kevin's older brother who, as far as it is known, had been exposed to the same level of violence, was at the time suffering from depression, suicidal thoughts and has a history of self-harm.<sup>1,2</sup>*

*"Kevin" and "Magnus" are fictive names.*

The case of Kevin and his older brother illustrates severe forms of intrafamilial violence and possible consequences of this. They both suffered repeatedly from physical beatings and sexual abuse. However, their own expressions of violence differed, one acting out aggression on another person, while the other directed the aggression towards himself. It is impossible to conclude that the violence that they both experienced in their childhood *lead to* their own violent behaviour. In order to make such a conclusion, one would have to know what the effect had been if they were not exposed, and since we cannot rewind history, we can only

make assumptions. However, research has suggested a connection between exposure to violence, expressed violence towards others and suicidal behaviour.

The main idea in this project is to investigate suicidal behaviour, violent behaviour directed towards others and the connection in-between. For the purpose of clarity, violent behaviour towards others will henceforward be referred to as *violent behaviour*, even though suicidal behaviour also is considered to be an act of violence.<sup>3</sup> Register data is used in the included studies, yielding large samples and reliable statistics. Frequencies of adverse events are calculated along with measures of association between suicidal behaviour and violent behaviour.

Suicide or lethal violence within the family are among the worst things that could happen to someone, and impossible to fully comprehend if not self-experienced. These events will afflict and alter the life of people related to the victim or the bereaved family. The consequences may be particularly severe and the process of grief perhaps more complicated when young children are involved. In this thesis, three different settings are used to examine suicide and lethal violence. All of these settings represent devastating incidents with children affected, either directly as victims of deadly violence, or indirectly, as bereaved of their mother in suicide or lethal violence. When using such material, it is impossible not to become deeply moved, even though the research is carried out with register data and without ever directly facing the individuals involved.

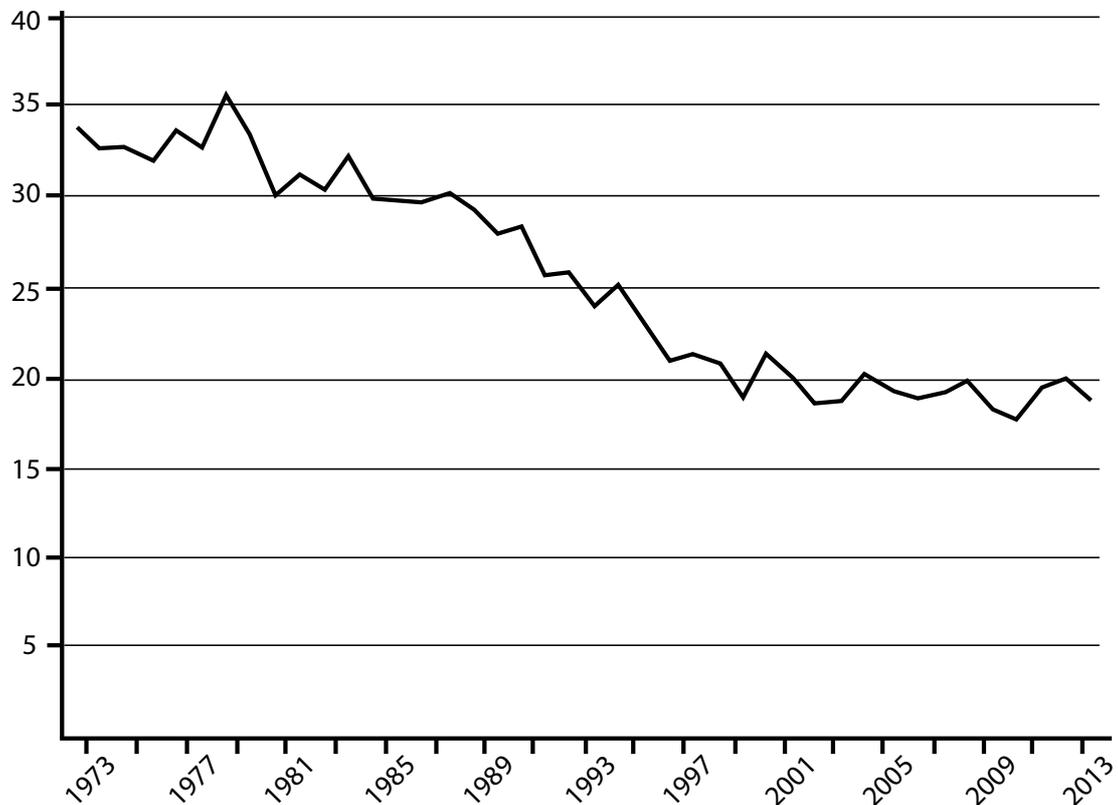
## **1.2 SUICIDE**

Suicide, either completed or attempted, refers to intentional acts of self-injury with at least some intention to die.<sup>4</sup> Suicide attempt is sometimes separated from non-suicidal self-injuries (NSSI), self-injury without any intention of death.<sup>5</sup> The broader concept of suicidal behaviour is heterogeneous in its nature, including both thoughts and expressions.<sup>6</sup>

To determine who is at risk of suicide is a hard, yet important task for psychiatry, social services and other community functions. Identified factors that constitute increased risk distinguish people at risk at a group level. The specific individual, whom you encounter in a clinical situation may have several known risk factors and still not be at actual risk of suicide, as well as the other way around. However, when trying to estimate risk in individuals we have to rely on risk factors identified in larger groups, since individual risk may be impossible to predict.

### 1.2.1 Prevalence of suicide

Suicide is the second leading cause of death globally among people 15-29 years old, making it a major health problem worldwide. The World Health Organisation estimates almost a million deaths each year from suicide. This corresponds to 1.4% of all deaths and making suicide the 15th leading cause of death over-all.<sup>7</sup>



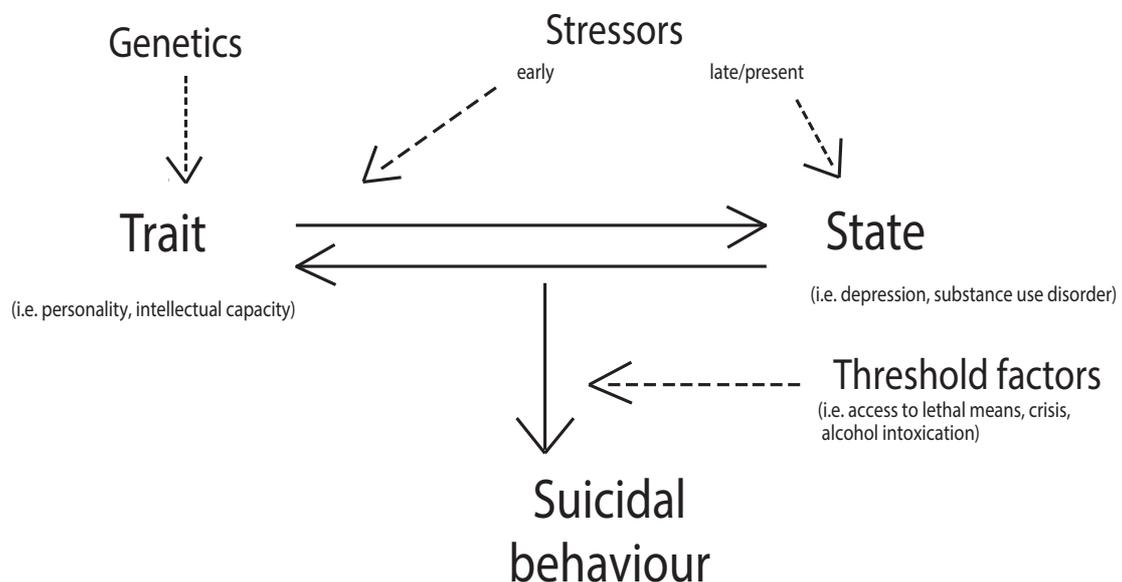
**Figure 1.** Incidence of suicide in Sweden 1973–2014. Number of suicides per 100 000 persons and year, all certain and uncertain verdicts are included. Data taken from the National Board of Health and Welfare and Statistics Sweden.

In Sweden, suicide rates are among the higher in the western world. However, a decline in suicide frequencies has been seen during the last decades (figure below), the reduction is seen in all age groups except in the youngest group.<sup>8,9</sup> In 2014, there were in total 1,531 suicides, corresponding to an incidence of 19.0 per 100,000 inhabitants aged >15 years. In Sweden, as well as in the world, men are overrepresented in suicide events with an incidence of 26.1/100,000 compared to women 11.9/100,00.<sup>10</sup>

### 1.2.2 Understanding suicidal behaviour

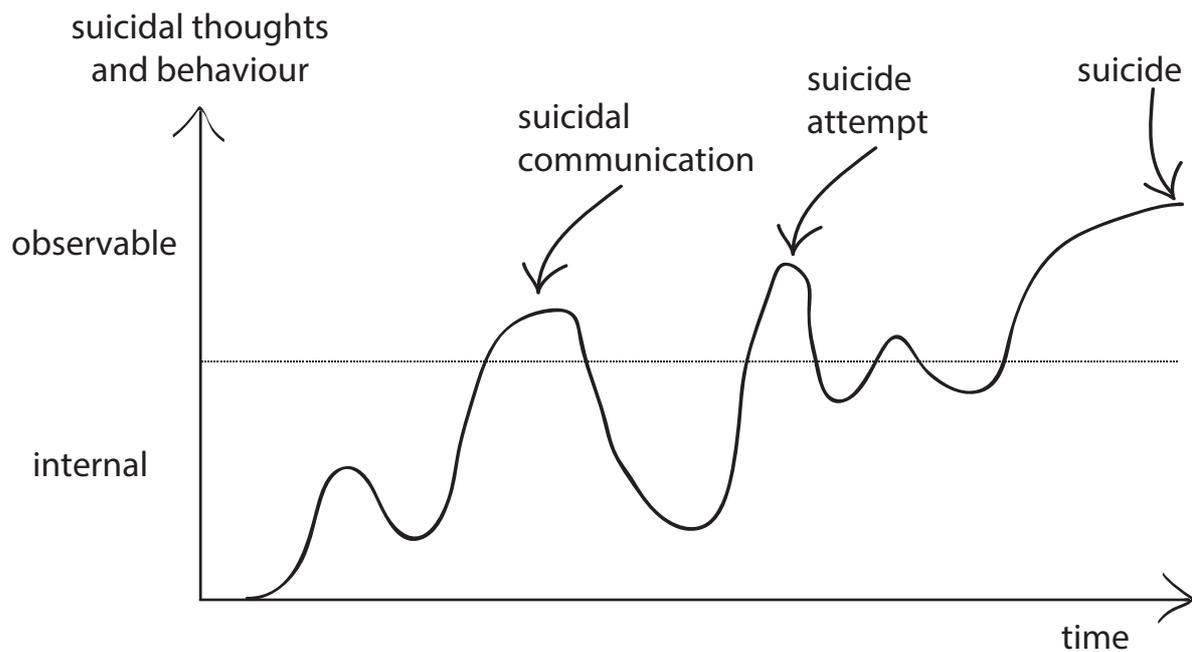
Searching for the causality behind suicide, even if applying a multifactorial model and taking numerous factors into account, is probably the most challenging task. However, there are factors strongly associated with suicide and suicidal behaviour. In a broad perspective,

suicide might be understood as the end-result of a combination of factors or exposures. One way of expressing this is the theory of trait and state. Personality traits is considered to be a pattern of emotions and thoughts as well as behaviour, patterns that are believed to be stable within the individual and related to genetic influence.<sup>11</sup> In contrast, state is the changeable disposition of the person<sup>12</sup> and could be affected by different exposures. The hypothesis that suicide is affected by both trait and state is recognised by different researchers, however, sometimes different terms are used to explain the theory. For example, Mann<sup>13</sup> and Hawton<sup>14</sup> use *distal factors* synonymous with trait and *proximal factors* synonymous with state. They use this terminology to distinguish between what is possible to modulate/treat and what is a part of the person's inherited vulnerability. Following this perspective, mental disorder is a proximal risk factor, while genetic factors and early trauma constitute distal risk factors. The main reasons for dividing risk factors in this manner are to make clinical risk assessments and work towards prevention. Both trait/distal factors and state/proximal factors may contribute to an increased risk of suicidal behaviour, whereas only the latter will be accessible for direct preventive efforts. However, since different factors (both trait/distal and state/proximal) that are associated with increased risk of suicide exist in the community without suicidal behaviour as a consequence, one could argue that suicidal behaviour needs some kind of triggering or *threshold factor*.<sup>15</sup>



