



UPPSALA
UNIVERSITET

*Digital Comprehensive Summaries of Uppsala Dissertations
from the Faculty of Medicine 970*

Maternal Mortality in Sweden

*Classification, Country of Birth, and Quality of
Care*

ANNIKA ESSCHER



ACTA
UNIVERSITATIS
UPSALIENSIS
UPPSALA
2014

ISSN 1651-6206
ISBN 978-91-554-8863-5
urn:nbn:se:uu:diva-216781

Dissertation presented at Uppsala University to be publicly examined in Rosénsalen, Akademiska sjukhuset ingång 95/96, Uppsala, Thursday, 13 March 2014 at 13:15 for the degree of Doctor of Philosophy (Faculty of Medicine). The examination will be conducted in English. Faculty examiner: Professor Jos van Roosmalen (Leiden University Medical Center, Department of Obstetrics, Leiden and VU University Amsterdam).

Abstract

Esscher, A. 2014. Maternal Mortality in Sweden. Classification, Country of Birth, and Quality of Care. *Digital Comprehensive Summaries of Uppsala Dissertations from the Faculty of Medicine* 970. 69 pp. Uppsala: Acta Universitatis Upsaliensis. ISBN 978-91-554-8863-5.

After decades of decrease, maternal mortality rates have shown a slight increase in Europe. Immigrants, especially Africans, have shown to be at higher risk than native women. This could not be explained solely by well-known obstetric and socio-economic risk factors. The aim of this thesis was to study incidence, classification and quality of care of maternal deaths in Sweden, with focus on the foreign-born population. The study population was identified through linkage of the Cause of Death Register, Medical Birth Register, and National Patient Register, and medical records obtained from hospitals. Data from registers, death certificates, and medical records were reviewed. Suboptimal care was studied by structured implicit review of medical records. Differences between foreign- and Swedish-born women were analysed by relative risks, Chi²- and Fisher's exact test.

Underreporting of maternal mortality was shown to be substantial: as compared to the official statistics, 64% more maternal deaths were identified. Women born in low-income countries were identified as being at highest risk of dying during reproductive age in Sweden. The relative risk of dying from diseases related to pregnancy was 6.6 (95% confidence interval 2.6–16.5) for women born in low-income countries, as compared to Swedish-born women. Major and minor suboptimal factors related to care-seeking, accessibility, and quality of care were found to be associated with a majority of maternal deaths and significantly more often to foreign-born women. Suboptimal factors identified included non-compliance, communication barriers, and inadequate care. The rate of suicides during pregnancy or within one year after delivery did not change during the last three decades, and was higher for foreign-born women. A majority of women who committed suicide had been under psychiatric care, but such documentation at antenatal care was inconsistent, and planning for follow-up postpartum was generally lacking.

The conclusion of this thesis is that foreign-born women are a high-risk group for maternal death and morbidity that calls for clinical awareness with respect to their somatic and psychiatric history, care-seeking behaviour, and communication barriers. Cross-disciplinary care is necessary, both in obstetric emergencies and in cases of maternal psychiatric illness, to avert maternal death and suicide.

Keywords: underreporting, foreign-born, immigrants, low-income countries, suboptimal care, audit, suicide, reproductive age, maternal death, maternal care

Annika Esscher, Department of Women's and Children's Health, International Maternal and Child Health (IMCH), Akademiska sjukhuset, Uppsala University, SE-75185 Uppsala, Sweden.

© Annika Esscher 2014

ISSN 1651-6206

ISBN 978-91-554-8863-5

urn:nbn:se:uu:diva-216781 (<http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-216781>)

När mammor dör, då förlorar man ett av väderstrecken. Då förlorar man vartannat andetag, då förlorar man en glänta. När mammor dör, då växer det sly överallt.

Ur Berömda män som varit i Sunne, av Göran Tunström

To my family

List of Papers

This thesis is based on the following papers, which are referred to in the text by their Roman numerals.

- I Esscher, A., Haglund, B., Högberg, U., Essén, B. (2013) Excess mortality in women of reproductive age from low-income countries: a Swedish national register study. *Eur J Public Health*, 23(2):274–279.
- II Esscher, A., Högberg, U., Haglund, B., Essén, B. (2013) Maternal mortality in Sweden 1988–2007: More deaths than officially reported. *Acta Obstet Gynecol Scand*, 92(1):40–46
- III Esscher, A., Binder-Finnema, P., Högberg, U., Mulic-Lutvica, A., Bødker, B., Essén, B. Suboptimal care and maternal mortality among foreign-born women in Sweden: Maternal death audit with application of the migration ‘three delays’ model. *Submitted*
- IV Esscher, A., Essén, B., Innala E., Papadopoulos F. C., Skalkidou A., Sundström-Poromaa, I., Högberg, U. Suicides during pregnancy and one year postpartum in Sweden 1980–2007. *Submitted*

Reprints were made with permission from the respective publishers.

Cover: *Self-Portrait on Her 6th Wedding Anniversary*, by Paula Modersohn-Becker (1876-1907). The artist died of a lung embolus at the age of 31, eighteen days after giving birth to her first child. Hence she represents a maternal death. Reprint made with permission from Museen Böttcherstraße, Paula Modersohn-Becker Museum, Bremen.

Contents

Introduction.....	11
Maternal mortality globally and in Sweden	11
Definitions of maternal mortality	12
Surveillance of maternal mortality	14
Reproductive health among immigrants.....	17
From the ‘three delays’ to the ‘migration three delays’ framework.....	19
Quality of care and assessment of quality of care	21
Suicides during pregnancy and postpartum.....	23
Rationale for the project.....	24
Aims.....	25
Material and methods.....	26
Study setting.....	26
Study population	27
Methods.....	28
Ethics considerations.....	30
Results.....	32
Discussion.....	36
Classification of maternal deaths	36
Maternal death and country of birth.....	39
Medical factors	39
Care-seeking	40
Accessibility of services	41
Maternal death and quality of care	41
Suicides	44
Strengths and limitations.....	45
Implications and recommendations	47
Conclusion	49
Sammanfattning på svenska – Summary in Swedish.....	50
Rekommendationer	54
Acknowledgements.....	56
References.....	58

Abbreviations

AIDS	Acquired immune deficiency syndrome
BMI	Body mass index
CDR	Cause of death register
CI	Confidence interval
CMACE	Centre for Maternal and Child Enquiries, since 2010: MBRRACE-UK (Mothers and Babies—Reducing Risk through Audits and Confidential Enquiries across the UK)
GNI	Gross national income
EPDS	Edinburgh postnatal depression scale
HIC	High-income country
HIV	Human immunodeficiency virus
ICD	International Statistical Classification of Diseases and Related Health Problems
LIC	Low-income country
MBR	Medical birth register
MIC	Middle-income country
MMR	Maternal mortality ratio
NFOG	Nordic Federation of Societies of Obstetrics and Gynaecology
NPR	National patient register
OR	Odds ratio
RR	Relative risk
SFOG	Svensk Förening för Obstetrik och Gynekologi, Swedish Society of Obstetrics and Gynaecology
WHO	World Health Organization

Preface

Fortunately, a maternal death is a rare event in Sweden. A majority of Swedish doctors and midwives will not experience more than perhaps one single case during their entire professional life, if any. Those who have been involved in the care of a maternal death are usually deeply affected and will remember the sequence of events in great detail; they sometimes ruminate on their own role and feel part of the responsibility for years. They will also carry with them thoughts and concerns about the deceased woman's family. Although I was not involved in these events, I will always carry with me the painful fates of the women whose histories I had the opportunity to gain insight into, and I feel a responsibility to ensure that we learn something from their deaths.

During my work with this research project I have met with a genuine interest in my research topic; from colleagues and other professionals working with maternal care, and also from lay people, family and friends. A number of colleagues have shared their personal experiences from events of maternal death that may have happened many years ago, and they have all contributed to my knowledge and understanding.

In low-income settings around the world, maternal deaths are still a part of everyday life. Despite a continued reduction in maternal death rates, the unimaginable number of between 700 and 800 maternal deaths occur globally every day, and the majority of these are due to causes that could have been avoided.

Women are not dying because of diseases we cannot treat. They are dying because societies have yet to make the decision that their lives are worth saving (1).

Professor Mahmoud Fathalla's historical quote is, unfortunately, still valid. However, in Sweden our society took the decision early on that women's lives are worth saving, resulting in an extraordinary decline in maternal mortality before labour wards, blood transfusions and antibiotics were available. Anna, my great-great-grandmother could not be saved, but luckily her daughter Ellen survived until the age of 92, and died when I was five years old. They are both a part of my history, but that is another story.

Introduction

Maternal mortality globally and in Sweden

Globally, maternal survival has improved substantially, with an annual maternal mortality decline of 1.9% reported between 1990 and 2011 (2). Although the progress on reducing maternal mortality in most countries is accelerating, between 700 and 800 maternal deaths occur globally every day. The fifth Millennium Development Goal (MDG 5), as determined by the World Health Organization (WHO), to reduce maternal mortality ratio by three-quarters between 1990 and 2015, seems to be one of those most difficult to achieve (2). The deaths continue to be concentrated in sub-Saharan African and South Asian countries, where the lifetime risk is 100 times higher for a mother to die of pregnancy-related causes than that of a woman from a high-income country (HIC) (2). The consequences of a maternal death are usually disastrous for the whole family (3), and maternal death is often additionally associated with death of the child. Obstetric complications, particularly in labour, are closely linked to stillbirth and neonatal death (4, 5). Furthermore, after the death of a mother, the children continue to be at higher risk of dying after the neonatal period, due to the absence of appropriate childcare and nutrition (3). Globally, a substantial number of women die as a result of the consequences of unwanted pregnancies, such as unsafe abortions. Satisfying the unmet need for family planning methods could be estimated to avert one-fourth of all maternal deaths yearly, by preventing unwanted pregnancies and spacing childbirth (6). For women who do not have access to family planning or when abortion is illegal, suicide may be the last resort. Unwanted pregnancy may be the principle cause of suicide in women from less well-off social conditions (7, 8). Furthermore, women die as a result of suicide associated with mental disorders, during pregnancy and after delivery, although no global estimates for the rate of suicides related to pregnancy are available.

Although 99% of maternal deaths occur in low-income countries (LIC) (9), young women still die in HICs due to complications of pregnancy and childbirth. Despite the fact that the absolute number is small, the death of a young mother or a pregnant woman is amongst the most tragic to encounter. Maternal deaths decreased in Europe up to the 1980s (10-15), but data from several European countries and the U.S. have lately indicated slightly

increasing maternal mortality rates (9, 16-20). In part, these changes are due to improved data assessment. However, demographic changes, such as increased maternal age and migration, might contribute to this rise (14-16, 18, 19, 21-23). Immigrants, especially women from sub-Saharan Africa, have shown, in several European countries, to be at higher risk of maternal death than native-born women (14, 18, 21-29). It has not always been straightforward to establish the causal relations between these data by adjusting for obstetric or well-known social risk factors. In Europe, we see increasing proportions of older and obese parturients, that is, women who are known to be at higher risk of obstetric complications (16, 17, 30). Furthermore, medical advances in the areas of assisted reproductive technology, cancer treatment, and congenital heart diseases, enable new groups of women to give birth, although their pregnancies and deliveries may be more complicated. Simultaneously, changes in obstetric practices do not always improve the maternal outcome. One such example is increasing caesarean section rates, which may increase the risk for the mother (19, 31).

In Sweden, maternal care was expanded during the 18th and 19th centuries. Foundations for this development were the priority of Swedish society as was the ambition of equal care for all, irrespective of domicile. The science of obstetrics was instituted as an academic discipline, and the implementation of national coverage of trained community midwives attending home deliveries was complete in the late 19th century. The introduction of aseptic techniques and task-shifting along with transfer of knowledge to the midwives, and team-work between province physicians and midwives all having complementary roles, were operative factors for the reduction of maternal mortality in Sweden over the same period (11, 32, 33). During the first decades of the 20th century the maternal mortality rate increased due to illegal unsafe abortions, but between 1930 and 1980 the steep decline in maternal mortality was one of the most impressive health achievements in the industrialised world. This success was made possible by improvements in maternal care, such as improved eclampsia treatment and safer caesarean sections, and by the introduction of antibiotics and safe blood transfusions. Furthermore, there was a demographic shift, with a smaller proportion of parturients of advanced age, poverty reduction, and general public health improvements (33, 34).

Definitions of maternal mortality

The WHO defines maternal death in its International Statistical Classification of Diseases and Related Health Problems Versions 9 and 10 (ICD-9 and ICD-10) (35) as the death of a woman while pregnant or within 42 days (that is, days 0-41) of termination of pregnancy – irrespective of the

duration and site of the pregnancy – from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes. This definition allows the identification of maternal deaths, based on their causes, as either direct or indirect. Direct obstetric deaths are those resulting from: obstetric complications (pregnancy, delivery, and postpartum); interventions, omissions, or incorrect treatment; or a chain of events resulting from any of the above. Indirect obstetric deaths are those resulting from pre-existing disease, or diseases that developed during pregnancy but were not due to direct obstetric causes, although they may have been aggravated by the physiological effects of pregnancy. Deaths due to haemorrhage, puerperal sepsis, or complications of anaesthesia, are examples of direct obstetric deaths; whereas deaths from epilepsy or aggravation of an existing cardiac disease are classified as indirect.

ICD-10 has been in use in Sweden since 1997, preceded from 1987 to 1996 by ICD-9. The concept of late maternal death was included in ICD-10 in order to capture deaths from pregnancy-related events that occur between six weeks and one year postpartum (36). A complication occurring during pregnancy can lead to death more than 42 days later, and increasingly available modern life-sustaining procedures and technologies enable more women to survive beyond this period. For the purpose of the international reporting of maternal mortality, only those maternal deaths occurring before the end of the 42-day period are included. However, the recording of late deaths is useful for national analytical purposes. The WHO definition of maternal mortality ratio (MMR) is the number of direct and indirect maternal deaths per 100 000 live births. It is important to note that MMR is a ratio, and not a measure of incidence, with the denominator of live births, a figure which is easy to count and therefore facilitates comparisons of statistics. In the UK the number of maternities, defined as a live birth at any point during gestation or stillbirths occurring at or after 24 weeks of complete gestation (25), is used as denominator.

Pregnancy-related mortality involves those deaths occurring during pregnancy or within 42 days after the end of pregnancy, irrespective of cause of death. This definition was introduced in ICD-10 to facilitate the identification of maternal deaths under circumstances in which cause of death attribution is inadequate. Fortuitous deaths are defined as death caused by unrelated causes which happened to occur during pregnancy or the puerperium. As with the reporting method of the UK Centre for Maternal and Child Enquiries (CMACE), we prefer to use the term ‘coincidental’ instead of ‘fortuitous’, since the term ‘coincidental’ is a more accurate description of the circumstance and the term fortuitous could imply that these events are ‘lucky’ (25).

Suicides are not included in the current ICD definition of maternal death, in contrast to both the UK Confidential Enquiry reports (25) and a proposal for coming ICD classification by the WHO Working Group on Maternal Mortality and Morbidity Classifications (37). Cancers, accidents, and homicides are classified as coincidental deaths, although the UK reports classify hormone-dependent cancers as indirect maternal deaths, and homicides as direct, indirect, or coincidental, depending on the individual circumstances (25). In addition to the ICD definitions, the U.S. Centers for Disease Control and Prevention and the American Congress of Obstetricians and Gynecologists coined the concept of ‘pregnancy-associated deaths’ in the late 1980s, including any death of a woman while pregnant or within one year of the end of pregnancy and irrespective of the cause of death (38, 39). This definition should not be confused with the ICD-definition of ‘pregnancy-related death’, and is avoided in this thesis.

Surveillance of maternal mortality

The necessity of recording the number and causes of death is not disputed. Mortality rates are widely used to monitor the health of a population and are essential in identifying groups at risk as well as problems within the health care system (40, 41). Accurate surveillance of maternal deaths may therefore lead to changes in patient care (25). Underreporting of maternal mortality appears to be substantial, even in HICs (27, 38, 42-44), including Sweden (13, 45, 46). Inadequate statistics not only impede the possibility of determining trends, but also affect inter-country comparisons of maternal mortality rates (43, 47).

In recent years, the rate of maternal near-miss, or severe maternal mortality, has been more commonly used and is considered to be the best quality indicator for maternity care (25, 41, 48). Maternal near-miss is defined as ‘a woman who almost died but survived a complication that occurred during pregnancy, delivery or within 42 days of termination of pregnancy’ (49). The advantage of studying near-miss in settings with low maternal mortality rates is that a much larger number of women suffer from near-miss morbidity than maternal death, which gives increasing power for studies to investigate the risk factors for the occurrence of disease and progression to death (49, 50). A recent Swedish study found a frequency of 2.9 maternal near-miss cases per 1000 deliveries (50). Moreover, investigating incidence of near-miss provides opportunities to interview the affected woman and her family about the event to broaden the understanding of factors that contribute to maternal morbidity (51, 52). However, surveillance of maternal near-miss should be seen as a complement to, and not a replacement of, surveillance of maternal deaths. This is because the same diseases and complications that cause

maternal life-threatening conditions do not necessarily cause maternal death (53-55).

In Sweden, national vital statistics have been available since 1749, before they were available in any other European country (33, 56). Swedish cause of death statistics are based on information given on the death certificate completed by the attending physician. The first part includes information about the death, and the second part is the cause-of-death certificate. The thoroughness of the cause-of-death investigation varies greatly, from a medical history gained from speaking to the relatives of the deceased, to a full forensic investigation involving a review of the full medical history and medical records, a comprehensive autopsy and toxicological examinations. Consequently, the reliability of the diagnosis varies with the thoroughness of the investigations that are carried out while the patient was still alive and those performed on the body of the deceased (56). The autopsy rate has declined in Sweden since the 1970s, and is lower for women than for men (57). High autopsy rates usually contribute to better data quality (56). According to Swedish law, in cases of sudden, unexpected death, if the death is or may be suspected to have been caused by external cause – including errors and omissions in the health care, or if no pre-existing diseases can explain the death – then the criteria for a forensic post-mortem examination are fulfilled (58, 59). In such cases the police must be contacted and take the decision about whether a forensic investigation will be performed.

