Obstetric outcomes of immigrants in a low-risk maternity ward in Norway.

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PREFACE

In my work as a midwife at Baerum hospital, I often met immigrant women in labor. My personal experience with poor communication during obstetric emergencies was the inspiration for writing my Master of Health Science thesis.[1] The feeling of being unable to calm a woman or convince her to cooperate results in a lack of my professional control and is one of the worst situations I have experienced. Gaining trust can sometimes be difficult, and, combined with communicative problems, can lead to situations in which one cannot explain that one's actions are intended to help rather than harm. The immigrant population is growing, and situations such as this are more and more common for midwives throughout the country. My personal experiences have led me to believe that immigrant women experience more complications during labour, which result from inadequate communication and suboptimal care. The findings described in my thesis indicated that my personal beliefs were true, and gave rise to a desire to continue my research on women at this low-risk maternity ward in order to increase focus on inequities in obstetric outcomes and contribute to the improvement of conditions for the increasing population of immigrant women giving birth at Norwegian hospitals.

Studying the differences in obstetric outcomes between immigrants and ethnic Norwegians can improve our understanding of health, diversity in health, and health practices. It can also help us to target our efforts toward certain groups of immigrants who need extra attention, which could ultimately help us to prevent adverse outcomes in the future. In addition, being able to study these differences in a low-risk maternity ward gave us the opportunity to study a particular group of women, where women with some pre-pregnancy health conditions and those expecting sick babies were excluded. Furthermore, the participants were likely to receive the same standard of care (i.e., the same guidelines are followed), as the study was conducted in a single maternity ward.

ACKNOWLEDGEMENTS

I was able to write this thesis because of many helpful people.

First, I would like to thank the Vestre Viken Hospital Research Fund for financing the project and enabling me to focus my work toward my PhD. I would also like to thank Marit Kristoffersen and Ingerid Helene Herstad Nygaard for giving me office space and including me as a member of staff at the Department of Gynecology and Obstetrics at Baerum Hospital.

Furthermore, I would like to express my gratitude to my two supervisors, Babill Stray-Pedersen and Ola H. Skjeldal. I can safely say that both have numerous irons in the fire but still managed to guide me through safely. Babill has many years of experience in research and with the immigrant population in Norway and has conducted several projects in many low-income countries. Her knowledge has been invaluable to me, as has her encouraging and warm manner in providing guidance. Ola is also a skilled researcher and began supervising my work when he was head of research at the women and children's division of the Vestre Viken Hospital Trust. His knowledge of ethics and research and as ability to see the totality of articles and provide good guidance has been very helpful.

I also want to thank the staff, particularly Jon Gunnar Tufta and Vernar Sundvor, at the Medical Birth Registry of Norway and Christina Lyle, Svein Rune Johansen, and Marit Slåen Sæther at Statistics Norway.

Furthermore, I received invaluable assistance from Are Hugo Pripp and Lien My Diep, statisticians at Oslo University Hospital. Thank you for your guidance.

Finally, I would not have achieved this without the support of my family. My father Inge, his partner Anita, and my dear mother Siri, who always praise and encourage me to continue. My loving husband Joachim and sweet little girl Sigrid have inspired me to reach my goals and finish what I started. Thank you so much!

Oslo, January 2016
Kjersti Sletten Bakken

SUMMARY

Background: A greater number of individuals are on the move today compared with any other time in human history. The health status of migrants and ethnic minority groups has often been demonstrated to be lower than the average population. Studies have also indicated that immigrants are at increased risks of adverse obstetric outcomes. At the low-risk maternity ward in Baerum Hospital, Norway, 40% of women who give birth are immigrants, and 63% of this group originate from non-Western countries.

Aim: The overall aim of this thesis was to examine the association between country of origin and adverse obstetric outcomes in women who give birth at the low-risk maternity ward in Baerum Hospital. We aimed to determine whether immigrant women had increased risk of adverse obstetric outcomes relative to Norwegians (papers I and III). We also aimed to establish whether originating from countries considered conflict-zones influenced obstetric outcomes (paper II). Finally, we aimed to determine whether there were differences in the obstetric outcomes between first- and second-generation immigrants (paper IV).

Material and methods: The study comprised a population-based observational study with a prospective, cohort design. The study population included women who gave birth at Baerum Hospital in Norway between January 1, 2006 and December 31, 2010 (papers I-III) and January 1, 2006 and December 31, 2013 (paper IV). The maternity ward lacks a children's section (i.e., it has no neonatal intensive care unit) and is referred to as a low-risk maternity ward. The women who give birth in this ward comprise a particularly low-risk group, which includes women at more than 35 weeks of gestation, who expect a healthy baby.

Data were extracted from information recorded during pregnancy, birth and the early postpartum period and were provided by the Medical Birth Registry of Norway. In addition, Statistics Norway provided information regarding maternal and paternal country of birth, country of origin, immigrant category, and age at immigration, which were obtained from the Population Database, and data regarding maternal education from the National Education Database.

The main exposure variables were country of origin/birth. In papers I and III, women were assigned to one of seven groups according to the country of origin: Norway; Eastern Europe; Latin America and the Caribbean; East, Southeast, and Central Asia; South and Western Asia; Africa; and Western Europe, North America, Australia, and New Zealand, which also included Nordic countries. In paper II, ethnic Norwegians and women from Somalia, Iraq, Afghanistan, and Kosovo, which are considered conflict-zones, were included. Paper IV included women of Pakistani origin, who were divided into first- and second-generation immigrants according to the country of birth.

We examined differences in the proportions of participants with specific background characteristics and obstetric outcomes using bivariate analyses. Differences in the risk of adverse obstetric outcomes were estimated using multiple regression analysis. The association between country of origin/birth and risk of obstetric outcomes was assessed in reference to ethnic Norwegians, and the analyses controlled for several confounding variables.

Results: *Paper I:* Relative to ethnic Norwegians, women from East, Southeast, and Central Asia were at increased risk of operative vaginal delivery, postpartum bleeding, and low Apgar scores. African women were at increased risk of postterm birth, meconium-stained liquor, episiotomy, operative vaginal delivery, emergency cesarean section, postpartum bleeding, low Apgar scores, and a low birth weight. Women from South and Western Asia were at increased risk of a low birth weight.

Paper II: Women from Somalia exhibited the greatest risk of adverse obstetric outcomes and had increased odds ratios for emergency cesarean section, postterm birth, meconium-stained liquor, and a small for gestational age infant. They also had a reduced odds ratio for the use of epidural analgesia and a large for gestational age infant. Women from Iraq and Afghanistan differed in the median gestational age and mean birth weight and had an increased odds ratio for infants regarded as small for gestational age. Women from Kosovo did not differ from ethnic Norwegians in any obstetric outcomes assessed.

Paper III: Seven hundred sixty-nine infants were treated for neonatal jaundice. Relative to infants born to ethnic Norwegians, infants born to mothers from East, Southeast, and Central Asia and African mothers were at an increased and decreased risk, respectively, of neonatal jaundice. A substantial number of jaundiced infants of African origin were transferred to neonatal intensive care units relative to jaundiced Norwegian infants.

Paper IV: Relative to the first-generation Pakistani immigrants, the second-generation reported more health issues prior to pregnancy and an increased proportion experienced preterm birth (week 35^0 to 36^6) relative to Norwegians. An increased number of newborns of first-generation immigrants were transferred to neonatal intensive care units relative to Norwegian newborns.

Conclusions and clinical implications: The results of this study suggest that even in a pregnant population that gives birth in a low-risk maternity ward, the obstetric outcomes of immigrants are significantly different from ethnic Norwegians. We introduced a theory that women of African origin, particularly from Somalia, are exposed to stressful pregnancies. The combined results of adverse obstetric outcomes give the impression of a fetus in distress with suboptimal conditions during pregnancy. To reduce stress and suboptimal conditions for these women, antenatal care must adapt to accommodate their needs. This adaption involves a substantial investment in the development of well-functioning interpreting services and strengthening midwifery services to facilitate a more individualized approach to high quality antenatal care.

SUMMARY IN NORWEGIAN

Innvandringen til Norge har økt kraftig de siste 20 årene og i dag utgjør innvandrere og deres barn 15,6 prosent av Norges befolkning. Helsetilstanden til innvandrere og etnisk minoriteter har vist seg å være dårligere enn for resten av befolkningen, og de har vist seg å ha høyere risiko for enkelte uheldige fødselsutfall. Ved Bærum Sykehus er 40 prosent av de fødende innvandrerkvinner, og av disse er det 63 prosent som kommer fra ikke-vestlige land.

Vi ønsket å undersøke sammenhengen mellom opprinnelsesland og risiko for uheldige fødselsutfall ved vår fødeavdeling og gjennomførte en observasjonsstudie i perioden 2006-2010/2013. Vi sammenliknet fødselsutfall av norske kvinner og ulike grupper innvandrerkvinner. Siden det ikke er barneavdeling tilknyttet sykehuset er de fødende en utvalgt gruppe kvinner med svangerskapsalder over 35 uker hvor man forventer et friskt barn. Fødeavdelingen ved Bærum sykehus er i denne studien referert til som en lav risiko avdeling.

Data til denne studien mottok vi fra Medisinsk Fødselsregister som inneholdt opplysninger om kvinnenes svangerskap, fødsel og den første tiden etter fødsel. I tillegg fikk vi opplysninger om kvinnenes fødeland, opprinnelsesland, innvandrings kategori, alder ved innvandring og utdannelsesnivå fra Statistisk Sentralbyrå.

Vi undersøkte fire ulike problemstillinger hvor vi studerte forskjeller i karakteristika ved kvinner og deres svangerskap og utfall av fødsel ved hjelp av krysstabell analyser. Vi estimerte også risiko ved hjelp av regresjonsanalyser hvor innvandrerkvinner ble vurdert i forhold til norske kvinner, og flere faktorer som kunne tenke seg å påvirke sammenhengen mellom opprinnelsesland og fødselsutfall ble justert for.

Resultatene fra denne studien viser at enkelte grupper innvandrerkvinner har økt risiko for uheldige fødselsutfall sammenliknet med de norske:

- Kvinnene fra Øst-, Sørøst- og Sentral-Asia hadde økt risiko for sugekopp/tang forløsning, blødning etter fødsel og lav Apgar score. I tillegg hadde deres nyfødte en økt risiko for å få gulsott.
- Kvinnene fra Sør- og Vest-Asia hadde økt risiko for å få barn med lav fødselsvekt.
- Kvinnene fra Afrika hadde økt risiko for overtidig fødsel, misfarget fostervann, episiotomi, sugekopp/tang forløsning, akutt keisersnitt, blødning etter fødsel, lav Apgar score og for å få barn med fødselsvekt under 2,5 kg. Deres nyfødte hadde en lavere risiko for å få gulsott, men de med gulsott ble oftere overflyttet til en nyfødt intensiv avdeling.
- Kvinnene fra Somalia var mest utsatt for uheldige fødselsutfall med økt risiko for akutt keisersnitt, overtidig fødsel, misfarget fostervann og for å få barn som veide mindre

enn svangerskapsalderen skulle tilsi. De hadde lavere risiko for å få epidural bedøvelse og for å få barn som veide mye i forhold til svangerskapsalder.

- Kvinnene fra Irak og Afghanistan hadde noen dager kortere svangerskap, lavere gjennomsnittlig fødselsvekt og de hadde økt risiko for å få barn som veide lite i forhold til svangerskapsalderen.
- Andregenerasjons Pakistanske innvandrer kvinner hadde flere registrerte helseproblemer før svangerskapet sammenliknet med førstegenerasjons innvandrere. Sammenliknet med de norske hadde nyfødte av førstegenerasjons Pakistanske innvandrere økt risiko for å bli overflyttet til en nyfødt intensiv avdeling, og andregenerasjons innvandrere hadde en høyere andel for tidlig fødsler (uke 35^0-36^6).

Funnene i denne studien tyder på at selv i en gravid populasjon som føder ved en lav risiko fødeavdeling er det betydelig ulikheter i risikoen for uønskede fødselsutfall mellom innvandrere og norske kvinner. Vi illustrerte en teori om at kvinner av afrikansk opprinnelse, spesielt kvinner fra Somalia, er utsatt for stress i svangerskapet. De samlede resultater for denne gruppen gav oss et inntrykk av at fosteret ikke har hatt optimale forhold i svangerskapet og virket stresset under fødsel. Dagens svangerskapsomsorg må justeres for å bidra til å redusere forskjellene i risiko for uønskede fødselsutfall. Det innebærer en betydelig investering i å utvikle velfungerende tolketjenester og styrking av jordmortjenesten i svangerskapsomsorgen for å tilrettelegge en mer individtilpasset omsorg av høy kvalitet.

ABBREVIATIONS

BMI	Body mass index
CI	Confidence interval
CS	Cesarean section
FGM	Female genital mutilation
HPA	Hypothalamic-pituitary-adrenal
ICD-10	International Classification of Diseases
LGA	Large for gestational age
LBW	Low birth weight
MBRN	The Medical Birth Registry of Norway
NICU	Neonatal intensive care unit
OR	Odds ratio
PSTD	Posttraumatic stress disorder
RR	Relative risk
SD	Standard deviation
SGA	Small for gestational age

DEFINITIONS

Country of birth	The individual's mother's country of residency at the time of birth.
Country of origin	The individual's mother's, or her father's country of birth. In cases were the parents had different countries of birth, the mother's country of birth is chosen. If this information was not available, the woman's country of birth was used.
Low-risk maternity ward at Baerum Hospital	A first-level maternity ward with no neonatal intensive care unit (NICU). Women giving birth comprise a selected low-risk group, at more than 35 weeks of gestation and expecting a healthy baby. Women with gestational diabetes and pre-eclampsia give birth at Baerum Hospital, but women with type 1 diabetes, preterm labor before week 35^0, pregnancies with more than two fetuses or fetuses with known health issues are referred to hospitals with a NICU. Sick babies are transferred to a NICU at another hospital.
Ethnic Norwegian	Norwegian-born of two Norwegian-born parents and four Norwegian-born grandparents.
Migration	People moving from one place to another, in this case from one country of origin to Norway.
Immigrants	Persons born abroad of two foreign-born parents and four foreign-born grandparents and that have immigrated.
Norwegian-born to immigrant parents	Persons born in Norway of two foreign-born parents and four foreign-born grandparents.
Immigrant population	Defined by Statistics Norway as persons born abroad of two foreign-born parents and four foreign born grandparents and persons that are Norwegian-born to immigrant parents.
Descendant	An individual born in (this case) Norway by two foreign-born parents and four foreign-born grandparents.
First-generation immigrant	Persons born abroad of two foreign-born parents and four foreign-born grandparents.
Second-generation immigrant	Persons born in Norway of two foreign-born parents and four foreign-born grandparents.
Consanguinity	Parents are considered consanguineous if they have at least one ancestor in common, i.e. blood relationship between spouses.
Obstetric outcomes	Outcomes of pregnancy, birth, and the first postpartum period of mother and fetus/infant.

LIST OF PAPERS

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

I Bakken KS, Skjeldal OH, Stray-Pedersen B. Higher risk for adverse obstetric outcomes among immigrants of African and Asian descent: A comparison study at a low-risk maternity hospital in Norway. *Birth.* 2015; 42(2): 132-140.

II Bakken KS, Skjeldal OH, Stray-Pedersen B. Immigrants from conflict-zone countries: a comparison study of obstetric outcomes in a low-risk maternity hospital in Norway. *BMC Pregnancy and Childbirth.* 2015; 15:163.

III Bakken KS, Skjeldal OH, Stray-Pedersen B. Neonatal jaundice and the immigrant population: A comparison study at a low-risk maternity ward in Norway. *Nordic Journal of Nursing Research.* 2015; 35:165-171, first published online 2 June 2015.

IV Bakken KS, Skjeldal OH, Stray-Pedersen B. Obstetric outcomes of first- and second-generation Pakistani immigrants: a comparison study at a low risk maternity ward in Norway. *Journal of Immigrant and Minority Health.* 2015; published online 26 December 2015.

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1. INTRODUCTION

1.1 Background

A greater number of individuals are on the move today compared with any other time in human history. To date, there are approximately 232 million individuals, which constitutes approximately 3.2% of the world's population, who live outside their country of birth.[2] This number has rapidly increased since 1990, when there were 154 million international migrants. The health status of migrants and ethnic minority groups has often been demonstrated to be inferior to the average population, and several studies conducted in different regions of the world have identified a health disparity between immigrants and native populations.[3-7] According to the World Health Organization, the health of immigrants and migration-related health issues are crucial public health challenges.[8] Immigrant health is predominately associated with the same factors that affect the health of native populations; however, a number of factors that exert an impact on health apply primarily or uniquely to immigrants. These factors include the socioeconomic status in the country of origin, experience of trauma or torture, fear of persecution, the asylum process, social network, work and living conditions in the new country, and acculturation and language issues.[9-13] Several issues, such as stigma, discrimination, social exclusion, language and cultural diversity, separation from family and sociocultural norms, and financial and administrative hurdles, may also limit an immigrant's access to health services.[8]

1.2 Classification of immigrants

Studies examining migration and health often use different words and labels to describe immigrants, due to differences in national policies and academic areas.[14] Therefore we sought to clarify the meanings of the terms used in this thesis (textbox "Classification of immigrants" p.15).

Classification of immigrants

Country of birth: The woman's mother's country of residency at the time of her birth.

Country of origin: The woman's mother's, or her father's country of birth. In cases where the parents had different countries of birth, the mother's country of birth was used. If this information was not available, the woman's country of birth was used.

Immigrant: Women born abroad of two foreign-born parents and four foreign-born grandparents and that have immigrated to Norway. Their descendants are also referred to as immigrant in this thesis.

First-generation immigrant: Women born abroad of two foreign-born parents and four foreign-born grandparents.

Norwegian-born to immigrant parents: Women born in Norway of two foreign-born parents and four foreign-born grandparents.

Second-generation immigrant: The same classification as "Norwegian-born to immigrant parents".

Descendant: The same classification as "Norwegian-born to immigrant parents".

Ethnic Norwegian: Norwegian-born to two Norwegian-born parents and four Norwegian-born grandparents.

1.3 The immigrant population in Norway

Norway's immigrant population is increasing. At the beginning of 1992, the number of individuals from foreign countries constituted 4.3% of the total population; to date, individuals from 222 different countries constitute 15.6% of Norway's population. This includes 2.6% of Norwegian-born to immigrant parents.[15] Immigrants and Norwegian-born to immigrant parents are, on average, substantially younger than the general population, with more than half of all immigrants aged between 20 and 40 years.[15] Figure 1.1 shows the 16 largest immigrant groups in Norway as of January 1, 2014, separated into immigrants and Norwegian-born to immigrant parents (i.e., second-generation immigrants). Pakistan has the largest group of second-generation immigrants in Norway, comprising 15,615 individuals, which is nearly half of the total Pakistani population in Norway.

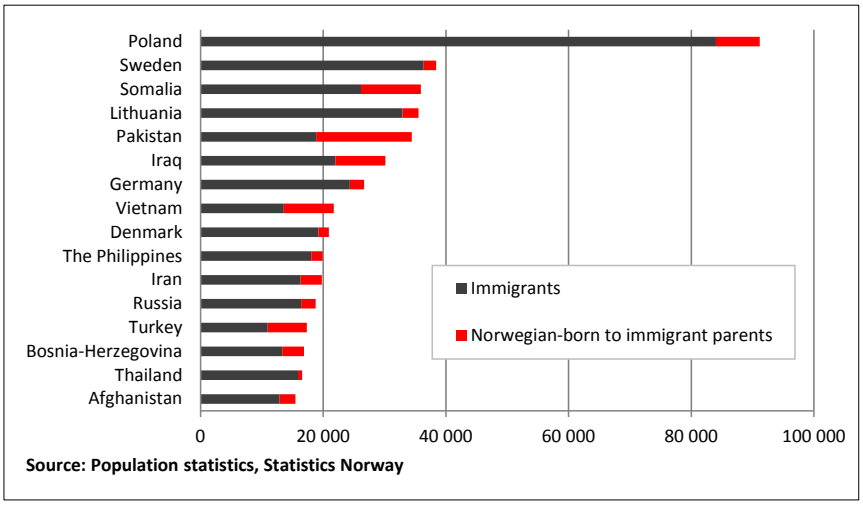

Figure 1.1 The 16 largest immigrant groups of immigrants and descendants living in Norway by January 1, 2014 in absolute figures.