**Figure 2.** Model of state-trait interaction in the suicidal process, van Heeringen 2003.<sup>15</sup>

Suicide may be preceded by a suicidal process, possibly observed by the people most close to the person and often, at least at some level, recognised by the person himself. This process may be long and include different expression of suicidality, or could be shorter and the subsequent suicide appearing unexpectedly and suddenly.<sup>16</sup> A suicidal process is believed to include, to some extent, thoughts of death and a desire to die, and sometimes a communication of these thoughts and behaviour in the form of suicide attempts. One of the most recognised models of the suicidal process is shown below.<sup>17</sup>



**Figure 3.** The suicidal process according to Beskow.<sup>17</sup>

### 1.2.3 Risk factors of suicide

#### 1.2.3.1 Previous suicide attempt

Previous suicide attempt is a strong risk factor for future completed suicide<sup>14,18</sup> and risk for both repetition and completed suicide exists during the years following a suicide attempt.<sup>19-21</sup> Even in the longer perspective, the risk of suicide is elevated given a previous attempt.<sup>22,23</sup> Non-fatal repetition rate was around 15% already the first year after an attempt, and the long-term rate of suicide was above 5% in a large review.<sup>24</sup>

#### 1.2.3.2 Mental disorder

Among individuals who die by suicide, the presence of mental disorder is estimated to be over 90%.<sup>25</sup> These figures are based on psychological autopsy studies, a method that includes

interviews with next of kin, and where the diagnosis is estimated, based on symptoms reported.<sup>18</sup> Psychological autopsy studies have the advantage of possible inclusion of the whole population within a defined area. Obviously, studies based on clinical samples do not include persons who have not been in contact with the mental healthcare system. Mental disorder is still considered one of the strongest risk factors of later suicide.<sup>26</sup> In a review article, 19% had been in contact with the mental health care in the month preceding the suicide and lifetime contact was found in 53% of the suicide cases.<sup>27</sup> In Swedish data, 25% of people committing suicide had been hospitalised with a mental disorder in the year preceding the suicide.<sup>28</sup> Previous contact with mental health service, and the proximity to this contact, has been found to be a marker of increased risk. Discharge from inpatient care during the last week, regardless of diagnosis, was more than 100 times more likely among those who committed suicide. The association of suicide and previous inpatient care remained for more than five years, and was most pronounced for affective disorders.<sup>29</sup> There is further evidence that the first admission in particular is associated with an increased risk of suicide.<sup>30</sup>

Substance use disorder is associated with increased risk of suicidal behaviour,<sup>31,32</sup> and seems to have a direct effect on the risk of suicide that is not mediated through mental disorder.<sup>33</sup> Among patients with substance use disorder, there seems to be an additive effect of previous self-harm and personality traits.<sup>34</sup> Evidence points at a different effect among women; Wilcox and colleagues reported more than three times the risk of suicide in women with alcohol use disorder, compared to men.<sup>35</sup>

### *1.2.3.3 Violent behaviour*

Previous violent behaviour has been suggested as a risk factor of suicidal behaviour.<sup>36,37</sup> Further, there seems to exist an association between exposure to violence in childhood and later suicidal behaviour,<sup>38,39</sup> the latter possible mediated by the expression of violence.<sup>40</sup> The increased risk of suicidal behaviour may partly be explained by increased impulsivity among violent offenders,<sup>41</sup> especially among those with an impulsive-reactive form of violent expression.<sup>42</sup>

## **1.3 VIOLENT BEHAVIOUR**

### **1.3.1 Prevalence of deadly interpersonal violent behaviour**

The frequencies of violence resulting in death (e.g. homicide or manslaughter) vary throughout the globe, with some of the largest numbers in Central America.<sup>43</sup>

In Sweden, we have seen a decrease in deadly violence over time. However, for the last 10 years the rate is unaltered. The frequency for 2014 was 87 homicides, manslaughters or assaults with deadly consequence,<sup>44</sup> corresponding to a rate of 1.0/100,000. Most cases

involve some kind of relationship between perpetrator and victim. Relationship or friendship is estimated to be present between perpetrator and victim in 75% of the cases, and 36% is considered as intrafamilial.<sup>45</sup>

### **1.3.2 Mental disorder as a risk factor of violence**

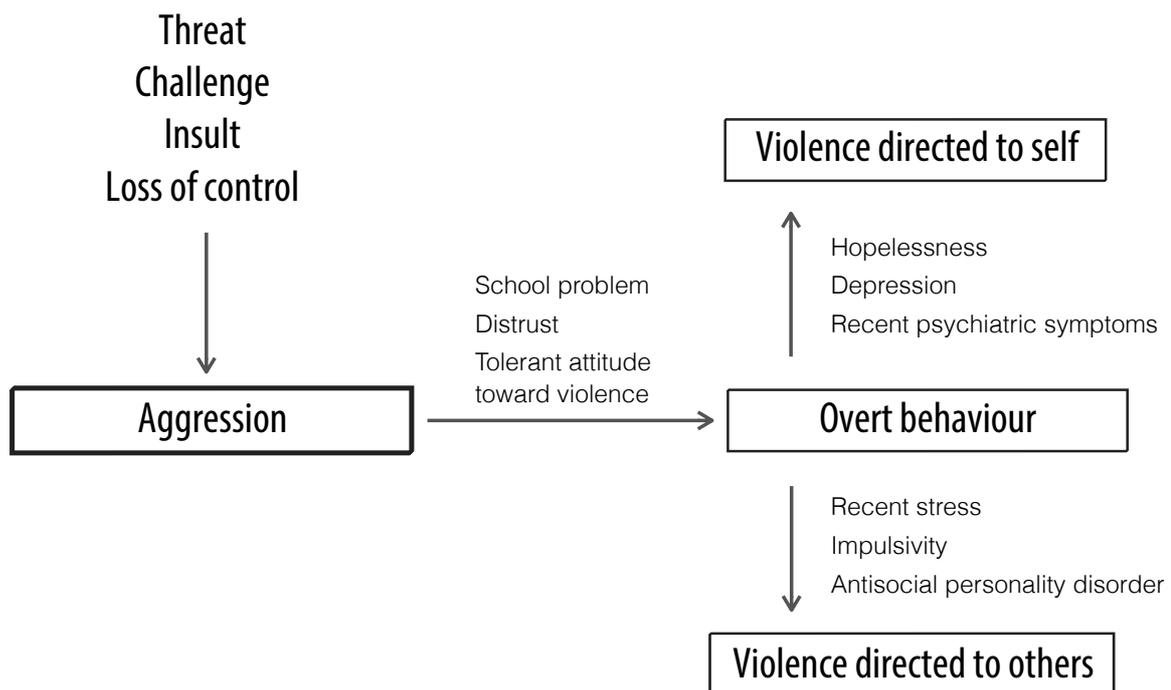
Risk factors of violent behaviour can be divided into factors related to genetic predisposition (trait) or to environmental influence (state). However, violent behaviour seldom has a clear and exclusive origin in either genetics or environment, and often, as in the understanding of suicidal behaviour, we imagine an interaction between different risk factors.

Among offenders of violent behaviour, there is an overrepresentation of mental disorders. Among homicide offenders in Sweden, over 90% had a mental disorder, according to forensic psychiatric evaluation or register data.<sup>46</sup> Psychotic disorders,<sup>47,48</sup> bipolar disorder,<sup>49,50</sup> and especially personality disorders<sup>48,51</sup> have been reported as risk factors of violent behaviour. However, this association has been debated, and other studies have shown that the previous results of a clear association have been confounded by different factors, most notably substance use disorder.<sup>52-54</sup>

## **1.4 SUICIDE AND VIOLENCE**

The two different forms of overt violent behaviour, interpersonal violence and suicidal behaviour might be related, however, only few studies have dealt with the interaction between these two different forms of violence.<sup>55</sup> Results from previous studies on suicide and violent behaviour favour the notion that either violent behaviour or suicidal behaviour may affect the risk of the other form, respectively.<sup>42,56,57</sup>

One of the first notions on suicide as an aggressive act, and that violent behaviour and suicide may share a common origin, was made by Freud in 1917. He described suicide as aggression turned upon the self: “We have long known, it is true, that no neurotic harbour thoughts of suicide which he has not turned back upon himself from murderous impulses against others [...]”.<sup>58</sup> Aggressive impulses are still considered the origin of different overt violent expressions.<sup>3,59,60</sup> If suicidal and violent behaviour are both derived from aggression, the temporal order between these two expressions may be hard to disentangle, given a substantial amount of recall bias or lack of detailed information in registers.



**Figure 4.** Proposed model of a pathway from aggression towards overt violent behaviour, either directed inward or outward.<sup>3</sup>

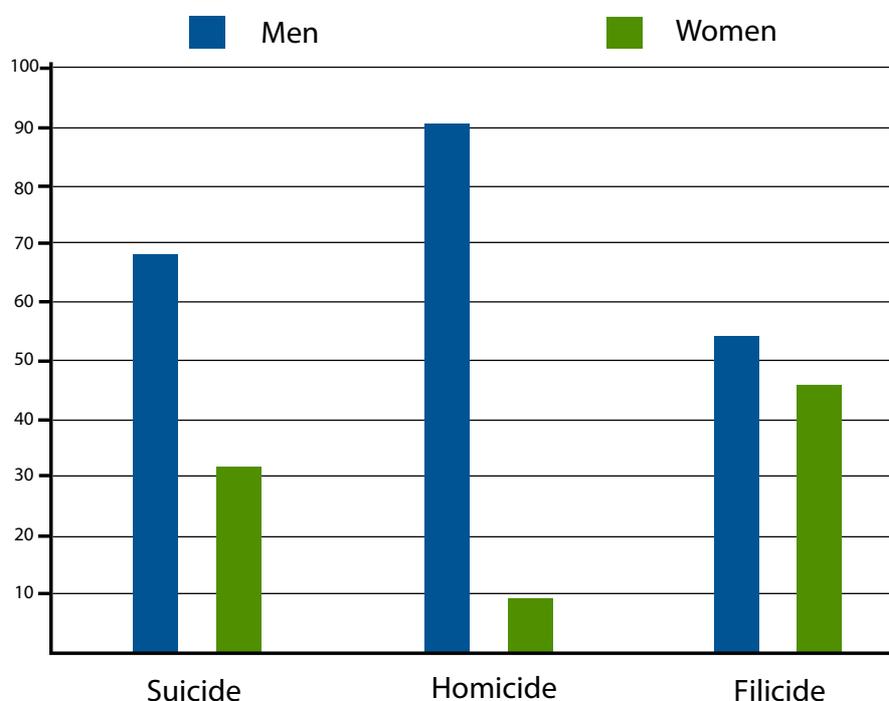
Most often, the different forms of violent expression are separated in time. To kill another person when committing suicide (e.g. homicide-suicide), is a rare example of the exception.<sup>61</sup> In these cases, aggression is inflicted upon the self as well as upon another person. This makes it particularly suitable to study, in order to gain more knowledge of the interrelationship of different violent expressions. When a person is assessed to be suicidal – is there a risk of a simultaneous homicide? In cases of homicide-suicide, the victim is often a member of the family. Homicide-suicide within the family makes up a substantial amount of all child homicide.<sup>62</sup> Another large group of victims in homicide-suicide is the female spouse.<sup>63</sup> In Sweden, approximately four women are killed every year in this dramatic manner.<sup>64</sup>

## 1.5 SUICIDAL AND VIOLENT BEHAVIOUR IN PARENTS

### 1.5.1 Filicide

Filicide is the killing of a child by the parent. This devastating form of interpersonal violence is fortunately quite unusual. However, when children are killed in Sweden, most commonly, the perpetrator is one or both of the parents.<sup>62</sup> Filicide differ from other instances of deadly

violence in respect of motives and the high frequency of subsequent suicide of the parent/perpetrator.<sup>57</sup> Filicide is also separated from other homicide with regard to the gender distribution among perpetrators. The proportion of women as perpetrators is greater than in other homicide and also greater than the proportion of women committing suicide.

