Perinatal outcomes of immigrants giving birth at a low risk central hospital in Norway.

- *A comparison study at Bærum hospital of different ethnic groups and Norwegian women.*

Kjersti Sletten

Thesis for Master of Health Sciences

Institute of Health and Society, Faculty of Medicine

UNIVERSITY OF OSLO

May 30, 2011

2011

Title: Perinatal outcomes of immigrants giving birth at a low risk central hospital in Norway.
-A comparison study at Bærum hospital of different ethnic groups and Norwegian women

Author: Kjersti Sletten

http://www.duo.uio.no/

Print: Reprosentralen, Universitetet i Oslo

Abstract

Purpose: The aim of this study was to examine whether first generation immigrant women had higher risks for perinatal complications than Norwegian women at Bærum hospital and to compare their background characteristics.

Literature review: There is an increasing immigrant population in Norway and more often can one meet immigrant women on the delivery wards in Norway. Previous studies have shown that the health status of migrants and ethnic minority groups is worse than that of the average population. Studies have also shown disparity in perinatal mortality and the prevalence of acute caesarian section compared to Norwegian and Swedish women.

Method: This is an observatory study where data was collected from medical records of women who gave birth at Bærum hospital during the period of June 2009 to June 2010. The 2437 women from 103 different country of origin were divided into six immigrant groups; Norway, Western Europe, Eastern Europe, Asia, Africa and Latin America. Cross tabulations was used in order to compare background characteristics and regression analyzes was performed in order to identify the immigrant groups at risk for perinatal complications.

Results: Women from Africa and Asia had increased risks for fetal distress (OR 2,2 and 1,7), meconium stained liquor (OR 1,6 and 1,8) and acute caesarian section (3,0 and 2,0) compared to the Norwegian women. Being from Africa or Asia also reduced their babies' weight by 156 and 218 gram respectively. Both groups had less risk of epidural analgesia (OR 0,4 and 0,7), but the women from Asia had an increased risk of receiving oxytocin-infusion (OR 1,9) and their babies were more often transferred to an neonatal intensive care unit (OR 2,1). On the other hand the Asian group had a reduced risk for induction of labour (OR 0,4). Women from Latin America had a higher risk for postpartum hemorrhage (OR 5,1) also for operative vaginal delivery (OR 3,2). This was only a small group of women and therefore these results should be interpreted with care. The women from Western and Eastern Europe had a reduced risk for episiotomy (OR 0,5 and 0,5) and the Western Europeans had an increased risk for operative vaginal delivery (OR 1,6) compared to the Norwegian women.

Conclusion: This study shows differences in background characteristics and perinatal outcomes between different immigrant groups compared to Norwegian women. Women from Asia and Africa were the at most at risk for adverse perinatal outcomes compared to the Norwegian women and these findings are comparable with previous studies. Sosio-economic relations, cultural differences and communicational difficulties can be possible explanations, but more research is needed in this area. By reducing linguistic barriers by teaching healthcare providers a better understanding of cultural sensitivity and enhance their skills in communication when using an interpreter, might reduce these differences.

Abstract in Norwegian

Perinatale utfall hos innvandrere som føder ved en sentral, lavrisiko fødeavdeling i Norge. En sammenlikningsstudie av ulike innvandrergrupper og norske kvinner ved Bærum Sykehus.

Formål: Formålet med studien var å undersøke om førstegenerasjon innvandrekvinner var forskjellig fra norske kvinner i bakgrunnskarakteristikk og om de har større risiko for perinatale komplikasjoner **s**ammenliknet med norske kvinner.

Teoretisk forankring: Innvandrerbefolkningen i Norge øker og flere innvandrerkvinner er å møte ved landets fødeavdelinger. Flere studier viser at helsen til innvandrere er dårligere enn den generelle befolkningens. Studier viser også ulikheter i perinatal mortalitet og forekomst av keisersnitt mellom ulike grupper innvandrerkvinner sammenliknet med norske og svenske kvinner. Dårlige sosioøkonomiske forhold har vist å påvirke perinatal mortalitet. Kulturelle forskjeller og språklige utfordringer er også vist å kunne påvirke perinatale utfall.

Metode: Det er en observasjonsstudie hvor datamaterialet ble hentet fra journalene til kvinner som fødte på Bærum sykehus fra juni 2009 til juni 2010. De 2437 kvinnene fra 103 forskjellige land ble delt i 6 innvandrergrupper; Norge, Vest-Europa, Øst-Europa, Asia, Afrika og Latin-Amerika. Krysstabell analyser ble brukt for å teste forskjeller i bakgrunnskarakteristikk og regresjons analyser ble brukt for å identifisere innvandrergrupper som risikofaktor for enkelte perinatale komplikasjoner.

Resultater: Kvinnene fra Afrika og Asia hadde økt risiko for føtalt distress (OR 2,2 og 1,7), misfarget fostervann (OR 1,6 og 1,8) og akutt keisersnitt (OR 3,0 og 2,0) sammenliknet med de norske kvinnene. Barna deres hadde en lavere vekt enn barn av norske kvinner på henholdsvis 156 og 218 gram. Begge gruppene hadde redusert risiko for epidural smertelindring (OR 0,4 og 0,7), men kvinnene fra Asia hadde økt risiko for å få oxytocin-infusjon (OR 1,9) og barna ble oftere overflyttet til nyfødtintensiv (OR 2,1). De Asiatiske kvinnene hadde derimot redusert risiko for indusert fødsel (OR 0,4). Kvinnene fra Latin-Amerika hadde en økt risiko for postpartum blødning (OR 5,1) og operativ vaginal forløsning (OR 3,2). Kvinnene fra Vest- og Øst-Europa hadde noe redusert risiko for episiotomi (OR 0,5 og 0,5) og gruppen Vest-Europa hadde noe økt risiko for operativ vaginal forløsning (OR 1,6) sammenliknet med de norske kvinnene.

Konklusjon: Studien viser forskjeller i bakgrunnskarakteristikk og i risiko for perinatale komplikasjoner mellom ulike innvandrer grupper sammenliknet med norske kvinner. Kvinner fra Afrika og Asia hadde større risiko for perinatale komplikasjoner og disse funnene er sammenliknbare med funn i tidligere studier. Det trengs flere studier for å forklare disse forskjellene men sosioøkonomiske forhold, kulturforskjeller og kommunikasjonsproblemer kan være mulige årsaker. Ved å redusere språkbarrierer og gi opplæring til helsepersonell om kultursensitivitet og kommunikasjon med tolk, kan bidra til å redusere disse forskjellene.

Preface

I was inspired to choose immigrant women as the topic of my thesis, due to my personal experience of poor communication with immigrant women during obstetric emergencies. In my work as a midwife at Bærum hospital, a central hospital near Oslo, I often meet immigrant women in labour. The feeling of not being able to calm a woman or get her to cooperate is one of the worst situations I know. Gaining their trust can be difficult, since I can't explain that what I am doing is in order to help. The immigrant population is growing and these situations are only going to occur more often.

Many of my colleagues share my concerns and frustration when caring for immigrant women in labour and agree that there is a need for more interpreters on the labour ward. The use of interpreters differs between the different labour wards in Norway and how the problem of poor communication during labour should be dealt with is unclear. My personal experience has lead me to believe that immigrant women experience more complications during labour and taking my masters degree was a god opportunity to examine this more closely.

This thesis is an internal quality control conducted at my workplace examining perinatal outcomes of women in different immigrant groups compared to Norwegian women. The width of research on immigrant health and immigrant women is large, but existing information had not yet influenced my daily practice as a midwife. Working with this matter has opened my eyes to a whole new world of importance. It has given me a desire to continue my research, and better the conditions for the increasing population of immigrant women giving birth at Norwegian hospitals.

I have several people to thank who made this thesis possible. Firstly I would like to express my gratitude to my supervisor Babill Stray-Pedersen for encouraging me throughout and for your invaluable knowledge on this matter. I always left smiling after my tutoring sessions with you. Secondly I would thank my dear colleague Anne Andfossen for reading my thesis and helping me with the English copyediting. Magne Thoresen at Institute of Basic Medical Sciences, Department of Biostatistics, helped me with some statistics in a desperate moment and I thank you for that. I also want to thank Marit Kristoffersen and other colleagues at Bærum hospital for making this study possible with giving me access and the necessary permit. And thank you Sandvik AS for giving me a research grant.

Writing my thesis has been like a roller coaster with its ups and downs. It has given me many challenges and I could never have done this without the help of my wonderful partner Joachim.

I hope you will enjoy reading my thesis for Master of Health Science.

May 2011, Kjersti Sletten

Abbreviations

Adj R2 – Adjusted R Square

BMI – Body Mass Index (kg/m²)

CI – Confidence Interval

CTG – Cardiotocography. Monitoring fetal heart rate and mother's contractions.

CS – Caesarian section

FGM – Female genital mutilation

gr – Gram

HELLP – **H**emolytic anemia, **E**levated **L**iver enzymes and **L**ow **P**latelet count, also known as HELLP syndrome

HG – Hyperemesis gravidarum

IOM – International Organization for Migration

IUGR – Intra uterine growth restriction

LBW – Low birth weight

MBRN – Medical Birth Registry of Norway

MFH – Migrant Friendly Hospitals

N (n) – Number of cases

NICU – Neonatal intensive care unit

OR – Odds Ratio

ROAM – Reproductive Outcomes and Migration

r_s – Spearman's rank correlation coefficient

SD – Standard Deviation

SGA – Small for gestational age

UTI – Urinary tract infection

WHO – World Health Organization

ß – Beta Standardized Coefficient in multiple linear regressions

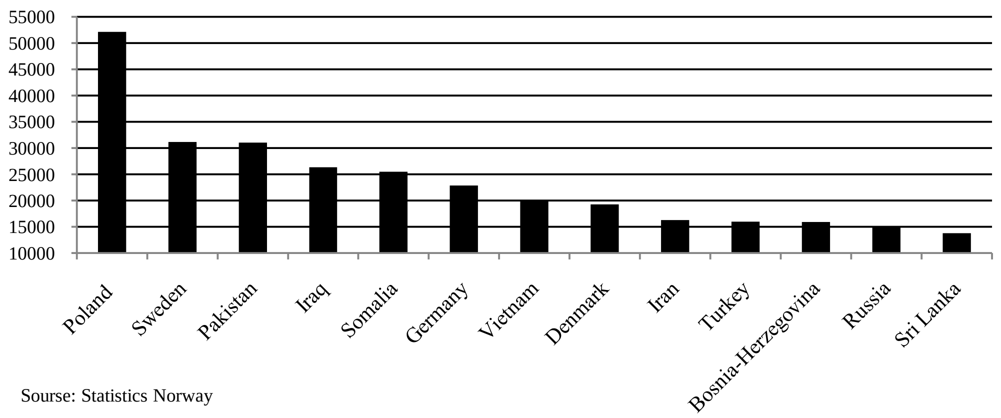
Table of contents

1. INTRODUCTION

1.1. Immigration in Norway

More people are on the move today than at any other point in human history. There are now about 214 million people living outside their country of birth, which is about 3,1% of the world's population (1). There is also an increasing immigrant population in Norway. Immigrants and those born in Norway to immigrant parents constitute 11.4 % of Norway's population and consist of people from 216 different countries (2). Statistics Norway defines immigrants as persons who are born abroad to two foreign-born parents, and who have moved to Norway (1.generation). Those born in Norway with two immigrant parents are defined as Norwegian-born to immigrant parents (2.generation). Figure 1 shows the largest groups of immigrants by country of origin including Norwegian-born immigrants.

Figure 1. The largest immigrant groups in Norway 1. January 2010. Absolute numbers.



Sourse: Statistics Norway

A total of 35% of the immigrants have gained Norwegian citizenship. Between 1990 and 2008, a total of 377 000 non-Nordic citizens immigrated to Norway. They have come as refugees (24%), as labour migrants (24%), to study (11%), or to join family living in Norway (17%) (2). It is common to distinguish between labor immigrants and refugees. Labor immigrants have left their country of origin voluntary in order to work. Refugees on the other hand have been forced to escape war or political persecution. This makes the refugees more endangered because of late effects of traumatic experiences in their country of origin (3).

Many of these immigrants are also young adults in their fertile stage of life, and about 42% of them are women (4). Therefore their first meeting with the health services will most likely be because of pregnancy and childbirth. The largest groups of children born in Norway with immigrant parents in 2008 were those who had parents from Somalia, Iraq, Poland and Pakistan (4).

1.2. Giving birth

The biological process of giving birth is considered to be a universal process surrounded by social and cultural characteristics. The sosio-cultural constructed childbirth is described differently depending on where and when the story is being told. The stories often have in common that giving birth is a life changing experience that involves psycho-social, socio-cultural and normative relations (5). The cultural characteristics of childbirth therefore vary in different countries. Bakhta and Lee (6) studied the attitudes of Russian women toward the presence of a support person during labor. They reported that the Russian women considered the labour to be a medical process that didn't need social interaction. Over 68% of these women did not have their husband present during labour. Bakhta and Lee conclude that there is a wide range of cultural differences regarding childbirth and physicians need to be aware of that. A Swedish study examined the childbirth experience of Somali women and men in Sweden (7). They found that in the Somali culture, the event of childbirth was a strictly female event and no husbands were present. They therefore had a difficult time adjusting to Swedish culture which also redefined their traditional roles as mother and father. Darvill et al. (8) have studied women's transition into motherhood and highlights the need for social support during this period. Many immigrant women lack their social network needed in order to meet their cultural needs surrounding childbirth in their new country. This is a challenge for healthcare workers in an increasingly multicultural society like Norway, also since they meet several different cultural needs.