By January 2014, 28.4% of immigrants were refugees, with individuals from Somalia and Iraq comprising the largest and second-largest groups, respectively.[16] Reasons for immigration influence the amount of time that immigrants remain in Norway. Of all immigrants, a larger proportion of refugees had remained in Norway (85.5%) relative to individuals who have immigrated for education (42%), as of January 1, 2014. Figure 1.2 shows the immigrant population in absolute numbers, according to the reason for

immigration, from 1990 to 2013. A drastic increase in labor immigration has occurred since 2004 because of the expansion of the European Union, which was joined by 10 new countries that year. Citizens from these countries were granted the right to seek employment in Norway.

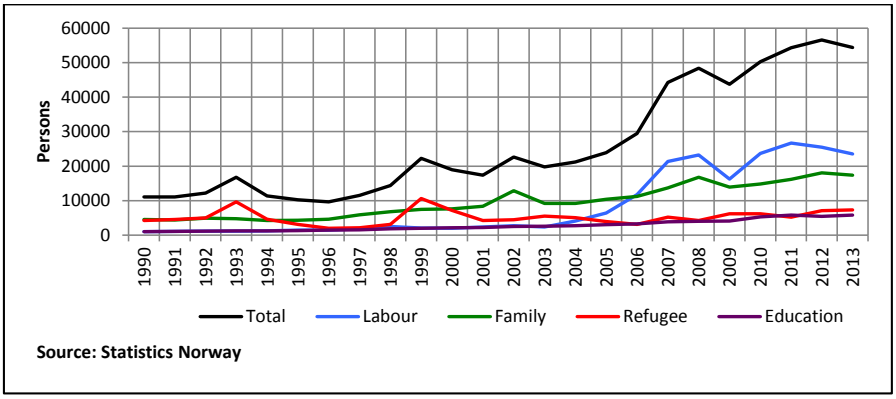

Figure 1.2. Reasons for immigration and time of immigration in absolute figures.

1.3.1. Socioeconomic position

In 2012, 50.1% of the refugee population was registered as employed; this proportion was lower than the total Norwegian (68.7%) and immigrant (62.8%) populations.[17] Figure 1.3 shows the employment rates for the total population for the 4th quarter of 2013 for nonimmigrant and immigrant populations. Figure 1.4 shows the employment rates for the various immigrant groups according to the world region. The employment rates were lowest in immigrants from Africa and Asia.

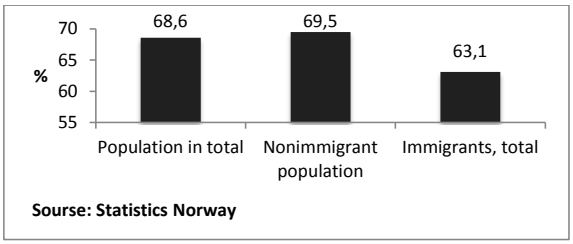

Figure 1.3. Employed total population divided in immigrants and nonimmigrants in Norway. Absolute prevalence (%) of persons aged 15–74 years. 4th quarter 2013.

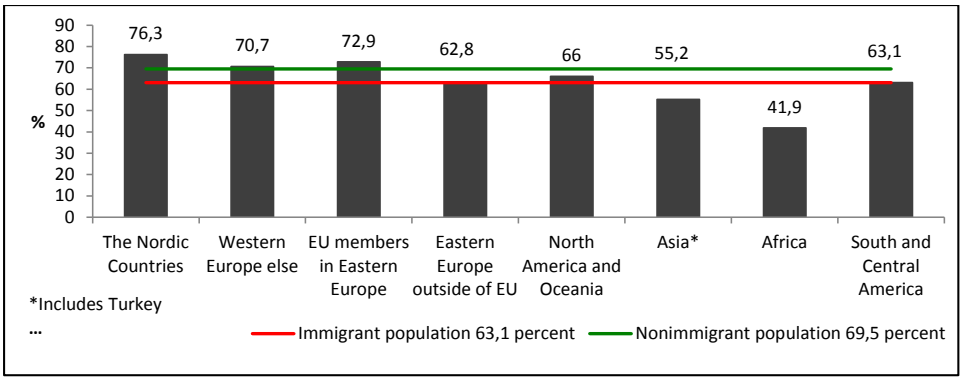

Figure 1.4. Employed nonimmigrants and immigrants in Norway by world region. Absolute prevalence (%) of persons aged 15–74 years. 4th quarter 2013.

A 2014 report regarding the employment rate for immigrants in Norway indicated that it increased with an increasing duration of residence in the country; however, this increase took longer for women.[18] The report also demonstrated that the number of individuals who receive economic transfers from the government decreased as the duration of residence in Norway increased. Refugees and family immigrants exhibited lower employment rates relative to other immigrants, and the rates were lowest for immigrants from Asia and Africa; however, this effect varied between countries in the same global region.

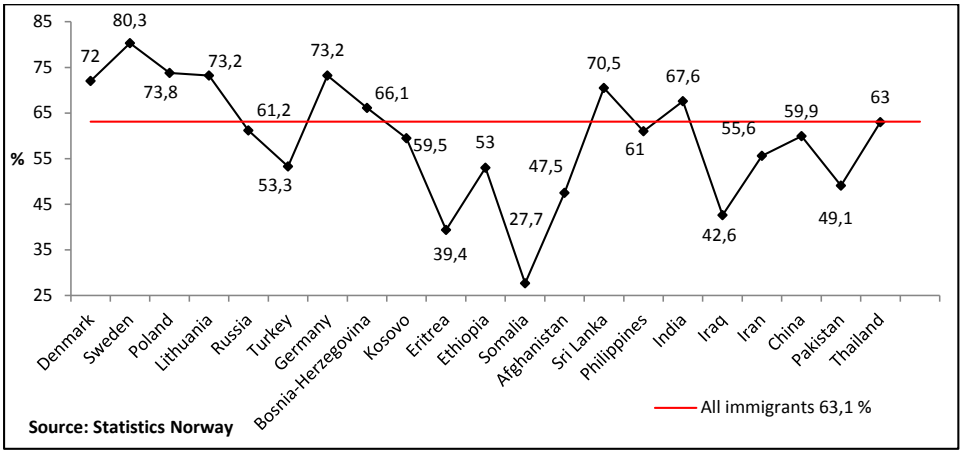

Figure 1.5. Employed immigrants in Norway by selected countries of birth. Absolute prevalence (%) of persons aged 15–74 years. 4th quarter 2013.

Figure 1.5 shows the employment rates for immigrants from specific countries and illustrates the differences in the rates between countries in the same region. The

employment rate for immigrants from Ethiopia is approximately 20% higher than the rate for immigrants from Somalia.

Unemployment is a corresponding socioeconomic factor. Unemployment rates are increased in immigrants relative to the nonimmigrant population.[19] Figure 1.6 shows the unemployment rates for immigrants according to their global regions of origin and demonstrates that the rates are highest for immigrants from Africa and Asia.

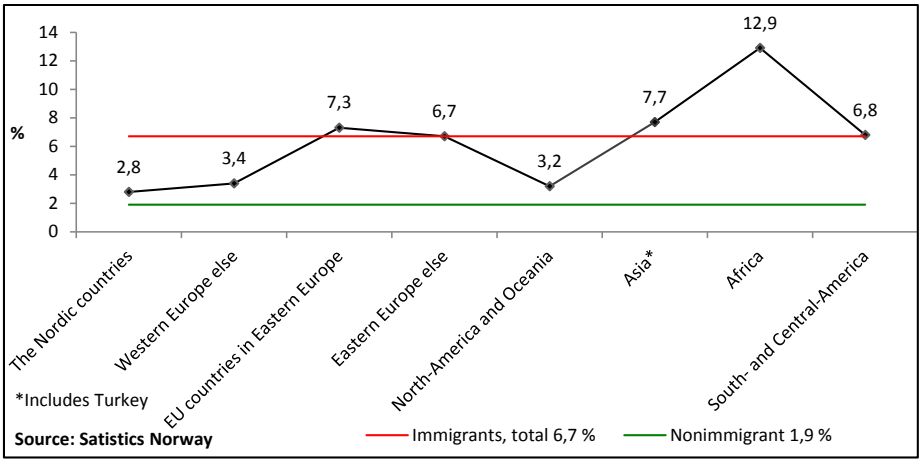

Figure 1.6. Registered unemployed in Norway by immigrant world region. Absolute prevalence (%) of the labour force. 4th quarter 2014.

A report regarding family immigration and migrant workers, published by Statistics Norway,[20] indicated that women who immigrate to Norway to establish a family with an individual with a nonimmigrant background were twice as likely to gain employment outside the home relative to women who came to Norway to reunite with a refugee. Bratsberg et al.[21] determined that second-generation immigrants were more similar to Norwegians in terms of educational attainment and participation in the labor market relative to their parents.

The immigrant population has also been demonstrated to be at a substantially greater risk of persistent financial poverty relative to the rest of the Norwegian population.[22] According to the Organization for Economic Co-operation and Development's measurements, 8% of immigrants, 10% of refugees, and only 1% of the nonimmigrant population live in poverty in Norway.[22] There are also substantial differences in the living conditions between immigrants according to their country of origin. The greatest degree of poverty was identified in immigrants from Somalia, 23% of whom were defined as impoverished between 1993 and 2007. In addition, 17% of the

Pakistani population were classified as poor.[22] A more recent update indicated that 12–20% of immigrants from Asia, Africa, and South America and 3–5% of immigrants from Western Europe, North-America, and Oceania lived in poverty in Norway.[23] An increased proportion of immigrants receive economic transfers from the government relative to Norwegians; 8% of immigrants older than 18 years of age received economic transfers in 2008, whereas this figure was only 3% for their Norwegian counterparts.[24] However, immigrant groups significantly differ in this regard because of differences in their reasons for immigration and their durations of residence. These two elements exhibit a considerable contribution to the prediction of need for social assistance.

1.4 Why are there ethnic differences in health outcomes?

Reports from Norway have indicated lower self-reported health in immigrants relative to ethnic Norwegians.[25] Immigrant groups vary substantially, and lower levels of self-reported health have been identified in immigrants who have experienced discrimination or violence. Immigrants with strong socioeconomic positions have been demonstrated to exhibit superior health relative to immigrants without a good education or employment.[25] Well-developed Norwegian language skills and a healthy life style also contribute to good health. However, Blom[26] determined that the duration of stay in Norway did not exert an impact on immigrant health.

Previous decades of research regarding health disparities between immigrants and the receiving country populations have resulted in several theories that illuminate the reasons for these differences. As previously mentioned, the health of immigrants is predominately associated with the same factors that affect the health of receiving country populations; however, a number of factors that exert an impact on health apply primarily or uniquely to immigrants. A short description of the most important factors is provided in this chapter.

Healthy migrant effect

Although the health of immigrants has often been demonstrated to be worse than the receiving country population in Europe, certain immigrant groups in Canada and the United States have exhibited better health outcomes.[27-30] One potential explanation for this finding may be a form of selection bias, in which the immigrants are a selected healthy

proportion of the population who are more able to migrate relative to the individuals who do not migrate; this effect often referred to as “the healthy migrant effect”.

Negative results of migration

Studies in Europe most often indicate that the health of immigrants is worse than the receiving country population; thus, theories regarding the effect of the migration process have emerged. One theory involves the interaction of genes and the shift in environment. One example is the increased risk of diabetes among immigrants from South Asia.[31] Immigrants from Sri Lanka and Pakistan who live in Oslo have been reported to change their food habits to a more fat rich food pattern.[32] This process is negative in the western context because adaptation of a more western diet increases the amount of fat relative to a traditional South Asian diet.[33]

Other negative results from migration are related to immigrant’s abilities to adapt to their new society. Various elements, including the willingness to adapt, the extent of cultural diversity between the country of origin and host country, and the ability to work and participate in the new society, influence the acculturation process.[34] A Norwegian report indicated that immigrants considered well socially anchored with good Norwegian language skills were also characterized as individuals in good health.[26] Individuals who had experienced discrimination, violence or threats, however, reported poorer health.[26] In the UK, a lack of acculturation, specifically, poor fluency in English, was reported to be an independent predictor of the persistence of depression in Pakistani women.[35]

Differences in socioeconomic status

Socioeconomic status has been demonstrated to exert an impact on inequities in health, regardless of immigrant status.[36] Furthermore, a poor socioeconomic status is more common in immigrants relative to receiving country populations. This finding is also the case in Norway as described more closely in chapter 1.3.1.

The effect of socioeconomic status on health outcomes may be described as materialistic and includes access to resources, such as safe environments at home and at work, and the ability to access healthcare services.[37] It may also be described as behavioral, which includes psychological factors, cultural factors, and the comprehension of health information (e.g., limited health literacy).[37] Research in Sweden has demonstrated that the majority of refugees who attend a language school for immigrants had inadequate or limited health literacy.[38]

Biological differences

Some disparities in health outcomes may be explained by different genetic and biological factors that increase the risk for specific diseases.[39]

Cultural differences

Cultural differences affect our lifestyle habits, such as food choices, level of physical activity, and body image.[40] A Swedish study reported that Somali women were aware that physical activity was an important contributor to a healthy lifestyle; however, they experienced several obstacles to become physically active.[41] The participants continued their traditional Somali food intake in Sweden, which is very high in sugar. Furthermore, they expressed that traditions were a part of one's identity, which became more important when moving to another country.[41]

Limited access to health care

Many factors may limit an immigrant's access to health care. Understanding the local healthcare system may be limited, and health services may not be tailored to accommodate cultural diversity.[42] There may be structural and societal factors that limit the availability of health care to certain immigrant groups; moreover, discrimination may also result in poorer access. In a recent review from the United States, the authors concluded that most healthcare providers appeared to have an implicit bias in terms of positive attitudes toward white individuals and negative attitudes toward individuals of color.[43] A Norwegian report has indicated that half of the immigrants in the study had experienced discrimination in one or several areas in the Norwegian society, and 7% believed that they had received poorer treatment from the Norwegian healthcare system because of their immigrant status.[44]

In a Swedish qualitative study, the physicians who were interviewed discussed two types of discrimination in the Swedish health care system.[45] One type was interpersonal discrimination, which occurred as a result of healthcare providers' attitudes and prejudices, lack of experience, or neglecting to call for an interpreter when needed. The other type was structural discrimination, exemplified by the interpreter services being expensive, which lead to interpreters being used for only a limited time.[45]

Difficulties in communication create misunderstandings that may exert a negative effect on treatment. These difficulties reduce access to proper healthcare services because patients are unable to express their needs as a result of cultural and linguistic issues.[46] The

impact of language barriers on the way in which asylum seekers report health problems following arrival in Switzerland has been examined.[47] The study identified inadequate language concordance in 18% of consultations, and adequate language concordance was associated with an increased incidence of reporting traumatic experiences and psychological symptoms. In consultations that involved inadequate language concordance, fewer asylum seekers were referred to psychological care. This finding highlights the importance of good communication and the use of interpreters. According to national and international standards, interpreting is the healthcare worker's communicative responsibility.[46]

1.5 Childbirth among the immigrant population in Norway

The number of immigrant women of fertile age in Norway increased from 50,000 in 1990 to more than 200,000 in 2013. In 2012, 23% of babies were born to immigrant mothers.[48] Figure 1.7 shows the 10 countries of origin with the largest increases in the numbers of Norwegian-born to immigrant parents in 2013 (i.e., the largest immigrant groups who gave birth in Norwegian hospitals in 2013).

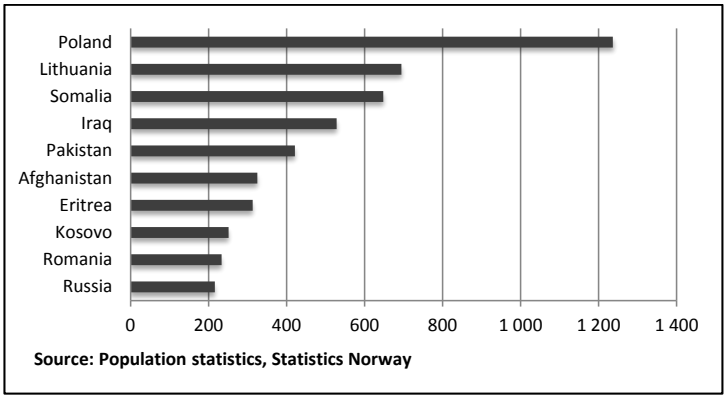

Figure 1.7 The 10 countries of origin with the largest increase in numbers of Norwegian-born to immigrant parents (i.e., second-generation immigrants) in 2013. Absolute figures.

Although there has been an increase in births to immigrant mothers in Norway, the fertility rate for immigrant women decreased from 2.6 in 2000 to 2.1 in 2012.[48] The fertility rate has been demonstrated to be highest immediately after women arrive in Norway and decreases with a longer duration of stay. In addition, recent fertility rates for

newcomers have been demonstrated to be lower relative to one or two decades earlier.[48] The fertility rate is increased in immigrants compared with Norwegians and was recorded at 1.78 for the total fertile female population in Norway in 2013.[49]

At the maternity ward in Baerum Hospital, women who originated from Sweden, Poland, and Somalia had the greatest numbers of births during 2006–2013 (Figure 1.8).

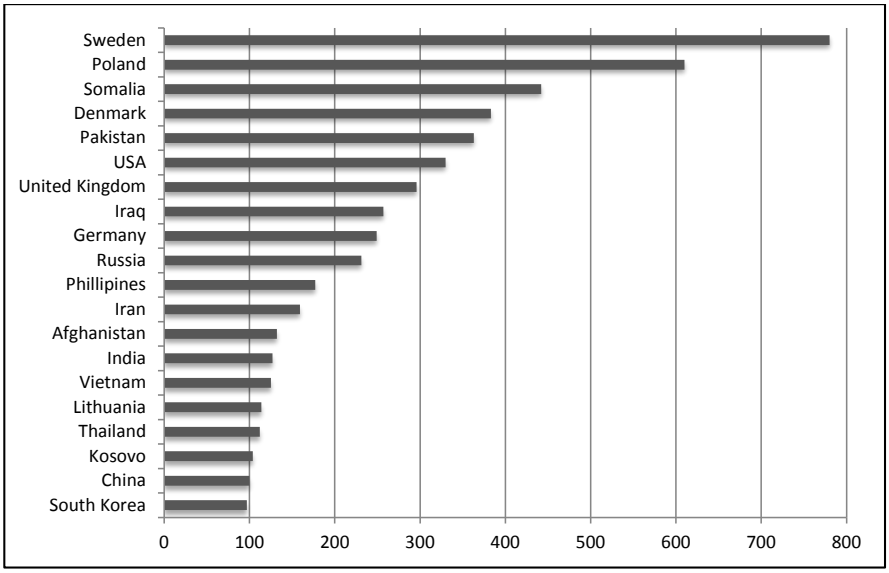

Figure 1.8. The 20 countries with the greatest number of births by immigrants at Baerum Hospital during 2006–2013 in absolute figures.

1.6 Reproductive health of immigrant women in Norway

A number of studies conducted in Norway have examined different aspects of reproductive health in immigrant women. Relative to Norwegians, immigrant women more frequently undergo induced abortions. Non-Western immigrants were a particularly high-risk group.[50-52] In addition, fewer immigrant women have been reported to use hormonal contraception relative to Norwegians, and this difference is greatest in the youngest age group (16−25 years).[53] In women from Southern Asia and North Africa, the prevalence of diabetes is high and has demonstrated to be seven times higher in pregnant women from these countries relative to pregnant ethnic Norwegians.[54, 55]

In the Pakistani population, the prevalence rates of postpartum depression and sexually transmitted infections have been reported to be lower relative to Norwegians.[56, 57] The pregnant Pakistani population has also exhibited a somewhat lower infectious

immune status.[58] During pregnancy and labor, immigrants have been found to be treated differently;[59] specifically, Pakistani women have been reported to be less likely than Norwegians to receive analgesia during labor.[60] An increased risk of birth defects and progressive encephalopathy have also been reported for infants born to Pakistani parents.[61, 62] A high prevalence of consanguinity (30.1%) explained this risk because infants with nonconsanguineous parents were not at an increased risk of birth defects. An increased risk of stillbirth and infant death has also been reported in consanguineous parents and was estimated to contribute to 29% of the deaths that occurred in the Pakistani population in Norway during the study period.[63] No risk difference was identified in infants born to nonconsanguineous parents. Furthermore, consanguinity has been reported to increase the risk of recurrence of birth defects and perinatal death.[64, 65] An increased risk of stillbirth and infant death was recently identified in Pakistani immigrants and persisted in second-generation Pakistanis.[66] Saastad et al.[67] examined stillbirths and determined whether optimal health care had been received by the mothers involved. The risk of stillbirth was 2.2 times higher in non-Western immigrants compared with Norwegians, and the non-Western group often received suboptimal care. However, differences in perinatal mortality between the ethnic groups were not explained by differences in birth weight.[68]

Substantial variation in the prevalence of hyperemesis gravidarum according to country of birth has been reported.[69, 70] Women born in India and Sri Lanka exhibited the highest frequency of emesis during pregnancy at 3.2% and were 3.4 times more likely to develop the condition compared with Norwegian women. This variation could not be explained by sociodemographic factors or the duration of residency in Norway. Grjibovski et al.[71] examined the relationship between consanguinity and the presence of hyperemesis gravidarum. The authors determined there were no association and could not explain the differences in the frequency of hyperemesis between Norwegian, Pakistani, and Turkish pregnant women.