The National Board of Health and Welfare (Socialstyrelsen) is responsible for assigning ICD-codes to the diagnoses on the cause-of-death certificates as defined according to coding rules of the WHO (35). One underlying cause of death is identified and defined as the disease or injury that initiated the pathological chain resulting in death; or the circumstances surrounding the accident or act of violence that caused a lethal injury. Other relevant diagnoses are assigned as contributory causes of death. Underlying and contributory causes of death are recorded in the Cause of Death register (CDR), a record maintained by the National Board of Health and Welfare. This register includes all residents, whether or not the person in question was a citizen or was present in Sweden at the time of death. However, undocumented migrants and those who died while seeking asylum or visiting Sweden are not included.

Sweden's official statistics on maternal mortality, reported to the WHO by the National Board of Health and Welfare, are based on the underlying cause of death. Thus, only deaths with an underlying cause of death identified in ICD-9 chapter XI (codes 630-676) or ICD-10 chapter XV (codes O00-O99) are reported as maternal deaths. The thought behind this policy is to capture deaths directly associated with a pregnancy, whereas death caused by an

aggravated pre-existing condition will be assigned the same code as the primary disease. For example, when a woman dies from an intrapartum myocardial infarction, the underlying cause of death will most likely be coded as cardiac disease (ICD chapter IX), and the pregnancy as a contributing cause of death. She will not be reported as a maternal death, although the definition of a maternal death clearly embraces this indirect death.

Internationally, different methods have been used to overcome the problem of underreporting maternal mortality. In a recent WHO report, an adjustment factor of 1.5 is applied to account for the misclassification of maternal deaths in countries with a civil registration characterised as complete, with good attribution of cause of death (9). This adjustment factor is the median of underreporting of maternal deaths in civil registration based on available studies. Early pregnancy deaths, deaths in later postpartum period, deaths at extremes of maternal age (youngest and oldest), and indirect deaths caused by miscoded cerebro- and cardiovascular diseases are the most common cases not reported as maternal death (43, 60, 61). The benefits of routine linkage of births and deaths registers have been shown to be useful in several studies (42, 44, 46, 60, 62), and this practice has been implemented in Denmark. Confidential enquiries are systematic multi-disciplinary anonymous investigations of maternal death which identify the numbers, causes and avoidable or remediable factors associated with them (41). In several countries, confidential enquiries have been able to identify more maternal deaths than the civil registration (21, 27, 43, 62).

Counting maternal deaths alone does not save lives, and, in contexts with small numbers of maternal deaths, it is not always possible to demonstrate statistically significant changes and draw conclusions from maternal death rates. The UK Confidential Enquiries began in England and Wales more than 50 years ago (25), and have since thoroughly reviewed each maternal death case, audited suboptimal factors, created hypotheses, shown trend lines, and made recommendations to improve maternal health. In their latest report, which has been disseminated internationally, the dramatic decrease in thromboembolic deaths is ascribed to recommendations made from earlier reports (22, 25). Confidential enquiries is an approach for reducing maternal mortality assessed by WHO to be the methodology that has the potential to make the greatest impact on the largest number of women's lives (41). However, national enquiries have been criticised for the limited evidence as to the impact their recommendations have had on improving the safety of health care, and the high costs for running them (63). Nevertheless, the UK Confidential Enquiries serve as the gold standard for other national groups performing confidential enquiries into maternal death (21, 28, 62, 64, 65). The Swedish Society of Obstetrics and Gynaecology (SFOG) Maternal

Mortality Group was formed in 2007, and has thus far assessed between five and seven deaths yearly, reported from obstetrics and gynaecology departments, but a routine linkage system of registers is not yet in place. The Nordic Federation of Societies of Obstetrics and Gynaecology (NFOG) maternal mortality collaboration (Sweden, Denmark, Finland, Iceland, and Norway) was established in 2011, increasing the possibilities of following trends in a population with almost 300 000 live births per year (66).

Reproductive health among immigrants

As most European societies are today, Sweden is a country with many minority groups. Sweden's 1.5 million foreign-born residents constitute 15% of its population (67). Following the labour immigration of the 1950s and 1960s, new waves of refugees from conflict zones in both European and non-European countries began to arrive (68, 69). The official Swedish definition of an immigrant is a person who was born in one country and has migrated to Sweden, irrespective of age or cause of migration (70). The ethnic background of immigrants could also be defined by country of birth of the parents (71), nationality (28, 72), or self-selected ethnic group or race. The latter is commonly used in studies from the U.S. (19, 73) and UK (25). In Sweden, persons of foreign background are defined as those who were born in Sweden, but who have either one or both parents who were born abroad (70).

Substantial inequalities in mortality between ethnic groups have been reported from several countries (74, 75). The mortality risk of immigrant populations may be higher or lower than the native population, and can vary greatly by cause of death, cause of migration, origin, sex, and age (69, 76-80). As do all people, migrants carry with them 'footprints' of the genetic, socioeconomic and cultural environments of their countries of origin (69, 81), although some studies suggest that socioeconomic position and social network in Sweden may be even more important for health and health care utilisation (82, 83). The self-rated psychiatric and somatic health is lower among immigrants than Swedish-born women (84). Those coming from LICs may bring with them diseases common in their countries of origin, such as rheumatic heart disease (85, 86), anaemia (87), vitamin D deficiency (88, 89), and infectious diseases (90-92), disparate from what is usually seen in Swedish women today.

Women who have migrated from LICs to Europe are reported to be at higher risk for maternal adverse outcomes as compared to native women. A recent meta-analysis of the level of risk for immigrants to suffer a maternal death in Western Europe was doubled as compared to native-born women (29). Over

the last decade the Confidential Enquiries in the UK have consistently shown that maternal deaths are more common among 'Black' African mothers, including women from LIC settings in sub-Saharan Africa, are significantly more prevalent and have more frequently resulted from direct deaths when compared to 'White' British-born women (22, 25). Increased maternal mortality rates were found in the Netherlands for women born in sub-Saharan Africa or Asia, with an odds ratio (OR) of 3.3 (95% CI 2.3–4.8) reported between 1996 and 2005 (18). In France the MMR for women with a sub-Saharan African nationality had an OR of 23.6 (95% CI 15.4–34.6) as compared to French women during the years 2003 to 2007 (28), while in Spain, they assessed a relative risk (RR) of 1.67 (95% CI 1.22–2.33) for all foreign-born women as compared to Spanish-born women in 1999 to 2006 (23). In Switzerland, the corresponding OR was 2.76 (95% CI 1.58–4.8) (27). Furthermore, several Scandinavian studies report higher perinatal deaths amongst immigrant women than in native women (76, 93-98). Severe maternal morbidity has also shown to be more common among immigrant women in HICs (50, 54, 55).

The care-seeking behaviours of Swedish immigrant pregnant women are reported to be different from those of native-born women, with a generally later first appointment booking and fewer planned visits to antenatal care, but more unplanned visits at the labour ward (97, 99, 100). The risk of instrumental delivery is increased for several immigrant groups (101, 102), while the use of epidural analgesia during labour is reportedly less common (103).

The objective of the Swedish health care system is to provide good health and good care on equal terms to the whole population (104). A recent report summarises that, although inequities in health are to a larger extent determined by inequities in society as a whole than by the results of the health care system, the latter carries a great burden (105). Substandard care has been shown to be disproportionately more common among non-Western immigrant women in cases of maternal and perinatal death (72, 93, 106, 107). Additionally, medical challenges are posed by immigrant patients with a spectrum of diseases that Scandinavian doctors and midwives may not be trained to recognise and manage (85, 88, 90, 101, 108), and the importance of awareness and preparedness to meet the linguistic and cultural challenges in the care encounter with a foreign-born woman may be neglected (106, 109-112). Essén et al. reported in 2002 that language barriers contributed to a higher perinatal mortality among women from the Horn of Africa living in Sweden (106). Since then, the issue of using professional interpreter services has been raised as one of the top ten recommendations to improve maternity services, based on an audit of maternal deaths in the UK (25). Swedish Law establishes that non-Swedish-speaking patients have the right to a

professional interpreter (104, 113). However, in Europe generally, getting care providers to consistently use interpretation services remains a challenge (112).

Furthermore, maternal pregnancy strategies, founded on experiences from poor health care and traditions in their countries of origin, may contribute to potentially avoidable adverse maternal outcomes after migration to Sweden (111, 114-117). One example is the fear of caesarean section among Somali women, a fear that is rational in their country of origin (111). Limited insight into these strategies by health care providers may contribute to the increased risk of adverse outcomes amongst immigrants, aside from the well-known obstetric risks.

From the ‘three delays’ to the ‘migration three delays’ framework

In 1994, Thaddeus and Maine (118) developed the ‘Three delays’ framework to identify obstacles to the provision and utilisation of high quality, timely obstetric care, assuming that a lack of timely and adequate care was the foundation of maternal death. The original model was developed for low-income, high-mortality African settings where giving birth at home is the norm; however, the three phases are posited by the authors as being viable across income contexts.

The three phases focused on the potential for delay occurring on the timeframe between a woman’s first suspicion of an obstetric complication and the outcome. A chronological order was emphasised. The first delay (Phase 1) is the decision to seek care, where delays mainly result from either perceived or actual barriers that create disincentives to act, such as having to negotiate with a partner involved in the decision-making process, or from a woman’s low status. These may influence an ability to judge the severity of a complication in relation to whether an appropriate care facility is accessible. Perceived barriers from negative expectations rely on a woman’s prior experience or those of others close to her. The second delay (Phase 2) consists of the infrastructure involved in reaching the health facility, where delays can result from the actual barriers of cost, bad roads, and lack of ambulances. Finally, the third delay (Phase 3) is the receipt of adequate treatment where the delays result from actual barriers at the health facility. This includes lack of skilled staff, technological equipment and medical supplies. Both actual Phase 2 and Phase 3 barriers, such as far distance to the health facility and the knowledge that the quality of care at the health-facility

is low, can act as Phase 1 barriers, reinforcing the disincentives to seek care (118).

To conceptualise sociocultural factors that can constitute barriers for the receipt of timely and high-quality obstetric care in a high-income setting among immigrant women who have migrated from a LIC to HIC (where facility-based care and childbirth is the norm), Binder et al. modified the original 'Three delays' to create the 'Migration three delays' framework (115), see Figure 1. The development of the migration framework was supported by interviews with immigrant African women and maternal care providers in an urban, Western European care context. Women avoid delays in an African context by overcoming both actual and perceived barriers. Maternal death results in situations when such attempts to avoid delays are not successful, and thus women are more likely to die while in pursuit of care rather than while at an actual care facility. In LICs, women's care choices are severely limited by a host of unavailable or inaccessible options. In Western high-income settings, however, maternal care options are more readily accessible, but a care-seeking immigrant woman may still be delayed because of her negative expectations (Phase 1), especially about care quality (Phase 3) resulting from her LIC experiences. She may not trust the new health care system (Phase 3), especially if she has heard rumours from her social network about quality of care in the new host setting (Phase 1). The combination of broken trust between the woman and the care provider (Phase 1) can combine with misconceptions about the care procedures and lead to low-adherence, delayed care-seeking, late-booking, or outright refusal of preventive interventions thereby restricting the woman's ability to receive high-quality care (Phase 3). Additionally, in contrast to the LIC African context where availability of transport is a major obstacle to reaching the maternal care facility (Phase 2), women in HICs do not experience this barrier. Instead, language discordance during the care encounter restricts the ability to reach the knowledge of the health care providers and thereby creates a problem of accessibility (Phase 2). This Phase 2 accessibility barrier is also reciprocal because it adversely affects the providers' ability to understand the woman and offer quality care in Phase 3.

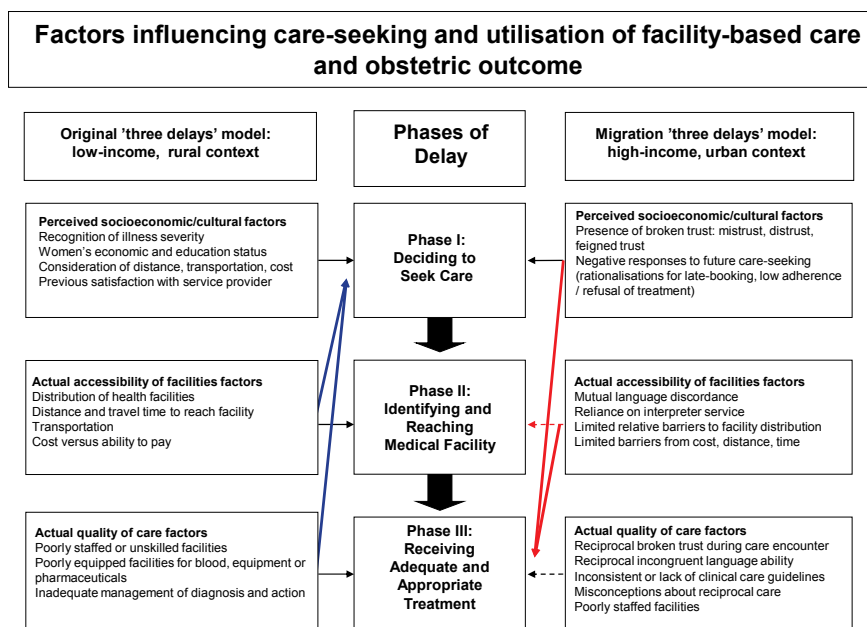


Figure 1. Factors influencing care-seeking and utilisation of facility-based care and obstetric outcome in low-income rural and high-income urban contexts (115). Reprint made with permission from *Social Science & Medicine*.

Quality of care and assessment of quality of care

Health care quality can be defined as:

... the extent to which health services provided to individuals and patient populations improve desired health outcomes. The care should be based on the strongest clinical evidence and provided in a technically and culturally competent manner with good communication and shared decision making (119).

Patient safety is defined as:

... the absence of the potential for, or the occurrence of, health care associated injury to patients created by avoiding medical errors as well as taking action to prevent errors from causing injury (120).

Patient safety is a cornerstone of high-quality health care. Three approaches have been emphasised in the patient safety literature: to prevent errors; to learn from the errors that occur; and to build on a culture of safety that involves health care professionals, organisations, and the patients (121). In

2011, Sweden enacted a new patient safety law that gives the care providers a clear responsibility to work systematically and preventively for improved patient safety and reduction of harm related to care (122). The caregivers are obliged to investigate events which actually did cause harm, or could have led to the harm of patients (122). ‘Root cause analyses’ of adverse events have become routine in Swedish health care services (123), and, in cases of severe events of care injuries, the caregivers are obliged to report those to the National Board of Health and Welfare, under a direction of a paragraph in the Patient Safety Act called ‘lex Maria’ (122). However, the science of how to measure preventable harm is still developing (124).

Quality of care assessment optimally includes the categories structure, process, and outcome (125). *Structure* denotes the attributes of the setting in which the care occurs and includes material resources, human resources, and organisational structure. *Process*, which denotes what is actually done in the giving and receiving of care. It includes the patients’ activities during seeking care and advice adherence as well as the care provider’s activities while making a diagnosis and recommending or implementing treatment. *Outcome*, represents the effect of care on the health status of patients and populations.

An audit could be defined as “the systematic critical analysis of medical care” (126) by which structure, process, and outcome can be assessed. A maternal mortality audit is a critical incident audit that begins with the occurrence of an adverse outcome (40). It can be performed at a number of different levels, the most basic of which simply records the number of deaths in an area. The next level of audit can result from assessing registered causes of death. The third level is to assess avoidable factors or suboptimal care (40). The basic assumption is that by examining an adverse event, solutions to the identified inadequacies will improve not only the quality of care provided for similar future cases, but also the quality of care provided for all other women (40). However, the scientific evidence of the audit’s effectiveness when it comes to improvement in clinical practice is thus far sparse (127, 128). The longest running and the most successful maternal audit is the UK Confidential Enquiries into Maternal Death (25). Because of the low *a priori* risk of maternal death, a thorough assessment of each case can provide important information on suboptimal factors in both structure and process (25). Based on this information, recommendations evolve and are disseminated to all maternal care providers, regardless of their involvement in a case, and implemented with the aim of improving their preparedness and patient safety.

Studying medical records is a widely used method to assess the quality of care. Three basic approaches to the recording of reviews are described:

implicit (holistic) review, explicit (criterion-based) review, and structured implicit review (129). In explicit review the care actually given is compared with a set of predefined criteria, which makes the method easy to reproduce and the inter-rater agreement high. When studying maternal death, the explicit review could be used for specific diagnoses, for which there are accepted standards for the care, like hypertensive disease in pregnancy (130, 131). However, in HICs, maternal mortality is rare, and a majority of deaths are caused by a disease or combination of diseases and events for which standards could not be specified. In the implicit review the reviewer judges the quality of care with his/her own internalised standards of good care, which allows freedom to judge care not covered by predefined criteria. The implicit review has been criticised for being idiosyncratic and reviewer dependent (132). However, this method could be improved by using the structured implicit review, where the reviewer is directed to look at specific issues and is instructed by information on the chart about where the reviewer should base any judgment. When all reviewers are guided to look at certain elements, without overly strict direction, the inter-rater reliability is enhanced, without losing the strengths of the implicit review (129).

Suicides during pregnancy and postpartum

The awareness of psychiatric disorders occurring during pregnancy and postpartum has increased considerably in recent years. The estimated prevalence of major depressive disorder is approximately 7% during pregnancy and 6% during the first three months postpartum (133). Women with bipolar disease constitute a particular challenge, as the risk for a manic/depressive or psychotic episode is substantially elevated postpartum (134, 135). The overall risk of developing a psychotic episode is increased during the first year after childbirth (136), and from 1/1000 to 2/1000 women are admitted to hospital due to puerperal psychosis (137).