1.3. Health of immigrants

The health status of migrants and ethnic minority groups has shown often to be worse than that of the average population (9). According to the World Health Organization (WHO) the health of immigrants and health related to migration are crucial public health challenges (10). A European project called "Migrant Friendly Hospitals" (MFH) was engaged in order to put migrant-friendly and culturally competent health care high on the European health policy agenda. MFH also aimed to compile practical knowledge and tools to support other hospitals (9). A review of effective intervention models, necessary for partner hospitals in the MFH project to select and implement suitable interventions for improvement in their own hospitals, was complied by Alexander Bischoff (11). He focused the interventions on these four areas; communication, responsiveness to sosio-cultural background, empowerment of migrant patients and monitoring the health of migrants. Bischoff concludes that:

"A health care system or institution is not providing quality care if it is not providing quality care to all its patients. Quality in terms of equality is thus a key issue in migrant and minority health care. It is also a political issue, because a national health care system is supposed to provide health care equally well to all its citizens." (11)

MFH have compiled a database of useful information and experiences that can be used to provide more equal health services for all. A network for MFH in Norway, NONEMI, completed an internal study in 2009 that showed a great challenge associated with the use of interpreters (12).

The health of migrants is on the political agenda and in March 2010 WHO, the International Organization for Migration (IOM) and the Ministry of Health and Social Policy of Spain organized a Global Consultation on Migrant Health in Spain. Approximately 100 officials, academics and experts gathered to review global data on the health of migrants in order to make better policies and create migrant-sensitive systems. They identified four areas of priority for action which includes the monitoring of migrant health and ensure standardization, policy and legal framework in international standards, evolvement of migrant sensitive health systems and a multi country cooperation (10).

Several studies in different parts of the world have shown health disparity between immigrants and the population of the receiving country (13-16). According to WHO, there are many factors which limit an immigrant's access to health services. These factors include stigma, discrimination, social exclusion, language and cultural differences, separation from family and socio-cultural norms, and financial and administrative hurdles (10). Nationals Syed and Vangen (17) have written a review on health and migration for the Center for Minority Health Research in Norway (NAKMI). They point out that Friederich Engles as early as 1845, noticed the role of ethnicity when he examined poor health and mortality records in Manchester. Engles drew the attention to the miserable social and environmental circumstances in which the Irish population lived. Syed and Vangen also mention Dr. John W. Trask's report from 1916 (18) where Trask showed different mortality rates among Whites and Blacks in the USA. Trask concluded that the Whites had more favorable sosio-economic circumstances than the Blacks and that their mortality rates would improve with the economic and industrial progress. Later several researchers have found the same differences in many countries. Stronks et al. (13) reported in 2001 that immigrants in Netherlands were less likely to use more specialized healthcare compared to people from the Netherlands. Underuse of more specialized services was also present among the lower socio-economic groups. Nielsen and Krasnik (19) found in their systematic review on self-perceived health in the European Union that most immigrants appeared to have lower self-perceived health than the majority of the population in the investigated countries. This was even after they controlled for age, gender, and socioeconomic factors. A Canadian national health survey identified the same, that the immigrant population reported poorer health status than the non-immigrant population (14). These findings are supported by a Swedish study which also reported a strong association between ethnicity and poor self reported health (15). This association seemed to be in relation to socioeconomic status, poor knowledge of Swedish and the feeling of being discriminated. A Norwegian study found that ethnic Pakistanis had higher prevalence of poor self-rated health, diabetes and psychological distress compared to ethnic Norwegians (20). They conclude that socio-economic status partly explains this inequality in health and that there are uncontrolled variables that also may have contributed to these results.

These ethnic differences in health and disease have shown to be a rather complex matter. Therefore several possible explanations have been discussed over the years. McKeigue (21) focuses his research on the genetic differences between different ethnicities, while others emphasize the social and economic inequalities (16;22) or the role of specific behavioral or biomedical risk factor explaining health disparity (23-26).

Several studies have found a healthy migrant effect, were the health status of immigrants on arrival is better than comparable native-born individuals. For instance Razum et al. (27) reported that the immigrants in Germany had a significantly lower mortality risk than the ethnic Germans. Kennedy et al. (28) compared data from several studies in the USA, the UK, Australia and Canada examining the healthy migrant effect. They reported significant evidence that immigrants from all regions were selected people on the basis of educational levels. The most highly educated immigrants came from both developed and developing countries. They state that this however does not fully explain the healthy migrant effect. Guendelman et.al (29) found in their study on birth outcomes where they compared immigrant from Mexico to the United States of America and from North-Africa to Belgium and France, that the immigrant women had better outcomes than the receiving-country women. They suggest that this can be due to selective immigration.

Refugees have increased prevalence of posttraumatic stress disorders, anxiety and depression according to Lustig et al.'s review (30). Risk factors that make immigrants more endangered for psychological disorders are the experiences of racism and exclusion, change of social structure, identity issues and stress related to being in a new culture and not being fully integrated in the new society. The magnitude of difference in the immigrant's original culture and that of the receiving country has influence on how tough the integration process will be. Skin color also has influence on how often they experience racism (3).

An international collaboration, Reproductive Outcomes and Migration (ROAM), focuses their research on migration and reproductive health. It is made up of investigators from the European Perinatal Epidemiology Network and currently consists of 33 researchers from 13 countries (31). A systematic review conducted by the ROAM collaboration (32) reported that Asian and African women were at greater perinatal health risk than receiving-country women. In another systematic review, the ROAM Collaboration looked at studies of immigrant women to detect the role of ethnicity, region of origin and destination on the outcomes low birth weight (LBW) and premature birth (33). They reported different results for immigrants in Europe and in the United States, though it was difficult to compare due to the differences in definitions of the immigrant women. The ROAM collaboration has also investigated stillbirths and infant deaths among immigrants in industrialized countries (34). They reported that the refugees were the most vulnerable group. For non-refugees, non-European migrants in Europe and foreign-born blacks in the

United States had the highest mortality. A Swedish study identified increased perinatal mortality amongst the immigrant population in Sweden, where women from sub-Sahara were at higher risk (35). The same research group also reported higher prevalence of suboptimal factors that likely resulted in perinatal death among the east African immigrant women (36). Ekésus et al. (37) studied all single births in Sweden from 1992 to 2005 and identified that the risk of stillbirth was higher for immigrant women but it varied by region of birth and time since immigration. African women and women from Middle East had the highest risk for stillbirths.

1.4. Immigrant women's health in Norway

In 2004 almost 15 % of all the newborns in Norway were born to an immigrant mother (38). Several studies have been performed in Norway examining different aspects of immigrant women's health. Eskild and Vangen with colleagues (39-41) reported that foreign women more often had induced abortion compared to Norwegian women and that Non-Western immigrants represented a risk group. Vangen and Holan with colleagues (42;43) have examined the prevalence and outcome of Diabetes among the immigrants. They found that women from South-Asia and North-Africa had a higher prevalence of diabetes, and that the prevalence was seven times higher than for ethnic Norwegians during pregnancy. They also demonstrated an association between maternal diabetes and adverse pregnancy outcomes and later cardiovascular and renal morbidity. The immigrant population from Pakistan in Norway is studied by Bjerke et al. (44-46). They have reported lower prevalence of postpartum depression and sexually transmitted infections in comparison to the Norwegians. However the pregnant Pakistani population had a somewhat poorer infectious immune status. When Vangen et al. (47) examined the pregnant Pakistani population and their use of obstetric analgesia at two hospitals in Oslo, they concluded that Pakistani women were less likely to receive analgesia in labour, compared to Norwegian women. Birth defects, still birth, infant death and parental consanguinity were examined by Stoltenberg et al., using data from The Medical Birth Registry of Norway (MBRN) (48;49). They reported that the risk of birth defects, stillbirth and infant death was almost equal for all groups they examined when there were no consanguineous present. In the Pakistani group, consanguinity was a major risk factor for birth defects, still birth and infant death because of its high prevalence which was at 31-40%. The same research group (50;51) also examined the risk of recurrence of birth defect and perinatal death and found that consanguinity increased the risk for recurrence for both outcomes. Saastad et.al (52) investigated stillbirths and categorized the health care as optimal or not. They found that non-western immigrants had 2,2 times increased risk of stillbirth compared to the Norwegian women. They also identified that the non-western immigrants more often received suboptimal care.

The association between birth weight and perinatal mortality in different ethnic groups was examined by Vangen et al. (53), and they concluded that the perinatal mortality differences between the ethnic groups were not explained by differences in birth weight.

Substantial variations in the prevalence of hyperemesis gravidarum (HG) according to the country of birth were reported by Vikanes et al. (54;55). Women born in India and Sri Lanka had the highest frequency of 3,2% and were 3,4 times more likely than the Norwegian women to develop HG. This variation could not be explained by sosio-demographic factors, neither could the length of residence in Norway. Grjibovski et al. (56) examined in 2008 the relationship between consanguinity and the presence of HG. They found no association and they could neither explain the difference in frequency of HG between Norwegian, Pakistani and Turkish women.

Research has also focused upon the Somali women in Norway since Vangen and colleagues reported that this group had one of the highest prevalence of acute caesarian section (CS) (57). The same research group (58) stated that the Somali women had more often perinatal complication compared to ethnic Norwegian women. They argue that this may be due to the elaborate use of female circumcision in Somalia. In a qualitative study interviewing Somali women and health care professionals about their perinatal care experience (59), the Somali women reported that they were afraid that they would receive suboptimal treatment due to the limited experience of Norwegian health care workers. They expressed a strong fear for CS. The health care workers were uncertain of how they should handle the infibulated women and sometimes CS was performed instead of deinfibulation. Johansen (60) have also studied healthcare workers experience of encounters with infibulated women in Norway. She reported that the healthcare workers experienced technical challenges regarding how to deinfibulate the women and they had emotional challenges related to their feelings about circumcision and in their opinion the expression of male oppression.

Vangen et al. (57) reported that also the Filipino women had a higher CS rate compared to the Norwegian women. Data from MBRN in the period 1986-1995 showed that Filipino women had a CS rate at 25,8% compared to 12,4% among the Norwegian women. It was considered that the high proportion of Filipino women married to Norwegian men could influence these results. Therefore ethnicity of the father was examined in order to determine any influence on the infant birth weight. Although there was found to be some increase in the infant birth weight of the mixed couples when compared to the Filipino couples, the risk for CS was higher for the Filipino couples. It was therefore concluded that other factors may also play a role in the outcomes of this patient group (61).
Al-Zirqi et al. (62) has examined the risk factors related to severe obstetric hemorrhage and reported amongst other findings that women from South-East Asia had an increased risk for severe postpartum hemorrhage, whilst Middle Eastern women had a decreased risk.

1.5. Sosio-economic differences

Socio-economic factors have been reported to affect perinatal mortality (63). A report from Statistics Norway (64) on family immigration and migrant workers showed that women who emigrate to Norway to establish a family with a person with non-immigrant background were twice as likely to gain employment outside of the home compared to women who came to Norway to reunite with a refugee. Another report (65) shows that the immigrant population is by far more at risk for persistent financial poverty than the rest of the population in Norway. According to OECD's measurements 8% of immigrants and 10% of the refugee population are living in poverty compared to 1% of the non-immigrant population in Norway. There are great differences between immigrants according to their country of origin. The greatest amount of poverty was found amongst the immigrants from Somalia, where 23% were defined as impoverished during the period of 1993-2007. Amongst the Pakistani population, 17% was defined as poor. A third report from Statistics Norway (66) showed that, 8% of the immigrant population over the age of 18 years received social assistance during 2008, compared with only 3% of the total population. However there are great variations among the different immigrant groups, due to the various reasons for immigrations and differences in the length of residence. These two factors contribute greatly in predicting those in need of social assistance. Arntzen and Andersen (67) looked at epidemiological studies from all the Nordic countries published in 1980-2001 in order to identify social determinants for infant mortality. They found that social inequalities in infant mortality were observed in all four countries. Arntzen et al. (68) also looked at data from the MBRN from 1967-1998 in order to examine the association between risk for infant death and socioeconomic status. They reported that even though the risk of infant death decreased during this period in all the educational groups examined an inverse association between socioeconomic status and risk for post neonatal death persisted.

A Swiss epidemiological study reported that the health status of asylum seekers varied (69). This variation depended on the political, psychosocial and economic circumstances in which the migration occurred. Refugees are less likely to have their social support needed in order to adjust to a different culture, and a new language in a host country. They are more likely to have experienced stressful life events, possibly the cause behind the escape from their own country (70). It is therefore a surprising finding in an Australian study were they reported no significant relationship between adverse outcomes of pregnancy and the refugee status (71). In the study conducted by the ROAM collaboration on the other hand, refugees were the most distinctive migrant group with high perinatal mortality (34). They point out that refugees have been shown to have more medical problems, but fewer interventions during labour. Refugees more frequently have a low social status, communication problems and a different understanding of health and diseases. They also state that these factors combined may play a role in adverse perinatal outcomes.

Canadian researchers have studied length of stay in Canada and the birth outcomes such as premature birth and small for gestational age (SGA), among the immigrant population (72). They reported that the immigrant women with residency less than five years in Canada had a lower risk for premature birth compared to non-immigrant women, however women who had resided over 15 years were at a higher risk. These results were consistent taking into account the differences in world region origin. The recent immigrants had a higher risk for SGA babies, however duration of residence had no impact on this increased risks. The authors argue among other things that acculturation can be the reason for adverse birth outcomes after ten years of residence since duration of residence has been associated with increase in BMI, smoking, alcohol consumption and physical inactivity. They also suggest that psychological factors may have an impact on adverse birth outcomes of immigrant women.

A group of researchers in the Netherlands raised the question if it matters which country the person migrates to (26). They state that the role of the residing country's national context in ethnic inequalities in health should be explored, since findings suggest that the health status of ethnic minority groups is not fixed across countries or generations. Norway is the world's richest country but that does not necessarily mean that Norway has a good enough system for taking care of immigrants in need of healthcare service.

1.6. Communication - Linguistic and cultural differences

Communication barriers are very relevant for most immigrant women. They tend to speak the language of the receiving country less fluently than men, even after several years of residence. They are also less exposed to the new culture because of their social roles which often keep them in the home (73). Bollini et.al (74) reported in their systematic review that pregnancy outcomes of immigrant women improved for the women who were better integrated in their new society. Difficulties regarding communication can create misunderstandings that can result in negative effects on the treatment of patients. It can also reduce the access of proper healthcare services when patients, of cultural and linguistic reasons, cannot express their needs (12). A Swiss study examined the impact language barriers had on asylum seekers reporting of health problems at arrival (75). They found that there were inadequate language concordance in 54% of the interviews between the nurses and the asylum seekers. Adequate language concordance was associated with higher reporting of traumatic experiences and psychological symptoms. Of the interviews with inadequate concordance, much fewer asylum seekers were referred to psychological care. This highlights the importance of good communication and the importance of the use of interpreters.