Research has also focused on Somali women in Norway since Vangen et al. reported that this group exhibited one of the highest prevalence rates of emergency cesarean section (CS).[72] The same research group stated that Somali women experienced perinatal complications more frequently relative to ethnic Norwegian women.[73] They argued that this finding may have been a result of the elaborate use of female genital mutilation (FGM) in Somalia. In a qualitative study in which Somali women and healthcare professionals were interviewed regarding their perinatal care experiences,

Somali women reported a fear of receiving suboptimal treatment because of the limited experience of Norwegian healthcare workers.[74] Somali women also expressed a strong fear of CS, and healthcare workers expressed uncertainty regarding how they should provide care for infibulated women. Another study that examined healthcare workers experiences in working with infibulated women in Norway reported that the workers faced technical challenges with respect to de-infibulation.[75] In addition, they faced emotional challenges related to their feelings regarding FGM and their opinions regarding the expression of male oppression. A study in Oslo indicated that Somali immigrants who had been residents in Norway for longer periods demonstrated a tendency to abandon the practice of FGM.[76, 77] Furthermore, of the 30% of immigrants who supported this practice, most immigrants had recently arrived in the country.

Data for 1986–1995 from the Medical Birth Registry of Norway (MBRN) indicated CS rates of 25.8% for Filipino women and 12.4% for Norwegians.[72] The high proportion of Filipino women married to Norwegian men was considered to exert an influence on these results. Therefore, the ethnicity of the father was examined to determine its influence on infant birth weight. There was an increase in infant birth weights in mixed couples (200 g) compared with Filipino couples; however, the overall risk of CS was higher for Filipino couples. The authors therefore concluded that other factors may also play a role in the outcomes in this patient group.[78]

Al-Zirqi et al.[79] examined the risk factors related to severe obstetric hemorrhage and, among other findings, reported that women from Southeast Asia were at an increased risk of severe postpartum hemorrhage; in contrast, Middle Eastern women had a decreased risk relative to Norwegian women.

Most recently, Sørbye and colleagues investigated the association between the duration of immigrant residence in Norway and pregnancy outcomes. The authors reported that the risk of nonspontaneous preterm birth increased with longer durations of residence in Norway.[80] in contrast, the risk of spontaneous preterm birth was not affected. Women from Vietnam and the Philippines exhibited the highest prevalence rates of spontaneous preterm birth. In addition, Sørbye et al.[81] examined the risk of CS according to residence duration in Norway. Women were assigned to groups according to the CS rates in their countries of birth, which were classified as low or high relative to the rate of 16% reported for non-immigrants. The risk of a planned rather than emergency CS differed according to the duration of residence in the low-level group (including immigrants from Iraq, Pakistan, Poland, Turkey, and Vietnam). In contrast, the risk of CS

did not significantly differ in the high-level group (including immigrants from the Philippines, Somalia, Sri Lanka, and Thailand).

1.7 Migration and pregnancy outcomes

Internationally, the associations between migrant background and adverse pregnancy outcomes have been examined in several epidemiological studies.[82-88] The findings are similar for some outcomes, but vary for other outcomes. This is not surprising because immigrant groups are heterogenic, and host countries are diverse with respect to culture and healthcare services. The factors that have been discussed in the literature as potential contributors to disparities in pregnancy outcomes are numerous and complex. Some of these factors will be presented in this chapter.

1.7.1 Biological aspects

Consanguineous marriages are prevalent in the Pakistani population in Norway, although in decreasing propotions.[89] Consanguinity has been demonstrated to increase the risk of recessive genetic disease for offspring, and it may increase the risk of preterm birth, congenital malformations, and fetal and infant mortality.[90]

Genetic deficiencies have also been reported in specific ethnic groups. A deficiency in the enzyme glucose-6-phosphate-dehydrogenase is the most common genetic disorder, which is prevalent in regions exposed to endemic malaria, and may increase the risk of neonatal jaundice.[91, 92] Studies have reported an increased risk of pre-eclampsia and eclampsia in women of Sub-Saharan African origin, and it has been suggested that this risk is dependent on biological and genetic factors; however, the causal genes have not yet been identified.[93, 94] Anemia during pregnancy may be caused by poor nutrition, iron deficiencies, and thalassemia, which is a genetically inherited blood disorder also prevalent in regions exposed to endemic malaria.[95]Anemia may cause low birth weight and preterm birth.[95]

The birth weights of babies born to mothers of Asian origin are often lower relative to western receiving country populations. The reason for this finding is often suggested to be biological or genetic, and birth weight curves tailored to the maternal geographical region of origin have been proposed.[96]

Other biological factors that influence pregnancy outcomes include the maternal body mass index (BMI). Maternal underweight has been associated with increased risks of preterm birth and low birth weight (LBW).[97] Maternal overweight has been associated with increased risks of gestational diabetes, pre-eclampsia, CS, and post-partum hemorrhage.[97] A previous CS has been demonstrated to increase the risk of maternal and neonatal morbidity, including placenta previa, uterine rupture, preterm birth, LBW, and stillbirth.[98]

1.7.2 Psychosocial aspects

During recent years, maternal stress during pregnancy has received increased attention. There is evidence to suspect that maternal psychosocial stress during pregnancy may have effects on babies' development, which may also be transmitted to the next generation (i.e., grandchildren).[99] The most commonly studied outcomes are LBW and preterm birth.[100] A recent systematic review identified strong evidence for an association between maternal psychosocial stress during pregnancy and spontaneous preterm birth.[101]

The mechanisms that control these affects have also gained substantial focus, with a predominate focus on the hypothalamic-pituitary-adrenal (HPA) axis. The HPA axis is activated during stress, which leads to the release of the hormone cortisol. Exposure to high levels of cortisol is thought to affect fetal behavior, immunological maturation, and brain development.[99] Increased maternal cortisol levels have been demonstrated to increase fetal cortisol concentrations and may lead to an increased production of corticotrophin-releasing hormone in the placenta, which has been related to reduced fetal growth.[99]

Stress may also affect the maternal immune system, thereby leading to increased vulnerability to infections, which is one of the primary causes of spontaneous preterm birth.[99] Furthermore, stress may affect maternal behavior, which may ultimately lead to adverse outcomes.[102, 103]

Asylum seekers and refugees have been demonstrated to more frequently fulfill the criteria of posttraumatic stress disorder (PTSD) relative to other immigrants.[10, 104] PTSD is associated with changes in the HPA axis.[105] However, conflicting results have been reported regarding the effect of PTSD on preterm birth and LBW.[106, 107] A recent study indicated that increased cortisol production was associated with increased exposure to stressful and traumatic lifetime events, independent of PTSD and depressive symptoms.[108]

Other adverse obstetric outcomes have also been reported in relation to maternal psychosocial stress. One study indicated that depressive symptoms in the third trimester increased the risk of an emergency CS.[109] A Swedish study reported an association between antenatal depression and/or anxiety and an increased use of elective CS and epidural analgesia.[110]

1.7.3 Socioeconomic position

Socioeconomic factors also influence pregnancy outcomes.[111, 112] In Nordic countries, the risk of preterm birth is inversely related to maternal educational attainment,[113] and epidemiological studies have indicated social inequalities in infant mortality and an inverse association between socioeconomic status and the risk of post-neonatal death.[114, 115] Educational levels involve several factors that enhance an individual's understanding and knowledge of health and nutrition, as well as the ability to engage in preventive behaviors.[116] For individuals from low-income countries and residents in Sweden, research has also identified an increased odds of severe maternal morbidity[117] and excess mortality in immigrant women of reproductive age.[118]

A Swiss epidemiological study reported that the general health status of asylum seekers varied.[119] This variation was dependent on the political, psychosocial, and economic circumstances under which the migration occurred. Refugees are less likely to receive the social support required to adjust to a different culture and a new language in a host country. Moreover, refugees are more likely to have experienced stressful life events, which are often the cause of the need to escape from their own countries.[120]

A group of researchers in the Netherlands raised the question of whether the country to which individuals migrate is important.[121] The researchers stated that the role of the national context of the country of residence with respect to ethnic health inequality should be explored because findings have suggested that the health status of ethnic minority groups is not fixed across countries or generations. Norway is the world's richest country; however, this does not necessarily indicate that it has an adequate system for the treatment of immigrants in need of healthcare services. Furthermore, Dutch researchers have examined the prevalence of adverse perinatal outcomes in Western and non-Western women according to the social quality of the neighborhoods in which they live.[122] The researchers reported that social deprivation played different roles for Western and non-

Western women, and improvements in social quality improved perinatal outcomes for Western women; however, this effect was not observed in non-Western women.

1.7.4 Access to maternity care, communication barriers, and equity in health care

Immigrant women have been demonstrated to provide poorer ratings of the maternity care they received compared with non-immigrants.[123] Furthermore, there is a problem of equity in maternity care across European countries.[124] Refugees have been reported to be the most distinctive migrant group with high perinatal mortality.[87] They have also been determined to experience an increased number of medical problems but receive fewer interventions during labor. Refugees are more likely to experience low social status and communication problems and have a different understanding of health and disease. In contrast, Gagnon et al.[125] reported that being a refugee or asylum seeker reduced the odds ratio (OR) for undergoing an emergency CS compared with other immigrants in Canada.

There are also challenges expressed by healthcare providers in the care of the immigrant patients. Interviews with Norwegian midwives indicated that the management of antenatal care was the same for all individuals and was not adjusted to the needs of migrant women.[126] The factors that comprise barriers for immigrant women in accessing maternity care are diverse and include the lack of knowledge regarding available services, language barriers, problems in transportation, a lack of child care, absence of partner, difficulties in making appointments, differences in cultural practices, waiting times for appointments, discrimination, and cold weather.[123, 127, 128] Recent systematic reviews have indicated that several women have reported of hurtful comments by healthcare professionals, in addition to the feeling of being discriminated against because of ethnic or racial backgrounds.[127, 129]

Healthcare providers and immigrants express the same difficulties regarding linguistic challenges in maternity care. Communication barriers are relevant to most immigrant women. They tend to speak the language of the host country less fluently compared with men, even after several years of residence.[130] Furthermore, they are less exposed to the new culture because of their social roles, which often keep them inside the home.[130] In a systematic review, Bollini et al.[124] reported that pregnancy outcomes for immigrant women improved with better integration into the new society. Using an interpreter may also reduce the likelihood of adverse pregnancy outcomes.[131]

There is also cultural diversity with respect to the expression of pain and the words used to describe the body. Misunderstandings are related not only to language barriers but also to differences in social and cultural imagination.[132] Different strategies and attitudes regarding pregnancy and childbirth have been documented in qualitative studies that involved Somali women.[74, 133] A common attitude held by Somali women was that the surveillance of pregnancy was unnecessary as long as things appeared normal.[133] Somali women considered an antenatal care program to merely comprise a routine checkup, and the authors argued that they did not appear to benefit from the program as intended.

Alderliesten et al. reported that immigrant women in Amsterdam were more likely to enter antenatal care later in pregnancy compared with nonimmigrants.[134] For immigrants from non-Western countries who did not speak Dutch, this difference was explained by poor language proficiency, low educational levels, and higher numbers of teenage pregnancies. Late entry into antenatal care has also been identified in black women in England,[135] as well as for most foreign-born women in Sweden.[136] A Swedish study indicated that a high number of foreign-born women visited delivery wards spontaneously, thereby missing out on the full benefits of planned, routine, antenatal care. Another Swedish study reported that Somali women entered antenatal care later in pregnancy, had fewer antenatal visits and were more likely to experience anemia, as well as other adverse pregnancy outcomes.[137] Castello et al.[138] reported an increased prevalence of LBW and preterm birth in immigrants in Spain. When they controlled for prenatal care, this difference was substantially reduced, which indicates that the receipt of inadequate prenatal care occurred more frequently in immigrants relative to the Spanish-born population. In Norway, Saastad et al.[67] identified an increased risk of stillbirth and suboptimal antenatal and obstetric care in non-Western women. In addition, non-Western women were less likely to attend an antenatal program and follow recommendations and postponed contact with healthcare services in cases that involved reduced fetal movement, membrane rupture, and placental abruption. Inadequate communication was also identified in approximately half of the cases in which non-Western women experienced stillbirth. Furthermore, Esscher et al.[139] determined that the receipt of suboptimal care occurred more frequently in foreign-born, relative to Swedish, women in cases that involved maternal death.

Because of cultural beliefs and language barriers, healthcare workers may also ignore problems experienced by immigrants' newborn babies, which affects the efficiency of perinatal care at a hospital level.[87] In a Swedish study, Essén et al.[140] demonstrated that

babies born to mothers from sub-Saharan countries were less likely to be transferred to a neonatal intensive care unit (NICU) relative to their ethnic Swedish counterparts, despite a high-risk profile. Furthermore, in Sweden, an increased prevalence of suboptimal care has been reported in infants born to mothers from the Horn of Africa compared with infants born to mothers from Sweden.[141] This finding was more likely to result in an increased incidence of potentially avoidable perinatal death, and the authors argued that these women received less optimal care as a result of inappropriate maternal pregnancy strategies, inadequate medical treatment, and miscommunication. A European study investigated the barriers to prenatal care and concluded that personal, socioeconomic, organizational, and cultural barriers existed in Europe.[142]

1.8 Childbirth and cultural diversity

The biological process of giving birth is considered a universal process that involves social and cultural characteristics. Socioculturally constructed childbirth is differentially described depending on where and when the story is told. In most stories, giving birth is a life-changing experience that involves psychological, social, cultural, and normative relationships.[143] Therefore, the cultural characteristics of childbirth vary according to country and region. For example, Russian women consider childbirth a medical process, with minimal room for social interaction.[144] A study that involved Somali women giving birth in Sweden reported that childbirth was a strictly female event, and no husbands were present.[145] The participants found it difficult to adjust to the Swedish culture because it redefined the traditional roles of mothers and fathers. Having studied childbirth in several cultures, Callister et al.[146] described Muslim women as verbally expressive individuals who, in some cases, cried and screamed during childbirth. The authors reported that Muslim women relied on God to help them through childbirth safely. In contrast, Chinese women described screaming as shameful. They believed that screaming and crying resulted in expending the energy required for the final stages of birth.[146] Mayan women in Guatemala were considered strong when silent or repeating a mantra, which required slow, deep breaths.[146]

In a study that investigated women's transition into motherhood, Darwill et al.[147] highlighted the need for social support during this period. Many immigrant women lack the social network required to meet their cultural needs surrounding childbirth in a new

country. This is a challenge for healthcare workers in increasingly multicultural societies, such as Norway because they are required to fulfill several distinct cultural needs.

1.9 Maternity institutions in Norway

The institutionalization of delivery occurred in Norway subsequent to World War II: in 1947, 62% of women gave birth in institutions compared with 99% of women during the early 1970s.[148] The number of maternity institutions increased in Norway from 11 in 1930 to approximately 200 in 1970; however, this number decreased from 158 in 1972 to 97 in 1980, as shown in Figure 1.9. In 1980, 80.2% of women gave birth in specialized maternity institutions. Maternity services have gradually become more specialized and centralized, with the exception of services in some regions of Norway. Specifically, 40.5% of women in the northern region of Norway gave birth in institutions without pediatric services in 1979 compared with 6.4% of women in the southern and eastern regions of the country.[148]

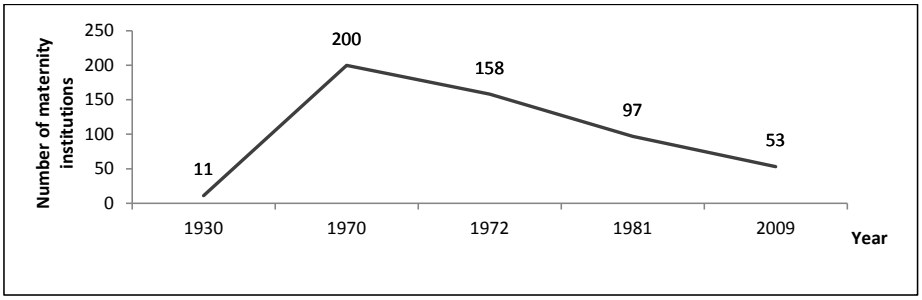

Figure 1.9. Number of maternity institutions in Norway by year.[148]

In 1981, it was concluded that Norway requires relatively decentralized maternity care because of the country's rugged geography.[148] Despite this finding, the closing of maternity clinics was upheld, and only 57 institutions with more than 10 deliveries annually were registered in 2000.[149] During the 1990s, discussions regarding the academic standards for maternity institutions began to emerge, and a classification system was suggested.[150] The Norwegian Board of Health Supervision was assigned the task of developing academic requirements for maternity institutions; in 1997, it published recommendations for the classification of maternity institutions according to three levels

of competence: women's clinics; maternity wards; and "maternity homes". These competence levels were defined as described in the textbox "Academic requirements to three levels of maternity institutions in 1997" (p.34).

Academic requirements to three levels of maternity institutions in 1997.

- ***Women's clinics:*** Minimum of 1,500 births per year, a gynecologist present, anesthesiologist on duty, and pediatrician on emergency preparedness, necessary midwifery and operating room staffing, and a children's section with neonatal intensive care.
- ***Maternity wards:*** Minimum of 400–500 births per year, gynecologist and anesthesiologist on emergency preparedness, necessary midwifery and operating room staffing and pediatrician affiliated to hospital.
- ***"Maternity homes":*** Minimum of 40 births per year, emergency readiness of midwives (not gynecologist) and clarified medical responsibilities.

In 2009, there were 53 maternity institutions in Norway, A white paper published by the Ministry of Health and Care Services in 2010 suggested that the three levels of institutional classification should be maintained with minor alterations: numerical limits should be replaced by national quality requirements, and maternity services for high-risk delivery should be provided at women's clinics.[151] Later that year, the Norwegian Directorate of Health published quality requirements for maternity care, which included concise recommendations for maternity institution at each level, with an additional classification of maternity wards into wards with and without a children's section.[152] They recommended that births that involved oligohydramnios and polyhydramnios and vaginal births planned subsequent to uterine surgery (individual assessment of women who have given birth vaginally following CS), should occur in hospitals with a children's section. However, they recommended that if maternity institutions believe that they possess the skills to manage conditions for which a referral to a women's clinic is advised, this should be clarified with the relevant health region's professional network and women's clinics and documented with the embodied procedures. Furthermore, they recommended that vaginal breech delivery and the birth of twins should be performed at women's clinics rather than maternity wards.[152]

2. RATIONALE FOR THE PROJECT

Even though the disparity in obstetric outcomes in immigrant and native women is well documented, interventions have not yet been enforced. The severity of the problem observed in studies examining this issue highlights a need for increased focus on this matter. We believed that it would also be useful to examine possible inequities in obstetric outcomes in a low-risk maternity ward, as existing knowledge had not yet differentiated between the levels of maternity care provided.

Currently, 40% of women who give birth in the maternity ward at Baerum Hospital are immigrants, which is higher than the average proportion of immigrants in Norwegian maternity wards overall.[153] Of these women, 63% originate from non-Western countries (see Table 4.1). Research examining the quality of maternal health care for immigrant women should therefore be prioritized in low-risk maternity wards as well as those providing care for women at greater risk.

3. AIMS OF THESIS

The overall aim of this study was to examine the association between country of origin and adverse obstetric outcomes in women giving birth in the low-risk maternity ward at Baerum Hospital.