Suicides are almost always associated with mental illness (138), and the suicide incidence has been reported to decrease in all groups in Sweden, except for women aged between 15 and 24 years (139). Despite a lower incidence of suicides among pregnant women and during the twelve months following delivery (140, 141), suicide remains one of the most common causes of death among women during the year following their pregnancy (13, 142). At no other time in their reproductive lifespan do women have more frequent contact with health care professionals. Because the objective of the provision of maternal health care is to identify and reduce risks and ill-health (143, 144), every suicide may represent a lost opportunity to diagnose and treat psychiatric illness.

Women who are not native-born in a specific setting are more likely to report symptoms of depression, post-traumatic stress, anxiety, and psychosomatic symptoms during pregnancy and postpartum (145-147), although there are studies showing that the opposite is true (148). Despite the known increased risk of mental symptoms among immigrants, a number of Swedish studies aimed at determining the prevalence of psychiatric ill-health excluded non-Swedish speaking women (133, 145, 149, 150). The screening of mothers at 6 to 8 weeks postpartum with the Edinburgh Postnatal Depression Scale (EPDS) is today recommended at Swedish child health centres (151), although a study from 2007 showed that it was rarely used for non-Swedish speaking mothers (152). At least some groups of foreign-born women (irrespective of pregnancy) seem to be at increased risk of committing suicide as compared to both Swedish-born women and other women in their countries of birth (153, 154). However, a recent Danish study did not find any difference in suicide incidence between immigrant or refugee women, as compared to native Danes (155).

Rationale for the project

Although maternal mortality in Sweden is low, surveillance remains important. Nevertheless, it is well-known that underreporting of maternal deaths is impeding its surveillance. Moreover, maternal death by suicide should optimally be included in the case surveillance. However, our present knowledge gap has yet to be filled about which women are dying as a result of suicide during pregnancy and after delivery.

Today, more than every fifth newborn in Sweden has a mother born abroad (156). This coincidentally represents women who are also well-known as being vulnerable to psychiatric ill-health and adverse perinatal outcomes. The elevated mortality risk among foreign-born parturients in other European countries is worth our attention, as is identifying potential causal relationships. Investigation into the quality of maternal health care for foreign-born women should therefore remain a top health system priority in Sweden.

Aims

The overall aim of this thesis is to study maternal deaths in Sweden with a focus on the foreign-born population.

The specific aims are:

- To analyse the causes of death in women of reproductive age and to seek a correlation between the underlying cause of death and country of birth 1988–2007 (Study I);
- To use the existing information in national registers and death certificates to acquire a more accurate number of maternal deaths in Sweden for calculating maternal mortality ratio and pregnancy-related mortality, 1988–2007 (Study II);
- To identify suboptimal factors of maternity care of women suffering a maternal death 1988–2010, and to explore these in relation to clinical care and sociocultural influences (Study III);
- To characterise the population of women who died as a result of suicide during and within one year after pregnancy in Sweden 1980–2007, from the maternal care perspective by analyses of: time trends and psychiatric disorders; and care, sociodemographic and obstetric factors (Study IV).

Material and methods

Table 1. Overview of the studies in this thesis. Study objectives, methods, periods, sources of data, and population

Study	Objectives	Study design	Study period	Source of data	Population
I	To analyse causes of death in women of reproductive age.	National register study	1988–2007	CDR	27 952 deaths of women of reproductive age
II	To use the information in national registers and death certificates to acquire a more accurate number of maternal deaths	National register study and review of death certificates	1988–2007	CDR, MBR, NPR and death certificates	478 women who died within one year after pregnancy
III	To identify suboptimal factors of maternal care preceding maternal death	Case-referent study with audit by structured implicit review	1988–2010	CDR, medical records	25 maternal deaths of women born in LIC and MIC and 50 Swedish-born maternal deaths
IV	To characterise women who died as a result of suicide during pregnancy and one year postpartum	National register study and review of medical records	1980–2007	CDR, MBR, medical records	103 deaths by suicide during pregnancy and one year postpartum

Study setting

All studies included in this thesis were performed in Sweden. Maternal care reaches practically all pregnant women (100, 157). The care, which is free of charge, is funded by taxes and almost all births occur in a hospital. Home deliveries account for less than 0.1% (157). Midwives and obstetricians have complementary roles and work in teams. Normal pregnancies and deliveries are managed by midwives. From 1980 to 2010, the mean age of primiparae has increased from 25 to more than 28 years, and for multiparae from 28.5 to

32 (158). The Body Mass Index (BMI) of pregnant women has increased, and in 2010 about 25% of the parturients were over-weight (BMI >25) and 12 % were obese (BMI >30) (158). The proportion of foreign-born women in the total population of women of reproductive age increased dramatically from 1988 to 2007, as shown in Figure 2. In 2007 17% of women of reproductive age were born abroad (67), and more than every fifth newborn had a mother born outside Sweden (156), although during the years 1988 to 2007, 15% of the newborns had a foreign-born mother.

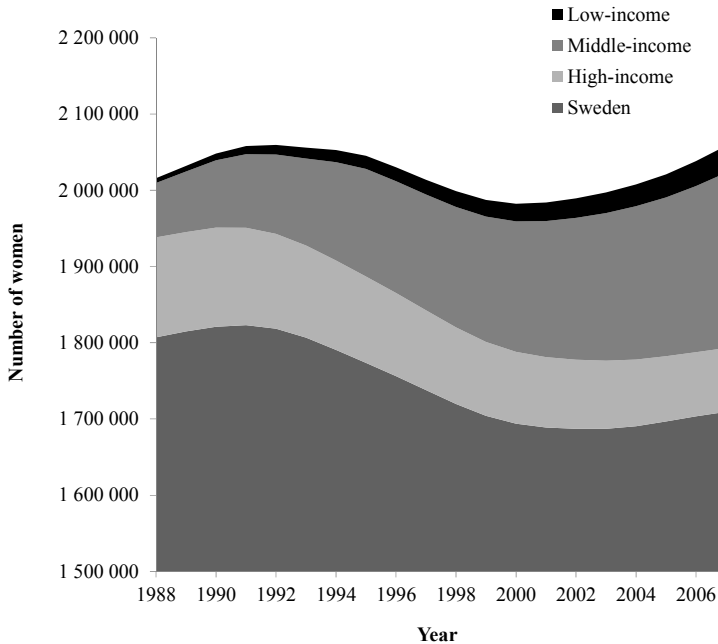


Figure 2. Composition of Swedish female population of reproductive age, 1988–2007, by country of birth (please, note that the y-axis begins at 1 500 000). Reprint made with the permission of the *European Journal of Public Health*

Study population

The base of all four studies in this thesis was the population of 27 957 female deaths of reproductive age (defined by the World Health Organization as 15 to 49 years old) in Sweden between 1988 and 2007, identified through the CDR. After excluding five women because of unknown countries of birth, 27 952 women born between 1939 and 1992 were included in Study I. Among these women there were 478 who had at least one diagnosis related to pregnancy within one year prior to death, and were included in Study II. From the population in Study II, a sample of 58

maternal deaths were included in Study III together with 17 maternal deaths from the years 2008 to 2010 obtained from the SFOG Maternal Mortality Group. The study population in Study IV was constituted by 73 suicides identified in Study II, and 30 postpartum suicides from 1980 to 1987 identified through an earlier study on maternal mortality (13), however the suicides were not earlier analysed (see Figure 3).

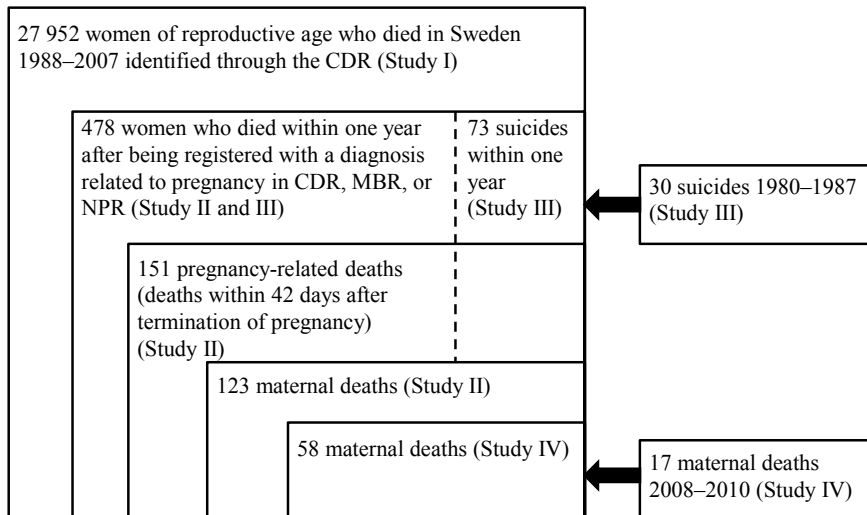


Figure 3. Study population

Methods

A person's country of birth is recorded in the Swedish Population Register and linked to the CDR, the Medical Birth Register (MBR) and the National Patient Register (NPR) by means of each resident's personal identification number. The deceased women in the studies of this thesis were categorised by country of birth according to the World Bank Country classification, based on the Gross National Income (GNI) in contrast to many studies grouping immigrants according to geographical regions. GNI is defined as the total value produced within a country (i.e. its gross domestic product) plus income received from other countries (interest and dividends), less similar payments made to other countries. Since GNI has been shown to be a major socioeconomic determinant of population health (159, 160), we hypothesised that women from poor countries would continue to be the most vulnerable group with regard to mortality after migration. The World Bank classification is revised every year, and we used the classification from 2007 (161) (Appendix 1), defining LICs to be those having a GNI per capita of

<936 USD, middle-income countries (MIC), often divided into lower and upper middle income, 936–11 455 USD, and HICs >11 455 USD. The most common HICs of birth among immigrant women in Sweden from 1988 to 2007 were Finland, Norway, Denmark, Germany and South Korea. The former Yugoslavia, Poland, Iran, Iraq and Turkey were the most common MICs, and Ethiopia, Somalia, Vietnam, Afghanistan and Pakistan were the most common LICs of birth in the population of women of reproductive age.

In Study I the underlying causes of death were grouped according to the chapters in ICD-10 (162) and the age-standardised mortality rate was calculated per 100 000 person years, using the Swedish-born women as a standard. RR with 95% CI for death and underlying causes of death were calculated in comparison with the Swedish-born group, using Poisson regression.

In order to identify all women who had been pregnant within one year before their deaths, the CDR, MBR, and NPR were linked in Study II. First, both underlying and multiple (contributory) causes of death of all deceased women of reproductive age in the CDR were reviewed. Second, the population was linked to the MBR to identify women who had given birth within one year before the death. Finally, by linking the population to the NPR women who had sought specialist care due to a diagnosis related to pregnancy were identified. Death certificates of all women who had given birth or who had had at least one pregnancy-related diagnosis in CDR or NPR were obtained. All information available in the registers and death certificates were reviewed to ascertain maternal deaths, classified as direct/indirect, early/late, or coincidental deaths. The number of maternal deaths identified through register linkage and review of death certificates was compared to the official number of maternal deaths, which counts the number of women who had a pregnancy-related diagnosis as an underlying cause of death in the CDR.

The analysis in Study I and the register linkage in Study II were performed with SAS version 9.2 and SAS Enterprise Guide 4.2 software packages (SAS Institute, Cary, NC, USA).

For Study III, all maternal deaths of women born in LICs and MICs (n = 26, but one was excluded because the medical record was not retrievable) were identified and each foreign-born case was matched with two Swedish-born maternal deaths. Medical records were obtained from all clinical departments where the woman had received care during her last pregnancy, delivery and postpartum period. A protocol was developed that applied both the ‘migration three delays’ framework (115) and a modified version of the Confidential Enquiry from the United Kingdom (163) (Appendix 2). The

medical records were summarised by two obstetricians independently. An audit group, comprising senior obstetricians, assessed whether the maternal death was direct or indirect. The audit group also identified and assessed suboptimal factors, categorised as being related to care-seeking (Phase 1), accessibility of services (Phase 2), or quality of medical care (Phase 3), by a structured implicit review (129). The severity of suboptimal factors were assessed as *minor* if it was a relevant contributory factor and an alternative care management strategy might have made a difference to the outcome, but the mother's survival was unlikely in any case. A factor was labelled as *major* if it contributed significantly to the death of the mother, and if the death could have most likely been avoided by different management of the case (25).

Fisher's exact test was used to compare suboptimal factors (major + minor) between Swedish-born and foreign-born women considering a *p*-value of <0.05 as being statistically significant. The analysis and interpretation of sociocultural factors involved the contribution of a medical anthropologist.

Antenatal and maternity records of 103 cases of suicide during pregnancy and within one year after delivery were obtained and reviewed in Study IV. Information on socioeconomic situation, somatic and psychiatric history, complications, medication, and care during pregnancy, delivery and postpartum period was collected. The data from medical records were complemented by data from NPR on all earlier psychiatric specialist admissions and out-patient appointments for each woman and from MBR on all pregnancies and deliveries. Socioeconomic background was compared to a reference population consisting of mothers of all live births in Sweden during the years 1980 to 2007 obtained from MBR, and differences were calculated using the chi-squared test considering *p*-values of <0.05 as being statistically significant. The chi-squared test was also used for testing for differences in psychiatric morbidity between women who died within six months as compared to 6 to 12 months after delivery. The analyses in Studies III and IV were performed with IBM SPSS statistics for Windows version 20.0 (IBM Corp., Armonk, NY, USA).

Ethics considerations

Ethics approval for this study was not needed according to Swedish laws on ethical review, because all women included were deceased. The Regional Ethics Committee in Uppsala, Sweden, confirmed that the study did not fall into the category of research requiring ethical clearance [2008/381, 2009-01-14]. All heads of clinical departments where a woman had been cared for were asked for consent to share a copy of the medical records.

The medical records were handled confidentially. We strived to de-identify the cases with the intent that no deceased woman, her relatives, involved hospitals, or individual care providers would be recognisable.

Results

Between 1988 and 2007, total mortality for women of reproductive age decreased. However, mortality for this period was significantly higher among women born in LICs and HICs, and lower among women born in MICs, as compared to Swedish-born. The most common underlying cause of death in all groups was neoplasm, followed by external causes of death, mainly suicide and traffic accidents. Death as a result of infectious diseases or complications of pregnancy and childbirth was uncommon, but among women who died of those diseases, large differences were found between the Swedish- and foreign-born women.

The age-standardised mortality rate for maternal death, according to the official method for identifying such death (i.e. reviewing the underlying cause of death), was 0.2 per 100 000 person years during the study period. Nevertheless, women born in LICs were found to be more likely to die due to diseases and complications related to pregnancy and childbirth at a RR of 6.6 (95% CI 2.6–16.5) as compared to Swedish-born. For women born in MICs and HICs no difference in risk compared to Swedish-born women was found. The risk of women born in LICs to die of infectious diseases was 15-fold, which could partly be explained by an uneven distribution of deaths from HIV/AIDS, but the risk remained 7-fold even after excluding HIV cases. Women born in LICs were also at a slightly higher risk of dying from malignant neoplasms. As compared to Swedish-born women, women born in HICs were at a higher RR of death due to diagnoses categorised in ICD as ‘mental and behavioural diseases’ (mainly alcohol and drug misuse), ‘external causes’ (suicides and accidents), and diseases of the circulatory system. In contrast, women born in MICs were at a lower risk of dying due to alcohol and drug misuse, and diseases of the circulatory system.

The total of 75 women who were registered with an underlying cause of death due to complications of pregnancy, childbirth and the puerperium (ICD-9 chapter XI and ICD-10 chapter XV) constituted the official number of maternal deaths in Sweden from 1988 to 2007, giving an MMR of 3.6 per 100 000 live birth. Through stepwise linkage of registers and review of death certificates we identified 123 maternal deaths, which is 64% higher than the official figure. In addition, two late maternal deaths and 75 suicides

occurring during pregnancy or within one year after delivery or early pregnancy loss were identified.

The MMR during the years 1988 to 2007 was 6.0, and for women born in Sweden 5.9, HIC 5.5, MIC 4.7, and for LIC 21.1 per 100 000 live births. Ratios over time for all, Swedish-born women, and women born in LICs and MICs are illustrated in Figure 4. The pregnancy-related mortality was 7.3 per 100 000 live births.

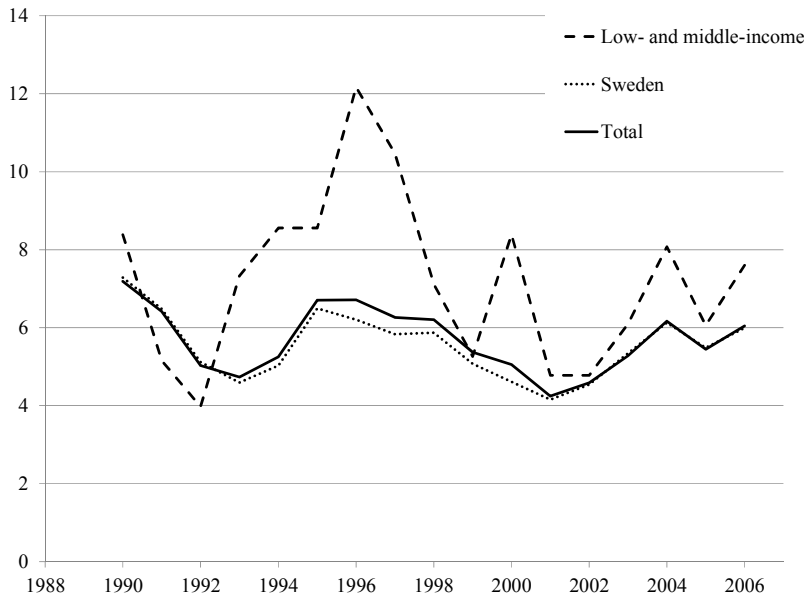


Figure 4. Maternal mortality ratio in Sweden 1988–2007 by country of birth. Sliding five year mean values

The care preceding the death of 73 direct and indirect maternal deaths that occurred between 1988 and 2007 was reviewed, and major and minor suboptimal factors were found to be associated with the majority ($n = 51$). In 36 assessed deaths at least one major suboptimal factor was identified, and hence the deaths were assessed as potentially preventable. In the remaining 15 cases, there were no major but at least one minor suboptimal relevant factor identified. Overall, significantly more suboptimal factors occurred in the care of the foreign-born women. Phase 1 factors (related to care-seeking) and Phase 3 factors (quality of medical care) occurred in both Swedish- and foreign-born women, but were significantly more common among the foreign-born women, whereas Phase 2 factors (related to accessibility of services) occurred in foreign-born women only.