There are cultural differences in expressing pain and the words we use to describe our body. Misunderstandings are not only related to different languages but it can also be due to differences in social and cultural imaginations (76). Differences in strategies and attitudes regarding pregnancy and childbirth, in comparison to native women, have been documented in qualitative studies of Somali women (59;77). The increased perinatal mortality among immigrants has also been suggested to be due to suboptimal perinatal care (34-36;52). Because of cultural beliefs and language barriers healthcare workers may be less able to observe problems among newborns of immigrants affecting the efficiency of perinatal care at hospital level (34). A Swedish study reported that babies of mothers from sub-Saharan countries were less likely to be transferred to neonatal intensive care unit (NICU) compared to their ethnic Swedish counterparts, despite a high-risk profile (35). The same research group (36) also reported a higher prevalence of suboptimal care received by infants born to mothers from the Horn of Africa in comparison to the Swedish. It was more likely to result in a higher incidence of potentially avoidable perinatal death and they argue that these women received less optimal care due to inappropriate maternal pregnancy strategies, inadequate medical treatment and miscommunication. In the Norwegian study by Saastad et al. (52) which reported that non-western women more often received sub-optimal obstetric care compared to western women, found that non-western women were less likely to attend a standard program for prenatal care. Non-western women also postponed contacting health care services in cases of reduced fetal movements, rupture of membranes and abruptio placenta. The writers argue that this may be due to communication problems and misinterpretation of clinical signs due to cultural differences. A high prevalence of inadequate communication was also discovered, and the writers argue that the lack of an interpreter limits the women’s ability to relate essential signs and symptoms, which may result in misunderstandings, delayed detection and treatment of serious obstetric complications. Vangen et al. (58) states that communicative problems have been officially defined as potential risk factors for adverse birth outcomes and that this understates the importance of using interpreters routinely.

Essén and colleagues (77) reported from interviews with Somali women that a common attitude in Somalia was that surveillance of the pregnancy was not necessary as long as things appeared to be normal. The Somali women perceived the antenatal care program as a routine check-up and the writers argued that the Somali women did not seem to benefit from the antenatal care program in the way it was intended. They also found that although Swedish law guarantees women the right to obstetrical anesthesia, few of the Somali women could remember receiving any information about anesthesia during the pregnancy. Part of the explanation for this could be due to sub optimal communication and the authors' states that better use of interpreters could improve the communication. An Italian study reported on the other hand no differences in perinatal outcomes when they compared women from the western world and immigrants from the non European Union countries (78). In this hospital, the immigrant population had access to interpreters and efforts were made to offer similar care to all women. The authors of this article experienced that high standard medical care was achievable regardless of ethnic group or origin of the women. An Australian study (79) of immigrant women with non-English speaking background found no statistical differences in the perinatal outcomes that they examined. However, the immigrants were English speaking at the time of the study, which would account for better communication and integration.

In a large qualitative study from Australia women were interviewed and outcomes and experiences for women with different levels of English fluency were studied (80). They reported that the women who were not fluent in English experienced more problems with communication and they had also less positive experiences of care. The women expressed difficulties when using a family member as an interpreter, as they would only translate parts of the conversation. The women also expressed a lack of knowledge and awareness from the healthcare worker, with regard to particular cultural preferences and practices that the women wished to follow. For instance, Vietnamese women believe that they should keep warm and avoid showering after birth. They should not move around too much, and avoid eating certain foods in order to promote their health. The authors also reported diversity in practices between and within different cultural groups in this study. They therefore argue that cultural awareness training may have unintended consequences that can reinforce stereotypes on the basis of their ethnicity or their culture. They suggest that the time and resources might be better spent on developing the practical skills which healthcare workers require to communicate with women from diverse backgrounds. A Swiss intervention study examined the effect of training physicians in communicating with patients of other language and using interpreters since this kind of communication is challenging (81). They reported that the quality of communication perceived by the patients improved after the specific training.

A recent Australian study on the effect of cultural and linguistic diversity on pregnancy outcome, reported that using an interpreter reduced the likelihood of an adverse pregnancy outcome (71). According to national and international standards, interpreting is the healthcare workers communicative responsibility. When the use of interpreter is indicated, it should be seen as part of the healthcare service (12).

1.7. Research question and aim of study

A total of 33% of the women who gives birth at Bærum hospital are immigrants. Even though disparity in perinatal outcomes among immigrant women is well documented, interventions have not yet been enforced. The severity of the findings highlights a need for much greater focus on this matter. The aim of this study was therefore to examine whether first generation immigrant women had different background characteristics and if they had a higher risks for perinatal complications than Norwegian women at Bærum hospital. The study was an internal quality control of the labour ward.

The research questions were:

Do first generation immigrant women giving birth at Bærum hospital have different background characteristics than Norwegian women?

Do first generation immigrant women have higher risks for perinatal complications than Norwegian women?

2. METHOD

2.1. Research design

The study was an observatory study with a prospective, cohort design. The data was extracted from information recorded during pregnancy, birth and the early postpartum period. Data was collected from patient journals after delivery trough the electronic patient's journals.

2.2. Study population

Bærum hospital is located in Akershus County near Oslo. The maternity clinic at Bærum Hospital is defined as a local delivery unit, since the hospital have no NICU. A pediatrician makes daily visits to the postnatal unit; otherwise the on call anesthetist is available for neonatal resuscitation. The women giving birth are a selected group, all being more than 35 weeks of gestation and expecting a healthy baby. Subsequently, women with complicated pregnancies such as: Diabetes Type 1, pregnancies with more than two fetuses or fetuses with health issues, are referred to hospitals nearby with NICU and pediatric service present at all times. Women with premature contractions are transferred to another hospital before delivery. Babies that show signs of disease or distress after birth are transferred by ambulance to another hospital, always accompanied by an anesthesiologist or a midwife.

Data was collected from 2625 women, and their babies, all deliveries taking place at Bærum hospital during the period of June 2009 until June 2010.

2.3. Background variables

In the analyses many confounding factors are controlled for, hereafter referred to as the independent variables. Each variable was categorized in several subgroups as shown in Table 1.

Table 1. Description of the independent variables.

Variable	Description	Categories
Maternal age		Numeric continues variable described in years.
Parity		• Para 0 • Para 1 • Para 2 • Para 3 or more
Educational level		• Less than 12 years of education • 12 years of education and more
Marital status		• Married or co living • Single (Unmarried, divorced or widowed)
Cigarette smoking		• Smoker in pregnancy • Nonsmoker
Body Mass Index (BMI)	The pre-pregnancy value, kg/m².	Was used as a numerical continues variable BMI-value, but was also divided into three groups; • Underweight with BMI less than 18,5 • Normal weight with BMI between 18,5 and 25,0 • Overweight with BMI more than 25,0
Maternal health	Describes any disorders before the pregnancy or sickness during the pregnancy. Some of the women were included in several of the subgroups.	• Preeclampsia or HELLP • Gestational diabetes • Hyperemesis gravidarum (HG) • Placenta praevia or Abruptio placenta • Earlier caesarian section • Anemia included women with hemoglobin levels < 9 during pregnancy. • Urinary tract infection (UTI) included recurrent urinary tract infection. • Other infections included viral and bacterial infections like hepatitis and infections in upper respiratory tract. • Pulmonary disorders included asthma and sarcoidosis of the lungs. • Psychological disorders included all the diagnoses of psychological type like bulimia, anorexia and anxiety disorders. • Gynecological disorders included surgery of ovaries or uterus, endometrioses, myoma uteri, polycystic ovarial syndrome, female genital mutilation and other cases of disorders in the genital area. • Endocrine disorders included hypo- and hyperthyroidism and chronic pancreatitis. • Other disorder included epilepsy, other neurological disorders, gastrointestinal disorders, arrhythmia, previous cancer, migraine and other uncomplicated disease.
Number of fetus		• Singleton pregnancy • Twin pregnancy, data obtained on twin number one
Presentation of the fetus		• Cephalic (head) presentation • Breech presentation • Transverse lie
Gestational age	Because Bærum hospital has no NICU, the threatening premature deliveries before 35 weeks gestation are transferred before delivery to another hospital. The gestational age in our material are mostly at term or post term. Sometimes the mother is admitted during labour and the babies are born at Bærum hospital but transferred after delivery.	Was used as a numerical continues variable in days and weeks, but also categorized; • Premature; less than 37 weeks gestation • At term; between 37 and 42 weeks of gestation • Post term; more than 42 weeks gestation

2.4. Perinatal complications

Twelve different perinatal complications or outcomes of pregnancy were examined. All variables had been documented in the mother's journal and each variable were divided in several subgroups. Table 2 shows a description of them.

Table 2. Description of the perinatal complications in the study.

Perinatal complication	Description	Categories
Start of labour		• Spontaneous start of labour • Induced labour
Epidural analgesia	.	• No epidural analgesia • Epidural analgesia
The use of oxytocin infusion during labour		• No oxytocin infusion • Oxytocin infusion
Fetal distress	The occurrence of fetal distress was documented based on CTG registrations showing fetal tachycardia, bradycardia, decreased variability or complicated decelerations.	• No fetal distress • Fetal distress present
Meconium stained liquor		• Meconium stained liquor absent • Meconium stained liquor present
Episiotomy		• No episiotomy • Episiotomy
Operative vaginal delivery		• No operative vaginal delivery • Operative vaginal delivery
Mode of delivery		• Vaginal delivery • Elective CS (performed before labour start) • Acute CS
Postpartum bleeding		• Postpartum bleeding less than 500 ml • Postpartum bleeding exceeding 500 ml
Transfer of the newborn to NICU		• No transfer • Transferred to a NICU
Baby's birth weight		Was used as a numeric continues variable in grams(gr), but also categorized; • LBW; less than 2500 gr • Normal weight; between 2500 and 4500 gr • Macrosomia; more than 4500 gr

2.5. Statistical analyzes

In order to examine if the immigrant mothers differed from the Norwegian mothers in background characteristics, different statistics methods was used depending on the variable. For categorical variables cross-tabulations with Pearson's chi-square test was used. For numeric variables Student T-test was applied when the material was normally distributed and Mann-Whitney U test was used for the non-normally distributed material.

Data for comparison of maternal and perinatal outcome of mothers in the present study and of mothers who gave birth in the counties Oslo and Akershus was collected in the

MBRN statistics database online (82). Statistical tests for differences were performed by using Pearson's chi-square test.

To find out whether immigrant women have a higher risk for perinatal complications compared to Norwegian women, each complication or outcome had to be examined for itself. The variable immigrant group was made an independent variable and examined among the other independent variables that contributes or not in the regression models for each complication or outcome. Because of some missing values, the number included in each model varies.

One numeric continues variable was normally distributed, birth weight, so one multiple linear regression model was made, and twelve multiple logistic regression models.

In order to make the multiple linear regression model, a correlation analyzes of all the independent variables that could have an effect on the baby's birth weight was performed through bivariate correlation analyzes using Spearman's correlation coefficient $r_{s.}$ Even though the variable birth weight was normally distributed; many of the independent variables were categorical or not normally distributed. The variables that correlated with birth weight with a p-value ≤ 0.1, was included in the multiple linear regression model. Using backward-stepwise approach the variables that contributed the least to the model was removed until the model was highly significant with a significance level set at $p \leq 0.05$ (83).

Most of the dependent variables were categorical dichotomies, if a complication occurred or not. The variable caesarian section (CS) was re-coded into elective CS or not and acute CS or not.

Every dependent variables relation to the independent variables was examined using crosstab-analyses with Pearson Chi-square tests. Variables with a strong relation to the dependent variable with significance level set at $p \leq 0,1$ were taken into the multiple logistic regression models. The variables that were not significantly contributing to the model was then removed using backward stepwise approach (83) until all the variables contributed significantly with p-value $\leq 0,05$. The variable immigrant group was the most interesting in this study, and it was sometimes forced in the model even though the Pearson Chi-square test showed no significant association. Some variables became statistic significant when put into the model and controlled for the other independent variables. Thus all the analyzes were repeated including all the independent variables, since only the variables needed to control for was collected in the first place. Backward stepwise approach was used and the least significant variable, contributing least to the model, was removed one at a time. Therefore in all the multiple logistic regression analyses, these variables are controlled for; maternal age, parity, educational level, marital status, cigarette smoking, BMI, maternal health, twin pregnancy, fetal presentation and gestational age. In some of the models the following variables are also controlled for; baby's birth weight, induction of labour, oxytocin infusion during labour, the use of epidural analgesia, CS and operative vaginal delivery.

The assumptions for the regression models are fulfilled in these analyses in order to provide valid models. The sample size in each regression model was large enough as no model contained more independent variables than 10% of the sample size. In the multiple linear regression model the residuals were normally distributed and there were no extreme values. There are some inter-correlations among the independent variables. The correlations and associations between the independent variables were examined with crosstab- and correlation-analyses. The presence of multicollinearity was examined between all the independent variables, making the categorical variables into dummy variables. The value of Tolerance indicates how much of the variability of the variable is not explained by the other independent variables in the model. The cut off values of Tolerance was set at less than 0,40. The Variance Inflation Factor (VIF) is 1/Tolerance, and measures how much the variance of the estimated regression coefficient is increased because of collinearity. The cut off value of VIF was set at 2,5 (84). There was no multicollinearity in these analyses.

In all the logistic regression models the fit of the model was tested using Hosmer and Lemeshow Goodness of Fit Test giving a well fit of test if the p-values were above 0,05 (84). The logistic regression models capacity to explain the variability of the dependent variables was given by Cox & Snell R Square and Nagelkerke R Square values (84). The statistical analyses were conducted using SPSS version 18 for Windows.

2.6. Ethical considerations

This study was based on data and information obtained from patient journals for internal quality control and was undertaken according to the Law for healthcare workers §26 (85). The study was approved by Bærum hospital's Privacy Ombudsman for research. Since the study was considered to be a study of internal quality control, ethical approval by the regional ethics committee was not needed.