The more specific aims were as follows:

1. To examine the risk of adverse obstetric outcomes in immigrant women relative to that of ethnic Norwegians (paper I).
2. To examine the association between originating from countries considered conflict-zones and risk of adverse obstetric outcomes (paper II).
3. To examine the risk of neonatal jaundice in immigrant women relative to that of ethnic Norwegians (paper III).
4. To examine the difference in risk of adverse obstetric outcomes between first- and second-generation immigrants (paper IV).
5. To disseminate new knowledge to antenatal healthcare providers and healthcare personnel working in maternity institutions and to help facilitate the implementation of research in clinical practice.

4. MATERIAL AND METHODS

4.1 Study design

This was a population-based observational study with a prospective, cohort design. The study population consisted of women who gave birth at Baerum Hospital, which is a low-risk maternity ward governed by the Vestre Viken Hospital Trust, located near Oslo, the capital city of Norway. The inclusion period for the first three papers was January 1, 2006 to December 31, 2010; this extended to December 31, 2013 for the fourth paper. The MBRN extracted data for the study from information recorded during pregnancy, birth, and the early postpartum. In addition, Statistics Norway provided information regarding maternal and paternal country of birth, country of origin, immigrant category, and age at immigration from the Population Database, and data concerning maternal education from the National Education Database. All four papers examined the relationships between maternal country of origin/birth and obstetric outcomes.

4.2 Data sources

4.2.1 The Medical Birth Registry of Norway

Information regarding all births and the pregnancies that end after 12 weeks of gestation is submitted to the MBRN.[154] For the study period, when a woman was discharged from the hospital after giving birth, a standardized MBRN form (see Appendix) was printed via the hospital's digital medical journal system and sent to the MBRN (today the submission of information to the MBRN is performed electronically). The information included in the form is recorded by midwives, nurses, and physicians at the hospital using women's antenatal cards, medical records, and personal interviews. This form includes data concerning maternal health prior to and during pregnancy and birth outcomes for mother and infant and information regarding the early postpartum period. The majority of information is notified by tick boxes and some is written as free text for further clarification. The free text is coded by the MBRN using definitions in the International Classification of Diseases (ICD-10)[155] and classifications by the MBRN.

4.2.2 Statistics Norway

The Statistics Norway Population Database includes information on all individuals with the right to reside in Norway.[49] The requirements for becoming a resident of Norway are laid out in the Population Registration Act of 16 January 1970 (last amended 1998). People from non- Nordic countries are considered residents of Norway when they have lived or intend to live in the country for at least six months, even though the stay here might be temporary. Individuals who stay in the country on a short-term basis (less than six months) and asylum seekers are not registered as residents in the population register nor included in the Population Database. However, asylum seekers with residence permits are registered as residents and included in the Population Database.

Statistics Norway provided information regarding maternal and paternal country of birth, country of origin, immigrant category, age at immigration, and educational level for all four papers.

4.2.3 Record linkage

The MBRN identified the study participants and provided information concerning pregnancy and childbirth. A list including the participant's 11-digit unique personal identification numbers and new identification numbers created by MBRN was sent to Statistics Norway. Statistics Norway used the participant's 11-digit unique personal identification numbers in locating information from their databases. Both MBRN and Statistics Norway sent us files with information concerning the participants were the 11-digit unique identification numbers were removed and replaced by the identification number previously created by MBRN. We then linked the two files by merging these created identification numbers. This linkage was performed on November 1, 2012 for papers I-III, and on March 10, 2015 for paper IV.

4.2.4 The low-risk maternity ward at Baerum Hospital

The maternity ward at Baerum Hospital is classified as a maternity ward without a children's section (i.e., NICU), also referred to as a low-risk maternity ward. There are a few maternity wards in Norway with the same function. A pediatrician visits the postnatal unit on a daily basis; otherwise, the on-call anesthetist is available to provide neonatal

resuscitation. Women who give birth at Baerum Hospital comprise a particular low-risk group, which includes those at more than 35 weeks of gestation expecting a healthy baby. However, the maternity ward handles certain conditions for which referral to a women's clinic is advised. Women with gestational diabetes, pre-eclampsia, twin pregnancies, oligo- or polyhydramnios, previous CS, or a fetus in breech position give birth at Baerum Hospital. However, women with Type 1 diabetes, preterm labor prior to week 35^0, or pregnancies with multiple fetuses or fetuses with known health issues are referred to hospitals with a NICU. Sick babies are transferred to a NICU at another hospital. The postnatal unit cares for preterm newborns from gestational week 35^0. The maternity ward manages some high-risk deliveries but is considered a low-risk maternity ward because it has no NICU.

The maternity clinic follows national guidelines regarding patient care.[156] The antenatal care in Norway is provided by general practitioners and/or midwives in primary care facilities. Specially trained midwives perform the routine ultrasound screenings at approximately pregnancy week 17−19 at the hospital. The maternity clinic includes an antenatal clinic cared for by midwives and obstetricians, which monitor women with special needs, such as twin pregnancies, and women referred by general practitioners or midwives in primary antenatal care. In the maternity ward, midwives and doctors are trained in intrapartum fetal monitoring using cardiotocography and fetal electrocardiogram with ST waveform analysis.

The maternity ward at Baerum Hospital is the largest ward of its kind in Norway, and it is situated in an urban area with a high immigrant population. In 2009, 2583 births occurred at the maternity ward.

4.2.5 Study population

Baerum Hospital functions as a local hospital for the suburban municipalities Asker and Baerum with a population of about 155,500 people. During the study period, and until 2011, the maternity ward also had responsibility for maternity services to the people living in the neighborhoods of Vestre Aker and Ullern in Oslo municipality with a population of almost 74,000 people.

All the women who gave birth at Baerum hospital during the study period (2006–2013) were included in the study. Births that occurred at a gestational age of <22 weeks were excluded from the analysis. For women who gave birth more than once during the

study period, we only included data for the first birth registered during the study period, in order to maintain independence for the women included in the study. For twin births, the analysis included data for first-born twins, with data for second-born twins excluded. The data included in papers III and IV were restricted to those of live births.

Figure 4.1 shows the flowchart for the first study period and the women included in papers I–III, while Figure 4.2 shows the flowchart for the second study period and the women included in paper IV.

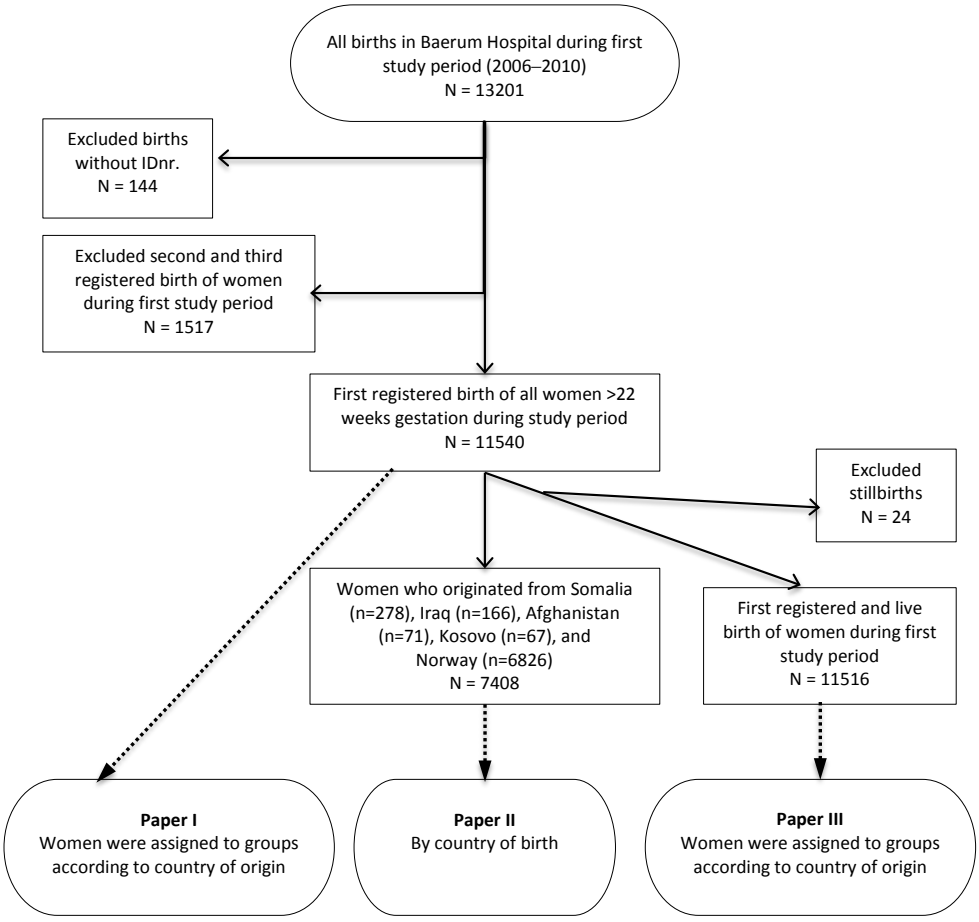

Figure 4.1. Flowchart of first study period, for papers I–III

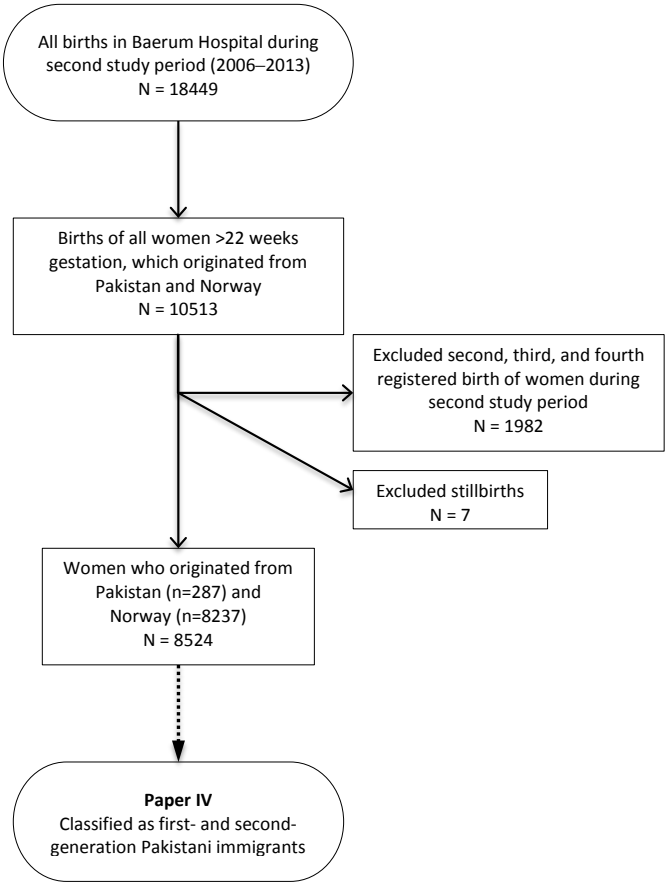

Figure 4.2. Flowchart of second study period, for paper IV.

4.3 Exposure variable: country of birth and origin

Information regarding maternal country of birth and country of origin was provided by Statistics Norway. Country of origin was the variable used in papers I and III. In order to examine the association between originating from countries considered conflict-zones and risk of adverse obstetric outcomes, the woman's country of birth is the variable in use in paper II. Each participant's country of origin was classified according to her own country of birth or that of her mother or father. In cases in which parents were born in different countries, the mother's country of birth was used. In the first study period (2006–2010; papers I–III), 144 women without identification numbers were excluded from the analyses. It was likely that these women were not residents of Norway when the data linkage was performed, and the information regarding their countries of birth and origin was unavailable.

In papers I and III, participants were assigned to immigrant groups according to their countries of origin. Table 4.1 shows how the immigrant groups were formed with the names of countries included for each group and the numbers of women who originated from each country. The immigrant groups were primarily based on the United Nations Statistics Division's geographical regions, as recommended in Reproductive Outcomes and Migration: an International Research Collaboration.[157] We included Western Europe, North America, Australia, and New Zealand, in one immigrant group, which also contained Nordic countries.

In paper IV, information regarding both country of origin and country of birth was used, as we classified women of Pakistani origin into first- and second-generation immigrants according to country of birth (i.e., second-generation Pakistani immigrants were born in Norway to two Pakistani-born parents, who were considered first-generation immigrants).

Table 4.1 Immigrant groups with the included countries of origin, and number of women originating from each country for papers I and III. N = 11,540

Immigrant group n (% of total population in study)	**Countries included in group** (Total number of women from each country when number ≥5)
Norway 6,286 (59.2)	Norway
Western Europe, North America, Australia, and New Zealand 1,796 (15.3)	Australia (17) Austria (19) Belgium (11) Canada (44) Denmark (235) Faroe Islands (8) Finland (64) France (66) Germany (157) Greenland (<5) Ireland (9) Iceland (38) Italy (15) Luxembourg (<5) Malta (<5) Netherlands (47) New Zealand (6) Portugal (7) Spain (31) Sweden (551) Switzerland (21) United Kingdom (204) USA (215)
Eastern Europe 884 (7.7)	Albania (6) Belarus (6) Bosnia-Hercegovina (38) Bulgaria (16) Croatia (15) Czech Republic (21) Estonia (24) Hellas (<5) Hungary (18) Kosovo (67) Latvia (18) Lithuania (51) Macedonia (34) Moldova (<5) Montenegro (<5) Poland (356) Romania (29) Russia (130) Serbia (20) Slovakia (6) Slovenia (<5) Ukraine (23)
Latin America and the Caribbean 182 (1.6)	Argentina (6) Bolivia (<5) Brazil (43) Chile (34) Colombia (22) Costa Rica (<5) Cuba (11) Dominica (<5) Dominican Republic (<5) Ecuador (5) Guatemala (6) Jamaica (<5) Mexico (15) Nicaragua (<5) Paraguay (<5) Peru (15) Saint Lucia (<5) Trinidad and Tobago (5) United States Virgin Islands (<5) Uruguay (<5) Venezuela (<5)
East, Southeast, and Central Asia 481 (4.2)	Cambodia (<5) China (55) Hong Kong (<5) Indonesia (25) Japan (17) Kazakhstan (<5) Kyrgyzstan (<5) Laos (<5) Malaysia (7) Mongolia (<5) Myanmar (17) North Korea (<5) Philippines (114) Singapore (6) South Korea (64) Taiwan (<5) Thailand (67) Uzbekistan (<5) Vietnam (90)
South and Western Asia 776 (6.7)	Afghanistan (71) Armenia (<5) Azerbaijan (<5) Bangladesh (<5) Cyprus (<5) India (74) Iran (94) Iraq (167) Israel (<5) Jordan (7) Kuwait (<5) Lebanon (15) Nepal (<5) Pakistan (217) Palestine (11) Saudi Arabia (6) Sri Lanka (36) Syria (10) Turkey (46) United Arab Emirates (<5) Yemen (<5)
Africa 622 (5.4)	Algeria (15) Angola (<5) Burundi (11) Cameron (7) Cape Verde (6) Democratic Republic of the Congo (12) Egypt (7) Eritrea (48) Ethiopia (44) Gabon (<5) Gambia (16) Ghana (13) Guinea (<5) Ivory Coast (<5) Kenya (16) Liberia (<5) Libya (<5) Madagascar (<5) Mauritius (<5) Morocco (59) Nigeria (10) Republic of the Congo (<5) Rwanda (<5) Senegal (<5) Sierra Leone (<5) Somalia (278) South-Africa (11) Sudan (9) Tanzania (6) Togo (<5) Tunisia (9) Uganda (10) Zambia (<5) Zimbabwe (<5)

4.4 Obstetric outcomes

The obstetric outcomes that were examined in the four papers are described in Table 4.2. Most were categorical dichotomies (indicating whether the outcome did or did not occur) described by the MBRN; in addition, the ICD-10 classifications have also defined some of the obstetric outcomes. The two numerical continuous variables, gestational age and birth weight, were also categorized, as shown in Table 4.2.

The occurrence of neonatal jaundice was examined in paper III. The MBRN had defined neonatal jaundice for infants who received treatment because of elevated levels of bilirubin in serum. This treatment consisted of either phototherapy provided at the postnatal clinic or phototherapy or more extensive treatment provided at a NICU. Norwegian guidelines[158] are followed at Baerum Hospital and clearly define the levels of bilirubin in serum that indicate a need for treatment, according to birth weight and gestational age.

Table 4.2. Obstetric outcomes/covariates examined in paper I–IV.

Variable	Definition	Categories	I	II	III	IV
Start of labor		Spontaneous, induced, or by cesarean section	x	x		x
Epidural analgesia	The use of epidural analgesia during labor	Yes or no	x	x		x
Labor dystocia	Cephalopelvic disproportion, stimulated contractions by oxytocin infusion, or slow progress	Yes or no	x	x	x	x
Meconium stained liquor	Amniotic fluid discolored, infected, or stinking	Yes or no	x	x	x	
Episiotomy		Yes or no	x	x		x
Mode of delivery						
Spontaneous vaginal delivery	Delivery by midwife	Yes or no	x	x	x	
Elective cesarean section	Decided at least 8 hours before cesarean section is performed and before women is in labor	Yes or no	x	x	x	x
Emergency cesarean section	Decided less than eight hours prior birth	Yes or no	x	x	x	x
Total cesarean section	Total cesarean section, elective and emergency	Yes or no to elective or emergency cesarean section	x			
Vaginal instrumental/operative delivery	Vacuum or forceps	Yes or no	x	x	x	x
Placental abruption	O45*			x		
Placenta previa	O44*	Yes or no		x		
Perineal rupture grade 3 or 4	O70.2* or O70.3*	Yes or no		x		
Umbilical cord complications	Any of these complications: entwined, true not, and missing vessel	Yes or no		x		
Post partum bleeding	Amount of bleeding after birth, estimated or weighed/measured by midwife	<500 mL or ≥500 mL	x	x		x
Gestational age	Dated by ultrasound performed at approximately week 18 or was calculated from the date of first day of the last menstrual period, completed gestational day at birth.	Numeric continues in days	x	x	x	x
At term	Week 37^0–41^6	Yes or no			x	
Early preterm	Week 22^0–34^6	Yes or no			x	
Late preterm	Week 35^0–36^6	Yes or no	x	x	x	x
Post term	≥42^0 weeks	Yes or no	x	x	x	
Apgar score	Low Apgar score at 5 minutes after birth: ≤7	Yes or no	x	x		
Birth weight	Weight of newborn baby	Numeric continues in gram or kg	x	x	x	x
Low birth weight	Birth weight <2.5 kg	Yes or no	x		x	
Macrosomia	Birth weight >4.5 kg	Yes or no	x		x	
Small for gestational age	10^{th} percentile according to weight-by-gestation curve by Skjærven et al.[159]	Yes or no		x		
Large for gestational age	90^{th} percentile according to weight-by-gestation curve by Skjærven et al.[159]	Yes or no		x		
Stillborn	Fetal death before birth	Yes or no	x	x		
Transfer to a NICU	Baby transferred/admitted to a NICU	Yes or no	x	x	x	x
Neonatal jaundice	Infant treated for neonatal jaundice because of elevated bilirubin levels in serum.	Yes or no		x	x	x

*International Classification of Diseases (ICD-10)

4.5 Background characteristics and covariates

The definitions for the background characteristics that are included in the four papers, and those used as covariates are presented in Table 4.3. We selected characteristics that we considered potential confounders in regression models and related to both the country of origin and obstetric outcome variables. The information for each variable was provided by the MBRN or Statistics Norway. Some variables are defined in the ICD-10 classifications. Table 4.3 also shows the categorization of variables, as our classification of the variables differed between papers. Many of the background characteristics and covariates were dichotomous, indicating whether the relevant condition was present or not.

Obstetric outcome variables shown in Table 4.2 were also used as covariates in some of the regression models in papers I–IV. These are explained more thoroughly in the chapter 4.6.3 Selection of covariates.

Table 4.3. Background characteristics/covariates used in papers I–IV.