Non-compliance (such as failure to turn up at follow-up appointments) was the most common Phase 1 barrier to optimal care-seeking, assessed as a major factor in three women and as a minor factor in seven, followed by late- or non-booking, and unhealthy lifestyle (substance misuse). Late- or non-booking was a minor factor among foreign-born women, whereas the three women who had suboptimal factors, all major, related to their substance misuse were Swedish-born. None of the women had planned for a home delivery, although one Swedish-born woman with a history of substance misuse gave birth at home.

Limited language congruence created a Phase 2 barrier to accessing health care services among 13 foreign-born women, and their care providers. In ten cases language incongruence was assessed as a minor factor, whereas in three it was a major factor, that is, it contributed significantly to the death of the mother, and could have most likely been avoided by different care management.

Among the Phase 3 barriers, inadequate care was the most common contributor (31 major and 18 minor) in both groups, but more commonly occurring among the foreign-born women. Inadequate care included missed or delayed diagnosis, and inadequate treatment. Delays in consultation or referral was the second most commonly occurring barrier in Phase 3, assessed as being a major factor in 16 women and minor in 8, followed by delayed treatment, in the category 'appropriate care, but too late'. There was no difference in occurrence of the other suboptimal Phase 3 factors, such as: consultation or referral; appropriate care, but too late; miscommunication between care providers; and limited use/priority of resources, between the groups. Among the foreign-born women, the influence of delay-causing barriers from Phase 1 and 2 on Phase 3 could not be ignored. To demonstrate, out of 14 cases of major inadequate care, 10 also had Phase 2 barriers from, for example, limited language congruence, and 8 of these also had Phase 1 barriers, including non-compliance or late-booking.

Four foreign-born women had medical conditions that most probably originated in the LICs of their birth. Only one woman was HIV-positive, although she died of a rheumatic heart disease. Two women died of complications caused by tuberculosis, and one woman who had recently arrived in Sweden suffered from severe chronic anaemia.

One-hundred-and-three suicides during pregnancy and within one year postpartum were identified between 1980 and 2007, corresponding to a ratio of 3.7 suicides per 100 000 live births during the entire study period. The rate did not change over time. In comparison to the background population (consisting of mothers of all live births in Sweden during the study period)

the women who committed suicide were significantly more often >35 years, smoked, lived alone, and were born in LICs or MICs.

Nearly half (48/103) of the women had a psychiatric history, either recorded in the antenatal records, in the NPR or both. Although almost all of these women had experienced at least one hospitalisation due to mental illness, the psychiatric history it was not documented in the antenatal record of 18 women. Seventeen women had sought specialist care due to an injury caused by intentional self-harm between 2 and 17 years before the index pregnancy, but only three suicide attempts were documented in the antenatal records. Thirty-one women received psychiatric care during pregnancy. Despite evidence that psychiatric disorders were common in these women's medical histories, and one-third received psychiatric care during pregnancy, only 20 women had a documented plan for psychiatric follow-up at discharge from the maternity ward. Nevertheless, half of the women received psychiatric specialist care in between discharge and death according to the NPR. One-fourth of the women expressed no indication of psychiatric disorder, either in their medical records or in the NPR.

The number of women who died as a result of suicide within the first six months was equal to that at 6 to 12 months postpartum, but women who took their lives within the first six months more often used violent methods of suicide. Furthermore, women who died as a result of suicide during the first six months less often had a psychiatric history prior to pregnancy as compared to the women who died from 6 to 12 months postpartum. The proportion of foreign-born among the women who died as a result of suicide increased from 5% during the first half of the study period to 32% during the latter half. A language barrier was documented in three cases, although a professional interpreter was only used in one.

Discussion

Maternal mortality in Sweden from 1988 to 2007 seem to be rather stable, despite increasing age of the parturients, increasing prevalence of obesity, and a substantial influx of foreign-born women. Nevertheless, the gap between the lines of the total maternal mortality and the maternal mortality of Swedish-born women illustrates the elevated maternal mortality among foreign-born women. Despite small absolute numbers, the MMR for women born in LICs was 6 to 7 times higher than that of Swedish-born women. Underreporting of maternal deaths was shown to be substantial: as compared to the official statistics, 64% more maternal deaths were identified. Major and minor suboptimal factors related to care-seeking, accessibility and quality of care were found to be associated with a majority of maternal deaths and significantly more often with foreign-born women. The rate of suicides during pregnancy or within one year after delivery did not change during the last three decades, and was higher for foreign-born women. A majority of women who died as a result of suicide had been under psychiatric care, but documentation at antenatal care was inconsistent, and planning for follow-up postpartum was generally lacking.

Classification of maternal deaths

Doubtless, maternal mortality in Sweden is among the lowest in the world, although both inconsistencies in definitions and underreporting of maternal deaths complicate the comparison between countries. We found 64% more maternal deaths than the 'official' number reported, which is equivalent to the adjustment factor that is applied by WHO to account for misclassification of maternal death in countries whose civil registration otherwise is characterised as complete (9). We identified flaws on three different levels. The first was that the pregnancy was not always recorded on the death certificate. Either the doctors completing these death certificates were unaware of the recent pregnancy, or they failed to recognise the importance of recording associations between a death and a pregnancy. Furthermore, we found cases where the pregnancy was recorded on the death certificate, but not coded in the CDR. Finally, although codes for indirect maternal death exist in ICD-10, the ICD-rules for assigning an underlying cause of death seem to aim at identifying direct maternal deaths only, not

indirect, and thus do not follow the ICD definition of a maternal death (35). However, we found that direct as well as indirect maternal deaths were registered as maternal death. At the same time, both direct and indirect maternal deaths were missed.

The proportion of late maternal deaths is probably higher in HICs, where the MMR is low, than in LICs and MICs, owing to high-quality care (164). Identifying late maternal deaths can be expected to be even more complicated than for the early deaths. On average, in ICD-10 datasets, less than 2% of maternal deaths are coded as late maternal. We identified two late maternal deaths only (0.6%), and it can be questioned whether review of register data and death certificates would sufficiently identify an accurate number of those deaths.

In Sweden, the absolute number of maternal deaths is so small that it could be questioned whether it is important to know whether four or six deaths occur yearly. However, it is important to illuminate the different levels where flaws occur in maternal death reporting, including in Sweden with its high-quality civil registration. Furthermore, the necessity to distinguish between direct and indirect maternal deaths needs to be highlighted (165, 166), because interventions for averting direct deaths do not necessarily reduce the indirect deaths, and vice versa. Therefore, when addressing the burden of maternal mortality in a particular context, by planning, monitoring and evaluating interventions for improving maternal health, analyses by disaggregating direct and indirect maternal deaths are essential. Accurate differentiation of direct and indirect maternal deaths requires the existence of specific mechanisms, not only for identifying and counting maternal deaths, but also for collecting detailed information on the cause of death. This presents a considerably greater challenge, than simply measuring and reporting all-cause maternal mortality, which, as previously discussed, is already difficult (166).

Review of all diagnoses in the CDR, together with linkage of the CDR and the MBR, showed to be effective in identifying additional maternal deaths. The linkage of the CDR to the NPR did not add equally as many maternal deaths, although this linkage is important to identify deaths after early pregnancy loss. Exclusion of legal abortions from the Swedish NPR inhibits studies on mortality after legal abortions, a method which is possible in other countries, for example, Finland (141). Register linkage needs to be supplemented by the examination of death certificates, or medical records, in order to differentiate direct and indirect maternal deaths. This process is time-consuming and requires obstetric expertise. With the publication of ICD-10, WHO recommended in 1991 the inclusion on death certificates of a checkbox of questions regarding current pregnancy and pregnancy within

one year preceding death (35), and this has been implemented other high-income settings (28, 167), however, not in Sweden. In France, a checkbox was introduced in 2000 and was expected to increase the number of previously unidentified maternal deaths, but it did not (28). In Maryland, the checkbox identified nearly all maternal deaths and about half of other deaths, such as suicides, accidents and homicides, occurring during the first year postpartum (167).

Precise classification of direct and indirect deaths depends on accurate assignment of cause of death. Knowing the pathology behind the cause of death is equally as important as knowing the death rate (40). As mentioned in the introduction, the thoroughness of the cause-of-death investigation varies greatly. In Study III we identified cases in which the quality of autopsy could be questioned which hampered the identification of cause of death. Some cases of sudden unexpected death also fulfilled the criteria for the need of forensic autopsy according to Swedish law, but these were then not performed (59). This finding suggests that some clinicians have limited knowledge about laws regulating post-mortem examinations. It also occurred that some of the relatives of the deceased women opposed autopsy. However, although the will of relatives normally should be respected, if the cause of death is unknown, the legal right to perform it remains intact despite opposition from the relatives (58). The importance of high-standard maternal autopsies are emphasised in the latest UK maternal mortality report, and the recommendation is that maternal autopsies should be centralised to develop national centres of expertise (25).

As mentioned earlier, suicides are not included in the current WHO classification of maternal deaths. The WHO Working Group on Maternal Mortality and Morbidity Classifications suggests that in coming classification, antenatal suicides and suicides related to chronic psychiatric disorders will be classified as an indirect maternal death, whereas postpartum suicides due to postpartum depression or psychosis, as well as postpartum suicides for which associations to psychiatric disorder is unknown, will be classified as direct maternal deaths (Lale Say, personal communication, October 27 2009). While we can expect it to not always be easy to assign a suicide as a direct or an indirect maternal deaths, this change in the classification acknowledges the associations between pregnancy, psychiatric disease and death as a result of suicide, which is a great progress. Surveillance will hopefully be simplified, and the knowledge gap filled about the contribution of psychiatric disorders to the global burden of maternal mortality.

Maternal death and country of birth

The composition of the population of women of reproductive age has changed dramatically in Sweden during the last 25 years. The multi-cultural population adds new dimensions to the challenges of providing good health and good care on equal terms to the whole population (104). Although our hypothesis suggesting that women from LICs would continue to be the most vulnerable group with regard to mortality after migration seems to be true, there seem to be more complex associations between country of birth and death in women of reproductive age from MICs and HICs.

The six- to seven-fold increase in risk of death due to complications of pregnancy and childbirth among women born in LICs, as reported in Study I, was based on the underlying cause of death only. However, the additional deaths identified in Study II were proportionally distributed between Swedish- and foreign-born women. This means that after also correcting for underreporting, the risk of maternal death among women born in LICs seems to be several times higher than that for Swedish-born women. Such differences in maternal mortality have earlier been reported in other European settings (14, 18, 20-29). However, ours is the first study confirming a corresponding difference in Sweden. We set out in Study III to find explanations for this difference.

Medical factors

One hypothesis for explaining the increased risk of maternal death among immigrant women could be that they bring with them medical conditions originating in their country of birth. Study I reported a substantial increase in risk of dying from infectious diseases, and especially HIV/AIDS, for women born in LICs in comparison to Swedish-born women of reproductive age. However, among the maternal deaths in Study III we identified only one foreign-born HIV-positive woman, and she died of a rheumatic heart disease and not from the HIV infection. Two foreign-born women died of complications caused by tuberculosis (TB), but the number of women who died of sepsis was too small to enable analysis of risk related to country of birth. National guidelines for antenatal care advocated generous HIV testing (143, 144), and it is less likely that pregnant women may have been missed.

Four women in total, who were born in LICs, primarily sub-Saharan Africa, died of diseases not usually seen in Sweden. In all four cases we found a limited professional insight into those diseases. This finding illustrates the importance of improving knowledge about rare diseases complicating pregnancies, such as TB, rheumatic heart disease and severe anaemia, which have lately returned to European obstetrics (85-87, 90, 92). Furthermore,

other premorbid risk factors, such as hypertension, type 2 diabetes and obesity, may increase the risk of severe pregnancy complications in some groups of immigrant women (168). The prevalence of hypertensive diseases of pregnancy has been found to be increased among sub-Saharan African women in France (72) and among African-American women (169), which may imply a higher risk of severe complications such as eclampsia, HELLP, DIC, cardio- and cerebrovascular diseases (25, 50, 168). Limited care provider insight may also conflict with women's limited insight into identifying potential risks to her pregnancy (114). Health care providers need increased skills not only in recognising but also in interpreting symptoms experienced by immigrant women and should appreciate that immigrant women have other medical needs than those expected for native-born women. Education of health care professionals should not stereotype women's care needs based upon presumed sociocultural barriers (112). If the care provider's focus relies too much on presumed cultural factors, the appropriate obstetric needs might be obscured by the interjection of culture-based misperceptions. Further, over-emphasising the culture behind a health issue might ultimately hand the problem over to the patient as a private matter and neglects the fact that women simply want to receive competent care (112).

Care-seeking

Sub-optimal factors related to care-seeking, such as late-booking and non-compliance, were more common among foreign-born than Swedish-born women, and in six cases such factors were assessed as major. However, it is difficult to reconstruct a woman's decision-making processes around her choices to seek care. The medical records can only document her registered contacts with a care centre, which become the perspective of the care provider, and from these we can presume whether or not a woman chose to comply. Socio-cultural explanations for delays to care-seeking have been theorised as the 'maternal migration effect', describing how factors related to the pre-migration experience, have the potential to influence women's obstetric choices after migration to a new setting (114). Other factors delaying care-seeking and utilisation of maternal care include mutual broken trust between the woman and the care giver during the care encounter, which is also exhibited as women's non-compliance/limited adherence to treatment advice and refusal of care, as well as care provider frustration at not being able to impart quality care as a matter of course (111, 115). These negative influences on care-seeking have the potential to delay the provision of optimal preventive advice as well as timely referral. All patients receiving care in Sweden have the right to decline care (104). However, limited guidelines exist for helping professionals to manage situations when this occurs (116).

It is worth noting that for three of the Swedish-born referents, but in none of the foreign-born cases, substance abuse was assessed as a major suboptimal care-seeking factor.

Accessibility of services

In rural low-income settings, delays to accessing the health care facility occur regularly due to such absolute factors as cost and poor transportation infrastructure. In our HIC material, there was one occasion when an ambulance was delayed, but this was due to language problems, assessed as a minor suboptimal factor. All other patients reached the health care facility without transport-related delays. Accessibility problems arose once they came into care. The ‘migration three delays’ framework offers the ability to model how language discordance acts as a negative influence to accessing optimal care. Despite both persons being present during a care encounter, the care provider cannot access the medical history, a component which is essential to make the right diagnosis, whereas the patient cannot access the knowledge and advice from the medical expertise because she cannot interpret or sufficiently describe her symptomatic history. Limited language congruence was assessed as a contributory factor in 13 out of the 25 foreign-born women, and in three of these as a major factor, that is, assessed as actually contributing to the death.

It seems as if the legal right to professional interpretation for non-native speaking persons (104, 113) is not always incorporated in the care management strategies. In one of the reviewed medical records, the midwife responsible documented that she had difficulties in understanding an English-speaking woman, which reminds us about the reciprocity of the language barrier. Optimally, there should be no need to call attention to the impossibility of taking a proper medical history from a person who does not speak the same language, but unfortunately it is, apparently, not a matter of course (25, 106, 112).

Maternal death and quality of care

In total, major or minor suboptimal factors were associated with two-thirds of the maternal deaths, and more commonly among foreign- than Swedish-born women. In nearly half the deaths we found at least one major suboptimal factor. Hence these deaths were assessed as potentially preventable. Suboptimal quality-of-care factors (Phase 3) were the most commonly occurring.

Suboptimal outcome does not necessarily imply suboptimal care and suboptimal care does not always result in suboptimal outcome. Two Swedish case-control studies showing associations between intrapartum substandard care and metabolic acidosis and low Apgar score respectively, also showed that substandard care was present in up to 40% of the controls (170, 171). The field of obstetrics is characterised by the possible need for urgent interventions. Some maternal deaths are truly sudden and catastrophic, in the sense that they could not have been predicted or prevented, and the course of events is too rapid to enable interventions to save the woman's life (172). However, a majority of the deaths are preceded by warning signs and a period of instability during which timely interventions may have helped to avoid the disaster. Interventions averting severe maternal complications usually require more than individual care providers' medical knowledge and necessary technological equipment, but also a well-functioning surrounding infrastructure. Adverse events usually result from several coincidental factors and mistakes that occur on several levels of the organisation (173) which underscores that patient safety work needs to involve health care professionals, as well as organisations, and the patients, to build a strong safety culture (121, 174).

Among the Phase 3 facility-based delays, the most common suboptimal factors were grouped under the heading 'inadequate care', and delayed treatment or misdiagnosis was the most commonly occurring event. In some cases, evidence-based treatment for hypertensive disorders or sepsis was delayed or inadequate. This finding is consistent with substandard care reported from other European countries (25, 130, 131), and illustrates that insufficient knowledge about current guidelines may occur, or that action is delayed for some reason. Early warning systems, such as the modified early obstetric warning system (MEOWS) which recently has been introduced at maternity wards in Sweden, provide support in identifying emerging complications (22, 175) although further validation is claimed to be needed (176).