After information was obtained from patient journals, the data was de-identified. The dataset was then examined closely in order to find out if any of the mothers could be recognized. Two cases were then removed from the dataset.

3. RESULTS

3.1. Background characteristics of the immigrant groups

Data was collected on a total of 2625 women. Two women were excluded from the analyses because of anonymity issues. Some of the women had gained Norwegian citizenship, and in some cases country of origin was found. A total of 186 women had Norwegian citizenship and a "non-Norwegian" name, but unknown country of origin, and were therefore excluded from the statistical analyses. Altogether 2437 women originating from 103 countries (Appendix 1) were analyzed and divided in six different groups (Table 3).

Table 3. Presentation of the immigrant groups and their country of origin (N = 2437)

Group	Number of women in group	Number of originating countries in group	The largest originating countries in the group
Norwegian	1634	1	Norwegian
Western Europe (including USA, Canada and Australia)	202	17	Sweden (n=77) Denmark (n=24) England (n=22)
Eastern Europe (including The Balkans)	201	19	Poland (n=89) Russia (n=28) Lithuania (n=13)
Asia	221	28	Pakistan (n=41) Iraq (n=30) The Philippines (n=27) Afghanistan (n=26)
Africa	150	25 (most from the Horn of Africa)	Somalia (n=61) Ethiopia (n=15) Eritrea (n=14)
Latin America (including South America)	29	13	Brazil (n=8) Mexico (n=5) Chile (n=4)

Table 4. Background characteristics of the 2437 women in the different immigrant groups Mean *(SD)* or n *(%)*

	Norwegian	Western Europe	Eastern Europe	Asia	Africa	Latin America	Total
	N = 1634	N =202	N =201	N = 221	N = 150	N = 29	N = 2437
Maternal age; year	32 (4,5)	32 (4,8)	28 (4,6)***	29 (5,4)***	29 (5,3)***	30 (5,8)*	31 (4,9)
Parity							
0	762 (46,6)	87 (43,1)	119 (59,2)**	103 (46,6)	51 (34,0)**	20 (69,0)*	1142 (46,9)
1	630 (38,6)	87 (43,1)	55 (27,4)**	78 (35,3)	42 (28,0)*	7 (24,1)	899 (36,9)
2	215 (13,2)	18 (8,9)	19 (9,5)	30 (13,6)	24 (16,0)	1 (3,4)	307 (12,6)
3 or more	27 (1,7)	10 (5,0)*	8 (4,0)*	10 (4,5)**	33 (22,0)***	1 (3,4)	89 (3,7)
Educational level							
12 years or less	327 (20)	58 (28,7)*	111 (55,2)***	151 (68,3)***	139 (92,7)***	17 (58,6)***	803 (33,0)
More than 12 years	1306 (79,9)	144 (71,3)*	90 (44,8)***	70 (31,7)***	11 (7,3)***	12 (41,4)***	1633 (67,0)
Marital status							
Single (Divorced/unmarried/widowed)	65 (4,0)	9 (4,5)	12 (6,0)	15 (6,8)	43 (28,7)***	1 (3,4)	144 (6,0)
Co-living/married	1569 (96,0)	193 (95,5)	189 (94,0)	206 (93,2)	107 (71,3)***	28 (96,6)	2292 (94,1)
Cigarette smoking	71 (4,3)	11 (5,4)	14 (7,0)	6 (2,7)	3 (2,0)	1 (3,4)	106 (4,3)
BMI; kg/m² Median (min - max)	22,3 (15,9 - 43,7)	21,7 (17,0 - 36,3)*	21,7 (16,6 - 42,5)**	21,8 (16,2 - 37,2)*	25,3 (15,9 - 44,9)***	22,3 (18,6 - 30,1)	22,3 (15,9-44,9)
Missing	103	21	20	32	40	2	218
Underweight; BMI<18,5	52 (3,2)	12 (5,9)*	18 (9,0)***	22 (10,0)***	5 (3,3)	0 (0,0)	109 (4,5)
Overweight; BMI >25,0	318 (19,5)	23 (11,4)*	35 (17,4)	40 (18,1)	59 (39,3)***	5 (17,2)	480 (19,7)
Maternal health							
Preeclampsia or HELLP	39 (2,4)	2 (1,0)	2 (1,0)	2 (0,9)	4 (2,7)	3 (10,3)***	52 (2,1)
Gestational diabetes	17(1,0)	1 (0,5)	0 (0)	7 (3,2)**	3 (2,0)	2 (6,9)**	30 (1,2)
Hyperemesis gravidarum (HG)	41 (2,5)	4 (2,0)	2 (1,0)	10 (4,5)	4 (2,7)	1 (3,4)	62 (2,5)
Placenta praevia or Abruptio	5 (0,3)	0 (0)	0 (0)	0 (0)	1 (0,7)	1 (3,4)**	7 (0,3)
Anemia	11 (0,7)	2 (1,0)	2 (1,0)	19 (8,6)***	7 (4,7)***	2 (6,9)***	43 (1,8)
Urinary tract infection (UTI)	250 (15,3)	21 (10,4)	22 (10,9)	27 (12,2)	18 (12,0)	2 (6,9)	340 (14,0)
Other infections	107 (6,5)	10 (5,0)	9 (4,5)	20 (9,0)	17 (11,3)*	1 (3,4)	164 (6,7)
Pulmonary disorders	98 (6,0)	9 (4,5)	2 (1,0)*	9 (4,1)	2 (1,3)*	4 (13,8)	124 (5,1)
Psychological disorders	93 (5,7)	6 (3,0)	4 (2,0)*	7 (3,2)	1 (0,7)**	1 (3,4)	112 (4,6)
Gynecological disorders	85 (5,2)	19 (9,4)*	4 (2,0)*	7 (3,2)	11 (7,3)	3 (10,3)	129 (5,3)
Endocrine disorders	54 (3,3)	5 (2,5)	4 (2,0)	3 (1,4)	1 (0,7)	1 (3,4)	68 (2,8)
Other disorders	143 (8,8)	15 (7,4)	11 (5,5)	14 (6,3)	6 (4,0)*	2 (6,9)	191 (7,8)
Earlier CS[1]	158 (18,1)	22 (19,1)	9 (11,0)	19 (16,1)	20 (20,2)	7 (77,8)***	235 (18,1)
Gestational age; days	280 (10)	279 (9)	281 (9)	278 (9)**	281 (12)	279 (11)	280 (10)
Preterm; <37 weeks gestation	36 (2,2)	2 (1,0)	4 (2,0)	8 (3,6)	6 (4,0)	2 (6,9)	58 (2,4)
Post term; >42 weeks gestation	85 (5,2)	8 (4,0)	18 (9,0)*	3 (1,4)*	14 (9,3)*	0 (0,0)	128 (5,3)
Twin pregnancy	14 (0,9)	3 (1,5)	1 (0,5)	3 (1,4)	3 (2,0)	0 (0)	24 (1,0)
Presentation of the baby							
Breech	65 (4,0)	7 (3,5)	11 (5,5)	6 (2,7)	3 (2,0)	1 (3,4)	93 (3,8)
Transverse	5 (0,3)	1 (0,5)	0 (0)	2 (0,9)	2 (1,3)	1 (3,4)**	11 (0,5)

* p ≤ 0,05
** p < 0,01
*** p <0,001
[1] Out of women with parity higher than 0.

Table 4 shows how the independent variables are distributed between the different immigrant groups. The mean maternal age was 32 years with an Standard Deviation (SD) of 4,5 in the Norwegian group, and 29 years in the African (SD 5,3) and Asian (SD 5,4) group. The youngest mean maternal age was in the Eastern European group at 28 years (SD 4,6). The African group had fewer mothers of parity 0, at 34% compared to 46,6% of the Norwegian mothers (p 0,003). They had more women of parity 3 or more with a frequency of 22% compared to 1,7% in the Norwegian group (p <0,001). The largest proportion of the Latin American group was of parity 0 at 69%. The African mothers were less educated with only 7,3% having more than 12 years education compared to 79,9% among the Norwegians (p <0,001). The mothers in the Asian group were also less educated with 68,3% having an education level of less than 12 years ($p < 0{,}001$). The African group had more single (unmarried, divorced or widowed) mothers with a frequency of 28,7% compared to the Norwegian group with only 4% ($p < 0{,}001$). The highest frequency of smokers (7%) was found in the Eastern European group and the lowest frequency (2%) in the African group. These did not statistical significant differ from the Norwegian group. The variable BMI had several missing values (see Table 4). The Western and Eastern Europeans and the Asians had lower mean BMI compared to the Norwegians ($p < 0{,}05$), whilst the Africans had higher mean BMI ($p < 0{,}001$). The African mothers were more often overweight with the highest frequency at 39,3% compared to the Norwegian mothers with a frequency at 19,5% ($p < 0{,}001$). The Western European mothers were less overweight than the Norwegians with a frequency of 11,4% (p 0,014). The Asian and the Eastern European mothers were more often underweight with frequencies of 10% and 9% compared to 3,2% in the Norwegian group ($p < 0{,}001$).

The variable maternal health was divided into 12 subgroups with few observations in some groups. The Latin Americans was a small group with only 29 women with a higher frequency of earlier CS (77,8%) compared to the Norwegian group ($p < 0{,}001$). Seven of the nine Latin American mothers who had previous children had an earlier CS. The Asians and the Latin Americans had a higher frequency of gestational diabetes than the Norwegian mothers with a frequency at respectively 3,2% and 6,9% ($p < 0{,}01$). These mothers along with the African mothers also had higher frequency of anemia with Asia at 8,6%, Latin America at 6,9% and Africa at 4,7% ($p < 0{,}001$). The African mothers had a higher frequency of other infections compared to the Norwegians (p 0,027). The African mothers had on the other hand a lower frequency of other disorders compared to the Norwegian mothers (p 0,044). This difference can also be shown in the subgroup of psychological disorders were the African group of had a frequency at 0,7% compared to the Norwegian group's frequency of 5,7% (p 0,008).

Out of the African mothers, 9,3% had a postterm pregnancy compared to the Norwegian mothers with a frequency of 5,2% (p 0,035). The Asian mothers on the other hand had less postterm pregnancies than the Norwegians with a frequency at only 1,4% (p 0,012).

Table 5. Comparison of maternal characteristics and perinatal outcome of births in Bærum hospital and the counties of Oslo and Akershus. N *(%)*

	Bærum hospital N = 2437	Oslo and Akershus[1] N = 16633	Pearson's chi-square test p
Parity			
0	1142 (46,9)	7671 (47,2)	0,779
1	899 (36,9)	5712 (35,1)	0,096
2	307 (12,6)	2038 (12,5)	0,959
3 or more	89 (3,7)	835 (5,1)	**0,001**
Marital status			
Divorced/separated/unmarried/widowed	144 (6,0)	971 (5,9)	0,792
Co-living/married	2292 (94,1)	15218 (93,6)	0,436
Cigarette smoking	106 (4,3)	566 (3,5)[3]	**0,037**
Maternal health			
Preeclampsia or HELLP	52 (2,1)	515 (3,2)	**0,007**
Gestational diabetes	30 (1,2)	210 (1,3)	0,879
Placenta praevia or Abrutio placenta	7 (0,3)	83 (0,5)	0,184
Anemia	43 (1,8)	114 (0,7)	**<0,001**
UTI	340 (14,0)	606 (3,7)[4]	**<0,001**
Pulmonary disorders	124 (5,1)	565 (3,5)[5]	**<0,001**
Twin pregnancy	24 (1,0)	295 (1,8)	**0,004**
Postpartum bleeding(exceeding 500 ml)	320 (13,1)	2784 (17,1)	**<0,001**
Episiotomy	437 (17,9)	2516 (15,2)	**<0,001**
Operative vaginal delivery	338 (13,9)	1873 (11,3)	**<0,001**
Caesarian section			
Elective	174 (7,1)	1285 (7,7)	0,3
Acute	195 (8,0)	1323 (7,9)	0,985
Induction of labour	260 (10,7)	2079 (12,5)	**0,009**
Oxytocin infusion	1005 (41,2)	5941 (36,5)[6]	**<0,001**
Epidural analgesia	855 (35,1)	4941 (30,4)	**<0,001**
Meconium stained liquor	478 (19,6)	2413 (14,6)	**<0,001**
Fetus presentation			
Breech	93 (3,8)	775 (4,7)	0,063
Transverse	11 (0,5)	67 (0,4)	0,867
Birth weight			
Low birth weight; <2500gr	42 (1,7)	940 (5,7)	**<0,001**
Macrosomia; >4500gr	76 (3,1)	429 (2,6)	0,149

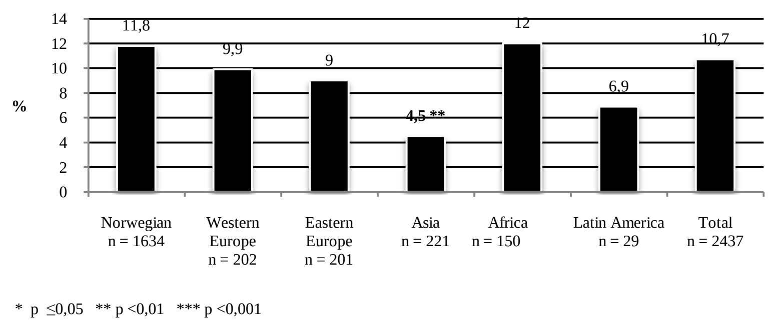
Significance level set at p<0,05
[1] Data from MBRN (66) from 2008.
[3]Frequency of women smoking at the end of the pregnancy.
[4]Frequency of Recurrent urinary tract infection
[5]Frequency of Asthma
[6]Frequency of Dystocia during labour

A comparison of maternal and perinatal outcome of mothers in the current study and of mothers who gave birth in the counties Oslo and Akershus in 2008 is shown in Table 5. The mothers in the present study differ from the mothers who gave birth in the counties Oslo and Akershus in 2008 when it comes to many of the maternal and perinatal outcomes. Mothers in this study had a higher frequency of anemia, UTI and pulmonary disorders. There were more mothers who smoked in the current study, but fewer of parity 3 or more. There were less twin pregnancies, preeclampsia and HELLP, postpartum bleeding and less induction of labour. On the other hand the frequency of meconium stained liquor, operative vaginal delivery and episiotomy was higher in the current study in comparison to the mothers who gave birth in the counties Oslo and Akershus in 2008. The mothers in this study received more often epidural analgesia and there had less LBW babies compared to the data from mothers giving birth in Oslo and Akershus counties in 2008.