Variable	Definition	Categories	I	II	III	IV
Maternal age	Maternal age at birth	Numeric continues variable in years	x	x	x	x
		Three categories: 25–34 years (reference), < 25 years, or ≥ 35 years			x	
Parity	Number of previous births	Two categories: 0 or ≥1		x	x	x
		Three categories: 0, 1, or ≥2	x			
Educational level	Maternal years of education at time of extracting data	Three categories: ≥ 12 years (reference), < 12 years, and unknown	x	x	x	x
Marital status	Marital status at time of birth	Two categories: married/co-living or single	x	x	x	x
Maternal age at immigration	Maternal age at immigration to Norway	Numeric continues variable in years				
Length of stay in Norway before birth	Maternal age at birth minus maternal age at immigration to Norway.	Numeric continues variable in years	x	x		
		Two categories: <2 or ≥2 years			x	
		Four categories: ≤1, 2-5, 6-10, or >10 years		x		
Maternal place of birth	Maternal country of birth (not country of origin)	Two categories: Norway or outside of Norway			x	
Consanguinity	Reported blood relationship between infant's mother and father	Yes or no	x	x	x	x
Previous stillbirth	Only women who were para 1+	Yes or no		x		
Previous cesarean section	Only women who were para 1+	Yes or no	x	x		
Maternal health						
Maternal health issues before pregnancy	Any of these registered health issues: Asthma, chronic hypertension, chronic kidney disease, recurrent urinary tract infection, rheumatoid arthritis, heart condition, epilepsy, diabetes mellitus, thyroid condition.	Yes or no		x	x	x
Maternal health issues during pregnancy	Registered any of these health issues during pregnancy: Bleeding (O46*), hypertension, eclampsia, preeclampsia, HELLP, anemia, rubella disease, venereal disease.	Yes or no		x	x	x
Diabetes Mellitus or gestational diabetes	Gestational diabetes/diabetes mellitus (O24*) or the prescription of antidiabetic drugs.	Yes or no	x	x		x
Bleeding during pregnancy	Vaginal bleeding (O46*)	Yes or no	x			
Anemia	Hemoglobin level <9 g/dL	Yes or no	x	x		x
Cigarette smoking**	Start of pregnancy	Yes or no	x	x		x
	End of pregnancy	Yes or no	x	x	x	
Gestational age	Dated by ultrasound performed at approximately week 18	Numeric continues variable in days	x		x	
Multiple gestation	Twin pregnancy/birth	Yes or no	x	x	x	x
Fetal presentation		Divided into three categories: normal head, breech, or deviant head presentation	x	x		
Sex of baby		Male or female			x	

*International Classification of Diseases (ICD-10) **Voluntary if women wants to give up information to the records

4.6 Statistical analysis

4.6.1 Differences in proportions and distribution

In all four papers, differences in proportions and distribution of background characteristics and obstetric outcomes were calculated using cross tabulation with Pearson's χ^2 test or Fisher's exact test. For numerous continues variables, Student's t test, One-way ANOVA test, or the Mann-Whitney *U* test was performed, depending on whether the variable was normally distributed or not. Differences in proportions and distribution between each immigrant group and the Norwegian group were examined. In paper IV, we examined differences in proportions and distribution between the two immigrant groups in addition to comparing each immigrant group to the Norwegian group.

4.6.2 Differences in risks

In all four papers, multiple regression analysis was performed to estimate the differences in risk of obstetric outcomes. In paper I, differences in risk were analyzed using Poisson log linear regression within generalized linear models to estimate relative risk (RR) with 95% confidence intervals (CI). In papers II–IV, differences in risk were analyzed using multiple logistic regression analysis to estimate ORs with 95% CIs. In addition, multiple linear regression analysis was performed in papers I, II, and IV to estimate β coefficients for differences in gestational age measured in days and birth weight measured in grams with 95% CIs. In the regression models, several confounding variables were controlled for, and ethnic Norwegian women were used as a reference.

4.6.3 Selection of covariates

In papers I, II, and IV, we preselected the covariates that were adjusted for in regression analysis on the basis of previous knowledge of outcomes and exposure factors.[1] Covariates that were included in the various regression models were either considered potential confounders or known to be associated with the outcomes (Table 4.2 and 4.3).

Paper I

The following background covariates were adjusted for in all analyses; maternal age, parity, marital status, and educational level. In addition, covariates that were strongly associated with the selected outcomes or known to increase the risk of their occurrence were adjusted for and included twin birth, fetal presentation, and previous CS when examining emergency CS; induction of labor when examining labor dystocia; and gestational age when examining transfer to a NICU; and birth weight.

Paper II

In this paper, the regression analyses were conducted stepwise by including more independent variables in each model made. Model 1 included maternal age and parity. Model 2 included the variables from model 1 in addition to marital status and educational level. Model 3 included variables from model 2 in addition to various obstetric and maternal confounders that were different for the various outcomes; twin birth was included in the models examining epidural analgesia and meconium-stained liquor; twin birth and induced labor were included in the model examining labor dystocia; twin birth, previous CS, and fetal presentations were included in the model examining emergency CS; twin birth and maternal cigarette smoking at end of pregnancy were included in the model examining small for gestational age (SGA); gestational diabetes was included in the model examining large for gestational age (LGA); and gestational age and twin birth was included in the model examining birth weight. In the models examining the obstetric outcomes induced labor and postterm birth, model 2 were the final models.

Paper III

In this paper, we sought to produce an explorative model of the occurrence of neonatal jaundice and therefore used a backward-stepwise approach.[160, 161] This involved adjusting for several covariates that were preselected for entry into the first model. Variables that did not contribute to the model (i.e., those that were not statistically significant) were removed individually. The following variables were included in the model at the first step: immigrant group (Norway; East, Southeast, and Central Asia; and Africa), time since migration (continues in years), maternal age (continues in years), marital status, educational level, parity (0 or ≥1), consanguinity, maternal health prior to pregnancy (any registered health issues), maternal health during pregnancy (any registered health issues), cigarette smoking at the end of pregnancy, meconium-stained liquor, twin birth, labor

dystocia, operative vaginal delivery, elective CS, sex of infant, and birth weight (categorical, normal: 2.5−4.5 kg; low: <2.5 kg; macrosomia: >4.5 kg). Variables that did not make a significant contribution to the model were then removed individually until all remaining variables contributed significantly, with *P* values of < 0.05.

Paper IV

The selection of possible confounders was limited because of small sample size in this study. We therefore chose to adjust for factors that were not related to the groups' distinctive characteristics but exerted the greatest influence on the outcomes. These factors included maternal age and parity when examining preterm birth; maternal age, parity, and infant birth weight when examining transfer to a NICU; and maternal age, parity, and gestational age in the analyses examining birth weight.

4.6.4 Missing

The variable educational level had a high proportion of missing values, particularly for immigrant women. The missing values were recoded as not documented and included in the regression models to prevent the exclusion of a great number of immigrant women from the analyses.

There were also missing information on birth weight and gestational age in some participants. These participants were excluded from analyses were these values were included.

Further, the variables cigarette smoking at the start and at the end of pregnancy had many missing values. The published proportions of smokers are therefore of those who were willing to provide this information to the MBRN, since women may reserve the right to not have their smoking habits on record. However, these variables were also recoded were those with missing information were coded as unknown in order to include all the participants in the regression analyses where these variables were included.

4.6.5 Statistical considerations

When examining multiple background characteristics and obstetric outcomes in several immigrant groups, there is a risk of rejecting a true null hypothesis; this problem is known

as multiple testing. In order to reduce the risk of a Type I error, some of the background characteristics were tested with a Pearson's χ^2 test for trend, giving one *P* value for all the included categories, so that the number of tests performed was reduced. We also performed Bonferroni corrections in papers II and IV, and the level of statistical significance was reported for all four papers. The threshold for statistical significance was set at $P \leq 0.05$ in papers I and III, $P < 0.01$ in paper II, and $P \leq 0.017$ in paper IV.

The assumptions for all of the regression models were fulfilled in these analyses, in order to provide valid models. The residuals were normally distributed in the multiple linear regression models in papers I, II, and IV. Furthermore, we tested for collinearity and interactions between exposure variables and covariates in all of the regression models. We defined interaction terms and included them in the models if it they were statistically significant, but no interaction was found in any of the regression analyses performed. We tested for collinearity between the country of origin (global region) and educational level variables; however, it was not present in the any of the analyses.

All of the statistical analyses were conducted using either SPSS version 18 for Windows or IBM SPSS Statistics version 21.0 for Windows

4.7 Ethical considerations

Using data from the MBRN in research is referred to in the legislative act governing health records and processing health information. It was not necessary to obtain informed consent from the participants, as their personal identification numbers were removed. However, as the study used information from the Population Database and from the National Education Database, dispensation from confidentiality rules by the Norwegian Tax Administration and the Ministry of Foreign Affairs was obtained. Furthermore, permission to link information from the MBRN and Statistics Norway was obtained from the Regional Committees for Medical and Health Research Ethics, REC South East (ref no. 2012/267). This is regulated by the legislative act governing medical and health research and the Regulations for Processing of Personal Data. The MBRN identified the study participants, and we received a file containing non-identifying information.

Assigning women to groups and highlighting disparities between them could contribute to some of them being labeled as members of challenging immigrant groups. However, we believed that increased knowledge of disparities would exert a positive

effect on the way in which we treated these women, which will, hopefully, ultimately contribute to improvements in their obstetric outcomes. Therefore, prudence should be exercised when presenting such results.

Using the geographical classification of immigrants into groups also raises some ethical issues. Some immigrant groups are small, and immigrants are not a homogenous group, even when assigned to groups according to geographical region. For instance, women who originate from Africa are of many different cultures and employ various religious practices, and several may have European roots. Therefore, knowledge of variation and disparity within immigrant groups should be taken into consideration when interpreting the results of this research.

Immigrants are frequently excluded from large studies due to of financial and practical issues resulting from poor language proficiency. Register studies are therefore appropriate when information regarding immigrants is required on a large scale. However, this often results in these studies lacking information regarding certain factors that are important in migration and could modify the effects observed. Amongst other factors, this includes socioeconomic status while grooving up, language fluency, and antenatal care attendance.

5. SYNOPSIS OF RESULTS

5.1 Paper I

Bakken KS, Skjeldal OH, Stray-Pedersen B. **Higher risk for adverse obstetric outcomes among immigrants of African and Asian descent: a comparison study at a low-risk maternity hospital in Norway.** *Birth.* 2015; 42(2):132-140.

We compared obstetric outcomes between immigrants and ethnic Norwegians who gave birth at Baerum Hospital. The women were classified into seven groups, as described in Table 4.1. The outcome measures were onset of labor, operative vaginal delivery, CS, episiotomy, postpartum bleeding of >500 mL, epidural analgesia, labor dystocia, gestational age, meconium-stained liquor, low 5-minute Apgar score (≤7), birth weight, and transfer to a NICU. Multivariate Poisson regression analysis was used to estimate RR with 95% CIs.

The study included 11,540 women who originated from 141 different countries. The immigrants from East, Southeast, and Central Asia; South and Western Asia; and Africa were at the greatest risk of adverse obstetric outcomes (Table 5.1).

Relative to ethnic Norwegians, women from East, Southeast, and Central Asia were younger, more often nulliparous and single, less likely to have completed higher education, and experienced fewer health issues prior to pregnancy; however, a higher proportion of this group developed diabetes and anemia during pregnancy relative to that of Norwegian women. They were at reduced risk of labor induction and at higher risk of operative vaginal delivery and postpartum bleeding of >500 mL. In addition, they experienced significantly shorter pregnancies and were at reduced risk of postterm births and delivering a baby with fetal macrosomia and an increased risk of delivering a baby with a low 5-minute Apgar score.

Women from South and Western Asia were also younger, less likely to have completed higher education, more often multiparous, had experienced fewer health issues prior to pregnancy, and experienced diabetes, anemia, and bleeding more often during pregnancy. Fewer women in this group smoked cigarettes, but they demonstrated the highest proportion of consanguinity at 11.7%, whereas the proportion of consanguinity was 0.1% in Norwegians. They also experienced significantly shorter pregnancies and

were at increased risk of experiencing labor dystocia and delivering a baby with LBW. In addition, they were at reduced risk of postterm birth and delivering a baby who weighed more than 4,500 g.

The women from Africa were also younger and fewer were married or cohabiting and had completed higher education. They also showed higher proportions of consanguinity and multiparity and experienced fewer health issues prior to pregnancy. However, at 6.8% the proportion of women who experienced anemia during pregnancy was highest in this group, while the proportion of Norwegians who experienced anemia was 0.9%. Furthermore, they were at an increased risk of postterm birth, meconium-stained liquor, episiotomy, operative vaginal delivery, CS, postpartum bleeding of >500 mL, and delivering a baby with a low 5-minute Apgar score or LBW. In addition, they were at a reduced risk of having an epidural or delivering a baby who weighed more than 4,500 g.

In summary, we found that immigrants' risk of adverse obstetric outcomes differed significantly from that of Norwegians, even in a low-risk maternity ward.

Table 5.1. (Paper I, Table 3) Relative risks of obstetric outcomes of women delivering in a low-risk maternity ward in Norway by country/region of origin in reference to ethnic Norwegian women.

	Western Europe, North America, Australia and New Zealand n = *1,769*	*Eastern Europe* n = *884*	*Latin America and the Caribbean* n = *182*	*East, Southeast, and Central Asia* n = *481*	*South and Western Asia* n = *776*	*Africa* n = *622*
Induced start of labor	0.95 (0.81−1.12)[e]	1.06 (0.86−1.32)[e]	1.28(0.87−1.90)[e]	**0.60 (0.42−0.85)**[e]	0.96 (0.76−1.22)[e]	1.09 (0.85−1.41)[e]
Labor dystocia[a]	1.01 (0.93−1.09)[f]	1.08 (0.98−1.20)[f]	1.19 (0.97−1.46)[f]	1.11 (0.97−1.27)[f]	**1.13 (1.01−1.27)**[f]	1.13 (0.98−1.29)[f]
Epidural analgesia	1.03 (0.95−1.12)[g]	1.00 (0.89−1.12)[g]	**1.37 (1.12−1.68)**[g]	0.92 (0.78−1.07)[g]	0.98 (0.86−1.11)[g]	0.84 (0.72−0.99)[g]
Operative vaginal delivery[b]	1.08 80.94−1.24)[g]	1.05 (0.87−1.26)[g]	1.13 (0.78−1.64)[g]	**1.28 (1.02−1.59)**[g]	1.21 (0.98−1.49)[g]	**1.29 (1.02−1.65)**[g]
Emergency cesarean section	0.88 (0.73−1.06)[h]	1.13 (0.90−1.43)[h]	1.40 (0.91−2.14)[h]	1.22 (0.92−1.62)[h]	1.25 (0.97−1.61)[h]	**1.48 (1.14−1.91)**[h]
Episiotomy	0.90 (0.80−1.03)[g]	**0.79 (0.66−0.95)**[g]	**0.65 (0.43−0.98)**[g]	0.87 (0.69−1.09)[g]	0.97 (0.80−1.18)[g]	**1.56 (1.28−1.89)**[g]
Postpartum bleeding > 500 mL	0.99 (0.86−1.15)[g]	**1.30 (1.09−1.56)**[g]	1.39 (0.98−1.98)[g]	**1.67 (1.36−2.05)**[g]	0.98 (0.79−1.23)[g]	**1.30 (1.03−1.64)**[g]
Gestational age, days*	0.0 (-0.5 to 0.6)[g]	0.2 (-0.6 to 0.9)[g]	0.1 (-1.4 to 1.7)[g]	**-3.4 (-4.3 to -2.4)**[g]	**-2.2 (-3.0 to -1.4)**[g]	**1.3 (0.3 to 2.2)**[g]
Preterm (35^0- 36^6 weeks)	0.69 (0.48−1.01)[g]	0.65 (0.39−1.09)[g]	0.98 (0.40−2.40)[g]	1.42 (0.88−2.30)[g]	1.46 (0.98−2.19)[g]	0.81 (0.46−1.43)[g]
Postterm (≥ 42^0 weeks)	0.94 (0.79−1.12)[e]	1.08 (0.86−1.36)[e]	0.71 (0.40−1.25)[e]	**0.50 (0.33−0.76)**[e]	**0.65 (0.47−0.89)**[e]	**1.38 (1.06−1.79)**[e]
Meconium-stained liquor[c]	0.91 (0.80−1.04)[g]	1.16 (0.98−1.37)[g]	0.88 (0.60−1.29)[g]	0.99 (0.79−1.25)[g]	1.17 (0.98−1.40)[g]	**1.68 (1.40−2.01)**[g]
Apgar score < 7 at 5 min[d]	0.80 (0.44−1.46)[e]	0.79 (0.34−1.86)[e]	1.19 (0.29−4.91)[e]	**2.24 (1.13−4.45)**[e]	1.33 (0.62−2.87)[e]	**2.60 (1.31−5.18)**[e]
Transferred to NICU	1.00 (0.95−1.05)[i]	0.99 (0.92−1.06)[i]	0.99 (0.85−1.15)[i]	1.01 (0.92−1.11)[i]	1.01 (0.94−1.09)[i]	1.01 (0.92−1.10)[i]
Birth weight, gram*	**-36 (-58 to -14)**[j]	**-39 (-70 to -9)**[j]	**-70 (-133 to -7)**[j]	**-107 (-146 to -68)**[j]	**-218 (-251 to -186)**[j]	**-197 (-235 to -160)**[j]
Low birth weight; < 2,500 g	1.38 (0.94−2.04)[j]	0.72 (0.34−1.50)[j]	2.03 (0.82−5.04)[j]	1.72 (0.99−3.01)[j]	**1.87 (1.18−2.98)**[j]	**2.15 (1.28−3.63)**[j]
Macrosomia; > 4,500 g	**0.65 (0.48−0.87)**[e]	0.77 (0.51−1.15)[e]	0.28 (0.07−1.11)[e]	**0.15(0.05−0.47)**[e]	**0.26 (0.13−0.50)**[e]	**0.34 (0.18−0.63)**[e]

*Data are presented as adjusted relative risks and 95% confidence intervals or *adjusted beta-values, and are in reference to ethnic Norwegians.*
[a]*Defined by presence of cephalo-pelvic disproportion, oxytocin infusion was used, or slow progress of labor.*
[b]*Operative vaginal delivery by forceps or vacuum extraction.*
[c]*Documented by in patient journal when amniotic fluid was stained by meconium.*
[d]*Stillborn babies were excluded from analyses.*
[e]*Adjusted for maternal age, parity, marital status, and educational level.*
[f]*Adjusted for maternal age, parity, marital status, educational level, twin birth, and induced labour.*
[g]*Adjusted for maternal age, parity, marital status, educational level, and twin birth.*
[h]*Adjusted for maternal age, parity, marital status, educational level, twin birth, fetal presentation, and previous cesarean section.*
[i]*Adjusted for maternal age, parity, marital status, educational level, and gestational age.*
[j]*Adjusted for maternal age, parity, marital status, educational level, twin birth, and gestational age.*

5.2 Paper II

Bakken KS, Skjeldal OH, Stray-Pedersen B. **Immigrants from conflict-zone countries: an observational comparison study of obstetric outcomes in a low-risk maternity ward in Norway.** *BMC Pregnancy and Childbirth.* 2015; 15:163.

In women who gave birth at Baerum Hospital from 2006–2010, we compared obstetric outcomes in immigrant women originating from countries considered conflict-zones; Somalia (n = 278), Iraq (n = 166), Afghanistan (n = 71), and Kosovo (n = 67) with those of ethnic Norwegians (n = 6,826). The obstetric outcomes included onset of labor, epidural analgesia, labor dystocia, operative vaginal delivery, CS, gestational age, Apgar score (≤7 at 5 minutes), meconium-stained liquor, birth weight, SGA, LGA, and transfer to a NICU. Multiple logistic regression analysis was used to estimate ORs with 95% CIs. Multiple linear regression analysis was performed to estimate β coefficients for differences in birth weight measured in grams.

Women from Kosovo did not differ from the Norwegians in any of the obstetric outcomes tested. Women from Iraq and Afghanistan differed in median gestational age, mean birth weight, and in risk of delivering an SGA infant. Median gestational age was a few days shorter relative to that of Norwegians for both immigrant groups. When maternal age, parity, marital status, educational level, twin birth, and gestational age were adjusted for, the weight differences were -170 g (95% CI -238 to -102) and -150 g (95% CI -252 to -47) for babies born to women from Iraq and Afghanistan, respectively, relative to those of Norwegian women. Both groups were also at an increased risk of delivering an SGA infant with an OR of 2.21 (95 % CI: 1.36−3.60) for women from Iraq and OR 2.77 (95% CI: 1.42−5.39) for Afghan women. Furthermore, women from Iraq were at a reduced risk of delivering an LGA infant relative to Norwegians with an OR of 0.35 (95% CI: 0.15−0.83).

However, Somali women differed from Norwegians in several obstetric outcomes. When confounding factors were adjusted for, they were at a reduced risk of epidural analgesia and delivering an LGA infant, but were at an increased risk of emergency CS, postterm birth, meconium-stained liquor, and delivering an SGA infant (Figure 5.1). The weight difference for babies born to Somali women was -280 g (95% CI -336 to -223).