Clinical decision-making is a complex process, and several of the cases in which the diagnosis was delayed or missed suggest cognitive errors of the care providers. The most evident was 'search satisfying', which is when the care provider becomes satisfied with an investigation once a single diagnosis is identified, even if it is not the root cause of the problem (177). 'Anchoring' and 'diagnosis momentum', terms meaning that a diagnosis is put too early in the diagnostic process and that once diagnostic label is attached to a patient it tends to remain there, even though additional data contradicts the given diagnosis, could also be identified. 'Omission bias', that is, the tendency toward inaction rooted in the principle of non-maleficence, resulted in some cases in delays labelled as 'appropriate care,

but too late'. The awareness of cognitive errors and strategies to minimise them have gained increasing attention in the literature during the last decade, but have not been sufficiently recognised in clinical training (177, 178).

Delays in consultation and referral occurred in one-third of the women, and could be described as a problem on both individual and structural levels. There were examples of cases admitted at a university hospital, where all necessary resources were available, but due to insufficient communication and dubious prioritisations, the right specialist did not investigate the patient, or the patient did not reach, for example, the intensive care unit, in time. In the larger cities we identified delays in care for a few women who were moved between hospitals, due to the fact that different medical specialities were available at different hospitals.

Communication between health care providers failed and contributed to the suboptimal care management of nine of the reviewed maternal deaths. Communication failures were associated with other delays and over-lapping may have occurred with factors described as, for example, delayed referral and limited use/priority of resources (179). In one of the cases, the obstetrician and the two anaesthesiologists spoke different Nordic languages and did not completely understand each other, which created misunderstanding based on an actual language barrier. In the other cases the health care providers all spoke Swedish. Teamwork training is known to improve patient outcomes (180-182). However, less is known about how to optimise team performance when the team may include varying professionals from different disciplines that may change over time (183), which sometimes occurred among the reviewed maternal deaths. A striking finding was that anaesthesiologists' documentation was often missing from the medical records, despite their known active involvement in many obstetric emergencies.

Greenberg et al. have studied how communication breakdowns pose a threat to surgical safety (184). The most common occurrence involved 'information never transmitted' and 'information was communicated but inaccurately received'. Frequent risk situations were handoffs and transfers of patients, and ambiguity about roles, responsibilities, and leadership were contributing factors. Our result supports that Greenberg's findings may be also valid for obstetric care. Standardising the content and format of communication activities and handoffs, such as using the concept of SBAR communication (Situation, Background, Assessment, and Recommendation) (185), is suggested to increase patient safety (182, 186), and has recently been introduced at Swedish hospitals (187, 188).

Suicides

In parallel with other studies, a majority of the women who died as a result of suicide during and after pregnancy had previously received specialist psychiatric care, and we found psychiatric morbidity prior to pregnancy common (25, 142). Although very few of all women presenting with psychiatric symptoms will die as a result of suicide, Study III shows that antenatal care has failed to take a proper psychiatric history in one-fifth of the women who died as a result of suicide. Taking psychiatric history at antenatal care is a challenge because women with psychiatric disorders may not be willing to share such events of their history with the health care provider. It is important that the health care providers have enough knowledge to identify severe psychiatric disorders and to improve their skills on interviewing women about this sensitive issue (143, 189). Serious psychiatric illness in the last few weeks of pregnancy and the first few weeks following childbirth have a tendency for sudden onset and rapid deterioration, and perinatal psychiatrists in the UK recommend that those at risk should be proactively managed (25, 190). Despite the well-known risk of many psychiatric disorders to deteriorate after delivery, only a minority of the women with psychiatric disorders prior to or during pregnancy had a documented follow-up plan at discharge from the maternity ward. Such follow-up plans are recommended by the SFOG guidelines from 2009 (189). The collaboration between psychiatry and maternal care was often deficient or non-existing. A suicide attempt constitutes a life-long risk factor for suicide (138). Our findings suggest a potential for improvement in taking psychiatric history in maternal care. The common use of violent methods in postpartum suicide has been noted earlier (13, 25, 140, 142). However, the differences in both pre-pregnancy psychiatric morbidity and method of suicide between women who died as a result of suicide within 6 months and from 6 to 12 months of delivery suggest that they have different risk profiles.

To our knowledge, an increased suicide risk during pregnancy and postpartum among foreign-born women (born in MICs and LICs) as compared to native-born women, as reported in Study IV, has not been shown previously. The social and psychiatric vulnerability of immigrant women in terms of psychiatric ill-health is well documented (145-147), as is the increased risk of partner violence among immigrant women (191). Since psychiatric vulnerability and experiences of intimate partner violence are known risk factors for death by suicide, these women need special attention. The special needs of immigrant women have been regarded in national guidelines for maternal care (143, 144) published during the study period. Again, we identified deaths of non-Swedish-speaking women for whom no professional interpreter was used at antenatal care, a situation which is unacceptable.

Screening women for depression with EPDS at 6 to 8 weeks postpartum, as recommended in Sweden (151), aims at early detection of women without prior depressive symptoms, which is important for the woman's well-being and the development of the child (192), although there is no knowledge about whether it reduces the number of suicides. EPDS is today validated for a number of foreign languages (151), although some of the most common languages among immigrants in Sweden are still missing and no recent studies were found on the coverage of the screening (152). However, EPDS is a screening instrument, and should not replace proper risk identification and care management plans for women with symptoms or disorders already identified during pregnancy or postpartum (22).

Strengths and limitations

The study setting is characterised by a homogenous, public, tax-financed health care organisation. The studies of this thesis are national and population-based, based on national registers known for maintaining high international standards of accuracy (193-195). Register linkage was possible through each resident's personal identification number. Complete medical records were available for a majority of the reviewed deaths. Experienced obstetricians reviewed the medical records, with assistance from specialists in cardiology, infectious diseases, neurology, pathology, psychiatry, and medical anthropology. A conceptual framework based on qualitative research was used for interpreting the suboptimal care of the audit procedure.

The main limitation of the studies in this thesis is the small sample size and the extended time period. However, these unique data are validated by having tracked the deaths nationally and by representing nearly completed record materials. The recruitment of cases represents an extended calendar period, which can be regarded as a limitation because both recording processes and clinical routines evolved during the study period. However, the long inclusion period was necessary in order to gain an utilisable sample size in this small population of Sweden.

We had no information on reasons for migration or number of years spent in Sweden. However, due to the small total sample size it could have been difficult to adjust for these factors. Socioeconomic situation was unknown for both foreign-born and Swedish-born women. We considered various socioeconomic indicators, such as disposable income or level of education, but we found these to be problematic. Because the studied population consisted of women of childbearing age, whose income might have been reduced due to parental leave, part-time work, or illness before their death,

their disposable income may not necessarily have accurately reflected their socioeconomic status. Education was another alternative socioeconomic indicator, but the misclassification of level of education is known to be bigger for foreign-born inhabitants than for Swedish-born and would therefore imply an error that was unevenly distributed between immigrants and native women (196).

The audit method enables determining the presence or absence of suboptimal care and thereby modifiable factors, thus generating new knowledge, especially in the case of rare events such as maternal death. It is, however, essential to be cautious when generalising the findings as true for all maternal care. We have no control group of women whose lives were saved thanks to optimal care or despite suboptimal care, although experiencing similar complications, a critique which also has been posed to confidential enquiries (63). As mentioned in the introduction, implicit reviews have been criticised for being idiosyncratic and reviewer dependent. However, explicit review with pre-defined criteria for suboptimal care was not an option, due to the nature of maternal deaths. Clinical practices evolved during the study period, but the majority of the suboptimal quality of care factors were not dependent on specific treatment strategies, but more often due to factors assessed as less dependent over time, such as delayed diagnosis or referral, and miscommunication. Apart from the development of clinical treatment strategies, the clinical documentation practices evolved over time. Medical records from the latter years of the study were more extensive and comprehensive, but more difficult to get an overview of than the medical records from the first years. Although we did our best in striving to review the care based on what information was available in each moment when a decision was taken, there is a risk of hindsight bias (177), because we knew the tragic outcome.

Access to psychiatric and primary care records would have given a more complete picture of psychiatric care of the women who died as a result of suicide. To assess the quality of psychiatric care was, however, beyond the scope of Study IV, and would have required a different study design. Moreover, Swedish psychiatric health care has been reorganised and decentralised during the 28 years covering study period. To retrieve psychiatric records would therefore have been extremely time-consuming and costly.

Implications and recommendations

For accurate maternal mortality statistics, including differentiating between direct and indirect maternal deaths, the current method for identifying cases is insufficient. Routine register linkage of the CDR and the MBR should be implemented, a policy which is also recommended by the Swedish Society of Obstetrics and Gynaecology Maternal Mortality Group (MM-ARG).

Although root cause analyses nowadays should be carried out after adverse events, the confidential enquiries of MM-ARG play an important role in spreading the knowledge gained from maternal deaths to maternal care providers nationally. The results from this thesis will thus increase the knowledge base of MM-ARG.

Every setting needs to find its own ways to combat suboptimal factors on the road to reducing the number of maternal deaths. The studies of this thesis suggest that it would be possible to further reduce maternal mortality in Sweden, despite already very low numbers.

The majority of maternal deaths are preceded by suboptimal care, both in a health care system approach and individual professional conduct. Cross-disciplinary collaboration, prioritisation of patient safety work, including ensuring good communication with *all* patients, and between health care providers, is crucial, irrespective of setting. Care providers should be trained in identifying cognitive mistakes and strategies to reduce them. Communication and teamwork skills avoid medical errors and ultimately save lives.

Non-adherence to the Swedish Administrative Act regulating non-Swedish-speaking inhabitants' right to professional interpretations services is remarkable. Despite the fact that more than ten years have passed since the first report on the associations between language barriers and perinatal adverse outcomes in Sweden, it still happens that maternal care providers try to communicate with non-Swedish-speaking women without a professional interpreter.

Non-compliance is not only the responsibility of the patient. The care provider has a responsibility to gain insight into possible misconceptions behind the behaviour.

During maternal care it is important to take into account that foreign-born women may carry with them health conditions nowadays rarely seen in Sweden. Obtaining a proper medical history includes gathering information related to the woman's health before, during, and after migration

As stated in the national guidelines, it is essential to identify women with a psychiatric pre-morbidity at antenatal care. A care management plan for follow-up postpartum should be mandatory for all women with a psychiatric premorbidity and women experiencing psychiatric symptoms during pregnancy. Foreign-born women constitute a vulnerable group in terms of psychiatric morbidity.

Conclusion

In conclusion, the MMR in Sweden was very low, but not really as low as the figure we reported to the WHO. To measure maternal mortality is difficult, but it is possible to acquire more accurate statistics by linking national registers. The risk of maternal death, as well as suicide during pregnancy and a year after delivery, is increased for women who were born in LICs. The elevated risk for maternal death could partly be explained by health conditions arising in the women's countries of origin, inadequate utilisation of professional interpretation services, and by an increased risk of inadequate medical care. More than half of the women who died as a result of suicide during pregnancy and within a year after delivery had a known psychiatric disorder, although this was not always observed by the antenatal care providers. In one-fourth of the suicides, there were no indications of psychiatric disorders in the medical records or the NPR.

Maternal deaths and suicides associated with pregnancy will continue to occur in Sweden. Some complications are brutally unpredictable and sudden, and will inevitably lead to death. We, who work as health providers in maternal care, will continue to make mistakes, because we are human beings. However, by studying the cases of the women who died, we can illuminate flaws in the health care process, which will hopefully lead to improvements for all pregnant women.

Sammanfattning på svenska – Summary in Swedish

Trots att 99% av alla mödradödsfall sker i låginkomstländer, händer det även i höginkomstländer att unga kvinnor dör på grund av komplikationer till graviditet och förlossning. Mödradödligheten i Europa har gått ned under flera decennier, men studier från flera europeiska länder samt USA har visat att nedgången har stagnerat och att mödradödligheten i vissa länder till och med har visat en svag uppgång. Utlandsfödda, särskilt kvinnor från Afrika söder om Sahara, har visat sig löpa högre risk för mödradöd än kvinnor födda i Europa. Detta har inte enkelt kunnat förklaras av enbart kända obstetriska eller socioekonomiska riskfaktorer.

Mödradöd definieras av WHO som död under graviditet eller inom 42 dagar efter att graviditeten avslutats, oavsett graviditetslängd, av sjukdomar eller komplikationer orsakade eller förvärrade av graviditeten. Däremot räknas inte olyckor och tillfälligt sammanträffande sjukdomar. Ett *direkt* mödradödsfall orsakas av en graviditets- eller förlossningskomplikation eller en kedja av händelser som startar med en sådan komplikation. Ett *indirekt* mödradödsfall orsakas av en sjukdom som uppstår före eller under men inte av graviditeten i sig, även om sjukdomens förlopp kan förvärras av de fysiologiska förändringar som graviditet medför. Dödsfall orsakade av förlossningsblödningar, barnsängsfeber och narkoskomplikationer är exempel på direkt mödradöd, medan död orsakad av försämring av en hjärt- eller njursjukdom klassificeras som indirekt. Mödradödlighet brukar mätas som en kvot; antalet mödradödsfall per 100 000 levande födda barn. I Sverige föds varje år omkring 100 000 levande födda barn. Nämnaren kan uppfattas som förvirrande eftersom en del kvinnor avlider utan att ha fött sitt barn, men den används ändå eftersom det är ett stabilt mått och det inte är möjligt att räkna antalet graviditeter.

Målet med denna avhandling var att studera aspekter av mödradöd i Sverige såsom förekomst, klassifikation och vårdkvalitet, med fokus på utlandsfödda kvinnor.

Vi fann att mödradödligheten i Sverige 1988–2007 var omkring sex per 100 000 levande födda barn. Med denna siffra hör vi till länderna med den

lägsta mödradödligheten i världen. Jämförelser mellan länder försvåras dock av underrapportering och olika sätt att definiera mödradödsfallen.

I den första studien studerade vi dödsorsaker hos alla kvinnor som avlidit i Sverige i reproduktiv ålder (15–49 år) under åren 1988–2007. Vi valde att gruppera de utlandsfödda kvinnornas födelseländer enligt Världsbankens klassifikation av ekonomier, i låg-, medel- och höginkomstländer samt Sverige, med hypotesen att kvinnor som kommer från fattiga länder kommer att fortsätta vara mer sårbara även efter migration till Sverige. Vi fann att risken att dö i reproduktiv ålder var högre för utlandsfödda kvinnor som var födda både i låginkomstländer *och* höginkomstländer än för svenskfödda kvinnor. Kvinnor födda i medelinkomstländer löpte lägre risk att dö i detta åldersintervall. Vi undersökte den diagnos som i dödsorsaksregistret var noterad som den underliggande dödsorsaken och försökte finna samband mellan dödsorsaken och kvinnans födelseland. Störst skillnad mellan svensk- och utlandsfödda fann vi för infektionssjukdomar, där risken var 15 gånger högre att dö för kvinnor födda i låginkomstländer än för svenskfödda. Detta kan till en del förklaras av att effektiva bromsmediciner för HIV inte fanns under den första halvan av studieperioden. Risken att dö på grund av en sjukdom eller komplikation kopplad till graviditet och förlossning visade sig vara sex till sju gånger högre för kvinnor födda i låginkomstländer.

Den andra studien handlar om underrapportering av mödradödsfall, vilket förekommer även i länder som har en väl fungerande registrering av dödsorsaker. När Sverige rapporterar mödradödsfall till WHO används dödsorsaksregistret och man identifierar de fall som har en underliggande dödsorsak kopplad till graviditet och förlossning. Med denna metod borde de direkta men inte de indirekta mödradödsfallen identifieras. Vi samkörde dödsorsaksregistret med medicinska födelseregistret och patientregistret och hittade på så sätt alla kvinnor som avlidit i Sverige inom ett år efter att de fött barn eller vårdats på grund av en graviditetskomplikation under åren 1988–2007. Vi granskade dessa kvinnors dödsorsaksintyg och klassificerade de som dött inom 42 dagar som direkta eller indirekta mödradödsfall, eller som dödsfall tillfälligt sammanträffande med graviditeten. På detta sätt fann vi 64% fler mödradödsfall än de som rapporterats till WHO. Vi fann både direkta och indirekta mödradödsfall bland de nytillkomna fallen. Brister i identifieringen av mödradödsfall fanns på tre olika nivåer. De två första bestod i bristande kunskaper eller insikter hos de läkare som fyllt i dödsorsaksintygen, respektive kodat dödsorsakerna i dödsorsaksregistret. Den tredje nivån låg på ett strukturellt plan och orsakades av att reglerna för hur dödsorsakerna kodas inte överensstämmer med definitionen av mödradöd.

I den tredje studien undersökte vi förloppet som ledde till mödradöd bland 25 kvinnor födda i låg- och medelinkomstländer samt 48 svenskfödda kvinnor under åren 1988–2010. Vi ville veta om skillnader i vårdens kvalitet kunde bidra till att förklara skillnaden i risk för mödradöd mellan utlandsfödda och svenskfödda kvinnor. Kvinnornas journaler granskades och bedömdes av en expertgrupp bestående av fem förlossningsläkare. Vi försökte rekonstruera förloppet och finna suboptimala faktorer (händelser som inte var gynnsamma) i vårdförloppet som slutade med att kvinnan avled. En suboptimal faktor bedömdes som betydande (major) om den bidrog väsentligt till kvinnans död och att hon troligen hade kunnat räddas av en annorlunda handläggning. En smärre (minor) suboptimal faktor definierades som en händelse som bidrog till det ogynnsamma förloppet, men att kvinnans liv förmodligen ändå inte hade kunnat räddas. I begreppet handläggning omfattas i detta sammanhang även sådant som kvinnan själv eller hennes familj hade kunnat göra annorlunda för att förhindra det tragiska förloppet.