3.2. Induction of labour

The prevalence of induction of labour showed small variations between the immigrant groups (Figure 2). The Asian group had the lowest frequency of 4,5% which was lower than the Norwegian group at 11,8% (p 0,001). A total of 260 women (10,7%) had their labour induced.

Figure 2. Induction of labour
-prevalence in the different immigrant groups



A multiple logistic regression model was made were all the independent variables described earlier in Table 1 was controlled for. Table 6 shows crude and adjusted values. The independent variables relations to induction of labour, unadjusted by the other independent variables, are shown with its crude Odds Ratio (OR) with 95% Confidence Interval (CI) and p-values. The final model shows the independent variables adjusted for all the variables in the final model. The model had a well fit and between 8,9 and 18,1 % of the variability in the prevalence of induction of labour could be explained by the model.

Table 6. Multiple logistic regression model; Induction of labour; 260 cases out of the 2437 women included in the model.

	Crude[1]		Adjusted[2]	
	OR (95% CI)	**p**	**OR (95% CI)**	**p**
Gestational age; at term between 37 and 42 weeks gestation	Reference	<0.001	Reference	<0.001
Preterm; <37 weeks (n= 58)	1,46 (0,65-3,27)	0,354	1,11 (0,46-2,71)	0,811
Postterm; >42 weeks (n= 128)	9,40 (6,45-13,71)	<0,001	11,21 (7,57-16,58)	<0,001
Twin pregnancy (n= 24)	10,36 (4,59-23,38)	<0,001	12,37 (5,23-29,23)	<0,001
Maternal age; year	1,04 (1,01-1,07)	0,006	1,03 (1,00-1,07)	0,021
Preeclampsia or HELLP (n= 52)	7,80 (4,45-13,68)	<0,001	9,52 (5,18-17,47)	<0,001
Gestational diabetes (n= 30)	3,11 (1,37-7,06)	0,007	2,78 (1,06-7,30)	0,038
Other disorders (n= 191)	1,86 (1,25-2,77)	0,002	1,86 (1,20-2,87)	0,005
Citizenship, Norwegian (n=1634)	Reference	0,043	Reference	0,186
Latin America (n=29)	0,56 (0,13-2,36)	0,426	0,47 (0,10-2,22)	0,341
Africa (n= 150)	1,02 (0,61-1,71)	0,928	0,89 (0,50-1,59)	0,707
Asia (n= 221)	0,36 (0,18-0,68)	0,002	0,42 (0,21-0,85)	0,015
Eastern Europe and the Balkan (n= 201)	0,74 (0,44-1,23)	0,242	0,73 (0,42-1,28)	0,278
Western Europe, USA, Canada and Australia (n= 202)	0,82 (0,51-1,34)	0,438	0,90 (0,54-1,51)	0,697

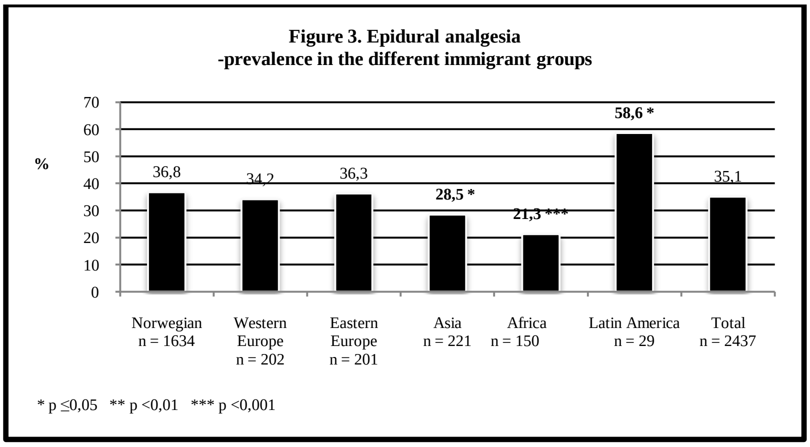
[1] Crude values; each independent variables relation to the use of induction of labour without adjusting for the other independent variables.
[2] The final model were all the included variables are statistic significant contributors with at significant level set at p ≤0,05.

As seen in Table 6 the strongest predictor for induction of labour was being pregnant with twins (OR 12,37, CI 5,23-29,23) or being postterm (OR 11,21, CI 7,57-16,58). The women who had preeclampsia or HELLP (OR 9,52, CI 5,18-17,47) and gestational diabetes (OR 2,78, CI 1,06-7,31) had an increased risk. The women with other disorders had an OR of 1,86 (CI 1,20-2,87, p 0,005) of having their labour induced. OR of 1,03 (CI 1,00-1,07) for maternal age indicates that for every year older the women is at the time of the delivery, the odds increase by 1,03 for having the labour induced.

As for the immigrant groups, only the Asian group had reduced likelihood of induction of labour (OR 0,42, CI 0,21-0,85). They were 0,42 times less likely to have their labour induced compared to the Norwegian group.

3.3. Epidural analgesia

The prevalence of the use of epidural analgesia showed some variations between the different immigrant groups (Figure 3). The Latin American group had a higher prevalence (58,6%) than what was found in the Norwegian group (36,8%, p 0,016). The Asian and African groups had lower frequencies at 28,5 and 21,3 % compared to the Norwegian group (p < 0,01).



A multiple logistic regression model was used and all the independent variables described in Table 1 were controlled for, including the variable induction of labour. Tests showed a well fit model were between 14,1 and 19,5 % of the variability in the use of epidural analgesia could be explained by the model.

Table 7. Multiple logistic regression model; Epidural analgesia; 855 cases out of the 2437 women included in the model.

	Crude[1]		Adjusted[2]	
	OR (95% CI)	**p**	**OR (95% CI)**	**p**
Gestational age; days	1,03 (1,02-1,04)	<0,001	1,03 (1,02-1,04)	<0.001
Para 0	Reference	<0,001	Reference	<0,001
Para 1 (n= 899)	0,29 (0,24-0,36)	<0,001	0,25 (0,20-0,31)	<0,001
Para 2 (n= 307)	0,19 (0,14-0,26)	<0,001	0,16 (0,11-0,23)	<0,001
Para 3 or more (n= 89)	0,32 (0,19-0,53)	<0,001	0,34 (0,19-0,57)	<0,001
Twin pregnancy (n= 24)	3,12 (1,36-7,16)	0,007	5,83 (2,32-14,67)	<0,001
Earlier CS (n= 236)	0,79 (0,59-1,06)	0,122	2,02 (1,45-2,79)	<0,001
Induction of labour (n= 260)	2,60 (2,01-3,38)	<0,001	2,25 (1,68-3,01)	<0,001
Immigrant group, Norwegian (n=1634)	Reference	0,207	Reference	0,001
Latin America (n=29)	2,43 (1,15-5,13)	0,019	1,93 (0,88-4,21)	0,1
Africa (n= 150)	0,47 (0,31-0,69)	<0,001	0,43 (0,27-0,67)	<0,001
Asia (n= 221)	0,68 (0,50-0,93)	0,017	0,72 (0,52-1,01)	0,054
Eastern Europe (n= 201)	0,98 (0,72-1,33)	0,898	0,82 (0,59-1,14)	0,233
Western Europe (n= 202)	0,89 (0,66-1,21)	0,465	0,92 (0,66-1,29)	0,645

[1] Crude values; each independent variables relation to the use of epidural analgesia without adjusting for the other independent variables.
[2]The final model were all the included variables are statistic significant contributors with at significant level set at p ≤0,05.

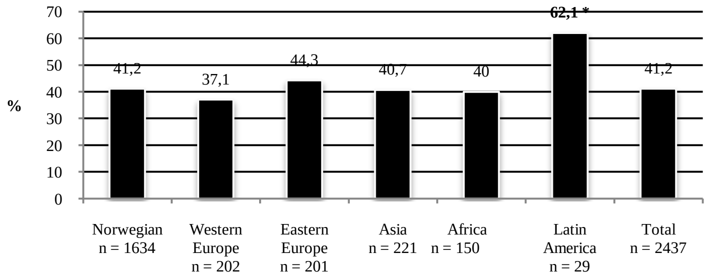
A total of 855 (35,1%) of the women in the study received epidural analgesia during labour. In this model the strongest predictor for the use of epidural was twin pregnancy with an OR of 5,83 (CI 2,32-14,67). The second strongest predictor was having the labour induced (OR 2,25, CI 1,68-3,01). Having had a previous CS made the use of epidural twice as more likely (OR 2,02, CI 1,45-2,79). Increasing gestational age by a day gave an OR of 1,03 (CI 1,02-1,04). Increasing parity was the most protective variable. Giving birth for the third time made it 0,16 times less likely to have epidural analgesia during labour compared to those who gave birth for the first time.

As for the immigrant groups, only the African group made a statistical significant contribution (OR of 0,43, CI 0,27-0,67) indicating that the African women were 0,43 times less likely to have an epidural analgesia compared to the Norwegian women.

3.4. Oxytocin infusion

The prevalence of oxytocin infusion during labour was quite similar in the different immigrant groups (Figure 4). The Latin American group had a higher frequency (62,1%) than the Norwegian group (41,2%, p 0,024).

Figure 4. Oxytocin infusion during labour
-prevalence in the different immigrant groups



* p ≤0,05 ** p <0,01 *** p <0,001

For statistical analyses, a multiple logistic regression model was made were all the independent variables described in Table 1 were controlled for, including the variables induction of labour and the use of epidural analgesia. Tests indicated a well fit model and between 38,2 and 51,4% of the variability in the use of oxytocin infusion during labour could be explained by the model.

Table 8. Multiple logistic regression model; Oxytocin infusion during labour; 924 cases out of the 2218 women included in the model.

	Crude[1]		Adjusted[2]	
	OR (95% CI)	**p**	**OR (95% CI)**	**p**
Gestational age; days	1,04 (1,03-1,05)	<0,001	1,04 (1,02-1,05)	<0.001
Para 0	Reference	<0,001	Reference	<0,001
Para 1 (n= 820)	0,23 (0,19-0,28)	<0,001	0,28 (0,21-0,36)	<0,001
Para 2 (n= 267)	0,19 (0,14-0,25)	<0,001	0,25 (0,17-0,37)	<0,001
Para 3 or more (n= 76)	0,38 (0,24-0,59)	<0,001	0,41 (0,22-0,77)	0,006
BMI; kg/m²	1,02 (0,99-1,04)	0,073	1,03 (1,00-1,07)	0,027
Education less than 12 years (n= 689)	1,12 (0,95-1,34)	0,181	1,31 (1,00-1,72)	0,05
Twin pregnancy (n= 23)	3,50 (1,45-8,48)	0,005	3,27 (1,06-10,02)	0,038
Earlier CS (n= 215)	0,72 (0,54-0,96)	0,024	1,59 (1,07-2,38)	0,023
Induction of labour (n= 260)	3,54 (2,69-4,67)	<0,001	2,80 (1,9-4,09)	<0,001
Epidural analgesia (n= 789)	18,91 (15,26-23,42)	<0,001	14,99 (11,80-19,05)	<0,001
Immigrant group, Norwegian (n=1530)	Reference	0,207	Reference	0,048
Latin America (n=27)	2,34 (1,09-4,98)	0,028	2,18 (0,73-6,49)	0,164
Africa (n= 110)	0,95 (0,68-1,34)	0,777	1,60 (0,92-2,80)	0,098
Asia (n= 189)	0,98 (0,74-1,31)	0,895	1,86 (1,21-2,84)	0,004
Eastern Europe (n= 181)	1,13 (0,84-1,52)	0,402	1,13 (0,73-1,73)	0,586
Western Europe (n= 181)	0,84 (0,62-1,14)	0,268	0,95 (0,62-1,44)	0,797

1 Crude values; each independent variables relation to the use of induction of labour without adjusting for the other independent variables.
2 The final model were all the included variables are statistic significant contributors with at significant level set at p ≤0,05.
Because of missing values in the variable BMI and one from the variable educational level, the n in this model are reduced.

A total of 924 (41,7%) of the women included in the regression model received oxytocin infusion during their labour. The strongest predictor was the use of epidural (OR 14,99, CI 11,80-19,05). The women receiving epidural analgesia were 15 times more likely to receive oxytocin infusion during the labour. The second strongest predictor was giving birth to twins (OR 3,27, CI 1,06-10,02). Increasing gestational age (OR 1,04, CI 1,02-1,05) and BMI (OR 1,03, CI 1,00-1,07) gave an increased risk for receiving oxytocin infusion during labour. The women with less than 12 years education also had an increased risk (OR 1,31, CI 1,00-1,72). Giving birth for the third time in comparison to the first time, gave the most protective value against needing the oxytocin infusion with an OR of 0,25 (CI 0,17-0,37). Having had previous CS gave an OR of 1,59 (CI 1,07-2,38). Having the labour induced made it almost 3 times more likely to need an oxytocin infusion during labour with a p-value <0,001.

Looking at the immigrant groups, only the Asian group (OR 1,86, CI 1,21-2,84) contributes to the model statistically significant indicating that they were almost twice as likely of receiving oxytocin infusion during labour compared to the Norwegian group.

3.5. Fetal distress

The occurrence of fetal distress (total 19,4%) showed small variations between the different immigrant groups and none of them were statistical significant (Figure 5).