In summary, we found that Somali women were at greater risk of adverse obstetric outcomes relative to that of Norwegians. However, the same increase in risk was absent in women who originated from the three other countries considered conflict-zones.

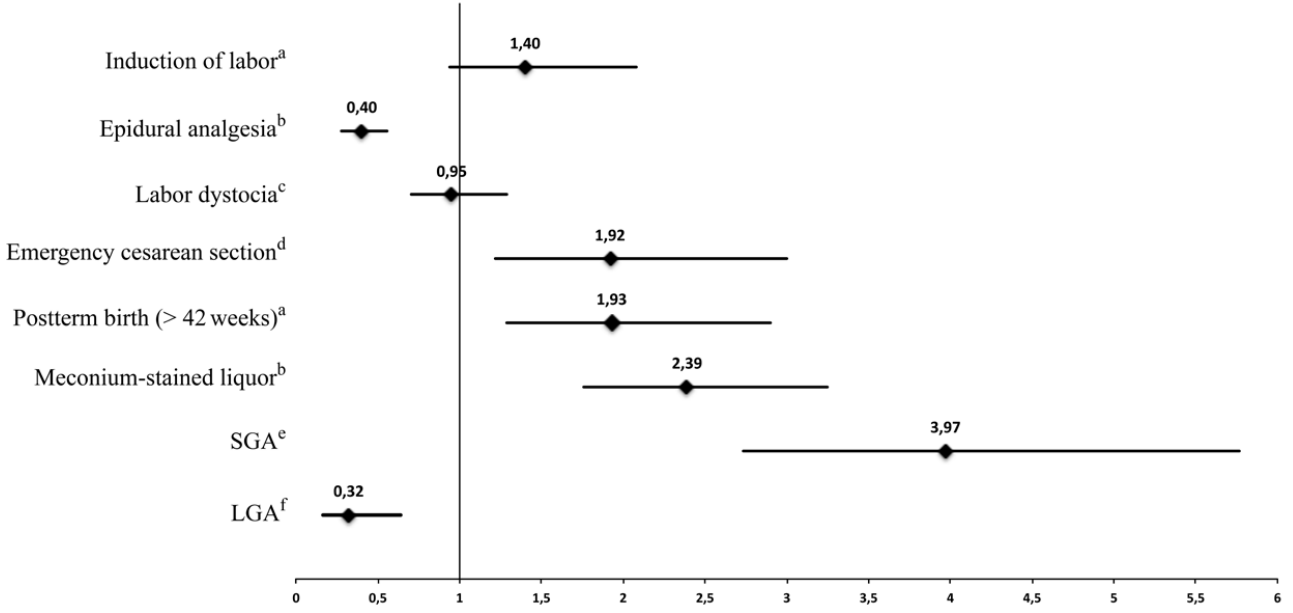

Figure 5.1. Forest plot with odds ratios and 95% confidence intervals for obstetric outcomes of women originating from Somalia in reference to ethnic Norwegians delivering in a low-risk maternity ward in Norway between 2006−2010.

[a]Adjusted for maternal age, parity, marital status, and educational level.

[b]Adjusted for a + twin birth.

[c]Adjusted for b + induced labour.

[d]Adjusted for b + previous cesarean section.

[e]Adjusted for b + maternal cigarette smoking at end of pregnancy.

[f]Adjusted for a + gestational diabetes.

5.3 Paper III

Bakken KS, Skjeldal OH, Stray-Pedersen B. **Neonatal jaundice and the immigrant population: A comparison study at a low-risk maternity ward in Norway.** *Nordic Journal of Nursing Research.* 2015; 35:165-171, first published online 2 June 2015.

We examined differences in the distribution of neonatal jaundice according to migration indicators (country of origin, time since migration, and place of birth), socioeconomic factors (marital status and educational level) and obstetric factors (parity, health during pregnancy, labor dystocia, operative delivery, gestational age, sex of infant, twin birth, and infant birth weight) in women who gave birth at Baerum Hospital between 2006 and 2010. Mother-infant pairs were classified into seven groups according to regions/country of origin, as shown in Table 4.1.

The main outcome measure was the occurrence of neonatal jaundice. Newborns were treated for elevated serum bilirubin levels with phototherapy or more extensive therapies at a NICU according to national guidelines, which are based on the measurement of total serum bilirubin levels. The presence or absence of treatment for neonatal jaundice was used as a dichotomous variable. In addition, we compared mothers whose infants had developed neonatal jaundice in two immigrant groups (East, Southeast, and Central Asia, and Africa) and the Norwegian group with respect to details of delivery and the characteristics of their infants.

A total of 11,516 mothers gave birth to a live infant during the study period, and 769 (6.7%) infants were treated for neonatal jaundice. A higher proportion of infants born to mothers who originated from East, Southeast, and Central Asia were treated for neonatal jaundice relative to those born to Norwegian mothers, whereas the proportion of such infants was lower in women of African origin. A comparison of mother-infant pairs, in which the infants were treated for neonatal jaundice according to country/region of origin, revealed that the immigrant mothers were younger, more often single, and educated to lower levels relative to the Norwegian mothers (Table 5.2). Vaginal instrumental delivery was more frequent in mothers from East, Southeast, and Central Asia relative to Norwegian mothers. In addition, infants born to African women showed a significantly lower mean birth weight, and a higher proportion of infants in this group were transferred to a NICU relative to Norwegian infants. Subsequent to adjustment, mothers who

originated from East, Southeast, and Central Asia were at an increased risk of having a jaundiced infant (OR 2.06, 95% CI 1.55–2.74) relative to that of Norwegian mothers. In contrast, African mothers were at a reduced risk of having a jaundiced infant (OR 0.53, 95% CI 0.34–0.82).

In summary, infants born to mothers from East, Southeast, and Central Asia were at increased risk, and African infants were at a decreased risk, of neonatal jaundice relative to Norwegian infants.

Table 5.2. (Paper III, Table 2) Comparison of characteristics of 526 mother-infant pairs whose infants were treated for neonatal jaundice by country/region of origin.

	Norway	East, Southeast, and Central Asia		Africa	
	n = 437	*n = 66*	*p* value[a]	*n = 23*	*p* value[a]
Maternal age, years, median (interquartile range)	31 (6)	29 (7)	0.049	27 (10)	0.001
Married/cohabitant	472 (95.0)	57 (86.4)	0.013	17 (73.9)	0.001
Educational level			<0.001		<0.001
≥12 years	310 (70.9)	30 (45.5)		3 (13.0)	
<12 years	127 (29.1)	20 (30.3)		14 (60.9)	
Undocumented	0	16 (24.2)		6 (26.1)	
Parity			0.243		0.982
0	286 (65.4)	48 (72.7)		15 (65.2)	
≥1	151 (34.6)	18 (27.3)		8 (34.8)	
Registered health issues during pregnancy[b]	82 (18.8)	11 (16.7)	0.682	5 (21.7)	0.784
Gestational age, days, median (interquartile range)	277 (21)	275 (17)	0.415	273 (26)	0.172
Labour dystocia[c]	219 (50.1)	41 (62.1)	0.069	10 (43.5)	0.535
Vaginal instrumental delivery[d]	91 (20.8)	23 (34.8)	0.011	3 (13.0)	0.594
Caesarean section					
Elective	13 (3.0)	2 (3.2)	1.000	0	1.000
Emergency	41 (9.4)	5 (7.6)	0.635	4 (17.4)	0.266
Sex of baby, male	231 (52.9)	38 (57.6)	0.474	11 (47.8)	0.637
Birth weight, g, mean (SD)	3391 (565)	3276 (481)	0.131	2964 (700)	0.001
Transferred to neonatal intensive care	50 (11.6)	6 (9.7)	0.651	7 (31.8)	0.013

Note. Data are presented as n (%) unless indicated otherwise.

[a]Pearson's chi-square test, Fisher's exact test, Mann-Whitney U test, or Student's t-test compared to the ethnic Norwegian women.

[b]Health issues included hypertension, preeclampsia, eclampsia, HELLP syndrome, anaemia (haemoglobin level <9 g/dL), gestational diabetes, and vaginal bleeding during pregnancy.

[c]Oxytocin infusion during labour.

[d]Vacuum extraction or forceps.

5.4 Paper IV

Bakken KS, Skjeldal OH, Stray-Pedersen B. **Obstetric outcomes of first- and second-generation Pakistani immigrants: a comparison study at a low risk maternity ward in Norway.** *Journal of Immigrant and Minority Health.* 2015; published online 26 December 2015.

We evaluated obstetric outcomes in first- and second-generation Pakistani immigrants and compared the results to those of ethnic Norwegians. We hypothesized that second-generation Pakistani immigrants would be more similar to ethnic Norwegians, because of increased acculturation.

The study included first registered births, excluding stillbirths, in women of Pakistani and Norwegian origin who delivered at Baerum Hospital between January 1, 2006 and December 31, 2013. Differences in background characteristics and obstetric outcomes between both immigrant groups and the Norwegian group and between both immigrant groups were assessed. Multiple logistic regression analysis was used to estimate ORs and 95% CIs for preterm birth and transfer to a NICU in first- and second-generation Pakistani immigrants relative to those of Norwegians infants.

A total of 8,524 births were included in the study. Of these, 211, 76, and 8,237 were born to first- and second-generation Pakistani immigrants, and ethnic Norwegian women, respectively (Table 5.3). We found a high proportion of consanguinity between spouses in both immigrant groups, suggesting that second-generation immigrants had maintained traditional Pakistani marriage pattern. Relative to first-generation immigrants, a higher proportion of second-generation were nullipara and reported more health issues prior to pregnancy. Further, a higher proportion of second-generation immigrants experienced preterm births relative to Norwegians (OR: 5.15, 95% CI: 2.50–10.60). A higher number of newborns of first-generation immigrants were transferred to a NICU relative to Norwegian infants (OR: 2.63, 95% CI: 1.62–4.28). In addition, the median gestational age of Norwegian infants was a few days longer, and their mean birth weight was higher, relative to those born to immigrant mothers. The mean adjusted difference in birth weight was -278 g (95% CI -335 to -220) and -292 g (95% CI -387 to -197) for infants born to first- and second-generation immigrant women, respectively, relative to that of Norwegian infants.

In summary, we found few intergenerational differences in background characteristics and obstetric outcomes between first- and second-generation Pakistani immigrants. Further research involving larger populations is required.

Table 5.3. (Paper IV, Table II) Obstetric outcomes of first- and second-generation Pakistani immigrants and Norwegian women delivering in a low-risk maternity ward in Norway. *N* = 8,524

	First-generation n = 211	*P* value[a] first-generation compared to Norwegian women	*P* value[a] of the difference between the two immigrant groups	Second-generation n = 76	*P* value[a] second-generation compared to Norwegian women	Norwegian n = 8237
Onset of labor		0.571	0.286		0.159	
Spontaneous	168 (79.6)			64 (84.2)		6642 (80.6)
Induced	31 (14.7)			11 (14.5)		1036 (12.6)
Cesarean section	12 (5.7)			1 (1.3)		559 (6.8)
Epidural analgesia	81 (38.4)	0.845	0.172	36 (47.4)	0.139	3217 (39.1)
Labor dyctosia[e]	97 (46.0)	0.490	0.113	43 (56.6)	0.023	3590 (43.6)
Assisted delivery		0.227	0.230		0.369	
Spontaneous vaginal delivery	160 (75.8)			56 (73.7)		5822 (70.7)
Instrumental vaginal delivery[f]	21 (10.0)			13 (17.1)		1203 (14.6)
Elective cesarean section	10 (4.7)			1 (1.3)		480 (5.8)
Emergency cesarean section	20 (9.5)			6 (7.9)		732 (8.9)
Episiotomy	35 (16.6)	0.181	0.917	13 (17.1)	0.486	1675 (20.3)
Postpartum bleeding >500 mL	26 (12.3)	0.600	0.293	6 (7.9)	0.150	1118 (13.6)
Gestational age						
In days, median (interquartile range)	279 (12)	<0.001[b]	0.068[b]	277 (14)	<0.001[b]	282 (13)
Preterm (35^0-36^6 weeks)	9 (4.3)	0.095	0.028[c]	9 (12.0)	<0.001[c]	205 (2.5)
Postterm (>42^0 weeks)	10 (4.8)	0.040	1.000[c]	4 (5.3)	0.277	732 (8.9)
Transfer to neonatal intensive care	21 (10.0)	<0.001	0.044	2 (2.6)	0.585[c]	372 (4.5)
Infant birth weight						
In kg, mean (SD)	3.3 (0.5)	<0.001[d]	0.054	3.2 (0.5)	<0.001[d]	3.6 (0.5)
Low birth weight (<2.5 kg)	9 (4.3)	0.003	0.534	5 (6.6)	0.004	113 (1.4)
Neonatal jaundice	9 (4.3)	0.324	0.027[c]	9 (11.8)	0.044[c]	484 (5.9)

Data are presented as n (%) unless indicated otherwise.
SD standard deviation
[a] Pearson's chi-square test unless indicated otherwise.
[b] Mann-Whitney U test.
[c] Fisher's exact test.
[d] Student's T-test.
[e] Defined by presence of cephalo-pelvic disproportion, oxytocin infusion was used, or slow progress of labor.
[f] Operative vaginal delivery by forceps or vacuum extraction.

6. DISCUSSION

6.1 Main findings

The results of this study confirmed the existence of disparities in obstetric outcomes between women in certain immigrant groups and ethnic Norwegian women, even in a low-risk maternity ward. We examined obstetric outcomes in regional immigrant groups, from countries considered conflict-zones, and in second-generation immigrants and found that African women, particularly those from Somalia, were at the greatest risk of adverse obstetric outcomes. However, the various immigrant groups faced different challenges.

- For women who originated from East, Southeast, and Central Asia, the greatest difference between their obstetric outcomes and those of Norwegians was that they were at greater risk of delivering an infant with a low 5 min Apgar score and neonatal jaundice.
- For women who originated from South and Western Asia, the greatest difference between their outcomes and those of Norwegians involved mean birth weight and risk of delivering a LBW baby.
- African women experienced the highest number of adverse outcomes, and those who originated from Somalia were at an even greater risk of experiencing several adverse outcomes. These adverse outcomes suggested stressful pregnancies and fetuses prone to stress, with increased risk of meconium-stained liquor, emergency CS, and delivering an SGA infant.
- We observed few differences between first- and second-generation Pakistani immigrant women, but the sample size was small for these groups. However, outcomes for these two groups differed from those of Norwegian women, and infants born to first-generation immigrants were at higher risk of being transferred to a NICU, while those born to second-generation immigrants were at higher risk of being born preterm (35^0–36^6 weeks).

The proportion of immigrants who had given birth at Baerum Hospital was higher than average proportions for Norwegian maternity wards in general.[153] Women who originated from non-Western countries constituted 25.8% of those who delivered in the low-risk

maternity ward at Baerum Hospital. This high proportion indicates that immigrant women are common patients for our midwives, and measures should be taken to reduce inequality in obstetric outcomes for immigrant women.

6.2 Methodological considerations

When investigating factors that are not controllable by individuals, such as country of origin, we must use the methods of observational studies. This implies that researchers are unable to control some of the factors and types of exposures examined. Therefore, we can only describe possible associations, which should be interpreted with caution. In this section, the methodological strengths and limitations of the study methods used in the present study, in addition to possible sources of error, are discussed in the context of the validity of the results.

6.2.1 Strengths and limitations of the study

The main strength of the study was that it included the entire population of women who gave birth at Baerum Hospital during the study period, which implies that the risk of selection bias was very small. Furthermore, all of the women included in the study had given birth at the same maternity ward, indicating that they would most likely have been subject to the same standard of care (i.e., the same guidelines are followed), which enhances the possibility that differences in obstetric outcomes observed between groups was genuine. The study period is limited to 5-8 years, minimizing the risk of great change in the procedures for care and the healthcare workers at the maternity ward. In addition, our study was conducted in a Norwegian context, which has a high immigrant participation in the public health system. The study population was well suited to the examination of obstetric differences between immigrant and Norwegian women, because many confounding factors were eliminated as a consequence of the good general health of the mothers and fetuses (i.e., a healthy baby was expected). Moreover, country of birth and origin were recorded accurately in the study.

The study was subject to several limitations. First, the sample size limited some of the analyses. This limitation was most prevalent in paper IV, in which the group of second-generation Pakistani immigrants was relatively small, even after the study period

was extended. This limitation also resulted in the division of women into immigrant groups based primarily on the geographical regions defined by the United Nations Statistics Division's geographical regions and recommended by Reproductive Outcomes and Migration: an International Research Collaboration,[157] which prevented the comparison of ethnic Norwegians and participants from each country of origin.

Second, country of birth was used as a representative for refugee background in paper II. However, immigrants originating from the four countries included were all on the list of highest number of immigrants with refugee background in Norway.[16]

Furthermore, data retrieved from the MBRN did not include information regarding maternal weight and height. This information could have altered the results somewhat, as shown in an earlier internal quality assurance study,[1] in which significantly higher proportions of women from Africa and Asia were overweight (BMI of >25.0 kg/m^2) and underweight (BMI of <18.5 kg/m^2), respectively, relative to Norwegians. High pre-pregnant maternal BMI has also been shown to increase risk of operative delivery.[162] Information regarding maternal BMI has been collected by the MBRN since 2011 and should be included in future studies.

Moreover, information on women's mental health issues, FGM, antenatal care attendance, need for an interpreter, and women's experience of care was not available for this study. This information could be useful in distinguishing effects.

Finally, educational level and marital status were the only two variables recorded as an indicator of socioeconomic position in our study. In addition, missing values for the variable educational level were more frequent for immigrant women, indicating that the variable did not distinguish between high and low socioeconomic positions adequately. Socioeconomic position has been shown to be an important variable in examining immigration-related inequalities in health.[116]

6.2.2 Reliability – How precise are the estimates?

Reliability refers to precision of measurement, and according to Rothman, Greenland, and Lash,[163] "… an estimate with little random error may be described as *precise*" [p.128]. Random errors are defined as errors that arise by chance and may occur in small studies due to random variation within the study population. Therefore, small differences in studies with small sample sizes must be interpreted with caution, as they could be attributed to random variation rather than actual difference. The precision of the effect

estimate (RR or OR) is displayed with 95% CIs in this thesis, indicating that we were 95% confident that the true values for these results (i.e., the values that we were attempting to estimate) lay within this CI. If the sample size is small and the outcome in question rare, this results in a large CI and imprecise estimation. Therefore, the narrower the CI, the more precise the estimate. The small sample size in papers II–IV resulted in large CIs and limited the possibilities of some analyses. However, we believe that the hypotheses tested in these studies are very relevant and should therefor be retested using national data to provide more reliable results.

6.2.3 Internal validity – Are the estimates biased by systematic errors?

The internal validity of a study describes the extent to which the conclusions drawn are appropriate with respect to the source population (i.e., immigrant women giving birth in low-risk maternity wards) in consideration of the study methods used and the participants characteristics.[163] The internal validity of a study could be weakened by systematic errors caused by inaccurate measurements of variables (information bias), selection bias, and confounding factors.

Information bias

Information bias may occur if there is a flaw in the information recorded, which can be due to differential or non-differential misclassification of variables.[163] The registration of the women's country of birth and origin were unlikely to have been flawed in the current study. And as the study examined births that took place in a single hospital, we can assume that the classification of outcomes and other variables was consistent. However, the obstetric outcomes that are assessed subjectively, such as blood loss estimation, can be subjected to bias. Still, these outcomes would probably be non-differential misclassified, which probably would not bias the effect estimate.[164] If the misclassification of the outcome however, is differentially according to women or infant's country of origin (e.g., skin-color in assessing symptoms for neonatal jaundice), it could result in an under- or over-estimation of the effect.[165] Validation studies involving MBRN data have shown conflicting results.[165-168] However, we examined hospital records and compared the data for selected obstetric outcomes with data from the MBRN and observed satisfactory consistency (Table 6.1).

Table 6.1. Comparison of proportion (%) of selected outcomes in data from hospital records and the one received from the MBRN (2006–2013).