I en del fall var förloppet så plötsligt och oundvikligt att inget hade kunnat göras för att rädda kvinnan, men i två tredjedelar (51/73) av mödradödsfallen, fann vi suboptimala faktorer. I hälften av fallen (36/73) förekom minst en betydande suboptimal faktor, vilket betyder att vi bedömde att dessa dödsfall hade kunnat undvikas genom en annan handläggning. Faktorer som relaterade till hur man söker vård, exempelvis att kvinnan skrev in sig sent i mödravården, inte följde läkarens/barnmorskans råd eller inte kom på planerade besök, inträffade både hos svenskfödda och utlandsfödda, men oftare bland de utlandsfödda. Faktorer relaterade till vårdens tillgänglighet omfattar i låginkomstländer oftast försenad transport till sjukhus. I detta material kom kvinnorna fram till vårdinrättningarna, men tillgängligheten till god vård begränsades av en språkbarriär. Om patient och vårdgivare inte talar samma språk får inte vårdgivaren tillgång till patientens sjukhistoria och patienten får inte tillgång till vårdgivarens kunskap. För att komma över denna barriär krävs professionell tolkning. Suboptimala faktorer relaterade till tillgänglighet förekom enbart bland utlandfödda kvinnor. I tre fall bedömdes språkbarriären vara en betydande suboptimal faktor, det betyder att döden kan ha kunnat undvikas om väl fungerande tolkning hade funnits på plats, och i tio fall bidrog språkproblemen till förloppet.

De vanligaste suboptimala faktorerna var relaterade till vårdens kvalitet och förekom i 50 fall (i 34 fall minst en betydande faktor och i 16 fall minst en smärre). Bristande vårdkvalitet omfattade att fel diagnos ställdes, att behandlingen fördröjdes, att remittering till annan vårdnivå/specialitet fördröjdes och/eller att kommunikationen brast mellan vårdgivare eller

kliniker. Faktorer som var relaterade till vårdens kvalitet drabbade oftare utlandsfödda än svenskfödda.

Fyra av kvinnorna dog på grund av komplikationer till sjukdomar som inte vanligen förekommer i Sverige, såsom tuberkulos och reumatisk feber. I dessa fall framgick att vårdgivarnas kunskaper om dessa sjukdomar brast.

Den fjärde studien är en beskrivande studie av alla kvinnor som tog sitt liv under graviditet eller inom ett år efter förlossning i Sverige under åren 1980–2007. Vi undersökte registerdata från dödsorsaksregistret, medicinska födelseregistret och patientregistret samt granskade journaler från kvinnornas sista graviditet, förlossning och BB-tid. I genomsnitt dog 3,7 kvinnor per 100 000 levande födda barn på grund av självmord under graviditet eller under första året efter förlossning. Denna kvot var stabil under studieperioden, medan självmord i nästan alla andra grupper i Sverige minskade. Kvinnor födda i låg- och medelinkomstländer löpte en högre risk (6,4 fall per 100 000 levande födda) än svenskfödda kvinnor (3,5 per 100 000 levande födda). Tre fjärdedelar (77/103) av kvinnorna som avled hade fått psykiatrisk vård före, under eller efter graviditeten, medan för en fjärdedel (26/103) av kvinnorna fanns inga tecken till psykisk sjukdom noterade i journalen eller i patientregistret. Ett flertal av kvinnorna som tidigare fått psykiatrisk vård fångades inte upp av mödrahälsovården. Trots kunskapen att många psykiska sjukdomar försämras under tiden efter förlossningen hade endast en femtedel av kvinnorna en dokumenterad plan för hur de skulle följas upp avseende sin psykiska hälsa när de skrevs ut från BB. Vi jämförde självmordssätt och psykiatrisk sjuklighet mellan de kvinnor som tog sitt liv under graviditet eller inom sex månader efter förlossning med de som tog sitt liv 6–12 månader efter förlossning. Vi fann att våldsamma självmordssätt var vanligare bland de kvinnor som dog under graviditet eller inom det första halvåret efter förlossning jämfört med de kvinnor som dog under det andra halvåret efter förlossning. Generellt brukar förgiftning, som brukar klassificeras som det icke-våldsamma självmordssättet, vara det vanligaste självmordssättet bland kvinnor. Kvinnorna som tog sitt liv under graviditet eller inom sex månader efter förlossning hade mer sällan en psykiatrisk sjuklighet före graviditeten än de som dog 6–12 månader efter förlossning.

Sammanfattningsvis var mödradödligheten i Sverige mycket låg, men inte riktigt så låg som den siffra vi rapporterade till WHO. Att mäta mödradödlighet är svårt, men man kan få mer sanningsenlig statistik genom att samköra register. Kvinnor födda i låginkomstländer löpte en högre risk för mödradöd samt för självmord under graviditet och året efter förlossning. Den förhöjda risken för mödradöd bland de utlandsfödda kvinnorna kunde till en del förklaras av sjukdomar med ursprung i kvinnornas

ursprungsländer, skillnader i hur man söker vård, bristande tolkanvändning samt att de oftare fick bristfällig vård. Mer än hälften av de kvinnor som begick självmord under graviditet och året efter förlossning hade en känd psykiatrisk sjuklighet, och den hade inte alltid fångats upp av mödravården. I en fjärdedel av självmorden fanns inga signaler till psykisk ohälsa dokumenterade.

Alla mödradödsfall och självmord i samband med graviditet kan inte undvikas, men genom att studera fall med dödlig utgång kan brister i sjukvården belysas och förhoppningsvis leda till förbättringar i vården.

Rekommendationer

För att statistiken över mödradödligheten i Sverige ska bli så sanningsenlig som möjligt rekommenderas rutinmässig samkörning av dödsorsaksregistret och medicinska födelseregistret.

Studierna i denna avhandling talar för att det skulle gå att minska mödradödligheten ytterligare, från en redan mycket låg nivå. Förutsättningarna för detta är ett nära samarbete mellan de olika specialiteter som kan vara inblandade vid svåra obstetriska komplikationer, samt att prioritera av patientsäkerhetsarbete vilket även omfattar att man säkerställer god kommunikation med *alla* patienter och mellan vårdgivare.

Enligt Förvaltningslagen har alla personer som inte behärskar svenska rätt till tolk i sjukvården. Mer än tio år har förflutit sedan den första studien publicerades som påvisade samband mellan kommunikationsproblem och ökad risk för perinatal död bland barnen till mödrar från Afrikas horn. Än idag händer det att man i sjukvården försöker kommunicera med icke-svenskspråkiga patienter utan professionell tolk, vilket är anmärkningsvärt.

Ansvar för att en patient inte följer vårdgivarens råd bör inte enbart läggas på patienten. Vårdgivaren har ansvar för att försöka förstå om det kan ligga missuppfattningar bakom patientens förhållningssätt.

Mer än var femte kvinna som söker mödrahälsovården i Sverige idag är född i ett annat land. En fullständig sjukhistoria omfattar att man efterfrågar kvinnans hälsa före, under och efter migration till Sverige. Man bör vara medveten om att utlandsfödda kvinnor kan bära med sig hälsotillstånd som vi inte är vana att se i Sverige idag.

I enlighet med mödrahälsovårdens nationella riktlinjer är det viktigt att fånga upp kvinnor med psykisk ohälsa, och särskilt viktigt är det att identifiera

kvinnor med svårare psykiatriska tillstånd. Samtliga kvinnor med tidigare psykisk ohälsa och kvinnor som uppvisar sådana symptom under graviditeten bör ha en dokumenterad plan för uppföljning efter förlossningen. Utlandsfödda kvinnor utgör en sårbar grupp avseende psykisk ohälsa.

Acknowledgements

The studies in this thesis were supported by a grant from the Swedish Council for Working Life and Social Research [FAS 2007–2026] and by the Medical Faculty, Uppsala University.

I wish to express my sincere gratitude and deepest appreciation to all those who supported and encouraged me all the way. In particular I wish to express my gratitude to:

Birgitta Essén, for sharing your knowledge, concern, and enthusiasm for the health of foreign-born women. Thank you for providing me with a PhD project that I have been burning for, and for giving me opportunities to work exclusively with research during extensive periods of time, which is a rare luxury for most clinicians.

Ulf Högberg, for your wise and respectful supervision and unwavering support.

Pauline Binder-Finnema, for sharing your perspicacity, for being my English conversation mentor, for showing the joy in cross-disciplinary research, and for being my friend.

Bengt Haglund, Ajlana Mulic-Lutvica, Birgit Bødker, Alkistis Skalkidou, Fotios Papadopoulos, and Inger Sundström-Poromaa, for sharing your knowledge, wisdom and engagement, and for frank and friendly feedback.

Karin Törnblom, for support in *all* kind of matters, not only the administrative.

Former and present heads of the Department of Obstetrics and Gynaecology at Akademiska sjukhuset, Bo Sultan, Gunilla Hallberg and Masoumeh Rezapour, for support. I am especially thankful to Gunilla for support along the road.

Kristine Eklund and Hans Lindgren, for taking care of my computer and me. Cristina Niska Bachelet, Malin Ghanem, Erika Anundsson, and Martin

Selinus, for help with administrative matters. Jan Gustafsson and Lena Hellström Westas, for support.

All staff, and the colourful family of former and present PhD students at IMCH, for scientific discussions and for sharing laughter and tears, success and setbacks. A special thanks to Malin Jordal, Mats Målqvist, Nguyen Thu Nga, and Åsa Wahlberg.

Teddy Primack and Aileen Ireland, for excellent language revision.

All Heads of Departments who allowed me to review medical records from their departments. Pernilla Olsson and Emelie Hallberg, and hospital archive staff all over Sweden who have been involved in retrieving medical records for my studies.

Shiva Ayoubi, Fereshte Ebrahim, and Ellen Lundqvist at the National Board of Health and Welfare, for providing me with register data. Lars-Age Johansson for sharing your knowledge on cause of death registration.

Sjoerd Finnema, for helping AnnikaPannika with figures and Dutch translations. Kajsa Lindroth Forsberg for review of the Swedish summary.

Colleagues and friends in MM-ARG, for sharing your vast clinical knowledge and the painful experience of reviewing maternal deaths.

Clinical colleagues at Department of Obstetrics and Gynaecology Akademiska sjukhuset, for friendship and support.

My friends, for being there. A special thanks to Charlotta Blank and Maria Lundberg.

My parents, Eva and Thomas Esscher, for love and constant support, and for outstanding engagement in the lives of your grandchildren. My sisters Cecilia and Helena, my sisters in-law Marie and Eva, and their families, for support and perspective.

Nils and Karl, for being the most loyal bonus sons and big brothers.

Aron and Axel, for filling my life with love, joy and adventure.

Matts, my love and closest friend, for standing steadily by my side.

References

1. Fathalla MF. Global trends in women's health. *Int J Gynaecol Obstet.* 1997 Jul;58(1):5-11.
2. Lozano R, Wang H, Foreman KJ, Rajaratnam JK, Naghavi M, Marcus JR, et al. Progress towards Millennium Development Goals 4 and 5 on maternal and child mortality: an updated systematic analysis. *Lancet.* 2011 Sep 24;378(9797):1139-65.
3. Filippi V, Ronsmans C, Campbell OM, Graham WJ, Mills A, Borghi J, et al. Maternal health in poor countries: the broader context and a call for action. *Lancet.* 2006 Oct 28;368(9546):1535-41.
4. Weiner R, Ronsmans C, Dorman E, Jilo H, Muhoro A, Shulman C. Labour complications remain the most important risk factors for perinatal mortality in rural Kenya. *Bull World Health Organ.* 2003;81(8):561-6.
5. Kusiako T, Ronsmans C, Van der Paal L. Perinatal mortality attributable to complications of childbirth in Matlab, Bangladesh. *Bull World Health Organ.* 2000;78(5):621-7.
6. Ahmed S, Li Q, Liu L, Tsui AO. Maternal deaths averted by contraceptive use: an analysis of 172 countries. *Lancet.* 2012 Jul 14;380(9837):111-25.
7. Fauveau V, Blanchet T. Deaths from injuries and induced abortion among rural Bangladeshi women. *Soc Sci Med.* 1989;29(9):1121-7.
8. Rizzi RG, Cordoba RR, Maguna JJ. Maternal mortality due to violence. *Int J Gynaecol Obstet.* 1998 Dec;63 Suppl 1:S19-24.
9. World Health Organization. Trends in maternal mortality: 1990 to 2008. Estimates developed by WHO, UNICEF, UNFPA and The World Bank. Geneva: World Health Organization 2010.
10. Augensen K, Bergsjø P. Maternal mortality in the Nordic countries 1970-1979. *Acta Obstet Gynecol Scand.* 1984;63(2):115-21.
11. Högberg U, Wall S. Secular trends in maternal mortality in Sweden from 1750 to 1980. *Bull World Health Organ.* 1986;64(1):79-84.
12. Högberg U. Maternal deaths in Sweden, 1971-1980. *Acta Obstet Gynecol Scand.* 1986;65(2):161-7.
13. Högberg U, Innala E, Sandström A. Maternal mortality in Sweden, 1980-1988. *Obstet Gynecol.* 1994 Aug;84(2):240-4.
14. Ibison JM, Swerdlow AJ, Head JA, Marmot M. Maternal mortality in England and Wales 1970-1985: an analysis by country of birth. *Br J Obstet Gynaecol.* 1996 Oct;103(10):973-80.
15. de Swiet M. Maternal mortality: confidential enquiries into maternal deaths in the United Kingdom. *Am J Obstet Gynecol.* 2000 Apr;182(4):760-6.
16. Salanave B, Bouvier-Colle MH. The likely increase in maternal mortality rates in the United Kingdom and in France until 2005. *Paediatr Perinat Epidemiol.* 1996 Oct;10(4):418-22.

17. Luque Fernandez MA, Cavanillas AB, Dramaix-Wilmet M, Soria FS, de Mata Donado Campos J, Guibert DH. Increase in maternal mortality associated with change in the reproductive pattern in Spain: 1996-2005. *J Epidemiol Community Health*. 2009 Jun;63(6):433-8.
18. Schutte JM, Steegers EA, Schuitemaker NW, Santema JG, de Boer K, Pel M, et al. Rise in maternal mortality in The Netherlands. *BJOG*. 2010 Mar;117(4):399-406.
19. Lang CT, King JC. Maternal mortality in the United States. *Best Pract Res Clin Obstet Gynaecol*. 2008 Jun;22(3):517-31.
20. Schutte JM, de Jonge L, Schuitemaker NW, Santema JG, Steegers EA, van Roosmalen J. Indirect maternal mortality increases in The Netherlands. *Acta Obstet Gynecol Scand*. 2010 Jun;89(6):762-8.
21. Schuitemaker N, van Roosmalen J, Dekker G, van Dongen P, van Geijn H, Bennebroek Gravenhorst J. Confidential enquiry into maternal deaths in The Netherlands 1983-1992. *Eur J Obstet Gynecol Reprod Biol*. 1998 Jul;79(1):57-62.
22. Confidential Enquiry into Maternal and Child Health (CEMACH). Saving mothers' lives: Reviewing maternal deaths to make motherhood safer, 2003-2005. The Seventh Report on Confidential Enquiries into Maternal Deaths in the United Kingdom. London: CEMACH 2007. Report No.: 7.
23. Luque Fernandez MA, Bueno Cavanillas A, de Mateo S. Excess of maternal mortality in foreign nationalities in Spain, 1999-2006. *Eur J Obstet Gynecol Reprod Biol*. 2010 Mar;149(1):52-6.
24. Luque Fernandez MA, Gutierrez Garitano I, Cavanillas AB. Increased risk of maternal deaths associated with foreign origin in Spain: a population based case-control study. *Eur J Public Health*. 2011 Jun;21(3):292-4.
25. Centre for Maternal and Child Enquiries (CMACE). Saving mothers' lives: Reviewing maternal deaths to make motherhood safer, 2006-2008. The Eighth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom. *BJOG*. 2011 Mar;118 Suppl 1:1-203.
26. Bollini P, Wanner P, Pampallona S. Trends in maternal mortality in Switzerland among Swiss and foreign nationals, 1969-2006. *Int J Public Health*. 2011 Oct;56(5):515-21.
27. Fässler M, Zimmermann R, QuackLotscher KC. Maternal mortality in Switzerland 1995-2004. *Swiss Med Wkly*. 2010 Jan 9;140(1-2):25-30.
28. Saucedo M, Deneux-Tharaux C, Bouvier-Colle MH. Ten years of confidential inquiries into maternal deaths in France, 1998-2007. *Obstet Gynecol*. 2013 Oct;122(4):752-60.
29. Pedersen GS, Grontved A, Mortensen LH, Andersen AM, Rich-Edwards J. Maternal Mortality Among Migrants in Western Europe: A Meta-Analysis. *Matern Child Health J*. 2013 Dec 14.
30. Sebire NJ, Jolly M, Harris JP, Wadsworth J, Joffe M, Beard RW, et al. Maternal obesity and pregnancy outcome: a study of 287,213 pregnancies in London. *Int J Obes Relat Metab Disord*. 2001 Aug;25(8):1175-82.
31. Schutte JM, Steegers EA, Santema JG, Schuitemaker NW, van Roosmalen J. Maternal deaths after elective cesarean section for breech presentation in The Netherlands. *Acta Obstet Gynecol Scand*. 2007;86(2):240-3.
32. Högberg U, Wall S, Broström G. The impact of early medical technology on maternal mortality in late 19th century Sweden. *Int J Gynaecol Obstet*. 1986 Aug;24(4):251-61.
33. Högberg U. The decline in maternal mortality in Sweden: the role of community midwifery. *Am J Public Health*. 2004 Aug;94(8):1312-20.