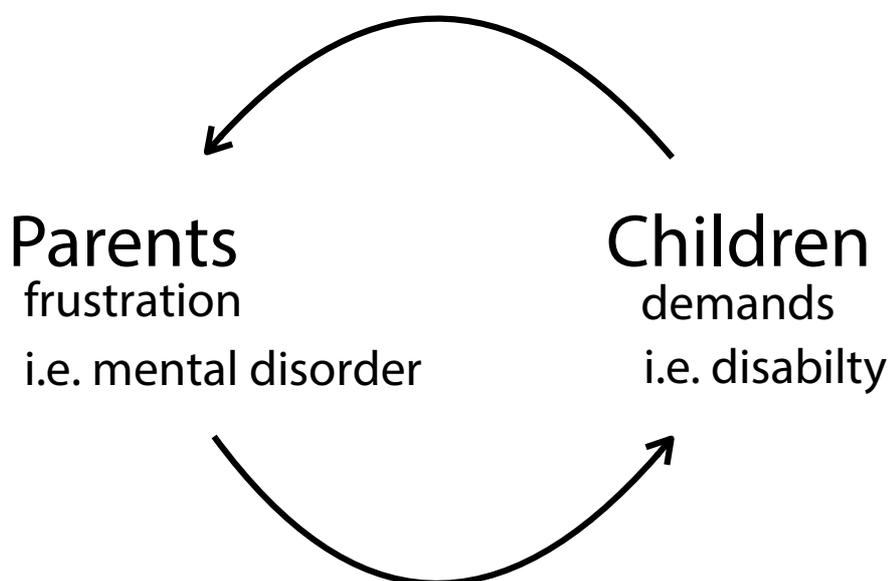


**Figure 5.** Proportion of men and women in suicide and violent behaviour, in Sweden.

It has been proposed that filicide often includes altruistic motives,<sup>65</sup> the parent holds a belief that death will save the child from danger or misery, either a factual danger or as part of a psychotic disorder. Delusions are recognised as a risk factor of filicide.<sup>66-68</sup> Suicide in direct connection to the filicide is common,<sup>57</sup> and investigation of the immediate circumstance in these cases is complicated by the lack of a surviving perpetrator. This limitation does not apply to studies based on register data, but details regarding the cases are sparse. In these cases, suicide might be regarded as the initial reason of violence, where the parent has a desire to commit suicide and includes the child in the act. To further enlighten this is problematic, since mental disorders in general, and depression in particular, are associated with both filicide and suicide.

Increased risk of filicide could include both *trait* and *state* factors connected to the perpetrator. Further, one could hypothesise that there might be *state* factors related to the child. For example, strain from parenting a child with impairment or severe disease, as a result of perinatal complications or conditions during pregnancy, may increase filicide risk.<sup>69</sup>

This stress may also be a *threshold factor* making a parent, already vulnerable from previous and/or current mental disorder, more at risk of using deadly violence towards his/her children.



**Figure 6.** Proposed model of an interaction between parental distress and children with increased needs.

### 1.5.2 Intimate partner femicide

In most cases of deadly violence, the victim and perpetrator have some kind of relationship. When women are killed, in 39-48% of the cases the perpetrator is a current or former male partner.<sup>64,70</sup> Interpersonal violence within the family, in the form of killing a present or former partner, is associated with mental disorder, including substance use disorder.<sup>71-74</sup> Similar to filicide, a substantial proportion of the perpetrators commit suicide in immediate connection to crimes of deadly intrafamilial violence.<sup>57,75</sup>

Efforts have been made to distinguish perpetrators of deadly violence within a partner relationship from other homicide offenders.<sup>73,76,77</sup> The conclusion drawn is that the former deviate less from the “normal person” than homicide offenders in general.<sup>78</sup>

### 1.5.3 Suicide in relation to delivery and early motherhood

Suicide risk is increased by age and male gender<sup>79</sup> and one would expect the suicide rate to be low in women who have recently given birth. This correlation holds true<sup>80-82</sup> and one could further speculate as to whether this is an association that comes from motherhood per se. Mental disorder, normally having a strong association with suicide,<sup>14,26,83,84</sup> has an

increased incidence risk in the postpartum period.<sup>85,86</sup> Despite this, the number of suicides in the year that follows delivery is less than expected. Further, the negative association between suicide and having children holds true even beyond the first year after childbirth.<sup>87</sup> Still, the fact that suicides among mothers do occur and the severe consequences, with special emphasis on the consequences for the child,<sup>88</sup> makes research and possible preventive efforts very important.

#### **1.5.4 Children exposed to bereavement of a parent**

The loss of someone close causes grief and the effects vary between individuals depending on age, nature of trauma, as well as other factors.<sup>89</sup> Children who are bereaved of their parent, still under psychological development and exposed to traumatic deaths, will most likely be affected and may suffer consequences both in the short term perspective and in the future.<sup>90</sup> Bereavement in childhood by suicide and other, non-natural deaths increases risk of future violent behaviour, substance use disorder, serious mental disorder and suicide. The association is most pronounced for suicide-bereavement.<sup>88,91</sup> Younger age at such exposure is associated with higher risk of later suicide.<sup>88</sup> Research in offspring's bereavement of a parent by homicide is sparse<sup>90</sup> and the few studies that are published are based on small samples. The future risk of suicide and other adverse events in children after loss of one parent in an event of intimate partner femicide has, to our knowledge, not been studied.

### **1.6 EPIDEMIOLOGICAL STUDIES**

#### **1.6.1 Study design**

##### *1.6.1.1 Cohort design*

The cohort design is often regarded as the best choice when exposure is rare, since it allows infrequent exposures to be captured with sufficiently large cohort. A cohort is defined as a group of individuals with some features in common. A commonly used cohort is the birth cohort, for instance all individuals born in Sweden during a certain year. In cohort studies in general, individuals are followed from a starting point until the outcome occurs, or until censoring. Censoring may occur due to loss to follow-up, emigration, or a competing outcome. Since the traditional cohort study gathers information prospectively, the exposure will per se take place before the outcome. This is one of the main advantages of the cohort design and the reason for its reputation of being more valid than the case-control design. However, as argued below, cohort design and case-control design could be reasonably alike in register-based research, since register data gives an unbiased temporal measure of exposure and outcome.

In a cohort design, the time between exposure and outcome is of utmost importance. If the outcome evolves in a short time interval among the exposed, the association is strengthened. Another essential part of the cohort design is censoring. For example, if the outcome is death in cancer, all other deaths, known as competing outcome, have to be censored since the entire cohort will die if the time is unlimited, regardless of exposure status. Further, if people leave the country, or in another way are impossible to follow in the study, they are censored. To allow this unmeasured time in the study could lead to inconclusive results.

#### *1.6.1.2 Case-control study*

When the outcome of interest is rare, is it often uneconomical and unpractical to follow a cohort over time, and observe only a few individuals who develop the outcome and many who do not, as in the traditional cohort-design. Instead, with the rare outcome in mind, one may start by identifying people with the outcome and compare these to unaffected controls, which corresponds to the case-control design.

The case-control design could imply highly different strategies of the actual execution. Two very different case-control settings for investigating the association between smoking and cancer may serve as illustration: In the first study, the investigator asks people with and without a cancer diagnosis about their previous smoking habits. In the second study, outcome status, being a case or control, is obtained from a register of biopsy verified cancer diagnosis and compared with regard to smoking habits which are estimated from national census and other register data. It is relatively easy to understand that the investigator's role in the first version is non-negligible with regard to the retrieved data on smoking. In addition, people with a cancer diagnosis may be more likely to remember even minor tobacco consumption in an effort to find a reasonable explanation for their condition, compared to how healthy controls remember the same exposure. Further, there is a chance in selection of people, since different individuals have a different tendency to be part of a study as described above. If the group that participates is unequal from the non-participants in respect of the outcome, there is a potential source of bias.

The two different sources of bias described above, recall bias and selection bias, are the main objections towards the case-control design. However, when performing a case-control study based on register data, these remarks lack significance. The major advantage of a case-control study based on prospectively collected data (i.e. registers/databases) is that the exposure of interest is registered before the outcome, and thus not affected by the outcome.

Crucial in the case-control study is the selection of controls, often referred to as the sampling procedure. Controls need to be as equal to cases as possible; in the ideal situation, only different in level of exposure (if there is an association between exposure and outcome). Further, in a case-control that attempts to mimic the cohort study, controls have to be at risk of the outcome. In a register based study this means that cases, known at the start of the

study, are allowed as controls to cases, given that the controls at a specific time still have not developed the outcome.<sup>92</sup>

### 1.6.2 The concept of causality

Defining causality is a challenging task and widely beyond the aim of this thesis. However, we are all aware of the concept of causality, even if we do not actively think of it as exposure and effect. For example, we know that if we drop a stone it will fall to the ground. The action of dropping (the exposure) will cause the stone to fall, due to the gravitational force acting on the stone. For this statement to be true, there are several other preconditions that must be fulfilled, even though the example looks simple and straightforward. For instance, the space between the stone and the ground must be free of obstacles, and this absence of objects could be considered as a part of the causal pathway.

In medicine, causality can be defined in infectious diseases like AIDS; the *Human Immunodeficiency Virus* (HIV) causes the sickness and is a *necessary* exposure of the subsequent effect. It is necessary in the sense that all individuals with AIDS have been exposed to HIV. In psychiatric research, and particularly in suicide research, it is hard to find causation in the form of *necessary* exposure, something that is required to cause suicide. And further, suicide will not occur if this specific exposure is lacking. Probably, such an exposure does not exist and the suicidal process may thus be considered to be a multifactorial phenomenon.<sup>7</sup>

There is a difference in causal effect depending on whether the effect is considered on a group level or an individual level. According to Hume's fourth point on causality; the same cause (exposure) always produces the same effect,<sup>93</sup> this could only hold true for a given individual at a given time-point. One could easily imagine an exposure that will cause different effects depending on who is affected, and further, different effects within the same person, depending on when the exposure takes place. For example, the dropping of the stone will cause a fall towards the ground and if there is a foot in between the stone and the ground, and also a sensation of pain, at least if the stone is big enough. However, an individual that has a prosthetic foot, without any sensory possibility, will feel no pain. Further, a person that does feel pain might some time later have a real foot replaced by a prosthetic foot, and hence no pain. The same cause will now produce no effect in the sensory system of the same individual. However, in a large sample, the dropping of a stone on a foot could be regarded as a causation of pain, since most people do not use prosthetic feet or lack the ability to feel pain, or have other abnormalities that could explain the lack of pain given by the dropping of the stone. This conclusion of causality could be tested and certified in an experiment. However, since we saw that this causation did not hold true for every individual, we conclude

that causation on a group level, denoted as the *average causal effect*, could be in contrast to the *individual causal effect*.<sup>94</sup>

A more dense definition on causality, without the intention of being comprehensive would be:

*An exposure could be regarded as the cause of an effect if the absence of the exposure, at the same time and situation, will lead to no effect*

This definition is based on causality being looked upon as the difference between the exposure and the counterfactual exposure. The counterfactual exposure represents the opposite exposure to the one actually being the case. Causality is assumed if the outcome of the exposure and the outcome of the counterfactual exposure are unequal. As we saw above, causality on an individual level requires both the actual exposure and the counterfactual exposure at the same time in the same individual. Testing causality in this manner: measuring an exposure and adherent effect at one time and situation, and at the same time and situation testing no exposure and no effect, is impossible. Following the definition above, the *individual causal effect* could not be concluded in practice and exists only as a theory. However, in a randomised intervention study, the group of individuals participating could be regarded as one entity. In such a study, the exposure or intervention will be given at random at the same time and situation, and the *average causal effect* could be calculated.

### **1.6.3 Association as a measure of causality**

In randomised experiments, the exposure is randomly assigned to some of the individuals and the others do not receive the exposure of interest. If the randomisation is performed in an optimal manner, the only characteristic that separates the groups above is the intervention as such. By randomly assigning intervention or not, we will evenly distribute any factor that could be associated with the outcome.

In an observational study, the intervention per se is not assigned within the study. We merely observe exposures already present. Exposure or not exposure could be associated with some factor but also assigned at random, for example winning the Lotto. However, if exposure at random exists, this lies beyond our control and could in fact be non-random even though it looks completely random.

If observational studies were executed without errors of any kind and with a clear hypothesis that was confirmed, one might consider the association as causal. However, errors such as selection bias and confounding will exist and hopefully some of them are detected. The results are thus possible to adjust on these conditions, others will be undetected and obscure our interpretation.

## 2 AIMS

The overall aim was to identify risk factors and in detail study defined aspects of suicide and violence that occurs within the family.

Specific aims of the included papers:

**Study I.** Identify risk factors of perpetrators of filicide, including child victim characteristics.

**Study II.** Identify risk factors of lethal interpersonal violence, directed towards a female partner. Further, we wanted to investigate the effect of bereavement for children after loss of their mother.

**Study III.** Investigate proximity to childbirth as a protective factor against suicide and risk factors of suicide within the first year after delivery.