Obstetric outcome	Hospital records (n = 13184) %	MBRN (n = 13057) %	Difference n (%)
Transfer to NICU	3.5	4.4	113 (1.10)†
Perineal rupture grade 3 and 4	1.7	1.7	11 (0)*
Instrumental vaginal delivery	12.6	12.8	19 (0.2)†
Elective cesarean section	5.9	6.0	14 (0.1)†
Emergency cesarean section	8.2	8.3	3 (0.1) †
Overall cesarean section	14.1	14.5	36 (0.4)†

†Additional registrations in data from MBRN
*Additional registrations in hospital records

The difference in total numbers of births was due to missing information for women without identification numbers in the data obtained from the MBRN. Furthermore, the hospital birth records did not include information concerning late-term abortions; however, this information is submitted to the MBRN. Finally, the higher number of infants transferred to a NICU found in the data from the MBRN can be attributed to the referral of infants to NICUs following discharge from Baerum hospital, indicating that their admittances to NICUs was not included in the hospital records.

Selection bias

All parturient women who were patients at the low-risk maternity ward at Baerum hospital were included in the study; therefore, the issue of selection bias was irrelevant with respect to internal validity. Nonetheless, missing values for some variables may have led to a selection bias in the regression analysis from which these participants were excluded. There were many women (particularly those of African origin) with missing values for the educational level variable. However, the variable included three categories, in which missing values were recoded as not documented, and included in all of the regression analyses in this category.

Confounding factors

There is a strong focus on controlling for the effects of confounding factors in observational studies.[169] Confounding factors are associated with both the exposure and outcome variables, but are not the result thereof. The presence of confounding variables can lead to an inaccuracy in the estimated effect of the exposure variable on the outcome, which occurs when the exposure variable is influenced by a third variable that also affects

the outcome.[163] Confounding factors can lead to over- or underestimation of effects, and we usually adjust for their influence when estimating the effect of exposure variable on the outcome of interest. We chose to make such adjustments in the multiple regression analyses, and the arguments were different for which variables we adjusted for in the four separate papers.

In papers I, II and IV, we preselected covariates that were included in the various regression models based on previous knowledge, and they were either considered potential confounders or known to be associated with the outcomes. Possible confounders in these papers included maternal age, marital status, and parity, as we were able to describe diversity in these variables when comparing the groups, by examining background characteristics. The educational level variable was a known confounder. Country of birth/origin affected the availability of education for the women included in the study. Furthermore, level of education is associated with health behavior and can affect many of the obstetric outcomes examined. Even though these two exposure variables (country of origin and educational level) were highly correlated, collinearity was not present in any of the analyses performed.

In paper III we made an explorative model using backward-stepwise approach.[160, 161] Several problems can occur with stepwise variable selection;[161, 169] the model can produce overoptimistic results, with excessively low P values and narrow CIs; the estimates may be too large; and stepwise procedures may lead to implausible associations and failure to evaluate clinical implications. The results of the regression analysis in this paper should therefore be interpreted with caution. However, we decided to present crude, as well as adjusted, estimates to ensure that the effects of the included covariates were visible.

In paper IV, we did not include educational level variable in the regression models due to the limited sample size. In this paper we therefore discussed the possible effect of educational level rather than adjust for the effect. Future research examining intergenerational differences in obstetric outcomes should include the variable educational level in their analyses.

Variables can also be part of a causal pathway between the main exposure variable, which was country of origin in this study, and the obstetric outcome of interest.[169] These variables are known as intermediate variables and should not be adjusted for in regression analyses, as this can lead to bias. Whether the educational level variable could be considered an intermediate variable was uncertain. We wished to estimate the direct effect

of country of origin on obstetric outcomes while controlling for the influence of educational level; however, this could have led to an underestimation of the effect of country of origin on the obstetric outcome.

Finally, our estimates may have been confounded by unmeasured variables, such as BMI, as mentioned in section 6.2.1. When interpreting the results of the study, the limitations and considerations presented should be born in mind.

6.2.4 External validity

When assessing the external validity of a study, the aim is to determine whether the results apply to populations other than that included in the study (i.e., generalization to a wider population).[163] Whether our findings can be generalized to other populations, such as immigrants giving birth in Norway, Scandinavia, or Europe was difficult to establish. The results are similar to those of previous studies using national data; however, our sole intention was to determine whether the previously established disparity in obstetric outcomes between immigrants and Norwegians was prevalent in the low-risk maternity ward. We should therefore restrict the generalization of the results to similar birth settings.

6.3 Interpretation of results

6.3.1 Variety in mean birth weight and gestational age

Consistent findings in many observational studies involving immigrants are that Asian infants' mean birth weight is lower, and that they are at higher risk of LBW (≤2.5 kg) relative to host populations.[85] These findings were also reported in Amsterdam by Doornbos et al.[170] However, when maternal height was controlled for, Asian and Dutch infants no longer differed with respect to mean birth weight. The authors concluded that the reason that Asian infants were smaller was merely that Asian mothers were smaller. Therefore, it would seem appropriate to consider maternal ethnicity and height when assessing birth weight in babies. Boshari et al.[171] discovered that birth weight percentiles in infants born at full term to immigrants in Canada were higher relative to those of native-born infants. Moreover, Urquia et al.[96] assessed the classification of SGA and LGA infants using a standard Canadian birth weight curve, in addition to a curve tailored to

maternal global region of origin. They discovered that the latter curve appeared more appropriate for assessing risk of adverse outcomes in infants classified as SGA and LGA born to immigrant mothers, particularly those who originated from East and South Asia. Furthermore, Norris et al.[172] examined the proportions of SGA and LGA infants in White British and Pakistani infants in Bradford, UK, using three different charts. They found that an ethnic-specific chart classified lower and higher numbers of Pakistani infants as SGA and LGA, respectively. However, all three charts performed poorly at predicting adverse neonatal outcomes. The weight-by-gestation by gender curves used in the current study was based on live single births in Norway with fetal age at least 20 weeks in a 12-year period from 1987–1998, not differentiated on maternal factors.[159] It is therefore time to develop a more customized birth weight curve in Norway, which takes maternal height, and possibly maternal country of birth, into consideration. This could reduce the number of infants considered SGA; moreover, it could be used to identify more infants who are considered LGA and in need of special attention. However, the analyses performed in the current study revealed that Asian infants were at a greater risk of LBW, which was adjusted for gestational age. Although a reduction in mean birth weight could be expected, the higher proportion of infants with LBW is harder to explain.

Despite the well-documented increased risk of LBW in Asian infants, Moore et al.[173] did not report the increased risk observed in African mothers in Canada. This is consistent with findings of a meta-analysis of Somali women's postmigration pregnancy outcomes conducted by Small et al.[84] Interview studies involving Somali women in Scandinavia have revealed that many Somali women limit their food intake during pregnancy, due to fear of delivering large babies.[74, 133] It has also been suggested that chewing the narcotic plant khat, during pregnancy, could influence the baby's birth weight.[174] Khat may cause loss of appetite and is frequently used in East Africa and the southwestern region of the Arabian Peninsula. High prevalence of LBW has been observed in areas in which women chew khat.[175] Khat is smuggled into Norway in increasingly large amounts and is chewed primarily by men of Somali origin; however, Somali women are also reported to chew it.[176, 177]

Several previous studies, the most recent of which was a Swedish population study,[178] have reported lower and higher mean gestational age in infants born to Asian and African women, respectively, relative to that of the native population. However, this contradicts the findings reported by Patel et al.[179] in London in 2003, in which gestational age was lower in Black infants relative to those of white European origin. They suggested

that these infants matured faster, as the incidence of meconium-stained liquor was higher in this group. The disparity between these results may be due to differences in the classification of immigrants, as these studies used self-reported ethnicity data, while we used data concerning country of origin. The increased risk of postterm birth observed in African women in the current study could have occurred as a result of their fear of interventions and possible reluctance to induce labor, which is normally performed at 11 days past term, due to their fear.[133]

6.3.2 Stressful pregnancy

In this thesis, a summary of the findings suggests that African women, particularly from Somalia, experience stressful pregnancies, in which increased risks of meconium-stained liquor, emergency CS, and SGA infants create an image of a fetus in distress and suboptimal conditions during pregnancy. Many factors may be attributed to this theory, and, as previously discussed, maternal nutritional factors may affect infant birth weight. The proportion of women who experience anemia was also increased in Somali women, which may explain the increased risk in our study to some extent.[180] Activation of the HPA axis as a result of stress may lead to increased cortisol levels during pregnancy, which may be a useful theory to explain Somali women's increased risk of adverse obstetric outcomes.[99] This theory is also supported by a recent study from the United States, which reported that maternal lifetime exposure to stressful and traumatic life events was associated with increased levels of cortisol measured in scalp hair in pregnant women.[108] A recent randomized controlled study reported that women with increased levels of cortisol in saliva had an increased risk of giving birth to a LBW baby.[181] Most women who originate from Somalia move to Norway as war refugees, and they are likely to have been subjected to stressful and traumatic life events.[182] In addition, refugees have been demonstrated to be at increased risk of adverse pregnancy outcomes compared with immigrants from non-humanitarian countries.[183]

Many of our findings have previously been described via national data, and our observations in the low-risk maternity ward are consistent with previous reports published in Norway and other Western countries.[73, 82, 84, 184] In contrast, the high proportion of meconium-stained liquor is seldom discussed in the literature. Limited studies have reported varying rates of this phenomenon between different racial groups.[185, 186] Passing meconium before birth is associated with fetal complications[187] and may be considered a

proxy for poor quality maternity care before and during labor. There are a number of potential causes for meconium-stained liquor, including hypoxia, maternal and fetal infection, maternal medication, and the normal functioning of a mature gastrointestinal tract.[188] Our findings in this regard may be attributed, in part, to the normal functioning of a mature gastrointestinal tract because the Somali participants were also at an increased risk of postterm birth, which was also identified in Somali women in Sweden.[178] Somali women also had a high proportion of anemia, which may explain some of their increased risk in our study.

An increased risk of emergency CS is well documented in African and Somali immigrant women and has now been demonstrated in a low-risk maternity ward. Several explanations for this risk, such as the high incidence of FGM (98%) in these women, have been suggested.[189] However, the most recent meta-analysis indicated there was no significant difference in the risk of CS between women who had and had not experienced FGM.[190] Furthermore, some Scandinavian studies have reported that at times, healthcare workers were uncertain regarding the correct procedures for providing care for infibulated women in labor; therefore, CS was performed in place of de-infibulation.[74, 191] Another factor is the reduced risk of elective CS in African women. This finding may be a result of their fear of interventions, as reported by Vangen et al.[74] and Essén et al.[133] Moreover, it is possible that some of these women would have undergone planned, rather than emergency, CS had they received optimal antenatal care and been well informed.

An increased risk of giving birth to a baby with a low Apgar score is also well documented in Somali women.[84] Low 5-minute Apgar scores may be linked to poor pregnancy conditions, which result in fetuses without the strength required to endure a long period of labor. This may be considered in combination with their increased risk of postterm birth, which may also increase the risk of low Apgar scores.[192] Low Apgar scores may also be linked to the receipt of substandard care during labor.[193] All of the women in our study gave birth in the same maternity ward; thus, it is reasonable to assume that they were all subject to the same standards of care. However, this does not indicate that they received equitable care. Interpreters are seldom present during labor, and we may therefore assume that these women may have experienced communication difficulties, which resulted in a lack of appropriate information and security.

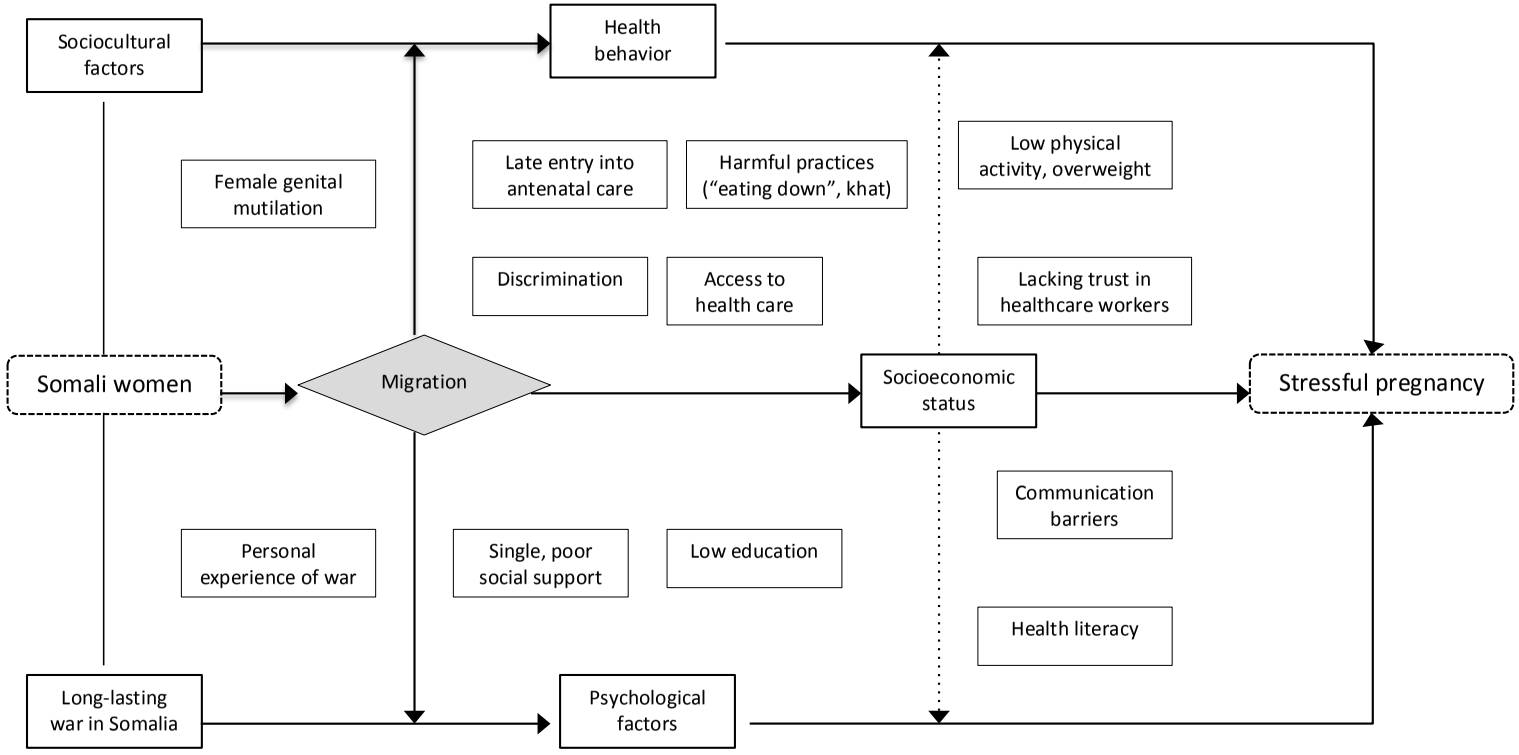

Figure 6.1. Illustration of factors that may affect Somali women's health and pregnancies. (Figure adapted by author Bakken KS from Kumar and Viken.[194])

Figure 6.1 illustrates our theory that Somali women experience stressful pregnancies. Many factors have been demonstrated to influence maternal health and pregnancy development. In addition, several unknown factors may contribute to the increased risk of adverse obstetric outcomes in this group. As they are immigrants from a different society, their health is influenced by their home country, the host country, and the migration process.[13]

Byrskog et al.[195] investigated the experiences of war and violence that had occurred prior to migration to Sweden in immigrant Somali women and determined that the act of war had created fear, an experience of loss, and separation from family. Several researchers have investigated the effects of PTSD on pregnancy outcomes.[107, 196] Rogal et al.[107] reported there were no significant relationships between PTSD and preterm delivery or LBW. However, they identified an association between minor depressive disorders and LBW. Yonkers et al.[196] recently reported that the risk of preterm birth increased fourfold in women who had experienced concurrent PTSD and depression during pregnancy. In the current study, the investigation of preterm birth was limited to women who gave birth between 35^0 and 36^6 weeks of gestation. African and Somali women did not have an increased risk of preterm birth; however, Somali women had an increased risk of postterm birth. This finding is consistent with previous findings reported from the United States.[197] However, these findings are contradictory to what we would expect because these women originate from a country with long-lasting war and conflict. Furthermore, Somali women have been reported to have a reduced risk of preterm birth post-migration relative to host populations.[84] One answer to this puzzle may be that there is no correlation between Somali women's experiences of war and our expectations of their increased risk of developing mental health problems because of these experiences. Råssjö et al.[137] determined that few of the Somali women in their study reported mental health problems. This finding may be a result of the manner in which Somali women handle challenges, as described by Byrskog et al.,[195] in which these women expressed that they had to accept the situation, look forward, and not dwell on what cannot be changed. Thus, because of the difficulties they had experienced, Somali women had learned to be strong.

The women of African origin had the lowest socioeconomic status in our study, with the highest proportions of single and poorly educated mothers relative to Norwegians. These variables also had the greatest effects on the estimates in the regression models performed stepwise in paper II. Dejin-Karlsson et al.[198, 199] in Sweden proposed a stress hypothesis, which implied that psychosocial factors influenced

intrauterine growth. The authors reported an increased risk of giving birth to infants considered SGA for women with low social stability, social participation, emotional support, and instrumental support (access to advice and information). An association between foreign origin and low access to psychosocial resources was also identified, and psychosocial factors were more important risk factors for having SGA infants in immigrant mothers relative to mothers of Swedish origin.[199] Their findings support our theory that the adverse obstetric outcomes, particularly in African and Somali women, may occur because of the stressful nature of their pregnancies.

6.3.3 Infants of East, Southeast, and Central Asian origin and risk of neonatal jaundice

We found that infants born to mothers from East, Southeast, and Central Asia were at an increased risk of neonatal jaundice relative to that of Norwegian infants, which is consistent with the results of previous studies.[200-204] The highest peak in serum bilirubin has been reported to be delayed in Asian infants, relative to British infants, and with high levels present for a longer duration.[205] Several studies have identified genetic mutations, deficiencies, and differences that may explain these findings.[92, 206-210]

Despite the presence of these differences, in our experience, the role of ethnic disparity in the occurrence of neonatal jaundice has not been subject of sufficient focus for personnel in Norwegian maternity and postnatal wards. Transcutaneous bilirubin measurements are measured in infants with darker skin when screening for hyperbilirubinemia. Therefore, most of our colleagues in postnatal wards believe that this screening is only required to evaluate newborns with darker skin, as their natural pigmentation makes the colour contribution made by bilirubin difficult to detect with the naked eye. They are somewhat unaware that screening is also instrumental in detecting jaundice at an earlier stage in Asian infants, who are at a greater risk of developing the condition.

Jaundice has been reported to be a common cause of readmission to hospital following early discharge in newborn infants.[211] Modern standards for postnatal care in Norway result in most mothers and their infants being discharged from hospitals within 48 hours of delivery. Given the short duration of the period spent under medical observation and a delayed peak in bilirubin levels in some infants, efforts should be made to inform parents about the signs and symptoms of neonatal jaundice and advise them as to the

circumstances under which the hospital should be contacted. This information should be provided to immigrant mothers in their native languages, in a manner that facilitates easy understanding.

Unfortunately, we could only count the number of infants treated for neonatal jaundice in our study and were unable to analyze the levels of bilirubin in serum or determine the extent of treatment required. Further studies should evaluate the quality of healthcare with respect to neonatal jaundice treatment, as the jaundiced African infants in our study were at an increased risk of requiring treatment at a NICU. Whether this is a matter of poor communication or underlying issues related to jaunudice is unknown.

6.3.4 Intergenerational differences in obstetric outcomes

As second-generation immigrants are born in the country of settlement, some of the issues related to migration (e.g., being unable to speak the language, experience of trauma, fear of persecution, the asylum process, and lack of a social network) may not be applicable. However, many factors, such as the willingness to adapt and the extent of cultural diversity in the heritage and host cultures, influence the acculturation process.[34] The hypothesis that there would be similarities between obstetric outcomes for second-generation Pakistani immigrants and those of ethnic Norwegians due to increased acculturation was not confirmed in this study. However, the sample size was small, and the hypothesis should be tested in a larger population such as the total birth cohort of Norway.

Although consanguinity rates were higher in the immigrant groups relative to that of the Norwegian group, the two Pakistani generations did not differ in this regard, which suggests that second-generation immigrants had maintained traditional Pakistani marriage pattern. This differs from the findings of a national Norwegian study in which consanguinity declined in Pakistani immigrants, particularly those who were born in Norway.[89]

The most recent study involving all recorded births in Norway, including those that took place in high-risk maternity wards, indicated an elevated risk of stillbirth and death in infants born to both first- and second-generation Pakistani immigrants. The authors concluded that elevated risk persist across generations and that the disparity in health outcomes remained a challenge.[66] However, Naimy et al.[212] found that the perinatal

mortality rate in Pakistani immigrants in Norway was lower relative to that of their country of origin (i.e., Pakistan).