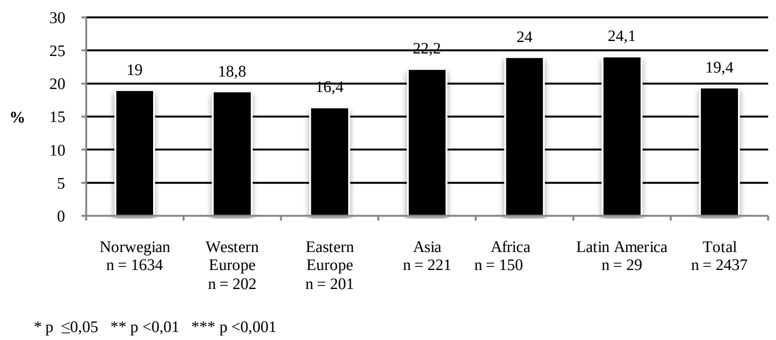


Figure 5. Fetal distress
- prevalence in the different immigrant groups

A multiple logistic regression model was made were all the independent variables described in Table 1 was controlled for and in addition the variables induction of labour, the use of oxytocin infusion and epidural analgesia (Table 9). Tests showed a well fit model and between 12,4 and 19,7 % of the variability in the occurrence of fetal distress could be explained by this model.

Table 9. Multiple logistic regression model; Fetal distress; 471 cases out of 2434 women included in model.

	Crude[1]		Adjusted[2]	
	OR (95% CI)	**p**	**OR (95% CI)**	**p**
Para 0 (n= 1141)	Reference	<0.001	Reference	<0.001
Para 1 (n= 899)	0,33 (0,23-0,42)	<0,001	0,39 (0,29-0,52)	<0,001
Para 2 (n= 305)	0,19 (0,12-0,29)	<0,001	0,21 (0,13-0,35)	<0,001
Para 3 or more (n= 89)	0,38 (0,20-0,71)	0,002	0,34 (0,17-0,68)	0,002
Education less than 12 years (n= 801)	1,39 (1,11-1,74)	0,004	1,67 (1,27-2,19)	<0,001
Gestational age; days	1,03 (1,02-1,04)	<0,001	1,03 (1,01-1,04)	<0,001
Earlier CS; yes (n= 235)	0,95 (0,67-1,33)	0,755	2,08 (1,38-3,15)	0,001
LBW; <2500gr (n= 40)	2,83 (1,49-5,38)	0,001	5,82 (2,75-12,32)	<0,001
Induction of labour (n= 260)	2,19(1,65-2,91)	<0,001	1,55 (1,13-2,13)	0,006
Oxytocin infusion during labour (n= 1004)	4,00 (3,23-4,96)	<0,001	2,28 (1,72-3,01)	<0,001
Epidural analgesia (n= 854)	3,00 (2,44-3,68)	<0,001	1,33 (1,02-1,74)	0,037
Immigrant group, Norwegian (n=1632)	Reference	0,43	Reference	0,003
Latin America (n=29)	1,36 (0,57-3,21)	0,484	0,94 (0,37-2,33)	0,885
Asia (n= 221)	1,22 (0,86-1,71)	0,259	1,70 (1,15-2,51)	0,008
Africa (n= 149)	1,35 (0,91-2,00)	0,137	2,22 (1,36-3,64)	0,002
Eastern Europe (n= 201)	0,84 (0,57-1,24)	0,381	0,78 (0,50-1,19)	0,248
Western Europe (n= 202)	0,99 (0,68-1,44)	0,956	1,10 (0,74-1,65)	0,630

[1] Crude values; each independent variables relation to fetal distress without adjusting for the other independent variables.
[2]The final model were all the included variables are statistic significant contributors with at significant level set at p ≤0,05.
Because of two missing values in birth weight and one missing value in educational level, the n in this model are somewhat reduced.

A total of 471 (19,4%) of the women included in the regression model, experienced fetal distress during labour. LBW was the strongest predictor of fetal distress with OR of 5,82 (CI 2,75-12,32). Only 40 out of 2434 babies had birth weight under 2500gr and it had a wide CI. The estimate is therefore rather uncertain. The use of oxytocin infusion during labour was the second strongest predictor value of fetal distress with OR of 2,28 (CI 1,72-3,01), while parity seems to have a protective effect with the biggest effect being Para 2 in comparison to Para 0 (OR 0,21, CI 0,13-0,35).

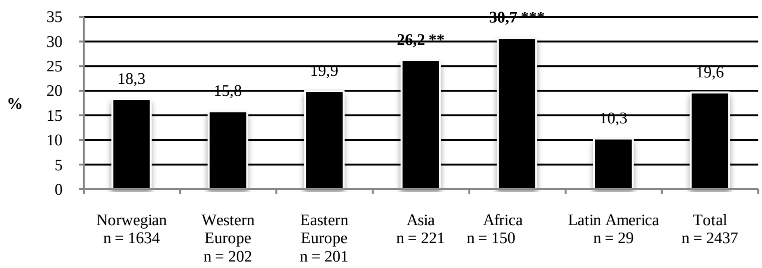
Looking at the variable immigrant group, it is only the African and Asian groups that have statistically significant OR. The African group had the third strongest predictor value with OR of 2,22 (CI 1,36-3,64). The Asian group had OR of 1,70 (CI 1,15-2,51).

The occurrence of fetal distress was strongly correlated with the occurrence of meconium stained liquor (p <0,001) and the use of episiotomy (p <0,001). Out of 478 cases with meconial stained liquor, one third (n=157) showed fetal distress. Out of the 473 cases of fetal distress, half (n=244) of the women had an episiotomy.

3.6. Meconium stained liquor

The prevalence of meconium stained liquor varied between the different immigrant groups (Figure 6). All together 478 of the mothers, a frequency of 19,6%, had meconium stained liquor. The Asian and Africans had higher frequencies compared to the Norwegians (p 0,005 and p <0,001).

Figure 6. Meconium stained liquor
- prevalence in the different immigrant groups



* p ≤0,05 ** p <0,01 *** p <0,001

A multiple logistic regression model was made were all the independent variables described in Table 1 were controlled for. Tests showed a well fit model, however only between 2,1 and 3,4 % of the variability in the presence of meconium stained liquor could be explained by it.

Table 10. Multiple logistic regression model; Meconium stained liquor; 422 cases out of 2219 women included in model.

	Crude [1]		Adjusted [2]	
	OR (95% CI)	**p**	**OR (95% CI)**	**p**
Normal weight; BMI 18.5-25.0	Reference	0,003	Reference	0,028
Underweight; BMI <18.5 (n= 109)	1,19 (0,74-1,95)	0,464	1,13 (0,69-1,86)	0,617
Overweight; BMI >25.0 (n= 480)	1,53 (1,19-1,95)	0,001	1,41 (1,09-1,82)	0,007
Gestational age; at term between 37 and 42 weeks gestation	Reference	<0,001	Reference	<0,001
Preterm; <37 weeks (n= 58)	0,31 (0,11-0,86)	0,025	0,17 (0,04-0,71)	0,015
Postterm; >42 weeks (n= 128)	2,05 (1,40-3,02)	<0,001	1,96 (1,28-2,99)	0,002
Maternal UTI (n=311)	1,42 (1,08-1,86)	0,011	1,41 (1,06-1,89)	0,02
Citizenship, Norwegian (n=1531)	Reference	<0,001	Reference	0,018
Latin America (n=27)	0,51 (0,15-1,71)	0,279	0,65 (0,19-2,20)	0,492
Asia (n= 189)	1,59 (1,15-2,19)	0,005	1,76 (1,13-2,74)	0,012
Africa (n= 110)	1,97 (1,36-2,85)	<0,001	1,61 (1,12-2,31)	0,01
Eastern Europe and the Balkan (n= 181)	1,11 (0,77-1,60)	0,581	1,11 (0,75-1,65)	0,599
Western Europe, USA, Canada and Australia (n= 181)	0,84 (0,56-1,25)	0,392	0,87 (0,57-1,33)	0,515

[1] Crude values; each independent variables relation to meconium stained liquor without adjusting for the other independent variables.
[2] The final model were all the included variables are statistic significant contributors with at significant level set at p ≤0,05.
Because of missing values in the variable BMI, the n in this model are reduced.

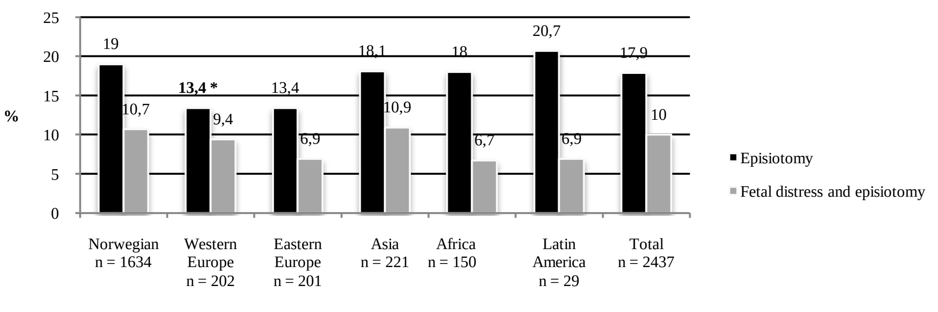
A total of 422 (19,0) of the women included in the regression model had meconium stained liquor. The strongest predictor was being postterm (OR 1,96, CI 1,28-2,99). Being overweight with a BMI-value over 25,0 gave an increased risk with an OR of 1,41 (CI 1,09-1,82). Women who had an UTI during the pregnancy also had an increased risk with an OR of 1,41 (CI 1,06-1,89).

Looking at the variable immigrant group, two of the groups showed a statistically significant OR. Being from Asia gave an OR of 1,76 (CI 1,13-2,74) in reference to the Norwegian group, making them almost twice as likely to have meconium stained liquor. This is also the models second strongest predictor and got stronger after controlling for the other independent variables. The other group was the African group who also had an increased risk with an OR of 1,61 (CI 1,12-2,31).

3.7. Episiotomy

The prevalence of episiotomy was 19% among the Norwegian group while it showed only small variations between the different immigrant groups (Figure 7). The lowest frequency of 13,4% was found in the Western and the Eastern European groups but only the Western Europeans differed statistical significant (p 0,052). Figure 7 also shows the frequency of the women who had an episiotomy where there also was the occurrence of fetal distress. In the Norwegian group, 8,3% (n= 135) had an episiotomy for other reasons than fetal distress.

Figure 7. Prevalence of episiotomy alone and related to fetal distress in the different immigrant groups.



* p ≤0,05 ** p <0,01 *** p <0,001

A multiple logistic regression model was made and all the independent variables described in Table 1 were controlled for, including these variables; operative vaginal delivery, induction of labour, the use of oxytocin infusion and epidural analgesia (Table 11). The tests indicated a well fit model and between 16,6 and 27,2 % of the variability in the prevalence episiotomy could be explained by the model.

Table 11. Multiple logistic regression model; Episiotomy was performed in 437 mothers out of the 2436 included in the model.

	Crude[1]		Adjusted[2]	
	OR (95% CI)	**p**	**OR (95% CI)**	**p**
Para 0	Reference	<0.001	Reference	<0.001
Para 1 (n= 899)	0,27 (0,21-0,35)	<0,001	0,34 (0,26-0,45)	<0,001
Para 2 (n= 306)	0,12 (0,07-0,20)	<0,001	0,15 (0,08-0,26)	<0,001
Para 3 or more (n= 89)	0,09 (0,03-0,27)	<0,001	0,10 (0,03-0,35)	<0,001
Education less than 12 years (n= 803)	1,62 (1,28-2,06)	<0,001	1,63 (1,21-2,20)	0,001
Operative vaginal delivery (n= 337)	9,31 (7,24-11,98)	<0,001	7,35 (5,62-9,61)	<0,001
Immigrant group, Norwegian (n=1633)	Reference	0,228	Reference	0,001
Latin America (n=29)	1,11 (0,45-2,76)	0,815	0,56 (0,19-1,61)	0,284
Africa (n= 150)	0,94 (0,61-1,45)	0,771	1,74 (1,01-3,02)	0,047
Asia (n= 221)	0,94 (0,66-1,36)	0,756	1,17 (0,76-1,80)	0,472
Eastern Europe (n= 201)	0,66 (0,43-1,01)	0,057	0,54 (0,33-0,88)	0,013
Western Europe (n= 202)	0,66 (0,43-1,01)	0,054	0,51 (0,32-0,83)	0,007

[1] Crude values; each independent variables relation to the use of episiotomy without adjusting for the other independent variables.
[2]The final model were all the included variables are statistic significant contributors with at significant level set at $p \leq 0,05$.
Because of one missing value in the variable educational level the n are reduced in this model.

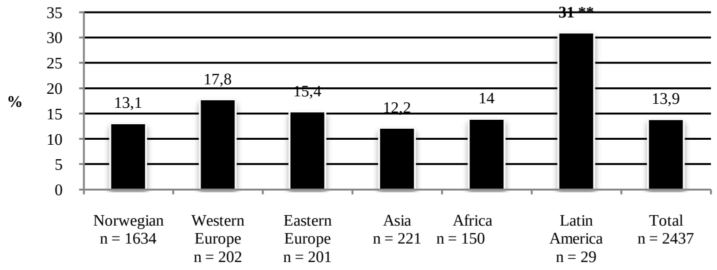
A total of 437 (17,9%) of the women included in the regression model had an episiotomy. The variable that had the strongest increased risk was operative vaginal delivery (OR 7,35, CI 5,62-9,61), while increased parity and being Para 3 or more seems to reduce risk (OR 0,10, CI 0,03-0,35). Having less than 12 years of education gave an increased risk with an OR of 1,63 (CI 1,21-2,20).

Looking at the variable immigrant group, there are three groups that contribute to the model statistical significantly. The African group is the only group with an increased risk (OR 1,74, CI 1,01-3,02) for having an episiotomy. Being in the Western or Eastern European groups seems to have had a protective effect with OR of 0,51 (CI 0,32-0,83) and 0,54 (CI 0,33-0,88).

3.8. Operative vaginal delivery

The prevalence of operative vaginal delivery was at 13,9% in this study and it seemed to be similar in the different immigrant groups except for the Latin American group with a prevalence of 31% (Figure 8). This was much higher than the prevalence in the Norwegian group at 13,1% (p 0,005).