## **3 MATERIALS AND MEASURES**

### **3.1 DATA SOURCES**

#### **3.1.1 The Swedish personal identity number**

The Swedish personal identity number (PIN) is given to every person that is living in Sweden with a permanent permit of residence. The number has been used since 1947 and consists of ten numbers, six of them reflecting year, month and day of birth. The following three numbers, the birth-numbers, are sex specific and were specific for the county of birth until the 1980s. The last digit, the tenth, was added in 1967 and acts as a control digit generated by calculation of the previous nine numbers.<sup>95</sup>

The Swedish PIN is used extensively in health care as well as in public administration. Data in national registries covering inpatient care, deaths, crime and further, are all register with the PIN as the number of identification. Thus, the PIN enables us to crosslink registers with data from different sources retained.

For ethical reason, all PINs were replaced with a random id-number in all data sets used in this thesis.

#### **3.1.2 National Patient Register**

The register holds information on discharges from inpatient care since 1964. The coverage is considered almost complete for all psychiatric hospital care in Sweden since 1973.<sup>96</sup> Data in the register includes the main diagnosis and up to eight secondary diagnoses, according to the International Classification of Diseases (ICD) 8<sup>th</sup>, 9<sup>th</sup> and 10<sup>th</sup> edition.<sup>97-99</sup>

The register is considered of high validity with only 1% of hospital discharges lacking PINs.<sup>100</sup> Previous research has demonstrated that data in the National Patient Register are reliable for diagnoses of severe mental illness.<sup>96,101,102</sup>

#### **3.1.3 Cause of Death Register**

The register was founded in 1952 and is considered to have almost complete coverage since 1961.<sup>103</sup> The register is held by the National Board of Health and Welfare and contains information on deaths among Swedish citizens living in Sweden or abroad. No data is registered on immigrants or tourists dying in Sweden, neither on stillborn children. Death is recorded with causes of death according to the ICD-system.

### **3.1.4 Multi-generation Register**

The register contains information on the link between biological or adoptive parents and their children. The register was initiated and constructed in 2000 and is held by Statistics Sweden. Every individual born in 1932 and onward and resident in Sweden at the time of 1961 or later is included in the register. Birth cohorts since 1968 are regarded as almost completely covered by the register. Information of parents of immigrants is registered if the index-person became a Swedish citizen before the age of 18 and at least one parent was/became a citizen.<sup>104</sup>

### **3.1.5 Medical Birth Register**

The register holds information on all births in Sweden since 1973 and is held and maintained at the Swedish National Board of Health and Welfare. All data on deliveries, including stillbirths, includes information on the mother and the delivery, for example previous pregnancies and caesarean section. Child-related variables are included in the register, for example gestational age, weight and Apgar score. The register is considered of high-quality and with little missing data.<sup>105</sup>

### **3.1.6 Education Register**

The Swedish Register of Education was initiated in 1985 by Statistics Sweden, but does also include information about educational level from previous decades, generated by national census.<sup>106</sup> For the period 1960–1990, a national population and housing census was performed every five years.

### **3.1.7 National Crime Register**

The register holds information on all criminal convictions in Swedish lower court. The register, which was founded in 1973 and contains data on type and date of offence, is held by The Swedish National Council for Crime Prevention. The identity of the victim is not included in the register for reasons of integrity. Since the minimum age for criminal responsibility in Sweden is 15 years, no verdicts on people younger than this are recorded. Further, the register also contains data on crime committed by persons regarded as having a severe mental disorder and sentenced to forensic psychiatric care.

## 3.2 MEASURES

### 3.2.1 Mental disorders

Individuals with mental disorders were identified through the National Patient Register (NPR). In general, we used only main diagnoses, with the exception of substance- or alcohol use disorders and personality disorders, which were accepted in any diagnostic position. To avoid power problems, we constructed diagnostic groups instead of testing all diagnoses as separate variables. Schizophrenia and other non-organic psychoses were categorised into psychotic disorders. Unipolar and bipolar affective disorders were categorised into affective disorder. In some analyses, we also used a broader group of *major mental disorder* containing psychotic disorder, affective disorder and personality disorder. In large, we followed the diagnostic categorisation of previous work.<sup>19</sup>

	ICD 8 (1969–1986)	ICD 9 (1987–1996)	ICD 10 (1997–)
Schizophrenia	295	295	F20
Other Non-Organic Psychotic Disorder	291 296.9 297–299	291–292 296X 297–298	F21–F25 F28–F29 F32.3 x.5 in F10–F 19
Bipolar disorder	296.1 296.3–296.8	296A 296C–296E 296W	F30–F31
Depression	300.4 296.2 296.0	300E 311 296B	F32 except F32.3 F33–F39
Phobic/Anxiety/Obsessive/ Dissociative/Somatiform Disorder	300 except 300.4	300 except 300.E	F40–F42 F44–F45 F48
Eating Disorder	-	307B 307F	F50
Adjustment Disorder, PTSD	307	308–309	F43
Alcohol Abuse/Dependence	303	303 305A	F10 except x.5
Drug Abuse/Dependence	304	304 305X	F11–F19 except x.5
Personality Disorders	301	301	F60–F62

**Table 1.** Included ICD-codes in Study I–III. The variable *any psychiatric disorder* includes all the groups above.

### 3.2.2 Violent and non-violent offending

A sentence of homicide was used to identify cases in Study I & II. Previous violent conviction and previous conviction of any kind were used as covariates in some analyses and categorisation of violent offending followed previous work.<sup>107</sup>

Offence	Law chapter/ paragraph
Murder	3:1
Manslaughter	3:2
Filicide	3:3
Guilty of manslaughter	3:7
Assault, aggravated assault	3:5, 3:6
Illegal threat	4:5
(Gross) violation of a person's/woman's integrity	4a
Robbery	8:5
Arson, aggravated arson	13:1, 13:2
Threats and violence against an officer	17:1,17:2
Kidnapping	4:1
Illegal restraint	4:2
Illegal coercion	4:4
Harassment	4:7
Any sexual offence	6:1–6:10, 6:12

**Table 2.** Offence codes according to the Swedish Penal Code. All of the above codes were used in the variable *violent crime/conviction of a violent crime*.

### 3.2.3 Suicide and suicide attempt

Previous suicide attempt is used as an explanatory variable (exposure) in Study I and defined as discharge from inpatient care under the verdict of self-injury. In Study II & III, the same ICD-codes are used but the variable is denoted *self-harm*. This inconsistency reflects a changed view during the doctoral project on how to interpret register data; the National Patient Register holds information on self-inflicted injuries, but no registration is made on the actual intention to die. Hence, the term self-harm<sup>108</sup> will more accurately describe the behaviour, since we cannot exclude non-suicidal self-injuries<sup>5</sup> based on register data.

Consistent with many other studies, we included both certain and uncertain suicides (ICD-8/9: E950-E959, E980-E989; ICD-10: X60-X84, Y10-Y34). This might be problematic, since some of the uncertain cases may be accidents or other deaths without intention to commit suicide. However, previous retrospective analysis of uncertain verdicts concludes that these should be included in suicide research to avoid underestimation.<sup>109</sup>

## 4 METHOD

### 4.1 OVERALL METHOD

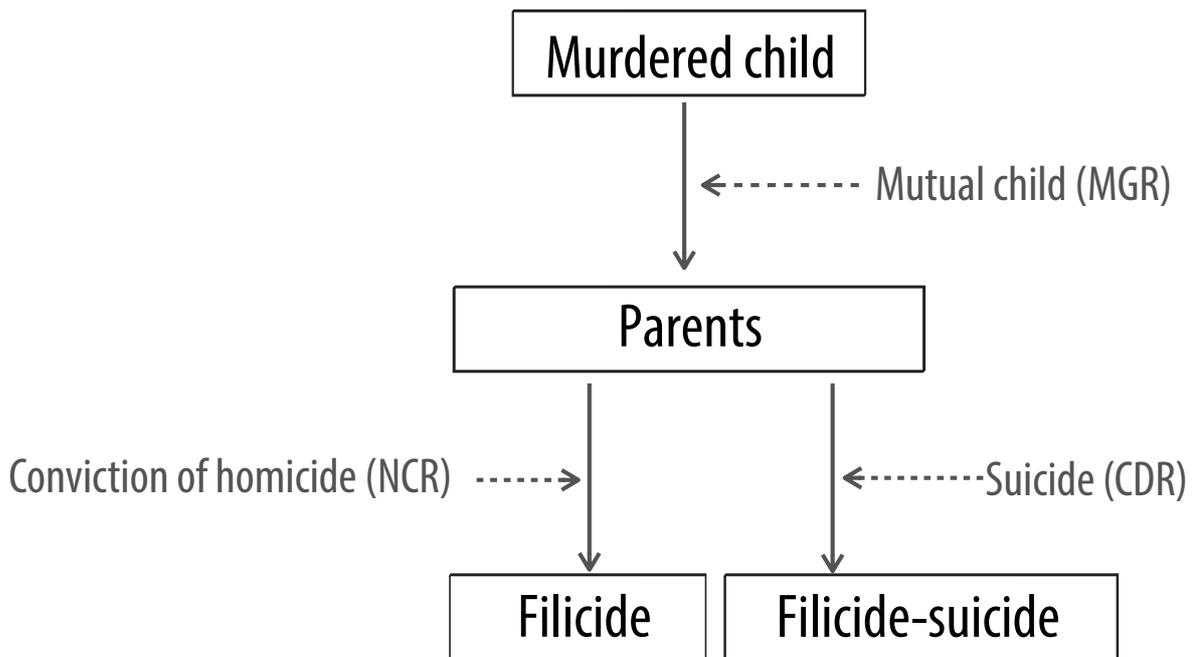
We linked register data in all three studies included in this thesis. Study I used data from 1 January 1973 to 31 December 2007. Study II & III were based on data with last observation on 31 December 2009. Linkage of registers was possible through the personal identity number (PIN).

In all the studies included in the thesis we use a defined sample of individuals. Within these samples we have made analyses based on classic cohort design and nested case-control design.

#### 4.1.1 Study I - Risk Factors for Filicide and Homicide

In order to identify parental deadly violence towards their children, we first identified dead children in The Cause of Death Register (CDR). Children were eligible for inclusion if their death was considered as death by the hands of another human (i.e. homicide). Every parent, biological, adoptive or stepparent were then linked to these children via the Multi-Generation Register (MGR). Stepparents are not directly linked to the index child in the MGR, and therefore we used the child's biological parent and identified children of this parent and some other person, not being the corresponding parent to the child. These individuals were considered stepparents to the index child.

When parents were identified, we used data in the CDR and National Crime Register (NCR). If either of the parents had a conviction of murder or manslaughter, with the time of crime set to be within three days of the death of the child, we considered this a case of filicide. Similarly, we looked for suicidal death of either of the parents in the CDR, and considered as case also if a parent's death by suicide within three days of the child's death was recorded. This latter definition is based on the assumption of filicide often being a combined homicide-suicide event.<sup>62</sup> Suicide as a result of the loss of a child in an event of deadly violence, inflicted on the child by another person, could not entirely be ruled out. However, suicide as a consequence of grief usually occurs later,<sup>110</sup> and suicide within days after the murdered child seems implausible if the two events are not directly connected.



**Figure 7.** Identification process of filicide offenders, including those who committed suicide in direct connection with the offence.

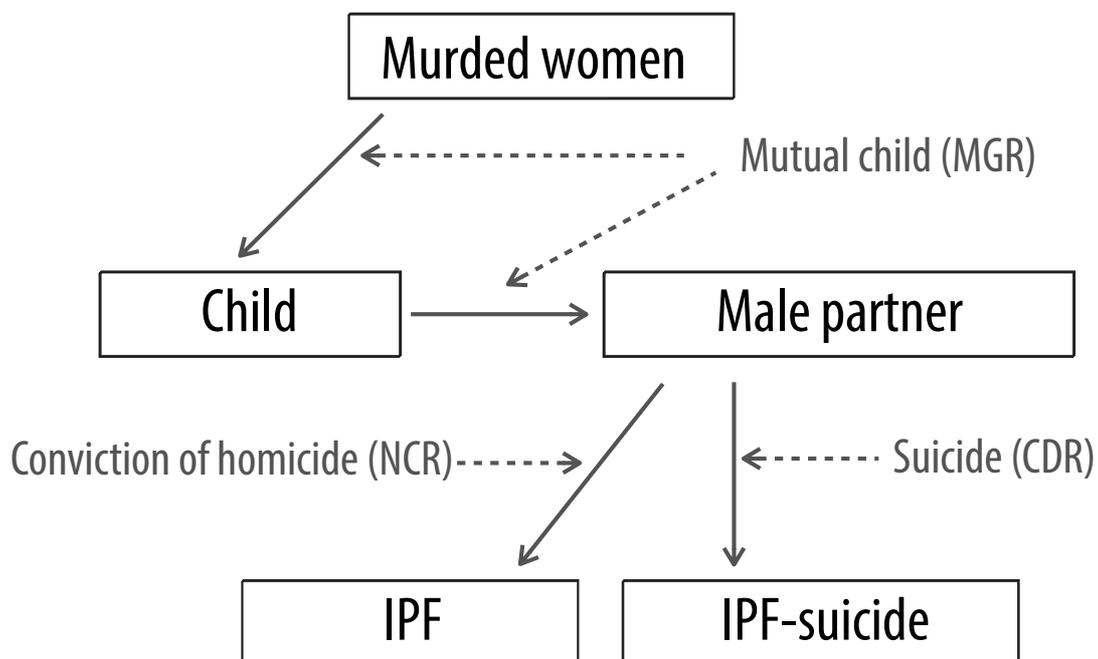
The cases of filicide, regardless of parental conviction or suicide, were matched to population controls. Matching was made on sex, age and number of children. The latter was done to reduce potential confounding from family life including several children, a factor that cannot be measured or estimated from register data. Further, we identified people convicted of homicide in general and matched these to population controls on sex and age. This procedure was made to generate a reference sample, and potentially highlight differences that not only reflected differences between filicide offenders and population controls.