6.3.5 Caring for immigrant women

Many studies conducted in various host countries have examined different aspects of caring for immigrant women. Communication difficulties have been reported to be a major challenge in the provision of maternity care for immigrants.[126, 213, 214] A failure to use an interpreter may limit a woman's ability to recognize essential signs and symptoms, which may result in misunderstandings and delays in the detection and treatment of serious obstetric complications.[67] Vangen et al.[73] posited that communicative problems may be officially defined as potential risk factors for adverse birth outcomes, which understates the importance of routinely using interpreters. Language barriers may be overcome through the use of well-trained interpreters when required. However, Norwegian studies have reported that interpreters are underutilized in the healthcare sector.[215, 216] Furthermore, the most frequently used interpreters in the metropolitan area are interpreters with no formal qualifications.[217]

The matter of caring for immigrant women may be discussed in the context of equity in health care. In 2013, the Norwegian government published a national strategy that aimed to promote equity in healthcare services for immigrants in Norway because present day care was not equitable.[218] Lyberg et al.[126] suggested that Norwegian maternity care is not sensitive to the needs of immigrant women. Suboptimal maternity care for immigrants has also been described in Sweden.[139] Lyberg et al.[126] interviewed midwives and public health nurses, who emphasized a need to systematically increase their knowledge with respect to providing maternity care to immigrants, as healthcare workers experienced difficulty in managing the diversity of this care. Healthcare workers indicated that the different cultures and values represented by migrant women led to difficulties in establishing a trusting relationship and confidence in maternity care. Structural factors, which affect how midwives may care for pregnant immigrants, may limit their ability to adapt the care. For example, the utilization of interpreters may be limited so that they cannot offer antenatal classes (labor and birth preparation courses) for women who do not speak Norwegian. Alternatively, information leaflets may not be translated into different languages because of limited resources. This issue may be viewed as discrimination

because these women are not provided with the same equity of care as Norwegian-speaking women.

In Finland, Somali women have been reported to be satisfied with healthcare services; however, they perceived healthcare providers as unfriendly and communication as poor.[219] Similarly, in Norway, healthcare professionals stated that linguistic difficulties, cultural traditions, and religious beliefs create problems when working with Somali women.[214] In London, Essén et al.[220] determined that Somali women expressed fear throughout pregnancy and avoided a CS by failing to follow advice or changing maternity clinics. Obstetric providers have found Somali women's resistance to a CS stressful in emergency settings and have stated that Somali women did not understand their advice or the role of preventive medicine. Somali women avoided a CS because of a fear of death, whereas healthcare workers wished to prevent death. They suggested the implementation of consultations designed to meet Somali women's specific needs, in which information regarding routine interventions could be provided, in addition to general, rather than personalized, advice as to why and when interventions are useful. They also suggest that this information should be discussed with Somali women in a sensitive manner that does not leave them with the belief that something is wrong with the pregnancy.

When examining the outcomes and experiences of women with different levels of English fluency in Australia, Small et al.[221] determined that women who were not fluent in English faced more problems with communication and less positive experiences with care. They expressed difficulty in using family members as interpreters because they would only translate parts of the conversations. The women also stated that healthcare workers lacked knowledge and awareness of the particular cultural preferences and practices they wished to follow. For example, Vietnamese women believed that they should keep warm and avoid showering, moving around too much, and eating certain foods immediately after birth to promote their health. The authors also reported diversity in practices between and within different cultural groups. They therefore argued that cultural awareness training may have unintended consequences that may reinforce stereotypes on the basis of ethnicity or culture. They suggest that time and resources may be better spent on the development of the practical skills required by healthcare workers in communication with women from diverse backgrounds. This statement was supported by the findings of a Swiss study that examined the effects of training physicians to communicate with patients in other languages and the use of interpreters, as this type of communication is

challenging.[222] They reported that patient perceptions of the quality of communication improved following specific training.

A multifaceted study in Australia suggested that the maternity care provided for African-born women needed to comprise a continuity of healthcare workers, high quality interpreters, educational strategies for educating women, as well as healthcare workers, and the provision of psychosocial support to women with refugee backgrounds.[223] Information regarding the challenges and gaps in understanding cultural inequities should be considered when developing and providing maternity care for immigrant women in Norway. Interpreter services should be improved, and their use should be critically enhanced in all maternity care facilities because this is a key factor in enabling communication, which may result in the enhancement of women's knowledge and is likely to create a trusting relationship.[224] A lack of trust in maternal care providers may result in late entry into antenatal care, low adherence to recommendations, and inappropriate decision making.[225] Binder et al.[224] determined that the Somali women in their study often stressed the necessity of language compatibility in contact with healthcare services over a desire to meet a provider of the same ethnicity. Furthermore, they discovered that these women considered the desire to be treated by female healthcare providers less important than experiencing a respectful and professional encounter. However, Somali women expressed a strong distrust of strangers as interpreters. Thus, there is a need for further research, and health authorities in Norway should increase their efforts to improve maternal care for immigrants. Fortunately, information regarding country of origin and the need for interpreters was included in the proposal for the new antenatal cards for pregnant women in Norway.[226]

Midwives also have different starting points in how to care for immigrant women. Midwives have different fluencies in foreign languages and different experiences with foreign cultures through our own practices and private travels. Until recently, there has been little focus on caring for immigrant women in the education of nurses and midwives in Norway. Although structural factors and healthcare systems are not properly adapted to facilitate equity in care for immigrants, individual midwives efforts may improve the women's experience of care. The individual meeting with a healthcare provider enhances women's understanding and wellbeing during maternity care. Individual midwives decide whether to use an interpreter, or increase the time spent in their antenatal check-ups. Midwives also need to create a trusting relationship to provide psychosocial support and a high quality of care for immigrant women, as well as ethnic Norwegians.

The immigrant woman as a patient who does not speak Norwegian or English is no longer an unusual situation in Norwegian maternity care. Therefore, this usual situation requires guidelines regarding treatment. With guidelines comes responsibility from healthcare systems, which makes the facilitation of high quality care easier.

7. CONCLUSIONS

The findings of this study suggest that immigrants' obstetric outcomes significantly differ from Norwegians, even in a pregnant population giving birth in a low-risk maternity ward.

Paper I: Women from Asia and Africa were at the greatest risk of adverse obstetric outcomes, and several factors, such as antenatal care, maternal nutrition, cultural preferences, language skills, and socioeconomic status, may have influenced these findings. These findings contribute to an increasing body of evidence that indicates immigrant women are in need of targeted care during pregnancy and childbirth, even in low-risk settings.

Paper II: Somali women were at the greatest risk of adverse obstetric outcomes, and in contrast to our hypothesis, we did not identify the same risk in other immigrant women who originated from countries considered conflict-zones. This study suggests that women from Somalia require dedicated, and possibly more adaptive, care during pregnancy and childbirth, even in low-risk birth settings.

Paper III: Infants born to mothers from East, Southeast, and Central Asia exhibited increased odds of neonatal jaundice relative to Norwegians. Furthermore, although the proportion of African infants with neonatal jaundice was lower relative to Norwegian infants, an increased proportion was transferred to a NICU for treatment. It is essential to use the parents' native languages to educate them regarding the signs of neonatal jaundice and provide clear instructions regarding the circumstances under which the hospital should be contacted.

Paper IV: We identified few intergenerational differences in the background characteristics and obstetric outcomes between first- and second-generation Pakistani immigrants. The proportion of consanguinity was high in both immigrant groups, which indicates the maintenance of the traditional Pakistani marriage pattern. Pakistani immigrants differed from Norwegians as follows: infants born to first-generation immigrant women were more likely to be transferred to a NICU, and second-generation immigrants were more likely to experience late preterm birth (35^0–36^6 weeks). The results of this study may contribute to the generation of new hypotheses in the field, as existing research is limited.

The immigrant population in Norway is growing and constantly changing, with substantial diversity, based on differences in social, cultural, and economic backgrounds,

in their reasons for immigration. Although disparities in obstetric outcomes were documented in national data 15 years earlier, it has now been documented for a low-risk maternity ward. We introduced the theory that women of African origin, particularly Somali women, are exposed to stressful pregnancies. The combined results regarding adverse obstetric outcomes in this study suggest fetuses in distress and suboptimal conditions during pregnancy. To reduce stress and suboptimal conditions for these women, antenatal care should be adapted to accommodate their needs. Health authorities must consider these findings and contribute to the development of robust maternal and reproductive healthcare services that are able to adapt to the current and future challenges. This process involves the development of guidelines, a significant investment in the development of well-functioning interpreting services, and strengthening midwifery services in antenatal care to ensure the facilitation of high quality care. Midwives should make individual adaptions for care, which involves the correct use of interpreters, accommodation of continuity of care, and providing a trusting relationship, psychosocial support, and health education for the pregnant immigrant population. In addition, training healthcare workers to communicate with immigrants with diverse backgrounds should be facilitated and included in the education of new midwives.

8. CLINICAL IMPLICATIONS

- Immigrant women, including second-generation immigrants, are in need of targeted care during pregnancy and childbirth, even in low-risk birth settings.

- Somali women constitute a high-risk group because of several factors including sociocultural conditions and long-term war in their country of origin.

- Enabling communication via the use of qualified interpreters could result in the enhancement of women's knowledge and the development of trusting relationships, which could ultimately improve obstetric outcomes.

- Harmful practices and undesirable health behavior in immigrant women could be reduced and avoided via the establishment of trusting relationships and good communication with midwives in antenatal care settings.

- It is essential to use parents' native languages to educate them about the signs and symptoms of neonatal jaundice and provide clear instructions regarding the circumstances under which the hospital should be contacted.

- Healthcare workers who provide maternity care for immigrant women should be trained in communication with women from diverse backgrounds.

- Immigrant women should be provided with continuity of healthcare workers.

- Women with refugee backgrounds should bee provided with psychosocial support.

- Guidelines describing maternity care for immigrant women should be developed.

9. FUTURE RESEARCH

Several research questions emerged while conducting this study, some of which we hope to explore in the near future.

Further observational studies using national data from the MBRN (i.e., all births in Norway between 1990 and 2014) could help to answer the outstanding research questions:

- Does the risk of adverse obstetric outcomes differ between first- and second-generation Pakistani immigrants?
- Are second-generation immigrants' obstetric outcomes similar to those of ethnic Norwegians?
- Are there ethnic differences in risk of adverse obstetric outcomes for women in Robson Groups I and III?

In order to ensure that giving birth is safer and reduce the increased risk of adverse obstetric outcomes for immigrant women, we should develop interventions and evaluate their effects. Further qualitative studies are required to explore women's preferences and understand the healthcare sector improvements required to provide more adaptive care. Experimental studies should evaluate the effects of the following interventions:

- Antenatal care adapted to cater for Somali women's preferences and cultural understanding, which should include group sessions with midwives and female interpreters trained to work in antenatal classes (i.e., the medical aspects of care and communicative and educational skills).
- Specially developed doula/interpreter services, which should be available to Somali women during pregnancy and labor. Develop a service that involves caregivers who play the combined roles of doula and interpreter. These female caregivers are trained as both doulas and interpreters and meet women during pregnancy; develop a trusting relationship, and follow them throughout antenatal care, birth, and the early postpartum period.

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11. APPENDIX

Melding om avsluttet svangerskap etter 12. uke – Fødsel, dødfødsel, spontanabort

Se utfyllingsinstruks for blanketten på baksiden

MFR

Sosial- og helsedirektoratet

A – Sivile opplysninger

Institusjonsnr: | Institusjonsnavn

Fødsel utenfor institusjon: ☐ Hjemme, planlagt ☐ Hjemme, ikke planlagt ☐ Under transport ☐ Annet sted

Mors fulle navn og adresse

Pikenavn (etternavn):

Mors sivilstatus ☐ Gift ☐ Ugift/enslig ☐ Annet ☐ Samboer ☐ Skilt/separert/enke

Slektskap mellom barnets foreldre? ☐ Nei ☐ Ja Hvis ja, hvorledes:

Mors bokommune

Fars fødselsdato | Fars fulle navn

Mors fødselsnr:

B – Om svangerskap og mors helse

Siste menstr. 1. blødn.dag ☐ Sikker ☐ Usikker

Mors tidligere svangerskap/fødte Levende-fødte | Dødfødte (24. uke og over) | Spontanabort/Død-fødte (12.–23. uke) | Spontanaborter (under 12. uke)

Ultralyd utført? ☐ Nei ☐ Ja UL termin:

Annen prenatal diagnostikk? ☐ Nei ☐ Ja, angi type:

Patologiske funn ved prenatal diagnostikk? ☐ Nei ☐ Ja, hvis bekreftet – spesifiser

Spesielle forhold før svangerskapet:
☐ Intet spesielt
☐ Astma ☐ Allergi ☐ Tidligere sectio ☐ Res. urinveisinfeksjon
☐ Kronisk nyresykdom ☐ Kronisk hypertensjon ☐ Reumatoid artritt ☐ Hjertesykom
☐ Epilepsi ☐ Diabetes type 1 ☐ Diabetes type 2 ☐ Annet, spesifiser i «B»

Regelmessig kosttilskudd: ☐ Nei (Før sv.sk. / I sv.sk.)
Multivitaminer ☐ ☐
Folat/Folsyre ☐ ☐

Spesifikasjon av forhold før eller under svangerskapet: B

Spesielle forhold under svangerskapet:
☐ Intet spesielt
☐ Blødning < 13 uke ☐ Blødning 13–28 uke ☐ Blødning > 28 uke ☐ Glukosuri ☐ Svangerskapsdiabetes
☐ Hypertensjon alene ☐ Preeklampsi lett ☐ Preeklampsi alvorlig ☐ Preeklampsi før 34. uke ☐ HELLP syndrom
☐ Eklampsi ☐ Hb < 9.0 g/dl ☐ Hb > 13.5 g/dl ☐ Trombose, beh. ☐ Infeksjon, spes. i «B»
☐ Annet, spesifiser i «B»

Legemidler i svangerskapet: ☐ Nei ☐ Ja – spesifiser i «B»

Røyking og yrke
Forutsetter mors samtykke – se rettledning på baksiden
☐ Skriftlig orientering gitt til mor ☐ Samtykker ikke for røykeoppl.

Røykte mor ved sv.sk. begynnelse? ☐ Nei ☐ Daglig ☐ Av og til Ant. sig. dagl.:

- ved sv.sk. avslutning? ☐ Nei ☐ Daglig ☐ Av og til Ant. sig. dagl.:

Mors yrke ☐ Samtykker ikke for yrkesoppl. ☐ Ikke yrkesaktiv ☐ Yrkesaktiv heltid ☐ Yrkesaktiv deltid

Mors yrke

Bransje:

C – Om fødselen

Leie/presentasjon: ☐ Normal bakhode ☐ Sete ☐ Tverrleie ☐ Avvikende hodefødsel ☐ Annet, spesifiser i «C»

Fødselstart: ☐ Spontan ☐ Indusert ☐ Sectio

Ev. induksjons-metode: ☐ Prostaglandin ☐ Oxytocin ☐ Amniotomi ☐ Annet, spesifiser i «C»

Indikasjon for inngrep og/eller induksjon ☐ Komplikasjoner som beskrevet nedenfor ☐ Fostermisdannelser ☐ Overtid ☐ Annet, spesifiser i «C»

Inngrep/tiltak ☐ Ingen ☐ Utskj. tang, hodeleie ☐ Annen tang, hodeleie ☐ Vakuumekstraktor ☐ Episitomi

Fremhj. ved setefødsel: ☐ Vanlig fremhjelp ☐ Uttrekning ☐ Tang på etterk. hode

Sectio: Var sectio planlagt før fødsel? ☐ Nei ☐ Ja ☐ Utført som elektiv sectio ☐ Utført som akutt sectio

Spesifikasjon av forhold ved fødselen/andre komplikasjoner C

Komplikasjoner ☐ Ingen ☐ Vannavg. 12–24 timer ☐ Vannavg. > 24 timer ☐ Mekaniske misforhold ☐ Vanskelig skulderforløsning
☐ Placenta previa ☐ Abruptio placentae ☐ Perinealruptur (grad 1-2) ☐ Sphincterruptur (gr. 3-4)
☐ Blødn.> 1500 ml, transf. ☐ Blødning 500–1500 ml ☐ Eklampsi under fødsel ☐ Navlesnorfremfall
☐ Truende intrauterin asfyksi ☐ Risvekkelse, stimulert ☐ Langsom fremgang ☐ Uterus atoni ☐ Annet:

Anestesi/analgesi: ☐ Ingen ☐ Lystgass ☐ Petidin ☐ Epidural ☐ Spinal ☐ Pudendal ☐ Infiltrasjon ☐ Paracervical blokk ☐ Narkose ☐ Annet:

Placenta: ☐ Normal ☐ Hinnerester ☐ Ufullstendig ☐ Infarkter ☐ Koagler ☐ Utskrapning ☐ Manuell uthenting Placenta-vekt

Navlesnor ☐ Normal ☐ Velamentøst feste ☐ Marginalt feste ☐ Karanomalier ☐ Omslyng rundt hals ☐ Annet omslyng ☐ Ekte knute Navlesnor-lengde:

Fostervann ☐ Normal ☐ Polyhydramnion ☐ Oligohydramnion ☐ Misfarget ☐ Stinkende, infisert ☐ Blodtilblandet

Komplikasjoner hos mor etter fødsel ☐ Intet spesielt ☐ Feber > 38.5° ☐ Trombose ☐ Eklampsi post partum ☐ Mor overflyttet ☐ Mor intensivbeh. ☐ Sepsis ☐ Annet, spesifiser

D – Om barnet

Fødselsdato | **Klokken**

Pluralitet ☐ Enkeltfødsel ☐ Flerfødsel For flerfødsel: Nr. Av totalt

Kjønn ☐ Gutt ☐ Pike Ved tvil spesifiser i «D» For dødfødte: ☐ Usikkert kjønn

Barnets vekt: | Hode-omkrets: | Total lengde: | Eventuelt sete–issemål:

Apgar score: 1 min | 5 min

Barnet var: ☐ Levendefødt

For dødfødte: ☐ Dødfødt/sp.abort Oppgi dødsårsak i «D»

For dødfødte, oppgi også ☐ Død før fødsel ☐ Død under fødselen ☐ Ukjent dødstidspunkt ☐ Død før innkomst ☐ Død etter innkomst

Levendefødt, død innen 24 timer Livet varte: Timer | Min.

Død senere (dato): | **Klokken**

Overfl. barneavd. ☐ Nei ☐ Ja Dato: | Overfl. til

Indikasjon for overflytting: ☐ Respirasjonsproblem ☐ Prematur ☐ Medfødte misd. ☐ Perinatale infeksjoner ☐ Annet, spesifiser

Neonatale diagn.: (Fylles ut av lege/pediater) ☐ Intet spesielt
☐ Hypoglyk. (< 2 mmol/l) ☐ Medf. anemi (Hb < 13.5 g/dl) ☐ Hofteleddsdyspl. beh. m/pute
☐ Transit. tachypnoe ☐ Resp. distress syndr. ☐ Aspirasjonssyndrom ☐ Intrakraniell blødning
☐ Cerebral irritasjon ☐ Cerebral depresjon ☐ Abstinens ☐ Neonatale kramper
☐ Konjunktivitt beh. ☐ Navle./hudinf. beh. ☐ Perinat. inf. bakterielle ☐ Perinat. inf. andre
☐ Fract. claviculae ☐ Annen fraktur ☐ Facialisparese ☐ Plexusskade

Behandlingskoder: ☐ Systemisk antibiotika ☐ Respiratorbeh. ☐ CPAP beh.

Icterus behandlet: ☐ Lysbehandlet ☐ Utskifting

Årsak: ☐ AB0 uforlik. ☐ RH immunisering ☐ Fysiologisk ☐ Annen årsak

Tegn til medfødte misdannelser: ☐ Nei ☐ Ja

D Spesifikasjon av skader, neonatale diagnoser og medfødte misdannelser – utfylles av lege

☐ **Kryss av hvis skjema er oppfølgingsskjema**

Jordmor v/fødsel:

Jordmor v/utskrivning:

Lege:

Lege barsel/barneavd:

Utskrivningsdato

Mor:

Barn:

Protokollnr.: /

IS-1002 23011. 07.06. Andvord Grafisk.