34. Högberg U, Joelsson I. The decline in maternal mortality in Sweden, 1931-1980. *Acta Obstet Gynecol Scand.* 1985;64(7):583-92.
35. World Health Organization. ICD-10: International statistical classification of diseases and related health problems: tenth revision. Volume 2. Instruction manual. 2nd ed. Geneva: World Health Organization; 2004.
36. Fortney JA. Implications of the ICD-10 definitions related to death in pregnancy, childbirth or the puerperium. *World Health Stat Q.* 1990;43(4):246-8.
37. Pattinson R, Say L, Souza JP, Broek N, Rooney C. WHO maternal death and near-miss classifications. *Bull World Health Organ.* 2009 Oct;87(10):734.
38. Atrash HK, Rowley D, Hogue CJ. Maternal and perinatal mortality. *Curr Opin Obstet Gynecol.* 1992 Feb;4(1):61-71.
39. Atrash HK, Koonin LM, Lawson HW, Franks AL, Smith JC. Maternal mortality in the United States, 1979-1986. *Obstet Gynecol.* 1990 Dec;76(6):1055-60.
40. Pattinson RC, Say L, Makin JD, Bastos MH. Critical incident audit and feedback to improve perinatal and maternal mortality and morbidity. *Cochrane Database Syst Rev.* 2005(4):CD002961.
41. World Health Organization. Beyond the numbers: reviewing maternal deaths and complications to make pregnancy safer. Geneva: World Health Organization 2004.
42. Gissler M, Kauppila R, Merilainen J, Toukomaa H, Hemminki E. Pregnancy-associated deaths in Finland 1987-1994--definition problems and benefits of record linkage. *Acta Obstet Gynecol Scand.* 1997 Aug;76(7):651-7.
43. Karimian-Teherani D, Haidinger G, Waldhoer T, Beck A, Vutuc C. Underreporting of direct and indirect obstetrical deaths in Austria, 1980-98. *Acta Obstet Gynecol Scand.* 2002 Apr;81(4):323-7.
44. Deneux-Tharoux C, Berg C, Bouvier-Colle MH, Gissler M, Harper M, Nannini A, et al. Underreporting of pregnancy-related mortality in the United States and Europe. *Obstet Gynecol.* 2005 Oct;106(4):684-92.
45. Elebro K, Rööst M, Moussa K, Johnsdotter S, Essén B. Misclassified maternal deaths among East African immigrants in Sweden. *Reprod Health Matters.* 2007 Nov;15(30):153-62.
46. Grunewald C, Nilsson E, Chattingius S, Westgren M, Stephanson O. Maternal mortality in Sweden underestimated. Registry study of death in connection with pregnancy, delivery and postpartum. [Mödradödligheten underskattad i Sverige. Registerstudie av död i samband med graviditet, förlossning och post partum]. *Läkartidningen.* 2008 Aug 20-26;105(34):2250-3.
47. Schuitemaker N, Van Roosmalen J, Dekker G, Van Dongen P, Van Geijn H, Gravenhorst JB. Underreporting of maternal mortality in The Netherlands. *Obstet Gynecol.* 1997 Jul;90(1):78-82.
48. Zwart JJ, Richters JM, Ory F, de Vries JI, Bloemenkamp KW, van Roosmalen J. Severe maternal morbidity during pregnancy, delivery and puerperium in the Netherlands: a nationwide population-based study of 371,000 pregnancies. *BJOG.* 2008 Jun;115(7):842-50.
49. Say L, Souza JP, Pattinson RC. Maternal near miss--towards a standard tool for monitoring quality of maternal health care. *Best Pract Res Clin Obstet Gynaecol.* 2009 Jun;23(3):287-96.
50. Wahlberg Å, Rööst M, Haglund B, Högberg U, Essén B. Increased risk of severe maternal morbidity (near-miss) among immigrant women in Sweden: a population register-based study. *BJOG.* 2013;120(13):1605-12.

51. Pattinson RC, Hall M. Near misses: a useful adjunct to maternal death enquiries. *Br Med Bull.* 2003;67:231-43.
52. Röst M, Altamirano VC, Liljestrand J, Essén B. Priorities in emergency obstetric care in Bolivia—maternal mortality and near-miss morbidity in metropolitan La Paz. *BJOG.* 2009 Aug;116(9):1210-7.
53. Pattinson RC, Buchmann E, Mantel G, Schoon M, Rees H. Can enquiries into severe acute maternal morbidity act as a surrogate for maternal death enquiries? *BJOG.* 2003 Oct;110(10):889-93.
54. van Roosmalen J, Zwart J. Severe acute maternal morbidity in high-income countries. *Best Pract Res Clin Obstet Gynaecol.* 2009;23(3):297-304.
55. Kayem G, Kurinczuk J, Lewis G, Golightly S, Brocklehurst P, Knight M. Risk factors for progression from severe maternal morbidity to death: a national cohort study. *PLoS One.* 2011;6(12):e29077.
56. Johansson LA. Targeting Non-obvious Errors in Death Certificates. Uppsala: Uppsala University; 2008.
57. Swedish National Board of Health and Welfare. Causes of Death 2010. Stockholm: Swedish National Board of Health and Welfare 2011.
58. National Board of Health and Welfares regulations and general advice on death in health care settings [Socialstyrelsens föreskrifter och allmänna råd om vissa åtgärder inom hälso- och sjukvården vid dödsfall SOSFS 1996:29], (1996).
59. National Board of Health and Welfare's regulations and general advice on clinical autopsies [Socialstyrelsens föreskrifter och allmänna råd om kliniska obduktioner m.m. SOSFS 1996:28] (1996).
60. Horon IL. Underreporting of maternal deaths on death certificates and the magnitude of the problem of maternal mortality. *Am J Public Health.* 2005 Mar;95(3):478-82.
61. Gissler M, Deneux-Tharoux C, Alexander S, Berg CJ, Bouvier-Colle MH, Harper M, et al. Pregnancy-related deaths in four regions of Europe and the United States in 1999-2000: characterisation of unreported deaths. *Eur J Obstet Gynecol Reprod Biol.* 2007 Aug;133(2):179-85.
62. Andersen BR, Westergaard HB, Bødker B, Weber T, Møller M, Sørensen JL. Maternal mortality in Denmark, 1985-1994. *Eur J Obstet Gynecol Reprod Biol.* 2009 Feb;142(2):124-8.
63. Angelow A, Black N. The use and impact of national confidential enquiries in high-income countries. *BMJ Qual Saf.* 2011 Jan;20(1):38-45.
64. Kildea S, Pollock WE, Barclay L. Making pregnancy safer in Australia: the importance of maternal death review. *Aust N Z J Obstet Gynaecol.* 2008 Apr;48(2):130-6.
65. Bødker B, Hvidman L, Weber T, Møller M, Aarre A, Nielsen KM, et al. Maternal deaths in Denmark 2002-2006. *Acta Obstet Gynecol Scand.* 2009;88(5):556-62.
66. Nordic Statistics. Nordic Statistics Databank. Copenhagen2013 [cited 16 December 2013]; Available from: <http://91.208.143.50/pxweb/pxwebnordic/dialog/statfile1.asp>.
67. Population Database [database on the Internet]. Statistics Sweden. 2014 [cited 11 Jan 2014]. Available from: <http://www.ssd.scb.se/databaser/makro/MainTable.asp?yp=tansss&xu=C9233001&omradekod=BE&omradetext=Population&lang=2&langdb=2>.
68. Högberg U. An "American dilemma" in Scandinavian childbirth: unmet needs in healthcare? *Scand J Public Health.* 2004;32(1):75-7.

69. Sundquist J, Johansson SE. The influence of country of birth on mortality from all causes and cardiovascular disease in Sweden 1979-1993. *Int J Epidemiol*. 1997 Apr;26(2):279-87.
70. Swedish Ministry of Culture. The concept of immigrants - the use by authorities [Begreppet invandrare – användningen i myndigheters verksamhet]. Stockholm: Regeringskansliet 2000.
71. Zwart JJ, Jonkers MD, Richters A, Ory F, Bloemenkamp KW, Duvekot JJ, et al. Ethnic disparity in severe acute maternal morbidity: a nationwide cohort study in the Netherlands. *Eur J Public Health*. 2010 Jun 3.
72. Philibert M, Deneux-Tharaux C, Bouvier-Colle MH. Can excess maternal mortality among women of foreign nationality be explained by suboptimal obstetric care? *BJOG*. 2008 Oct;115(11):1411-8.
73. Saftlas AF, Koonin LM, Atrash HK. Racial disparity in pregnancy-related mortality associated with livebirth: can established risk factors explain it? *Am J Epidemiol*. 2000 Sep 1;152(5):413-9.
74. Marmot MG, Adelstein AM, Bulusu L. Lessons from the study of immigrant mortality. *Lancet*. 1984 Jun 30;1(8392):1455-7.
75. Stirbu I, Kunst AE, Bos V, Mackenbach JP. Differences in avoidable mortality between migrants and the native Dutch in The Netherlands. *BMC Public Health*. 2006;6:78.
76. Essén B, Hanson BS, Östergren PO, Lindquist PG, Gudmundsson S. Increased perinatal mortality among sub-Saharan immigrants in a city-population in Sweden. *Acta Obstet Gynecol Scand*. 2000 Sep;79(9):737-43.
77. Westerling R, Rosen M. 'Avoidable' mortality among immigrants in Sweden. *Eur J Public Health*. 2002 Dec;12(4):279-86.
78. Bos V, Kunst AE, Keij-Deerenberg IM, Garssen J, Mackenbach JP. Ethnic inequalities in age- and cause-specific mortality in The Netherlands. *Int J Epidemiol*. 2004 Oct;33(5):1112-9.
79. Albin B, Hjelm K, Ekberg J, Elmståhl S. Mortality among 723,948 foreign- and native-born Swedes 1970-1999. *Eur J Public Health*. 2005 Oct;15(5):511-7.
80. DesMeules M, Gold J, McDermott S, Cao Z, Payne J, LaFrance B, et al. Disparities in mortality patterns among Canadian immigrants and refugees, 1980-1998: results of a national cohort study. *J Immigr Health*. 2005 Oct;7(4):221-32.
81. Lindström M, Sundquist K. The impact of country of birth and time in Sweden on overweight and obesity: a population-based study. *Scand J Public Health*. 2005;33(4):276-84.
82. Beckman A, Merlo J, Lynch JW, Gerdttham UG, Lindström M, Lithman T. Country of birth, socioeconomic position, and healthcare expenditure: a multilevel analysis of Malmo, Sweden. *J Epidemiol Community Health*. 2004 Feb;58(2):145-9.
83. Klinthäll M, Lindström M. Migration and health: a study of effects of early life experiences and current socio-economic situation on mortality of immigrants in Sweden. *Ethn Health*. 2011 Dec;16(6):601-23.
84. Iglesias E, Robertson E, Johansson SE, Engfeldt P, Sundquist J. Women, international migration and self-reported health. A population-based study of women of reproductive age. *Soc Sci Med*. 2003 Jan;56(1):111-24.
85. Konar H, Chaudhuri S. Pregnancy complicated by maternal heart disease: a review of 281 women. *J Obstet Gynaecol India*. 2012 Jun;62(3):301-6.

86. Huisman CM, Zwart JJ, Roos-Hesselink JW, Duvekot JJ, van Roosmalen J. Incidence and predictors of maternal cardiovascular mortality and severe morbidity in the Netherlands: a prospective cohort study. *PLoS One*. 2013;8(2):e56494.
87. Nybo M, Friis-Hansen L, Felding P, Milman N. Higher prevalence of anemia among pregnant immigrant women compared to pregnant ethnic Danish women. *Ann Hematol*. 2007 Sep;86(9):647-51.
88. Madar AA, Stene LC, Meyer HE. Vitamin D status among immigrant mothers from Pakistan, Turkey and Somalia and their infants attending child health clinics in Norway. *Br J Nutr*. 2009 Apr;101(7):1052-8.
89. Bergström I, Palmer M, Persson J, Blanck A. Observational study of vitamin D levels and pain in pregnant immigrant women living in Sweden. *Gynecol Endocrinol*. 2013 Nov 11.
90. Farah MG, Tverdal A, Selmer R, Heldal E, Bjune G. Tuberculosis in Norway by country of birth, 1986-1999. *Int J Tuberc Lung Dis*. 2003 Mar;7(3):232-5.
91. Jimenez BC, Cuadros-Tito P, Ruiz-Giardin JM, Rojo-Marcos G, Cuadros-Gonzalez J, Canalejo E, et al. Imported malaria in pregnancy in Madrid. *Malar J*. 2012;11:112.
92. Knight M, Kurinczuk JJ, Nelson-Piercy C, Spark P, Brocklehurst P. Tuberculosis in pregnancy in the UK. *BJOG*. 2009 Mar;116(4):584-8.
93. Saastad E, Vangen S, Froen JF. Suboptimal care in stillbirths - a retrospective audit study. *Acta Obstet Gynecol Scand*. 2007;86(4):444-50.
94. Gissler M, Alexander S, MacFarlane A, Small R, Stray-Pedersen B, Zeitlin J, et al. Stillbirths and infant deaths among migrants in industrialized countries. *Acta Obstet Gynecol Scand*. 2009;88(2):134-48.
95. Malin M, Gissler M. Maternal care and birth outcomes among ethnic minority women in Finland. *BMC Public Health*. 2009;9:84.
96. Ekeus C, Cnattingius S, Essén B, Hjern A. Stillbirth among foreign-born women in Sweden. *Eur J Public Health*. 2011 Dec;21(6):788-92.
97. Råssjö EB, Byrskog U, Samir R, Klingberg-Allvin M. Somali women's use of maternity health services and the outcome of their pregnancies: a descriptive study comparing Somali immigrants with native-born Swedish women. *Sex Reprod Healthc*. 2013 Oct;4(3):99-106.
98. Naimy Z, Grytten J, Monkerud L, Eskild A. Perinatal mortality in non-western migrants in Norway as compared to their countries of birth and to Norwegian women. *BMC Public Health*. 2013;13:37.
99. Ny P, Dykes AK, Molin J, Dejin-Karlsson E. Utilisation of antenatal care by country of birth in a multi-ethnic population: a four-year community-based study in Malmö, Sweden. *Acta Obstet Gynecol Scand*. 2007;86(7):805-13.
100. Darj E, Lindmark G. [Not all women use maternal health services. Language barriers and fear of the examination are common]. *Läkartidningen*. 2002 Jan 10;99(1-2):41-4.
101. Vangen S, Stoltenberg C, Johansen RE, Sundby J, Stray-Pedersen B. Perinatal complications among ethnic Somalis in Norway. *Acta Obstet Gynecol Scand*. 2002 Apr;81(4):317-22.
102. Robertson E, Malmström M, Johansson SE. Do foreign-born women in Sweden have an increased risk of non-normal childbirth? *Acta Obstet Gynecol Scand*. 2005 Sep;84(9):825-32.
103. Ekeus C, Cnattingius S, Hjern A. Epidural analgesia during labor among immigrant women in Sweden. *Acta Obstet Gynecol Scand*. 2010;89(2):243-9.
104. Health Care Act 1982:763 [Hälso- och sjukvårdslagen], (1982).

105. Diaz A. Vård på (o)lika villkor – en kunskapsöversikt om sociala skillnader i svensk hälso- och sjukvård [(In-)equity in care – an overview of the knowledge base of social differences in the Swedish health care system]. Stockholm: Swedish Association of Local Authorities and Regions [Sveriges Kommuner och Landsting, SKL] 2009.
106. Essén B, Bødker B, Sjöberg NO, Langhoff-Roos J, Greisen G, Gudmundsson S, et al. Are some perinatal deaths in immigrant groups linked to suboptimal perinatal care services? *BJOG*. 2002 Jun;109(6):677-82.
107. van Roosmalen J, Schuitmaker NW, Brand R, van Dongen PW, Bennebroek Gravenhorst J. Substandard care in immigrant versus indigenous maternal deaths in The Netherlands. *BJOG*. 2002 Feb;109(2):212-3.
108. Egnell K, Svedhem V. 23% of newly diagnosed HIV cases in 2007 at Karolinska University Hospital had opportunistic infections. *Journal of the International AIDS Society*. 2008;11(Suppl 1):P256.
109. Samuelsson E, Hellgren M, Högberg U. Pregnancy-related deaths due to pulmonary embolism in Sweden. *Acta Obstet Gynecol Scand*. 2007;86(4):435-43.
110. Ny P, Plantin L, E DK, Dykes AK. Middle Eastern mothers in Sweden, their experiences of the maternal health service and their partner's involvement. *Reprod Health*. 2007;4:9.
111. Essén B, Binder P, Johnsdotter S. An anthropological analysis of the perspectives of Somali women in the West and their obstetric care providers on caesarean birth. *J Psychosom Obstet Gynaecol*. 2011 Mar;32(1):10-8.
112. Binder P, Borne Y, Johnsdotter S, Essén B. Shared language is essential: communication in a multiethnic obstetric care setting. *J Health Commun*. 2012;17(10):1171-86.
113. Administrative Act 1986:223 [Förvaltningslagen], § 8 (1986).
114. Binder P. The maternal migration effect. Exploring maternal healthcare in diaspora using qualitative proxies for medical anthropology. Uppsala: Uppsala University; 2012.
115. Binder P, Johnsdotter S, Essén B. Conceptualising the prevention of adverse obstetric outcomes among immigrants using the 'three delays' framework in a high-income context. *Soc Sci Med*. 2012;75(11):2028-36.
116. Essén B, Johnsdotter S, Binder P. Maternal mortality in Sweden—comprehending the incomprehensible refusal to accept acute caesarean section. *Women's health to gender medicine [serial on the Internet]*. 2011; 75: Available from: <http://ki.se/content/1/c6/15/00/87/Womenshealth.pdf#page=77>.
117. Essén B, Johnsdotter S, Hovellius B, Gudmundsson S, Sjöberg NO, Friedman J, et al. Qualitative study of pregnancy and childbirth experiences in Somalian women resident in Sweden. *BJOG*. 2000 Dec;107(12):1507-12.
118. Thaddeus S, Maine D. Too far to walk: maternal mortality in context. *Soc Sci Med*. 1994 Apr;38(8):1091-110.
119. Pelletier LR, Beaudin CL, National Association for Healthcare Quality (U.S.). *Q solutions : essential resources for the healthcare quality professional*. 2nd ed. Glenview, IL: National Association for Healthcare Quality; 2008.
120. Agency for Healthcare Research and Quality (AHRQ). *AHRQ's Patient Safety Initiative: Building Foundations, Reducing Risk*. Rockville, MD: Agency for Healthcare Research and Quality; 2003 [cited 12 December 2014]; Available from: <http://www.ahrq.gov/research/findings/final-reports/pscongrpt/index.html>.
121. Mitchell PH. *Patient Safety and Quality: An Evidence-Based Handbook for Nurses*: Agency for Healthcare Research and Quality (US); 2008. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21328780>.