We tested the associations between being a filicide offender and having a mental disorder, history of suicide attempt or previous convictions for violent crime. Factors related to delivery and perinatal complications for the index child and their association to filicide were also tested. We used logistic regression, conditional on matching variables. Variables were first tested separately and variables with significant bivariate associations were carried forward in a multivariate model.

#### 4.1.2 Study II – Killing the Mother of One’s Child

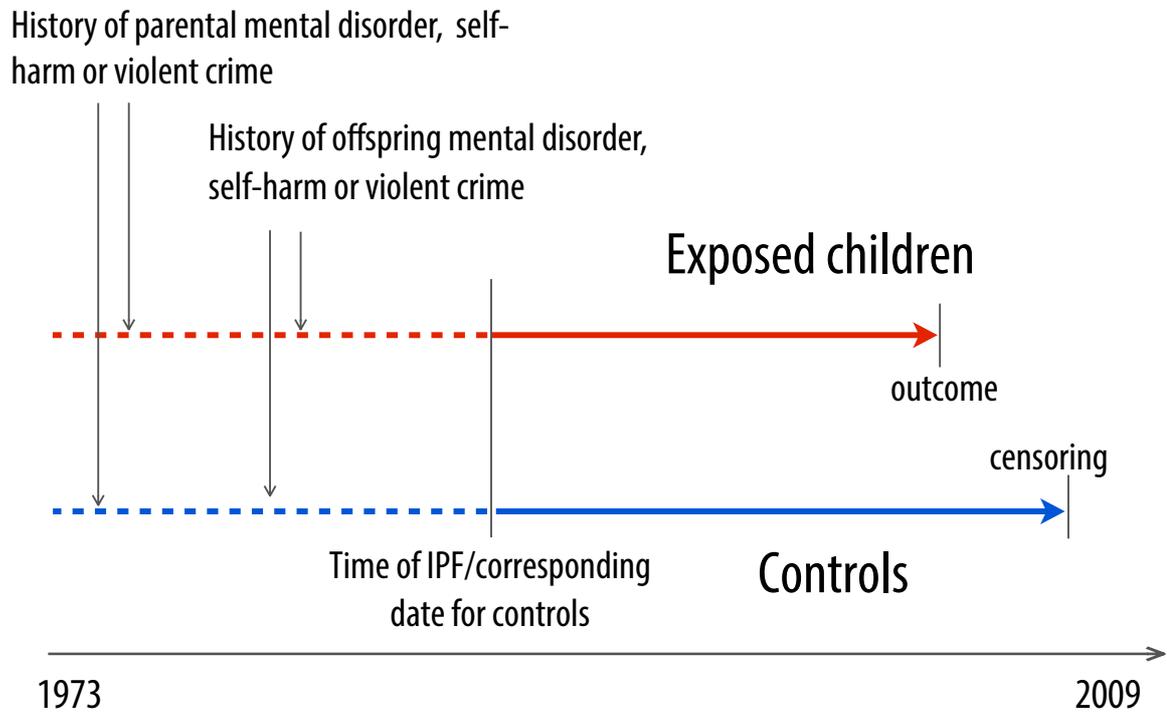
In order to identify females that had been killed by their partner from 1973 to 2009, we used mutual children as the link between two individuals. In Sweden, registration of housing and linkage of people living in the same household is only possible since 2008, so a direct

identification of partners is not possible for events prior to this date. There is a possibility that a mutual child does not reflect a present relationship, which we mention as a weakness in the published paper. We first identified murdered females from the CDR and linked these females via children to a present or former partner. If the male partner had been convicted of homicide with estimated time of crime being within three days of the murder, a case was established. Similar to the phenomenon of filicide, in a substantial part of the deadly violence against women with a partner as the offender, the offender commits suicide in direct connection to the offence.<sup>63</sup> Thus, suicide of the offender within three days of the murder, retrieved from the CDR, were also considered cases. In general, suicide and homicide in Sweden are rare, and the occurrence of both, within the same family and at the same time, is highly unlikely to be unconnected. Cases were matched to population controls at random, ten controls to each case, conditional on age and sex. Similar to the filicide study, we used a reference group of homicide offenders, other than the included offenders, and matched these to population controls.



**Figure 8.** Identification process of IPF offenders, including those who committed suicide in direct connection with the offence.

Secondly, we used the previous linkage of murdered females and their children to create a child cohort of bereaved children (in some cases adult offspring). These children were followed through the registers to end of follow-up or to the occurrence of the outcome of interest. The follow-up time ranged from 0.25 to 37 years. Ten controls were assigned each index child and matched according to age, eliminating the issue of truncation of data. We analysed data with Cox-regression, taking into account time to outcome. Our primary outcomes were mental disorder, violent offending, self-harm and suicide.



**Figure 9.** Illustration of the analysis between children exposed to IPF and corresponding controls, with parental factors and other pre-index factors included in the model.

#### 4.1.3 Study III – Maternal Suicide

In our paper on suicide shortly after delivery we had two major aims and used different design between the first and the second aim.

Our first aim was to investigate the association between recent delivery and suicide, and to enable this we identified all women who had given birth 1974–2009. We were able to include women who had given birth during 1973, but selected to exclude these since data on psychiatric inpatient care is not available before 1973 and hence, there was no possibility to identify mental disorder. Further, we included only mothers who were 41 years or younger at time of suicide in order to avoid suicides without the possibility of recent delivery (i.e. post-menopausal women). Mothers without suicide (until the end of 2009) made up the control population and ten controls were randomly drawn from this population. Matching was made on maternal year of birth. We applied a logistic regression model with suicide as the dependent variable. The model was conditional on the matching variable (age of the woman) and as the explanatory, independent variable we used time since delivery. The independent variables of time since delivery were constructed as three different dichotomised variables with time interval from delivery set as  $\leq 42$  days (according to WHO definition of maternal death),<sup>111</sup>  $\leq 6$  months and  $\leq 1$  year. Low educational level and immigrant status were included as potential confounders.

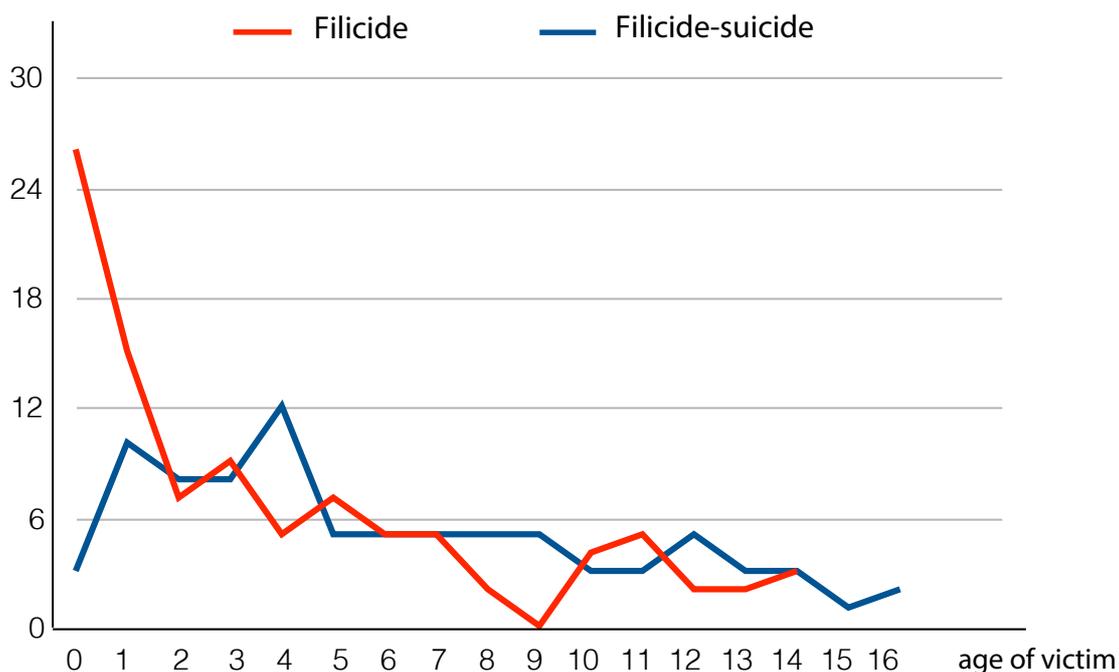
For the analyses according to our second major aim, we selected cases from our sample in the first part of the study, as mothers who died by suicide within one year after delivery. All mothers, regardless of age at delivery were used in the analysis. Controls were drawn at

random from the population of mothers without suicide the first year following childbirth. Hence, women considered as cases in the first analysis could be included as controls in the second analysis under the condition of suicide >1 year after delivery. This less restrictive approach of sampling controls will yield more conservative estimates of the potential association between the exposure and outcome.

## 5 RESULTS

### 5.1 STUDY I – RISK FACTORS FOR FILICIDE AND HOMICIDE

We found 151 filicide offenders 1973–2008. These were responsible for the death of 184 children. Almost half of the offences (42.4%) included perpetrator suicide. Eighty-two (54.3%) of the perpetrators were men and 69 (45.7%) women. The majority (96%) were biological parents.



**Figure 10.** Number of filicide cases as a function of the age of the victim, Sweden 1973–2008

One fifth of filicide perpetrators had been admitted to psychiatric care prior to the crime. In the fully adjusted model, risk factors for filicide were major mental disorder (aOR=8.6; 95% CI 3.7–20.0), previous suicide attempt (aOR=11.6; 95% CI 4.0–33.3) and previous violent offending (aOR=6.6; 95% CI 3.0–14.2). However, major mental disorder also had a strong association to other forms of deadly violence, as shown by analysis in our comparison group of homicide offenders. Major mental disorder was concluded as a general risk factor of violent behaviour and not specifically for filicide.

We found differences between the filicide cases and homicide in general; primarily the lack of an independent effect of substance use disorder for filicide offending. Further, suicidal behaviour in the past had a stronger association to filicide than to homicide.

**Table 3.** Filicide and homicide offender risk factors, respectively, in Sweden 1973–2008

	Filicide (N=151)					Non-filicide homicide (N=3,979)				
	Crude				Adjusted model <sup>a</sup>		Adjusted model <sup>b</sup>			
	n	(%)	OR	(95% CI)	OR	(95% CI)	n	(%)	OR	(95% CI)
Major mental disorder <sup>c</sup>	29	(19.2)	12.4	(7.0-21.9)	8.6	(3.7-20.0)	827	(20.7)	5.0	(4.3-5.9)
Substance use disorder	9	(6.0)	2.9	(1.3-6.3)	0.5	(0.2-1.5)	1,061	(26.6)	3.4	(2.9-3.9)
Self-harm	21	(13.9)	16.1	(7.9-32.6)	11.6	(4.0-33.3)	554	(13.9)	2.0	(1.6-2.4)
Conviction of violent crime	20	(13.3)	6.8	(3.6-12.9)	6.6	(3.0-14.2)	1,973	(49.6)	17.3	(15.7-19.1)

All risk factors were measured before the index killing among offenders and at the corresponding time among controls matched on birth year and gender

OR=Odds Ratio, CI=Confidence interval

- a) Adjusted for the effects of all other tested covariates with multivariable logistic regression modelling, including education and immigrant status and variables related to the killed child (not seen in table)
- b) Adjusted for the effects of all other tested covariates with multivariable logistic regression modelling, including education and immigrant status
- c) Psychotic-, affective-, and personality disorders

## 5.2 STUDY II – KILLING THE MOTHER OF ONE’S CHILD

We identified 261 men responsible of intimate partner femicide (IPF) during the study period 1973–2009. In 80 cases (30%) the perpetrator committed suicide in direct connection to the offence. The average age of the perpetrators was 45.8 years.