Figure 8. Operative vaginal delivery
-prevalence in the different immigrant groups



* p ≤0,05 ** p <0,01 *** p <0,001

A multiple logistic regression model was made and all the independent variables described earlier in Table 1 were controlled for, including these variables; induction of labour and the use of epidural analgesia. Test indicated a well fit model and between 9,0 and 16,4 % of the variability in the prevalence of operative vaginal delivery could be explained by the model.

Table 12. Multiple logistic regression model; Operative vaginal delivery; 302 cases out of 2218 women included in model

	Crude[1]		Adjusted[2]	
	OR (95% CI)	**p**	**OR (95% CI)**	**p**
Para 0	Reference	<0.001	Reference	<0.001
Para 1 (n= 820)	0,26 (0,19-0,35)	<0,001	0,22 (0,16-0,31)	<0,001
Para 2 (n= 267)	0,18 (0,10-0,31)	<0,001	0,11 (0,06-0,22)	<0,001
Para 3 or more (n= 76)	0,21 (0,08-0,52)	0,001	0,17 (0,06-0,49)	0,001
Education less than 12 years (n= 689)	1,57 (1,21-2,04)	0,001	1,48 (1,06-2,08)	0,023
Maternal age; years	0,99 (0,97-1,02)	0,828	1,05 (1,02-1,08)	0,002
BMI; kg/m²	0,95 (0,92-0,99)	0,006	0,96 (0,92-0,99)	0,027
Gestational age; days	1,04 (1,03-1,06)	<0,001	1,05 (1,03-1,06)	<0,001
Immigrant group, Norwegian (n=1530)	Reference	0,054	Reference	0,041
Latin America (n=27)	2,99 (1,34-6,64)	0,007	3,24 (1,34-7,83)	0,009
Africa (n= 110)	1,08 (0,67-1,75)	0,754	1,59 (0,78-3,22)	0,199
Asia (n= 189)	0,92 (0,60-1,42)	0,715	1,23 (0,75-2,04)	0,415
Eastern Europe (n= 181)	1,21 (0,80-1,82)	0,361	1,05 (0,65-1,69)	0,841
Western Europe (n= 181)	1,44 (0,98-2,12)	0,066	1,60 (1,03-2,48)	0,035

[1] Crude values; each independent variables relation to the use of vacuum or foreceps without adjusting for the other independent variables.
[2]The final model were all the included variables are statistic significant contributors with at significant level set at p ≤0,05.
Because of missing values in the variable BMI and one missing in the variable educational level, the n in this model are reduced.

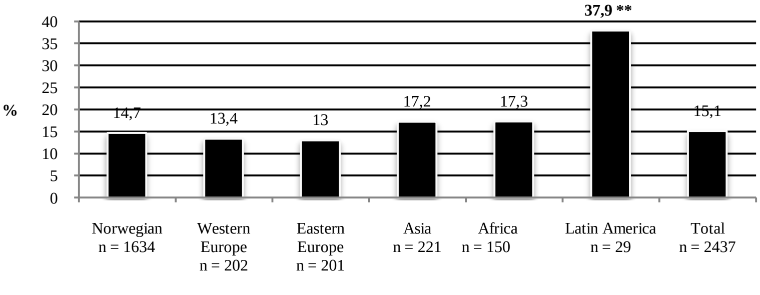
A total of 302 (13,6%) of the women included in the regression model had an operative vaginal delivery. Having less than 12 years of education gave an increased risk (OR 1,48, CI 1,06-2,08), while being Para 2 seemed to have the most protective effect (OR 0,11, CI 0,06-0,22). The OR of maternal age and gestational age indicates that for every year older the women is and the fetus is at the time of the delivery, the odds increase by 1,05 for having a operative vaginal delivery.

The strongest predictor in this model was the immigrant group Latin America, in reference to the Norwegian group, with its OR of 3,24 (CI 1,34-7,83). Also the Western European group had statistical significant values (OR 1,60, CI 1,03-2,48), indicating that women in this group were 1,6 times more likely for having operative vaginal delivery compared to the Norwegian women.

3.9. Caesarian section

The prevalence of CS in this study was 15,1% with little difference between the immigrant groups (Figure 9). The highest frequency of 37,9% was found in the Latin American group. This was higher than the prevalence in the Norwegian group at 14,7% (p 0,001).

Figure 9. Caesarian section
-prevalence in the different immigrant groups

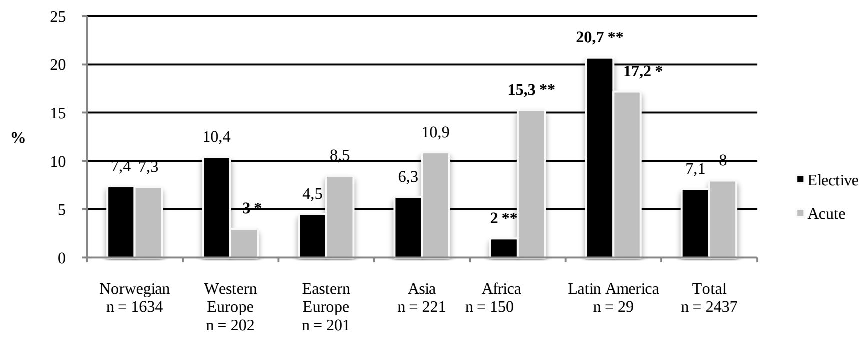


* p ≤0,05 ** p <0,01 *** p <0,001

Figure 10 shows the prevalence of the subgroups acute and elective CS in the different immigrant groups. In the Norwegian group a frequency of 7,4% was observed for elective CS and 7,3% of acute CS. The Western European group had lower frequency than the

Norwegians of acute CS of only 3% (p 0,02). The African group had a higher frequency of acute CS at 15,3% (p 0,001). The African group also had a lower frequency of elective CS (2%) compared to the Norwegians (p 0,013). The Latin American group had the highest frequency of acute and elective CS of 17,2% and 20,7% which was statistically significant higher than the Norwegian group (p 0,045 and 0,008).

Figure 10. Caesarian section divided in acute and elective -prevalence in the different immigrant groups



* p ≤0,05 ** p <0,01 *** p <0,001

3.9.1. Elective caesarian section

A multiple logistic regression model was made and the following maternal variables were controlled for; age, parity, educational level marital status and cigarette smoking, including the maternal health issues like; BMI, gestational diabetes, HG, earlier CS, psychological and gynecological disorders (Table 13). It was also controlled for two pregnancy related factors; twin pregnancy and presentation of the baby. Tests indicated a well fit model and between 15,4 and 38,3 % of the variability in the prevalence of elective CS could be explained by the model.

Table 13. Multiple logistic regression model; Elective caesarian section; 174 cases out of 2436 women included in model.

	Crude[1] OR (95% CI)	p	Adjusted [2] OR (95% CI)	p
Maternal age; years	1,11 (1,08-1,15)	<0,001	1,11 (1,06-1,16)	<0,001
Para 0	Reference	0,001	Reference	0,02
Para 1 (n= 899)	1,79 (1,27-2,54)	0,001	0,438(0,28-0,82)	0,007
Para 2 (n= 2305)	2,06 (1,31-3,25)	0,002	0,60 (0,32-1,11)	0,104
Para 3 or more (n= 89)	0,86 (0,31-2,43)	0,782	0,20 (0,06-0,72)	0,013
Education less than 12 years (n= 803)	0,95 (0,69-1,32)	0,783	0,46 (0,29-0,72)	0,001
Presentation of the baby; Head	Reference	<0,001	Reference	<0,001
Breech presentation (n= 93)	14,94 (9,57-23,31)	<0,001	25,27 (14,69-43,46)	<0,001
Transverse presentation (n= 11)	9,93 (2,87-34,35)	<0,001	7,84 (1,62-38,08)	0,01
Placenta praevia or Abrutio placenta (n = 7)	9,91 (2,20-44,63)	0,003	40,08 (8,16-196,99)	<0,001
Earlier caesarian section (n= 235)	12,96 (9,23-18,21)	<0,001	23,55 (14,24-38,96)	<0,001
Gynecological disorders (n= 128)	3,68 (2,32-5,84)	<0,001	3,49 (1,93-6,32)	<0,001
Citizenship, Norwegian (n=1633)	Reference	0,004	Reference	0,024
Latin America (n=29)	3,26 (1,30-8,16)	0,012	1,56 (0,47-5,20)	0,47
Africa (n= 150)	0,25 (0,08-0,81)	0,021	0,09 (0,02-0,46)	0,003
Asia (n= 221)	0,85 (0,48-1,49)	0,566	0,81 (0,39-1,65)	0,564
Eastern Europe and the Balkan (n= 201)	0,59 (0,29-1,17)	0,131	0,74 (0,33-1,65)	0,462
Western Europe, USA, Canada and Australia (n= 202)	1,45 (0,89-2,36)	0,135	1,55 (0,84-2,85)	0,162

[1] Crude values; each independent variables relation to the use of elective caesarian section without adjusting for the other independent variables.
[2]The final model were all the included variables are statistic significant contributors with at significant level set at $p \leq 0{,}05$.
Because of missing value in educational level the number in this model are reduced by one.

A total of 174 (7,1%) of the women included in the regression model had an elective CS. The variable with the strongest increased risk was having placenta praevia or abrutio placenta (OR 40,08, CI 8,16-196,99). This variable had a large CI and the estimate is therefore rather uncertain. Having a breech presentation of the baby was the second strongest predictor and it made it 25 times more likely of having an elective CS. Having had an earlier CS gave an OR of 23,55 (CI 14,24-38,96). The variable maternal age had an OR of 1,11 (CI 1,06-1,16), indicating that for every year older the mother is at delivery, the odds of having an elective CS increase by 1,11 times. The women who had less than 12 years of education were 0,46 times less likely of having an elective CS. The variable parity seems to have a protective effect on elective CS with being Para 3 or more in reference to Para 0 gave an OR of 0,20 (CI 0,06-0,72). Women who had a gynecological disorder had an increased risk of having an elective CS (OR 3,49, CI 1,93-6,32).

Looking at the variable immigrant group, only the African group had a statistically significant value (OR 0,09, CI 0,02-0,46) which indicated that they were 0,09 times less likely than the Norwegian women of having an elective CS.

3.9.2. Acute caesarian section

A multiple logistic regression model was made and all the independent variables described in Table 1 were controlled for, including the variables induction of labour and the use of oxytocin infusion during labour (Table 14). Tests indicated a well fit model and between 10,1 and 23,3 % of the variability in the prevalence of acute CS could be explained by the model.

Table 14. Multiple logistic regression model; Acute caesarian section; 152 cases out of the 2219 women included in the model.

	Crude[1]		Adjusted[2]	
	OR (95% CI)	**p**	**OR (95% CI)**	**p**
Para 0	Reference	<0.001	Reference	<0.001
Para 1 (n= 820)	0,50 (0,36-0,71)	<0,001	0,27 (0,16-0,44)	<0,001
Para 2 (n= 268)	0,43 (0,25-0,75)	0,003	0,18 (0,08-0,37)	<0,001
Para 3 or more (n= 76)	0,71 (0,32-1,58)	0,405	0,24 (0,08-0,66)	0,006
Normal weight; BMI 18.5-25.0	Reference	<0,001	Reference	0,004
Underweight; BMI <18.5 (n= 109)	1,28 (0,63-2,60)	0,494	1,04 (0,53-2,48)	0,733
Overweight; BMI >25.0 (n= 480)	2,19 (1,58-3,04)	<0,001	1,89 (1,29-2,76)	0,001
Presentation of the baby; Head	Reference	<0,001	Reference	<0,001
Breech presentation (n= 88)	2,83 (1,63-4,89)	<0,001	3,04 (1,64-5,61)	<0,001
Transverse presentation (n= 10)	22,13 (6,41-76,33)	<0,001	26,88 (5,32-135,91)	<0,001
Preeclampsia or HELLP (n= 49)	16,85 (9,54-29,79)	<0,001	10,26 (5,31-19,81)	<0,001
Gestational diabetes (n= 29)	6,0 (2,77-13,02)	<0,001	3,42 (1,33-8,78)	0,011
Placenta praevia or Abrutio placenta (n = 7)	15,63 (3,47-70,34)	<0,001	28,45 (4,51-179,48)	<0,001
Earlier CS (n= 215)	2,31 (1,56-3,41)	<0,001	6,33 (3,59-11,12)	<0,001
Induction of labour (n= 263)	2,73 (1,89-3,93)	<0,001	2,56 (1,65-3,97)	<0,001
Immigrant group, Norwegian (n=1531)	Reference	<0,001	Reference	0,001
Latin America (n=27)	2,63 (0,98-7,01)	0,054	1,06 (0,31-3,68)	0,925
Africa (n= 110)	2,28 (1,41-3,69)	0,001	3,01 (1,63-5,57)	<0,001
Asia (n= 189)	1,54 (0,97-2,44)	0,069	2,03 (1,18-3,47)	0,01
Eastern Europe (n= 181)	1,17 (0,69-1,98)	0,571	1,24 (0,68-2,29)	0,484
Western Europe (n= 181)	0,39 (0,17-0,89)	0,025	0,48 (0,20-1,16)	0,103

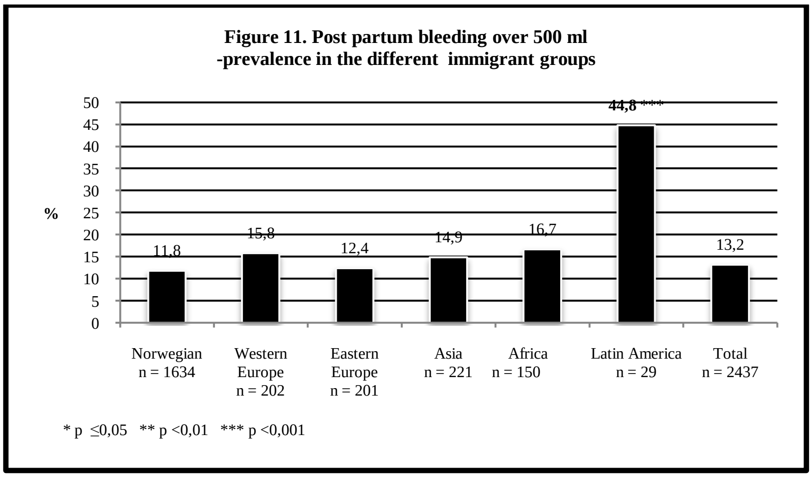
[1] Crude values; each independent variables relation to the use of acute caesarian section without adjusting for the other independent variables.
[2] The final model were all the included variables are statistic significant contributors with at significant level set at $p \leq 0{,}05$.
Because of missing values in the variable BMI, the n in this model are reduced.