122. Patient Safety Act 2010:659 [Patientsäkerhetslagen] (2010).
123. The Patient Insurance LÖF, County Council of Östergötland, Swedish National Board of Health and Welfare, County Council of Stockholm, Swedish Association of Local Authorities and Regions (SALAR). Risk analysis and root cause analysis. Handbook for patient safety work. [Riskanalys & händelseanalys. Handbok för patientsäkerhetsarbete]. Stockholm: Swedish National Board of Health and Welfare 2009.
124. Pronovost PJ, Holzmueller CG, Ennen CS, Fox HE. Overview of progress in patient safety. *Am J Obstet Gynecol*. 2011 Jan;204(1):5-10.
125. Donabedian A. The quality of care. How can it be assessed? *JAMA*. 1988 Sep 23-30;260(12):1743-8.
126. Oxford University Press. Oxford Dictionaries Online. Oxford University Press; [cited 15 August 2012]; Available from: www.oxforddictionaries.com.
127. Jamtvedt G, Young JM, Kristoffersen DT, O'Brien MA, Oxman AD. Audit and feedback: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev*. 2006(2):CD000259.
128. Ivers N, Jamtvedt G, Flottorp S, Young JM, Odgaard-Jensen J, French SD, et al. Audit and feedback: effects on professional practice and healthcare outcomes. *Cochrane Database Syst Rev*. 2012;6:CD000259.
129. Ashton CM, Kuykendall DH, Johnson ML, Wray NP. An empirical assessment of the validity of explicit and implicit process-of-care criteria for quality assessment. *Med Care*. 1999 Aug;37(8):798-808.
130. Andersgaard AB, Herbst A, Johansen M, Ivarsson A, Ingemarsson I, Langhoff-Roos J, et al. Eclampsia in Scandinavia: incidence, substandard care, and potentially preventable cases. *Acta Obstet Gynecol Scand*. 2006;85(8):929-36.
131. Schutte JM, Schuitemaker NW, van Roosmalen J, Steegers EA. Substandard care in maternal mortality due to hypertensive disease in pregnancy in The Netherlands. *BJOG*. 2008 May;115(6):732-6.
132. Goldman RL. The reliability of peer assessments of quality of care. *JAMA*. 1992 Feb 19;267(7):958-60.
133. Andersson L, Sundström-Poromaa I, Wulff M, Åström M, Bixo M. Depression and anxiety during pregnancy and six months postpartum: a follow-up study. *Acta Obstet Gynecol Scand*. 2006;85(8):937-44.
134. Marangell LB. Current issues: women and bipolar disorder. *Dialogues Clin Neurosci*. 2008;10(2):229-38.
135. Munk-Olsen T, Laursen TM, Mendelson T, Pedersen CB, Mors O, Mortensen PB. Risks and predictors of readmission for a mental disorder during the postpartum period. *Arch Gen Psychiatry*. 2009 Feb;66(2):189-95.
136. Terp IM, Mortensen PB. Post-partum psychoses. Clinical diagnoses and relative risk of admission after parturition. *Br J Psychiatry*. 1998 Jun;172:521-6.
137. Valdimarsdottir U, Hultman CM, Harlow B, Cnattingius S, Sparen P. Psychotic illness in first-time mothers with no previous psychiatric hospitalizations: a population-based study. *PLoS Med*. 2009 Feb 10;6(2):e13.
138. Hawton K, van Heeringen K. Suicide. *Lancet*. 2009 Apr 18;373(9672):1372-81.
139. Titelman D, Oskarsson H, Wahlbeck K, Nordentoft M, Mehlum L, Jiang GX, et al. Suicide mortality trends in the Nordic countries 1980-2009. *Nord J Psychiatry*. 2013 Jan 7.
140. Appleby L. Suicide during pregnancy and in the first postnatal year. *BMJ*. 1991 Jan 19;302(6769):137-40.

141. Gissler M, Berg C, Bouvier-Colle MH, Buekens P. Injury deaths, suicides and homicides associated with pregnancy, Finland 1987-2000. *Eur J Public Health*. 2005 Oct;15(5):459-63.
142. Austin MP, Kildea S, Sullivan E. Maternal mortality and psychiatric morbidity in the perinatal period: challenges and opportunities for prevention in the Australian setting. *Med J Aust*. 2007 Apr 2;186(7):364-7.
143. Swedish Society of Obstetrics and Gynecology (SFOG). Antenatal care, sexual and reproductive health [Mödrhälsovård, sexuell och reproduktiv hälsa]. Stockholm: SFOG 2008.
144. Swedish National Board of Health and Welfare. Health care prior to, during and after pregnancy [Hälsovård före, under och efter graviditet]. Stockholm: National Board of Health and Welfare [Socialstyrelsen] 1996.
145. Rubertsson C, Wickberg B, Gustavsson P, Rådestad I. Depressive symptoms in early pregnancy, two months and one year postpartum-prevalence and psychosocial risk factors in a national Swedish sample. *Arch Womens Ment Health*. 2005 Jun;8(2):97-104.
146. Wangel AM, Schei B, Ryding EL, Östman M. Mental health status in pregnancy among native and non-native Swedish speaking women: A Bidens study. *Acta Obstet Gynecol Scand*. 2012 Aug 11.
147. Collins CH, Zimmerman C, Howard LM. Refugee, asylum seeker, immigrant women and postnatal depression: rates and risk factors. *Arch Womens Ment Health*. 2011 Feb;14(1):3-11.
148. Bjerke SE, Vangen S, Nordhagen R, Ytterdahl T, Magnus P, Stray-Pedersen B. Postpartum depression among Pakistani women in Norway: prevalence and risk factors. *J Matern Fetal Neonatal Med*. 2008 Dec;21(12):889-94.
149. Andersson L, Sundstrom-Poromaa I, Bixo M, Wulff M, Bondestam K, Åstrom M. Point prevalence of psychiatric disorders during the second trimester of pregnancy: a population-based study. *Am J Obstet Gynecol*. 2003 Jul;189(1):148-54.
150. Schytt E, Hildingsson I. Physical and emotional self-rated health among Swedish women and men during pregnancy and the first year of parenthood. *Sex Reprod Healthc*. 2011 Apr;2(2):57-64.
151. Rikshandboken i barnhälsovård. National handbook for child health care [Rikshandboken barnhälsovård]. Stockholm: Inera AB; 2013 [cited 4 January 2014]; Available from: <http://www.rikshandboken-bhv.se/Texter/Psykisk-halsa/Depression-hos-nyblivna-mammor-och-screening-med-EPDS-Psykisk-halsa/>.
152. Massoudi P, Wickberg B, Hwang P. Screening for postnatal depression in Swedish child health care. *Acta Paediatr*. 2007 Jun;96(6):897-901.
153. Johansson LM, Sundquist J, Johansson SE, Bergman B, Qvist J, Traskman-Bendz L. Suicide among foreign-born minorities and Native Swedes: an epidemiological follow-up study of a defined population. *Soc Sci Med*. 1997 Jan;44(2):181-7.
154. Westman J, Sundquist J, Johansson LM, Johansson SE, Sundquist K. Country of birth and suicide: a follow-up study of a national cohort in Sweden. *Arch Suicide Res*. 2006;10(3):239-48.
155. Norredam M, Olsbjerg M, Petersen JH, Juel K, Krasnik A. Inequalities in mortality among refugees and immigrants compared to native Danes--a historical prospective cohort study. *BMC Public Health*. 2012;12:757.
156. Statistics Sweden. Childbearing among native and foreign born [Barnafödande bland utrikes födda]. Stockholm: Statistics Sweden 2008.

157. Hildingsson IM, Lindgren HE, Haglund B, Rådestad IJ. Characteristics of women giving birth at home in Sweden: a national register study. *Am J Obstet Gynecol.* 2006 Nov;195(5):1366-72.
158. Swedish National Board of Health and Welfare. Pregnancies, Deliveries and Newborn Infants. The Swedish Medical Birth Register 1973–2009. Assisted Reproduction, treatment 1991–2008. Stockholm: National Board of Health and Welfare [Socialstyrelsen] 2011.
159. Schell CO, Reilly M, Rosling H, Peterson S, Ekström AM. Socioeconomic determinants of infant mortality: a worldwide study of 152 low-, middle-, and high-income countries. *Scand J Public Health.* 2007;35(3):288-97.
160. Lindström C, Lindström M. "Social capital," GNP per capita, relative income, and health: an ecological study of 23 countries. *Int J Health Serv.* 2006;36(4):679-96.
161. The World Bank. World Bank Country Classification. Washington DC: The World Bank; 2007 [25 August 2009]; Available from: <http://go.worldbank.org/U9BK7IA1J0>
162. World Health Organization. International Statistical Classification of Diseases and Related Health Problems, 10th Revision. Version for 2007. Geneva 2007 [15 January 2010]; Available from: <http://apps.who.int/classifications/apps/icd/icd10online/>.
163. Confidential Enquiry into Maternal and Child Health (CEMACH). Maternal Death Enquiry. London: CEMACH 2006 [15 October 2008]; Available from: <http://www.cemach.org.uk/getdoc/2780b68a-756a-467e-b02a-ac9b41d03e4f/MDR1-202006-2009.aspx>.
164. Hogan MC, Foreman KJ, Naghavi M, Ahn SY, Wang M, Makela SM, et al. Maternal mortality for 181 countries, 1980-2008: a systematic analysis of progress towards Millennium Development Goal 5. *Lancet.* 2010 May 8;375(9726):1609-23.
165. Garenne M, Kahn K, Collinson MA, Gomez-Olive FX, Tollman S. Maternal mortality in rural South Africa: the impact of case definition on levels and trends. *Int J Womens Health.* 2013;5:457-63.
166. Cross S, Bell JS, Graham WJ. What you count is what you target: the implications of maternal death classification for tracking progress towards reducing maternal mortality in developing countries. *Bull World Health Organ.* 2010 Feb;88(2):147-53.
167. Horon IL, Cheng D. Effectiveness of pregnancy check boxes on death certificates in identifying pregnancy-associated mortality. *Public Health Rep.* 2011 Mar-Apr;126(2):195-200.
168. Jenum AK, Sommer C, Sletner L, Morkrid K, Baerug A, Mosdol A. Adiposity and hyperglycaemia in pregnancy and related health outcomes in European ethnic minorities of Asian and African origin: a review. *Food Nutr Res.* 2013;57.
169. Zhang S, Cardarelli K, Shim R, Ye J, Booker KL, Rust G. Racial disparities in economic and clinical outcomes of pregnancy among Medicaid recipients. *Matern Child Health J.* 2013 Oct;17(8):1518-25.
170. Jonsson M, Nordén-Lindeberg S, Östlund I, Hanson U. Metabolic acidosis at birth and suboptimal care—illustration of the gap between knowledge and clinical practice. *BJOG.* 2009 Oct;116(11):1453-60.
171. Berglund S, Pettersson H, Cnattingius S, Grunewald C. How often is a low Apgar score the result of substandard care during labour? *BJOG.* 2010 Jul;117(8):968-78.

172. Maine D, Rosenfield A. The AMDD program: history, focus and structure. *Int J Gynaecol Obstet*. 2001 Aug;74(2):99-103; discussion 4.
173. Pronovost PJ, Thompson DA, Holzmueller CG, Lubomski LH, Morlock LL. Defining and measuring patient safety. *Crit Care Clin*. 2005 Jan;21(1):1-19, vii.
174. Swedish Association of Local Authorities and Regions (SALAR). Patient safety culture - Summary of results from county council measurements of patient safety culture [Patientsäkerhetskultur - Sammanfattning av resultat från landstingens mätningar av patientsäkerhetskultur]. Stockholm: Swedish Association of Local Authorities and Regions (SALAR) 2012.
175. Singh S, McGlennan A, England A, Simons R. A validation study of the CEMACH recommended modified early obstetric warning system (MEOWS). *Anaesthesia*. 2012 Jan;67(1):12-8.
176. Mackintosh N, Watson K, Rance S, Sandall J. Value of a modified early obstetric warning system (MEOWS) in managing maternal complications in the peripartum period: an ethnographic study. *BMJ Qual Saf*. 2014 Jan;23(1):26-34.
177. Croskerry P. The importance of cognitive errors in diagnosis and strategies to minimize them. *Acad Med*. 2003 Aug;78(8):775-80.
178. Groopman J. *How doctors think*. New York: Mariner Books; 2008.
179. Makeham MA, Mira M, Kidd MR. Lessons from the TAPS study - communication failures between hospitals and general practices. *Aust Fam Physician*. 2008 Sep;37(9):735-6.
180. Catchpole K, Mishra A, Handa A, McCulloch P. Teamwork and error in the operating room: analysis of skills and roles. *Ann Surg*. 2008 Apr;247(4):699-706.
181. Siassakos D, Draycott TJ, Crofts JF, Hunt LP, Winter C, Fox R. More to teamwork than knowledge, skill and attitude. *BJOG*. 2010 Sep;117(10):1262-9.
182. Cornthwaite K, Edwards S, Siassakos D. Reducing risk in maternity by optimising teamwork and leadership: an evidence-based approach to save mothers and babies. *Best Pract Res Clin Obstet Gynaecol*. 2013 May 3.
183. Andreatta P, Marzano D. Healthcare management strategies: interdisciplinary team factors. *Curr Opin Obstet Gynecol*. 2012 Dec;24(6):445-52.
184. Greenberg CC, Regenbogen SE, Studdert DM, Lipsitz SR, Rogers SO, Zinner MJ, et al. Patterns of communication breakdowns resulting in injury to surgical patients. *J Am Coll Surg*. 2007 Apr;204(4):533-40.
185. Haig KM, Sutton S, Whittington J. SBAR: a shared mental model for improving communication between clinicians. *Jt Comm J Qual Patient Saf*. 2006 Mar;32(3):167-75.
186. Arora VM, Johnson JK, Meltzer DO, Humphrey HJ. A theoretical framework and competency-based approach to improving handoffs. *Qual Saf Health Care*. 2008 Feb;17(1):11-4.
187. Swedish Association of Local Authorities and Regions (SALAR). National initiative to improve patient safety. Safer care. Handbook of basic patient safety work [Nationell satsning för ökad patientsäkerhet. Säkrare vård och omsorg. Handbok i grundläggande patientsäkerhetsarbete]. Stockholm: Swedish Association of Local Authorities and Regions (SALAR); 2011.
188. Swedish Society of Obstetrics and Gynecology (SFOG), Swedish Association of Midwives, Swedish Paediatric Society, The Patient Insurance LÖF. Project safe child birth [Projekt säker förlossningsvård]. Stockholm: Swedish Society of Obstetrics and Gynecology, Swedish Association of Midwives, Swedish Paediatric Society, the Patient Insurance LÖF 2011.

189. Swedish Society of Obstetrics and Gynecology (SFOG). Child-birth and mental disease [Barnafödande och psykisk sjukdom]. Stockholm: SFOG2009.
190. Oates M. Perinatal psychiatric disorders: a leading cause of maternal morbidity and mortality. *Br Med Bull.* 2003;67:219-29.
191. Fernbrant C. Violence against foreign-born women in Sweden. Lund: Lund University; 2013.
192. Wickberg B, Hwang CP. The Edinburgh Postnatal Depression Scale: validation on a Swedish community sample. *Acta Psychiatr Scand.* 1996 Sep;94(3):181-4.
193. Nyström L, Larsson LG, Rutqvist LE, Lindgren A, Lindqvist M, Ryden S, et al. Determination of cause of death among breast cancer cases in the Swedish randomized mammography screening trials. A comparison between official statistics and validation by an endpoint committee. *Acta Oncol.* 1995;34(2):145-52.
194. Källén B, Källén K, Otterblad Olausson P. The Swedish Medical Birth Register - A summary of content and quality. Stockholm: Swedish National Board of Health and Welfare 2003.
195. Johansson LA, Björkenstam C, Westerling R. Unexplained differences between hospital and mortality data indicated mistakes in death certification: an investigation of 1,094 deaths in Sweden during 1995. *J Clin Epidemiol.* 2009 Apr 11.
196. Statistics Sweden. Evaluation of the Swedish register of education [Evalvering av utbildningsregistret]. Stockholm: Statistics Sweden (SCB) 2006.

Acta Universitatis Upsaliensis

*Digital Comprehensive Summaries of Uppsala Dissertations
from the Faculty of Medicine 970*

Editor: The Dean of the Faculty of Medicine

A doctoral dissertation from the Faculty of Medicine, Uppsala University, is usually a summary of a number of papers. A few copies of the complete dissertation are kept at major Swedish research libraries, while the summary alone is distributed internationally through the series Digital Comprehensive Summaries of Uppsala Dissertations from the Faculty of Medicine.

Distribution: publications.uu.se
urn:nbn:se:uu:diva-216781



ACTA
UNIVERSITATIS
UPSALIENSIS
UPPSALA
2014