We found that major mental disorder was associated with IPF (aOR=5.9; 95% CI 3.3–10.6) and further, that substance use disorder - otherwise known as strongly correlated to deadly violence - lacked association to IPF. In our reference group of homicide offenders, this association was found; which indicates a relevant difference between offenders who murder their female partners and other homicide offenders.

For the analyses of offspring consequences, we identified 494 children who lost their mother because of IPF. Mean age at the loss was 8.6 years. If the exposure to IPF occurred before 18 years of age, we noticed a higher incidence of mental disorder, substance use disorder, violent crime and self-harm than in controls during follow-up. The association with later major mental disorder (aHR=5.7; 95% CI 3.0–10.6), substance use disorder (aHR=5.7; 95% CI 3.0–11.1) or self-harm (aHR=5.7; 95% CI 3.0–11.1) were all statistically strong. We found no suicides during follow-up in those who were younger than 18 years of age at exposure. Among the older offspring, the suicide risk was four times higher (aHR=4.3; 95% CI 1.3–14.5).

**Table 4.** Male IPF and homicide offender risk factors, respectively, in Sweden 1973-2009

	Intimate partner femicide (IPF) (N=261)				Non-IPF homicide (N=3,439)			
	Crude			Adjusted model <sup>a</sup>	Crude		Adjusted model <sup>a</sup>	
	n	(%)	OR 95% CI	aOR (95% CI)	OR (95% CI)	aOR (95% CI)	OR (95% CI)	aOR (95% CI)
Major mental disorder <sup>b</sup>	33	(13.4)	8.1 (5.0-12.9)	5.9 (3.3-10.6)	16.8 (14.9-19.1)	4.3 (3.6-5.2)	16.8 (14.9-19.1)	4.3 (3.6-5.2)
Substance use disorder	15	(5.7)	2.0 (1.1-3.6)	0.4 (0.2-1.0)	22.5 (20.1-25.2)	4.3 (3.7-5.1)	22.5 (20.1-25.2)	4.3 (3.7-5.1)
Self-harm	11	(5.0)	4.2 (2.2-8.1)	1.9 (0.8-4.3)	19.6 (16.8-22.9)	3.4 (2.7-4.3)	19.6 (16.8-22.9)	3.4 (2.7-4.3)
Conviction of violent crime	43	(16.5)	6.6 (4.4-10.0)	4.4 (2.7-7.2)	28.9 (26.3-31.8)	15.3 (13.8-17.1)	28.9 (26.3-31.8)	15.3 (13.8-17.1)

a) Adjusted for the effects of all other tested covariates with multivariable logistic regression modelling, including education and immigrant status

b) Psychotic-, affective-, and personality disorders

**Table 5.** Offspring risk of major mental disorder, substance use disorder, self-harm, violent crime, suicide and non-suicidal death following IPF divided by age at exposure.

	Offspring aged 0-17 years (n=308)				Offspring aged 18+ years (n=186)			
	No. of events	IR	Crude HR (95% CI)	Adjusted HR <sup>a</sup> (95% CI)	No. of events	IR	Crude HR (95% CI)	Adjusted HR <sup>a</sup> (95% CI)
Major mental disorder <sup>b</sup>	26	4.6	7.4 (4.5-12.4)	5.7 (3.0-10.6) <sup>c</sup>	9	2.9	1.5 (0.7-3.0)	1.4 (0.7-2.8) <sup>d</sup>
Substance use disorder	23	4.0	8.6 (4.9-15.1)	5.8 (2.8-11.9) <sup>c</sup>	7	2.3	1.0 (0.5-2.2)	1.1 (0.5-2.5) <sup>d</sup>
Self-harm	20	3.5	6.2 (3.6-10.9)	5.7 (3.0-11.1) <sup>e</sup>	7	2.3	2.0 (0.9-4.6)	2.1 (0.9-4.9) <sup>e</sup>
Conviction of violent crime	21	3.7	3.8 (2.2-6.3)	2.4 (1.2-4.5) <sup>e</sup>	11	3.7	4.1 (2.0-8.6)	3.2 (1.2-8.5) <sup>f</sup>
Suicide	0	0	NA	NA	5	1.6	4.3 (1.4-13.0)	4.3 (1.3-14.5) <sup>e</sup>
Non-suicidal death	3	0.5	1.5 (0.4-4.9)	1.3 (0.4-4.7)	10	3.3	2.1 (1.0-4.1)	2.1 (1.0-4.1)

IR= Incidence ratio (no. of events/1,000 person years), HR= Hazard ratio derived from Cox regression modelling, NA = not applicable

a) Adjusted for parental immigrant status and mother's level of education,

b) Psychotic, affective, and personality disorders

c) Adjusted for parent's previous mental disorder

d) Adjusted for parent's and offspring's previous mental disorder

e) Adjusted for parent's and offspring's previous self-harm

f) Adjusted for parent's previous conviction of violent crime and offspring's previous conviction of crime of any type

### 5.3 STUDY III – MATERNAL SUICIDE

In the sample of mothers, limited to those who were 40 years or younger at time of delivery, we identified 1,786 suicides. We found that the first year after delivery was associated with a minor decrease in suicide rate (aRR=0.82; 95% CI 0.7–0.99). Associations between delivery within shorter time periods and suicide were non-significant.

We identified 145 mothers who committed suicide during the first year after childbirth. Among these mothers, a low level of education and being born outside Sweden, were more frequent compared to controls. Further, they more often had a current mental disorder and a history of self-harm. The most frequent diagnostic categories were psychotic and affective disorders.

**Table 6.** Association of suicide during the first year after delivery and, mental disorders and self-harm

	Suicide N=145		Controls N=13,786		Crude Analysis		Adjusted model <sup>a</sup>	
	n	(%)	n	(%)	RR <sup>b</sup>	(95% CI)	RR <sup>b</sup>	(95% CI)
Any mental disorder	41	(28.3)	41	(0.3)	124.8	(76.0–205.0)	–	–
Psychotic disorders	18	(12.4)	17	(0.1)	110.9	(55.6–221.0)	83.7	(37.0–189.3)
Affective disorders	17	(11.7)	10	(0.1)	174.1	(77.2–393.5)	133.9	(45.9–390.6)
Personality disorders	3	(2.1)	2	(0.0)	149.7	(25.0–895.9)	2.4	(0.2–29.3)
Substance use disorders	5	(3.4)	7	(0.1)	61.6	(17.0–221.3)	16.9	(3.5–80.3)
History of self-harm <sup>c</sup>	30	(20.7)	155	(1.1)	132.6	(63.3–278.0)	47.6	(18.2–124.0)

a) Adjusted for the effects of all other tested covariates with multivariable logistic regression modelling, including education and immigrant status

b) Rate ratios from logistic regression with matching on maternal year of birth

c) Registered in the National Patient Register before index event

The effect of any mental disorder on suicide within the first year after delivery was strong (RR 124.8, 95% CI 76.0–205.0). The effect was most prominent for affective disorder, even after adjustment for low educational level, immigration status, other coexisting mental disorder, and self-harm (aRR=133.9; 95% CI 45.9–390.6). Self-harm had a strong independent association with suicide during the first year after childbirth (aRR=47.6; 95% CI 18.2–124.0). Further, substance use disorder (aRR=16.9; 95% CI 3.5–80.3) and a low educational level (aRR=5.1; 95% CI 3.4–7.6) remained independent risk factors after adjustment.

No differences were found between cases and controls with regard to delivery-related variables.

## 6 DISCUSSION

The overall aim of this thesis has been to identify risk factors of violent and suicidal behaviour within the family. To be considered a risk factor,<sup>112</sup> a certain kind of exposure (the potential risk factor) must be associated with the outcome and also with a plausible mechanism between exposure and outcome. Further, this association should not be confounded by any other factor. The term risk factor does not imply causality but is probably often interpreted as something that *causes* the outcome, given by the notion that the factor increases the risk of an outcome. In other words, when the aim of the thesis is estimation of risk factors of suicide and violent behaviour, our aim was partly to approach causality. However, as highlighted in the introduction, statement on causality is difficult, even when conducting studies that include intervention. In observational studies, sometimes the only possible choice and the base of the present thesis, causality is even harder to imply.

### 6.1 METHODOLOGICAL CONCERNS

In Sweden, suicide and lethal violence towards others is infrequent and hence, impractical as an outcome for intervention studies. When investigating specific forms of suicide and specific forms of violent behaviour, small studies are impossible given the rare nature of these outcomes. Further, with exposures like mental disorder (Study I, II & III), bereavement (Study II) or pregnancy (Study III), intervention studies would be either impossible or highly unethical.

Mainly due to infrequent outcomes, we chose to base our studies on registers that cover the entire population. Following the same argumentation, we used long periods of time in order to increase the number of individuals with the outcome. Since we have used observational data, some limitations will hinder any direct statement on causality. Some of the concerns and possible ways to moderate their effects on the interpretation are described below.

#### 6.1.1 Concerns about observational data

Observational data reflects the reality in the sense that the data are the final result of different kinds of exposures and their effect on specific outcomes. Observational data is the script of events actually taking place. Under the assumption that the data is gathered in an accurate manner and that misclassification and errors in data are absent, observational data present the truth. However, observational studies are not considered as reliable as intervention studies<sup>113</sup> and this might seem paradoxical given the statements above. The problem that originates from observational data is not due to a false nature of the data as such, but from our

interpretation of the data and our assumptions. Studies with observational data will further suffer from bias, primarily in the form of confounding.<sup>114</sup>

Given a causal effect on a specific outcome, we could use observational data to conclude this factual causal effect. If the causal effect exists, the observation of events will provide data that could verify this effect. So, how is it that studies from observational data often talk about *associations* instead of *causal effect*? The answer is that the factual causal effect is unknown and we try to measure a hypothesised causal effect. The effect we have estimated will not have a straightforward causal interpretation since we violate the rule of exchangeability. The term of exchangeability refers to individuals in a particular study having an equal chance of being exposed.<sup>115</sup> In randomised intervention studies, this is possible because the exposure is designated to individuals at complete random.

### 6.1.2 Unmeasured confounding

Confounding by any known factor that is present in a dataset as a variable poses no major problem. Such a factor is possible to include in a regression model, and inclusion of a confounding variable will reveal the independent effect, the effect that is free of confounding, between the exposure and outcome. Confounding becomes problematic when we either do not know that the results are confounded by any unknown variable or when we cannot measure a known confounding factor. Confounding that is immeasurable could, to some extent, be handled by using a control sample that is matched on certain variables.<sup>116</sup> We have used this procedure in all of the studies included in the thesis but the effect on confounding is most notable in Study III.

Filicide offending may be affected by several child-related variables. However, the analysis only revealed a weak association between multiple birth and filicide. The reasons for a possible discrepancy between the results in the study and the actual state could be confounding in the form of unmeasured factors. These confounding factors, related to the child, make the effect of the included variables on filicide less accurate. Such confounding factors could include conduct disorder and learning disability, both associated to child maltreatment.<sup>117</sup>

Children bereaved of their mother in Study II had a worse prognosis when compared to children without this exposure. The exposed children developed mental disorder, engaged in self-harm and were convicted of violent crime more often than the controls. Since both mental disorder<sup>118,119</sup> and suicidal behaviour<sup>120</sup> are considered heritable to some extent, the crude effect was adjusted. In the adjusted analysis, parental status of mental disorder, parental self-harm and violent conviction, prior to the deadly offence, were used. The effect on the different outcomes were somewhat attenuated but remained significant. This points towards an independent effect of the bereavement per se. However, the adjustment variables do not

fully capture the actual situation before the bereavement. These children could have suffered, to a greater extent than their controls, from abusive, mentally unstable parents, but these factors may be unregistered and hence, this effect could not be measured.

In Study III we wanted to estimate the effect of recent delivery in contrast to a mixed effect of recent delivery and motherhood as such. Motherhood could influence the incidence of suicide and was considered a confounder in the analysis. To avoid the latter, we only included controls that had a registered delivery in the Medical Birth Register, thus matching on the presence of at least one delivery.

### **6.1.3 Concerns about the National Patient Register**

Register data is a well-used resource in Swedish research and the advantages are obvious. Rare exposures and diseases with long time between exposure and the development of the disease could be studied in a timesaving and inexpensive manner. The disadvantages are almost as evident, being primarily the lack of sufficient resolution, well illustrated by the National Patient Register. This register holds information on diagnoses, main diagnosis as well as secondary diagnoses. Also included is the date of admission, length of stay and date of discharge. There is little concern about missing data in the register<sup>96</sup> and the diagnoses registered seem to be reliable. Secondary opinions, based on evaluation of charts, is concordant to register data.<sup>101,102</sup> However, register data are far from perfect measures of mental disorder and to an even lesser extent of mental health. A major source of error is that mental disorders are undetected, and this limitation could be divided into two groups of measurement bias. First, some people with a true mental disorder do not visit mental health care and thus, remain healthy in the register. Second, some people with a true mental disorder are evaluated and found not in need of inpatient care. The latter will render that they also remain healthy in the register.

Sweden has a well-established system of registration of different factors in national registries, but major information-loss is obvious. There is a discrepancy between the number of people admitted to psychiatric inpatient care, as registered in the National Patient Register, and the true number of individuals suffering from mental disorders.<sup>121</sup> The results in the thesis should be interpreted with caution; mental disorder as an exposure, measured in the studies presented, does not equal a true mental illness; it indicates that mental disorder was identified by psychiatric care and that the patient was evaluated as in need of inpatient care.

In registers, the exposure of particular interest may not be recorded at all. An exposure we have hypothesised as the cause of an effect is not measured (e.g. socio-economic status), and we are thus constrained to the use of a proxy that *is* measured and covered by the register (e.g. educational level and immigrant status). The latter may, of course, be less suitable but

the best existing option. This problem resembles the lack of factors that may introduce unmeasured confounding, as discussed above.

#### **6.1.4 Generalisability of the results**

Whether the results in this thesis could be applied to the total population in Sweden alone, or other populations internationally, is mainly a question of the validity of the identification process of the affected individuals and sound judgment.<sup>122</sup>

##### *6.1.4.1 Study I*

We used the National Crime Register (NCR) to identify those convicted of homicide with the date of crime equal to the date that their child was killed. More optimal had been a direct identification by linking the perpetrator to the victim in the NCR. Unfortunately, due to integrity reasons, this information is absent. A problem often met in other designs is that a significant number of perpetrators of filicide commit suicide before the possibility of a conviction. These perpetrators are often missing in research on filicide<sup>123,124</sup> since they are dead at the time of the start of the study. With register data we were able to include these under the assumption that suicide of a parent immediately after the child's violent death, and with the other parent not being convicted of homicide, constituted a case of filicide. In order to validate the process of identification we compared our results with the Swedish researcher Hans Temrin who has used a different source of identification<sup>125,126</sup> (i.e. police records). In doing so, we noticed a difference of only one case. However, some cases are certainly missing; most obvious are cases of filicide that are a part of the parent's suicide, misclassified as accidents. Further, there are cases of misclassification as accidental deaths without further specification, most notably the "shaken baby syndrome".<sup>127</sup> Missing cases could also include filicide when the perpetrator committed suicide more than three days after the killing of the child. These instances will not be recognised as filicide with subsequent suicide since they fall beyond our time-frame of inclusion and there is no perpetrator alive to prosecute. However, cases of filicide, not detected in our study as described above, are difficult or impossible to include in any other type of study due to the nature of the bias. Given the design of this paper on filicide and the comparison and validation of the method of identification, as described above, the generalisability of our results on all filicides in Sweden seem to be satisfactory.

##### *6.1.4.2 Study II*

The sample of perpetrators was identified in a similar way as the offenders of filicide. We used any mutual children of the perpetrator and the victim to establish a link between the two. This identification procedure limits the generalisability of intimate partner femicide, since cases without mutual children are absent. This could favour an over-inclusion of deadly

violence in longer relationships and cases with older women, since the probability of children increase with the length of the relationship and age of the woman.

The children exposed to bereavement identified through the murdered mother, should represent the true number of children bereaved in this manner from 1973 through 2009. However, it is possible that the death of the mother was misclassified as accident, suicide or other form of death other than homicide.

#### *6.1.4.3 Study III*

All mothers in Sweden 1974–2009 are included in the study. Diagnoses of mental disorder and previous self-harm are drawn from the National Patient Register. As mentioned before, this underestimates the true rate of mental disorder and self-harm. If the study results are to be transferred and interpreted among mothers with undiagnosed mental disorder and self-harm, register data will limit generalisability.

## **6.2 ETHICAL CONSIDERATIONS**

All three studies were approved by the Regional Ethical Review Board in Stockholm (2009/939-31/5).

Integrity of individuals is of utmost importance when research is conducted, maybe even more important when the focus is lethal violence, suicide and the enrolment of children in research. A fundamental part of research involving individuals, is informed consent. In register-based research, it could be that informed consent is highly impractical due to large samples. The question of ethics, however, is also a question of benefits from studies contra privacy protection and violation of integrity. The benefits of the work presented in this thesis may be difficult to measure but, in general, the acceptance of register-based research without informed consent is high.<sup>128</sup>

In the dataset used in Study I-III, each individual has a serial number as replacement of the Swedish pin, thus making informed consent impossible. Even though identification of the majority of the individuals included is made impossible by the use of serial number instead of the pin, some individuals with data on specific crimes and corresponding date of crime, may be possible to identify. This is even more problematic when different registers are linked and data on each individual are more comprehensive. Since identification is a possibility, data are only presented in aggregated form, and no further stratification than on gender is made. This latter procedure restrains identification in the papers.

## 6.3 GENERAL DISCUSSION

### 6.3.1 Mental disorder associated with suicide and violent behaviour

Based on our findings we conclude that mental disorder among parents is associated with both suicidal and violent behaviour. In all three studies in this thesis, caseness was associated with mental disorder. That is, being either a parent who commit homicide or a parent who commit suicide, there is an association to previous or current mental disorder. This finding is not unexpected, since mental disorder, regardless of context, has previously been found to have strong associations with suicide<sup>26,129</sup> and violent behaviour.<sup>130,131</sup>

#### 6.3.1.1 *Mental disorder as a proxy*

The strongest effect of mental disorder on the outcome of suicide or violence was observed among women who had taken their life within the first year after childbirth. In this paper we found more than a 100-fold increase of suicide rate among women with a current severe mental disorder. Mental disorder was only registered if discharge from psychiatric care was recorded within the last year before suicide, or corresponding date for women who did not commit suicide; and therefore the mental disorder could be considered a current mental disorder. In line with our findings, Appleby and colleagues have previously demonstrated a strong association between discharge from psychiatric clinic and suicide within the first year after delivery.<sup>132</sup> The straightforward conclusion would be that that mental disorder is a risk factor of suicide in the postpartum period, implying a close to causal link between mental disorder and later suicide. The latter is also possible amongst filicide offenders who take their own lives in connection to the filicide offence. Within this group, there is more than a 10-fold effect of mental disorder on the outcome of filicide-suicide. However, another explanation, moving away from the direct causal effect of mental disorder on suicide, is to consider mental disorder as a proxy of something else. More precisely, a discharge, and a preceding admission to psychiatric clinic, might be a proxy. Since we use register data from the National Patient Register we are not really measuring the presence or absence of a mental disorder but merely people in need of psychiatric inpatient care. This need of inpatient care is of course highly correlated with an actual mental disorder, but not completely; it might also be correlated to other factors. One such factor is the present severity state of a specific diagnosis as discussed above. Yet another (and possibly more problematic) factor may be suicidal thoughts or intention. It is quite possible that reasons for admission, conditional on the same level of sickness in a specific mental disorder, could actually be the presence of suicidal thoughts.<sup>133</sup> If the latter holds true, we are in some cases not really estimating mental disorder and its association with later suicide, but rather suicidal thoughts or intent and the association with later suicide. Unfortunately, we have no measurement of suicidal intention at the time of admission in our register data. The only direct measure of suicidality is register data of previous self-harm that has generated inpatient care. Previous self-harm is also registered as a variable in all three studies, regardless of time between a possible mental disorder and the

event of self-harm. In summary, we have not been able to further investigate whether the association between mental disorder and suicide is confounded by suicidality. The potential confounding effect may attenuate the associations we have found but does not alter the clinical interpretation of the result; individuals with previous inpatient care due to a mental disorder have an increased risk of later suicide.

### 6.3.1.2 *Mental disorder and violent behaviour*

To be a perpetrator of the killing of one's child and the killing of one's present or former partner are both associated with previous mental disorder. This association is robust and in line with previous work on filicide<sup>134,135</sup> and intimate partner femicide.<sup>46,136</sup> The same association between mental disorder and deadly violence is also present in the comparison groups of homicide offenders in Study I & II. Mental disorder is, however, a quite heterogeneous composition of diagnoses and to use mental disorder, without further specification, as a marker of an increased risk of violent behaviour might be both untrue and introduce unnecessary stigma. We did not perform separate tests on the less severe forms of mental disorder and their association to the outcome. Even though the variable of *any mental disorder* was associated to the outcome of lethal violence, this was mostly due to the high frequency of the severe forms of mental disorder; psychotic-, affective-, and personality disorder.

### 6.3.1.3 *Mental disorder as a cause of adverse outcome*

We observed a strong effect of mental disorder on suicide as well as violent behaviour (e.g. filicide and femicide). From this finding, two central questions arise; first, is the finding relevant for clinicians and second, does the finding imply causality? The first question, regarding clinical implications, is discussed at the end of the discussion section.

How about causality between mental disorder and suicide or violence? The study of filicide may serve to exemplify this question, or more directly, whether mental disorder causes filicide. When scrutinising the results in Study I, it is quite clear that mental disorder is not a *necessary* cause of filicide since some of the filicide perpetrators lack previous inpatient care due to mental disorder. In our study we found no record of mental disorder among 75% of the offenders. If mental disorder was to be a *necessary* cause of filicide, all events of filicide should include a perpetrator with a mental disorder. However, this conclusion is based on the assumption that perpetrators without register data on mental disorder are mentally healthy. With great certainty, this is not true, as discussed in paragraph 6.1.3. Thus, it is not certain that we could rule out mental disorder as a *necessary* cause. On the other hand, if mental disorder works as *necessary* cause, 75% of the offenders are suffering from mental disorder but are undetected in the NPR. Unfortunately, there is no possible way of knowing if this is true. Regardless of what kind of medical setting we are gathering data from

(e.g. psychiatric out-patient setting, district health centre) some individuals would remain undetected. So the question is whether it is reasonable to assume that three quarters of the filicide offenders are undetected by the mental health? Some clues may be given by studies of suicide and the frequency of inpatient care before the suicide. In studies based on register data, approximately 50% had been patients at a psychiatric hospital at some time before the suicide.<sup>29</sup> This is in contrast to psychological autopsy studies, where the findings of mental disorder are substantially higher. The prevalence of mental disorder preceding the suicide has been estimated to more than 90% in studies using this method.<sup>83,137</sup> The discrepancy between these figures illustrates the large number of people with undetected mental illness, at least not known to the psychiatric health care system.

Nor could mental disorder be considered a *sufficient* cause of filicide, since individuals with mental disorder do very rarely murder their children. Obviously, there is only an extremely small fraction of individuals with mental disorder that end up as filicide offenders.

Even though mental disorder is probably not the exposure that directly causes filicide, it could still be a part of a causal pathway. Causal explanation of filicide is probably a pathway with interaction of different factors.<sup>139</sup>

### **6.3.2 Substance use disorder**

We found no association between substance use disorder and filicide, and neither to intimate partner femicide. Previous studies on filicide<sup>134,140</sup> and intimate partner femicide<sup>78,141</sup> indicate an increased risk of substance use disorder as well as acute intoxication by alcohol or drugs. Our findings are further confusing because of the strong connection between substance use disorder and violence in general<sup>142,143</sup> and especially the strong relation to alcohol.<sup>143</sup>

A plausible explanation may be that our estimates of substance use disorder are, in all studies, based on hospital diagnoses. This will underestimate the “true” prevalence of substance use disorder. For the risk estimates, however, inference was made with general population controls. We have no reason to assume that detection rates should differ between perpetrators and controls, why this would only have affected statistical precision, i.e. the size of the estimates.<sup>144</sup>

### **6.3.3 Exposure of violence associated with suicide and other adverse outcome**

Part of Study II focused on offspring’s exposure of violence. Children bereaved of their mother due to lethal violence were followed from exposure until any of the defined outcomes occurred or to end of follow-up. In the study, there was an association between this type of

dramatic bereavement and poor long-term prognosis. Among the youngest children, aged below 18 at the traumatic event, the risk of future mental disorder (including substance use disorder), self-harm, and convictions for violent crimes were increased. The risk of suicide and non-suicidal death was only increased for those older than 18 years. However, in this group, no associations were found between exposure and mental disorder and substance use disorder.

Research on bereavement due to this specific form of violent behaviour is sparse and studies on the subject are based on small samples.<sup>145</sup> However, bereavement by parental suicide has showed increased risk of mental disorder<sup>146</sup> and risk of suicide.<sup>147</sup>

#### **6.3.4 Self-harm associated with suicide and violent behaviour**

We found that a history of self-harm was strongly associated with later suicide among mothers with recent delivery and filicide offenders. In the comparison sample of homicide offenders in Study I & II, we found an association between self-harm and homicide but to a lesser extent than in the groups of mothers and filicide offenders. Among men that murdered an adult female partner, former or present, the association with self-harm did not reach significance even though the point estimate indicated a positive association. It appears that previous self-harm is associated with later suicide, but the association to violent behaviour is less prominent. The association between self-harm and filicide may seem contradictory, since these are all cases of lethal violence towards another person, and yet the association is strong. Maybe this could be explained by the large proportion of subsequent suicide among the filicide offenders<sup>57</sup> and hence, probably making filicide more alike suicide than intimate partner femicide and other forms of homicide. Among surviving and convicted offenders of filicide, yet another portion of offenders could have tried to commit suicide in connection to the offence but survived. Finally, some offenders may have had the intention to commit suicide but did not or could not pursue after the initial murder of their child. This phenomenon has been described in filicide literature as a “relief of tension”.<sup>138</sup>

Previous self-harm is one of the strongest predictors of later suicide<sup>14,148</sup> and this finding is confirmed in the papers included in this thesis. The mechanism between an act of self-harm and the increased risk of completed suicide is somewhat self-evident or could be said to have strong face validity.

A verdict of self-harm is registered in the National Patient Register if the patient displays an injury that is considered as a self-inflicted injury and most fundamental, if the patient with self-inflicted injury is presented at a hospital. The latter needs to be emphasised since many individuals with self-harm are undetected by the medical community. In a large study of young individuals with a history of self-harm, the authors concluded that only one in seven of the self-harm events lead to hospital presentation. Those who became known to hospital staff

were more often males and with methods of self-harm other than cutting.<sup>149</sup> One could speculate if the great numbers of undetected self-harm introduces a selection bias when using this data as a measure of self-harm.

## **6.4 FINDINGS AND CLINICAL IMPLICATION**

In this thesis, the focus has been on some aspects of risk of suicide and violent behaviour related to family life. Three studies have been conducted in order to investigate different factors and their association to suicide and violence. Common to all three studies is the low frequency of all the studied outcomes; suicide less than one year after childbirth, murder of one's child or the murder of the mother of one's child, and the occasional subsequent suicide. These expressions of suicidal and violent behaviour are sub-forms of the general expressions of violence and suicide and hence, even more infrequent.

### **6.4.1 Study I**

Filicide is an unusual form of violent behaviour, including a high frequency of suicide in direct connection to the offence.<sup>65,150-152</sup> To have included these offenders in research on filicide improves generalisability of the present findings. Filicide offenders might be considered a heterogeneous group of violent offenders. The fact that almost half of the perpetrators commit suicide is one sign of this, another one is the distribution of risk factors, varying with gender.<sup>65,150,151,153,154</sup> In the analysis, we stratified on gender and the result was partly consistent with previous research. However, further stratification on simultaneous suicide would have been preferable. Unfortunately, the lack of sufficient sample size made these analyses impossible.

The most important risk factors were found to be major mental disorder, previous self-harm and previous violent crime. Among those with a mental disorder, psychotic- and affective disorders were prevalent, and the mechanisms between these disorders and filicide may be different. In the literature, it has been proposed that psychotic symptoms, especially in women are common in filicide offenders<sup>124,155</sup> and that the motive of filicide may be altruistic, an attempt to save the child from perceived danger.<sup>65,156</sup> Depression is also reported as prevalent among these offenders, both men and women<sup>65,157,158</sup> and this condition may include psychotic symptoms.<sup>159</sup> The motive for filicide was not possible to investigate in our Swedish data, but a high frequency of psychosis and depression may favour the assumption of mentally ill offenders who kill due to delusion. Depression without psychotic features could represent a factor in another pathway between mental disorder and lethal violence. Depression is a well-established risk factor of suicide<sup>26</sup> and we found almost half of our sample to be filicide-suicides. These cases may represent a primary suicide and a secondary

filicide, a feeling of hopelessness and thoughts of suicide and as the consequences of this, an urge not to leave the child behind.<sup>160</sup> Our finding of a high rate of previous suicide attempts may further strengthen the interpretation that these filicides resemble suicides without subsequent homicide.

A record of previous violent behavior was found to increase the risk of filicide and this may represent yet another type of filicide offenders. It has been suggested that a substantial part of filicide cases are due to neglect and physical abuse.<sup>155,156</sup> In these cases, an abusive parent may kill, in some cases with the intention of killing and in some, the filicide could be considered an accident.<sup>65</sup>

In comparison with other homicide offenders, filicide offenders were less influenced by substance use disorder, which is partly in contrast to previous work on filicide.<sup>154,161</sup> A possible explanation could be that we included filicide-suicide offenders, who might deviate from other homicide offenders and thus dilute the results.

Among the tested child-related factors, only multiple births was associated to filicide. Our interpretation is conservative, and the results need replication due to small sample sizes. However, twin birth may function as a stressor in vulnerable parents and ought to be recognised.

#### **6.4.2 Study II**

Perpetrators of deadly violence directed towards a female partner, previous or present, more often had a previous episode of major mental disorder compared to controls. Most frequent were affective disorders, in line with previous studies on Intimate Partner Femicide (IPF).<sup>63,136</sup> Partly in contrast to previous work, self-harm and substance use disorder were not independently associated to IPF.<sup>72</sup> Acute intoxication of alcohol is related to intrafamilial violence,<sup>75</sup> but due to limitation of register data, this variable is absent in the study.

One-sixth of the offenders had previously been convicted of a violent crime and in line with a review that outlines domestic violence as the strongest risk factor of IPF,<sup>162</sup> we found mental disorder to have a stronger independent effect than violence. However, this measure of violence includes different forms and different victims, not limited to domestic violence and directed towards the partner. Questions regarding previous domestic violent behaviour should be included when assessing the risk of IPF.

Offspring younger than 18 years at the time of bereavement had a poorer prognosis, compared to controls. These children had elevated incidence of mental disorders and substance use disorders. In line with previous work on exposure to violence<sup>38,163</sup> and bereavement,<sup>146</sup> the risk of suicidal behaviour was increased as well as violent behaviour. Only those older than 18 years of age had elevated risk of completed suicide. This may seem

like a contradiction; the youngest group was more often suffering from mental disorder, but without suicide during follow-up, compared to the older group which was not in the need of psychiatric care. The finding might be explained by a low mean age, among the young group, and a short follow-up time in the study. The risk of suicide increases with age conditional on the same mental disorder.<sup>79</sup> Low age at the start of the study gave these children a low baseline risk of suicide, enough to compensate for a speculative high risk generated by the bereavement.

### **6.4.3 Study III**

Childbirth is associated with a weak negative effect on the incidence of suicide. The interpretation of a strong protective effect in previous work<sup>80-82</sup> may partly be explained by differences in risk between mothers and women without children. In Study III, we used controls who were also mothers and hence, eliminating the possible effect of motherhood on the risk of suicide.

Among mothers with suicide in the first year following delivery, the risk of suicide was increased several times in the presence of mental disorder. A recent discharge from psychiatric hospital, among the population at large, increases the risk of suicide<sup>29</sup> and the findings in newly delivered mothers do not deviate from this. In our study, one-fourth of the mothers that committed suicide had a mental disorder that led to hospital stay in the year prior to the suicide. As discussed in previous sections, the actual number that suffers from mental disorders is many times higher than the number of patients. Further, we know that the risk of mental disorder is increased in the postpartum period,<sup>86</sup> and most probably, these 25% with a mental diagnosis found in our study represent a fraction of the actual prevalence of mental disorder among mothers who commit suicide. The majority of the mothers who were admitted had diagnoses of affective-, or psychotic disorder, both of them severe forms of mental disorder and associated with lifetime risk of suicide.<sup>164</sup> In the shorter perspective, the risk is higher and especially for women with admission due to affective disorders.<sup>29</sup> The well-known association between a history of self-harm and suicide<sup>14</sup> also applies to these mothers as we saw a major increase of the risk of suicide if previous self-harm was registered. Our findings suggest that women with recent delivery and signs of mental disorder or history of self-harm are a group of mothers that require marked attention. For some mothers, the risk of suicide persists even after inpatient stay.

## **6.5 FUTURE STUDIES**

In the introduction of this thesis, I described the case of “Kevin” and his older brother. They had both experienced severe exposure of violence, but their own expression of violence

became quite different. In the thesis, I have demonstrated similarities of suicide and violent behaviour, and that several risk factors are shared. It could be that the expression of either suicidal behaviour or violent behaviour is subject to quite insignificant events.<sup>3</sup> To further disentangle the path between aggression and suicide or violence, a combination of studies is warranted. One of the major disadvantages in register studies is unmeasured confounding. To some extent this could be handled by using samples with sibling or twin controls.

A second major problem is unmeasured variables, i.e. data on exposure that is not covered by the register data. This problem highlights the need for studies based on data with higher resolution.

A third major problem in suicidal research and research on violent behaviour is the small samples. Fortunately, the events of suicide and homicide are infrequent, but this also limits our possibility to make relevant stratification in the group of suicide and homicide offenders. These individuals share some exposures, given that they have displayed the same behaviour, but often have different motivation in doing so. Examination of risk factors among relevant sub-samples could be a way forward towards a greater understanding.

## 7 SVENSK SAMMANFATTNING

### 7.1 BAKGRUND

Självmod och våld mot andra människor är två olika uttryck för aggression. När dessa två uttryck förekommer i en familj, kan konsekvenserna vara särskilt förödande. I denna avhandling har fokus varit våldsamt beteende inom familjen, både våld i form av självmord och av dödligt våld mot andra. Syftet har varit att identifiera riskfaktorer för dessa olika uttryck av dödligt våld och undersöka kopplingar mellan självmord och våld mot annan person.

### 7.2 METOD

Studierna som ingår i avhandlingen bygger på flera av de nationella register som finns tillgängliga för forskning i Sverige.

I första delstudien är alla föräldrar som dödar sina barn, filicidförövare, jämförda med befolkningskontroller. Jämförelser har även gjorts med andra personer som dömts för mord eller dråp.

I andra delstudien undersöks förövare av dödligt våld som riktar sig mot en nuvarande eller tidigare kvinnlig partner, med vilken förövaren har barn. Dessa förövare jämförs med kontroller och även med andra förövare av dödligt våld.

I en andra del av delstudie två undersöks även de barn som blir berövade sin moder på detta dramatiska sätt. Barnen följs från händelsen och framåt och deras prognos jämförs med barn som inte exponerats för denna typ av förlust.

I tredje delstudien studeras mödrar och risken för självmord året efter förlossningen. Alla som födde barn mellan åren 1974–2009 ingår i studien.

### 7.3 RESULTAT

Riskfaktorer för filicid var allvarlig psykisk störning, tidigare självmordsförsök och tidigare våldsbrott. Beroendesjukdom, annars vanligt bland förövare av dödligt våld, var inte en oberoende riskfaktor.

Likaså var allvarlig psykisk störning en riskfaktor även för våld som riktas mot en partner. Även här saknades en oberoende effekt av beroendesjukdom.

Barnen som berövades sin mor före 18-års ålder hade sämre prognos jämfört med andra barn. De berövade barnen hade större risk att utveckla psykisk störning och beroendesjukdom. Barnen skadade sig själva och var våldsamma mot andra i större utsträckning än kontroller.

Kvinnor som fött barn senaste året hade en något minskad risk för självmord. Denna effekt var relativt svag men i linje med tidigare forskning. Självmod som skedde under det första

året efter förlossning uppvisade ett starkt samband med psykisk störning och tidigare självskada.

#### **7.4 SAMMANFATTNING**

Psykisk störning var associerat till våld mot andra och självmord. Tidigare självskadebeteende utgjorde en riskfaktor för både självmord och våldsamt beteende mot andra. Att som barn vara exponerad för dödligt våld i familjen medför ökad risk för senare psykisk störning och självmordsbeteende.

Riskfaktorerna som identifieras i avhandlingen kan inte tolkas som kausala för självmord och mord. Detta beror framförallt på begränsningar i registerdata, metodologiska svagheter samt den inneboende heterogeniteten i både självmord och mord. Sambanden som avhandlingen visar på är dock statistiskt tillförlitliga och riskfaktorerna kan användas för att förbättra detektionen av individer i riskzon för dödligt våld mot sig själv eller annan person.

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