A total of 152 (6,8%) of the women included in the model had an acute CS. Increasing parity seems to have a protective effect on acute CS whilst the baby presenting in the transverse position and having a placenta praevia or abrutio placenta, were the strongest predicting risk values with OR of 26,88 (CI 5,32-135,91) and 28,45 (CI 4,51-179,48). Having preeclampsia or HELLP gave an OR of 10,26 (CI 5,31-19,81). The women who had their labour induced (OR 2,56, CI 1,65-3,97) and the women who had gestational diabetes (OR 3,42, CI 1,33-8,78) had an increased risk for acute CS. Women who were overweight were almost twice as likely of having an acute CS. The women who had had a previous CS had an OR of 6,33 (CI 3,59-11,12).

As for the immigrant groups, the Asian and African group had increased risk for acute CS with OR-values at respectively 2,03 (CI 1,18-3,47) and 3,01 (CI 1,63- 5,57) in reference to the Norwegian group.

3.10. Postpartum bleeding

The prevalence of postpartum bleeding showed only small variations between the different immigrant groups (Figure 11). The Latin American group stands out since 13 of the 29 women had a postpartum bleeding giving a frequency of 44,8%. This was much higher than the Norwegian group with a frequency at 11,8% (p <0,001).



A multiple logistic regression model was made and all the independent variables described in Table 1 were controlled for including the following variables; operative vaginal delivery, caesarian section, induction of labour, the use of oxytocin infusion and epidural analgesia (Table 15). Tests showed a well fit model and between 6,0 and 11,2 % of the variability in the prevalence of postpartum bleeding could be explained by the model.

Table 15. Multiple logistic regression model; Postpartum bleeding; 273 cases out of 2219 women included in the model

	Crude [1]		Adjusted[2]	
	OR (95% CI)	**p**	**OR (95% CI)**	**p**
Normal weight; BMI 18.5-25.0	Reference	0,011	Reference	0,042
Underweight; BMI <18.5 (n= 109)	1,78 (1,08-2,93)	0,024	1,74 (1,03-2,94)	0,038
Overweight; BMI >25.0 (n= 480)	1,40 (1,05-1,87)	0,022	1,31 (0,96-1,79)	0,084
Placenta praevia or Abruptio placenta (n = 7)	40,29 (4,83-335,73)	0,001	20,14 (2,24-180,75)	0,007
Twin pregnancy (n = 23)	4,83 (2,13-10,96)	<0,001	4,21 (1,73-10,24)	0,002
Operative vaginal delivery (n= 303)	1,75 (1,30-2,37)	<0,001	2,28 (1,62-3,19)	<0,001
Vaginal delivery	Reference	<0,001	Reference	<0,001
Elective CS (n = 164)	1,88 (1,25-2,83)	0,002	2,08 (1,33-3,24)	0,001
Acute CS (n = 180)	4,47 (3,23-6,19)	<0,001	4,45 (3,08-6,41)	<0,001
Immigrant group, Norwegian (n=1531)	Reference	<0,001	Reference	0,002
Latin America (n=27)	6,07 (2,87-12,80)	<0,001	5,07 (2,25-11,45)	<0,001
Asia (n= 189)	1,31 (0,88-1,95)	0,184	1,17 (0,74-1,84)	0,501
Africa (n= 110)	1,49 (0,95-2,35)	0,084	1,39 (0,81-2,39)	0,233
Eastern Europe (n= 181)	1,06 (0,68-1,65)	0,796	0,97 (0,59-1,59)	0,9
Western Europe (n= 181)	1,40 (0,94-2,11)	0,101	1,48 (0,95-2,31)	0,082

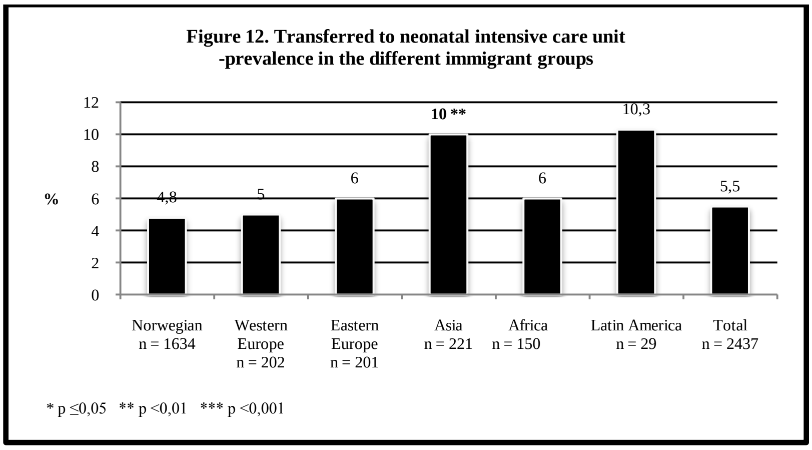
[1] Crude values; each independent variables relation to postpartum bleeding over 500 ml without adjusting for the other independent variables.
[2] The final model were all the included variables are statistic significant contributors with at significant level set at $p \leq 0,05$.
Because of missing values in the variable BMI, the n in this model are reduced.

A total of 273 (12,3%) of the women included in the regression model had a postpartum bleeding. Having placenta praevia or abrutio placenta was the biggest risk factors (OR 20,14, CI 2,24-180,75). Having operative vaginal delivery and CS also increased the risk for postpartum bleeding, most of all acute CS (OR 4,45, CI 3,08-6,14). Women with a twin pregnancy were over 4 times more likely of having a postpartum bleeding compared to singleton delivery (OR of 4,21, CI 1,73-10,24). Being underweight gave an OR of 1,74 (CI 1,03-2,94).

As for the immigrant groups, only the Latin American was statistical significantly (OR of 5,07, CI 2,25-11,45), being at increased risk for postpartum bleeding.

3.11. Transferred to neonatal intensive care unit

The prevalence of babies transferred to NICU showed small variations between the different immigrant groups (Figure 12). The Asian group had a statistic significant higher frequency than the Norwegian group with 10% transfer (p 0,001).



A multiple logistic regression model was made and all the independent variables described earlier in Table 1 were controlled for. Tests indicated a well fit model, however only between 2,3 and 6,6 % of the variability in the transfer of the baby to NICU could be explained by the model.

Table 16. Multiple logistic regression model; Transferred to neonatal intensive care unit; 134 cases out of the 2435 women included in the model.

	Crude[1]		Adjusted[2]	
	OR (95% CI)	**p**	**OR (95% CI)**	**p**
Para 0	Reference	<0.001	Reference	<0.001
Para 1 (n= 899)	0,36 (0,23-0,56)	<0,001	0,36 (0,23-0,57)	<0,001
Para 2 (n= 305)	0,53 (0,29-0,96)	0,037	0,51 (0,28-0,96)	0,037
Para 3 or more (n= 89)	1,02 (0,46-2,28)	0,957	0,92 (0,39-2,17)	0,847
Birth weight; normal between 2500-4500gr	Reference	<0,001	Reference	0,021
LBW; <2500gr (n= 42)	5,84 (2,79-12,13)	<0,001	3,19 (1,36-7,47)	0,008
Macrosomia; >4500gr (n= 76)	1,03 (0,37-2,88)	0,947	1,53 (0,53-4,36)	0,428
Gestational age; at term between 37 and 42 weeks gestation	Reference	<0,001	Reference	0,012
Preterm; <37 weeks (n= 58)	4,79 (2,47-9,31)	<0,001	3,16 (1,46-6,81)	0,003
Post term; >42 weeks (n= 128)	0,90 (0,39-2,09)	0,815	0,83 (0,35-1,96)	0,676
Immigrant group, Norwegian (n=1633)	Reference	0,047	Reference	0,117
Latin America (n=29)	2,30 (0,65-7,77)	0,179	1,49 (0,39-5,53)	0,555
Africa (n= 149)	1,27 (0,62-2,59)	0,505	1,04 (0,48-2,29)	0,913
Asia (n= 221)	2,20 (1,34-3,62)	0,002	2,12 (1,28-3,53)	0,004
Eastern Europe (n= 201)	1,27 (0,68-2,37)	0,46	1,11 (0,59-2,11)	0,742
Western Europe (n= 202)	1,04 (0,53-2,04)	0,912	1,05 (0,53-2,10)	0,880

[1] Crude values; each independent variables relation to the transfer to newborn ward without adjusting for the other independent variables.
[2] The final model were all the included variables are statistic significant contributors with at significant level set at p ≤0,05.
Because of two missing values in the variable birth weight, the n are reduced in this model.

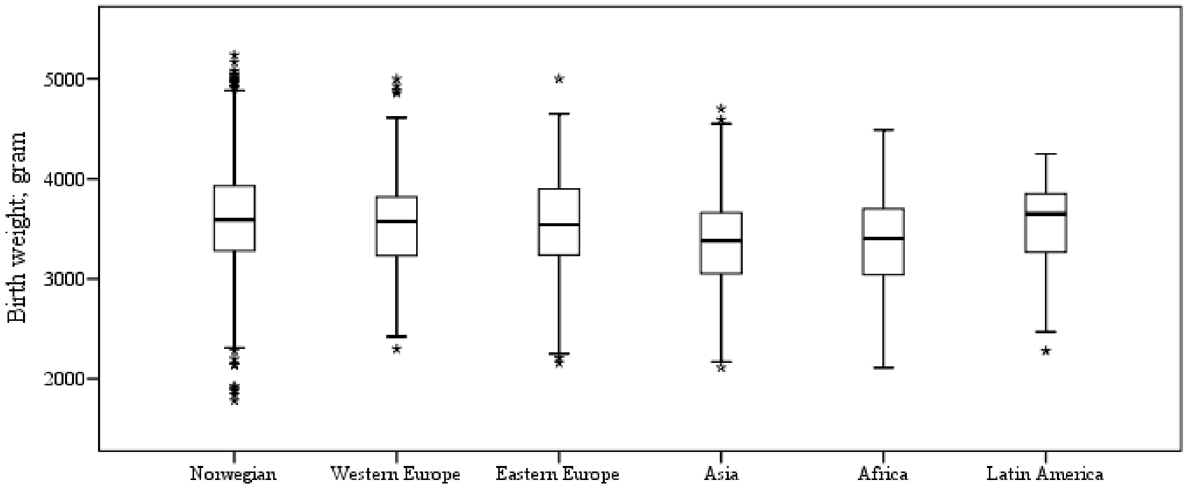
A total of 134 (5,5%) of the women included in the regression model had their babies transferred to a NICU. Four independent variables were included in this final regression model. Premature birth (OR 3,16, CI 1,46-6,81) and having a LBW (OR 3,19, CI 1,36-7,47) gave an increased risk. Women who were Para 1 had the most protective OR of 0,36 (CI 0,23-0,57) for having their baby in need of medical attention at a NICU.

As for the immigrant groups, only the Asian group had an statistically significant contribution to the model (OR 2,12, CI 1,28-3,53), indicating that the Asian mothers were over twice as likely to have their baby transferred to a NICU compared to the Norwegian mothers.

3.12. Birth weight

Figure 13 shows a box-plot of the distribution of birth weight in gram within the different immigrant groups.

Figure 13. Box-plot. Babies birth weight in gram, distribution in the different immigrant groups at Bærum Hospital.



Each box containes 50% of the cases in each immigrant group. The line inside the box represent the median birth weight. Each line going out of the box shows the lowest and the highest birth weight in the group. Outliers are marked with *.

Table 17. Baby's birth weight in the different immigrant groups. Mean *(SD)* or n *(%)*

	Norwegian	Western Europe	Eastern Europe	Asia	Africa	Latin America	Total
	N = 1633	N =202	N =201	N = 221	N = 149	N = 29	N = 2435
Birth weight; gram	3600 (492)	3536 (498)	3540 (519)	**3360 (457)*****	**3384 (480)*****	3540 (476)	3554 (497)
LBW; <2500gr	18 (1,1)	4 (2,0)	**6 (3,0)***	6 (2,7)	**6 (4,0)****	**2 (6,9)****	42 (1,7)
Macrosomia; >4500gr	55 (3,4)	10 (5,0)	7 (3,5)	4 (1,8)	**0 (0,0)***	0 (0)	76 (3,1)

* p ≤ 0,05
** p < 0,01
*** p <0,001
Because of two missing values in the variable birth weight, the n are reduced.

The variable birth weight was normally distributed with a mean of 3554gr (SD 497) as shown in Table 17. The babies born to Asian and African mothers had a statistically significant lower mean birth weight compared to the Norwegians (p <0,001). The mothers from Eastern Europe, Africa and Latin America had a higher frequency of LBW babies (p 0,019 and p <0,01). There were no babies weighing over 4500gr born of African mothers.

In order to examine whether being a woman with immigrant background had an impact on the baby's birth weight; a multiple linear regression model was made where all the independent variables described in Table 1 were controlled for. Table 18 shows the variables eligible for inclusion in the regression model.

Table 18. Bivariate correlation, dependent variable: Birth weight n=2435

	Spearman Correlation Coefficient (r_s)	p
Maternal age	0,121	<0,001
Parity	0,16	<0,001
Educational level	0,128	<0,001
Marital status	0,078	<0,001
Cigarette smoking	0,088	<0,001
BMI	0,182	<0,001
Multiple pregnancy	0,131	<0,001
Gestational age	0,484	<0,001
Preeclampsia/ HELLP	0,086	<0,001
HG	-0,039	0,053
Earlier CS	-0,072	<0,001
Immigrant group	-0,142	<0,001

Significant correlation with p≤0,1
Because of two missing values in the variable birth weight, the n are reduced.

Table 19. Multiple linear regression model; Birth weight; gram n=2217

	Crude [1]		Adjusted[2] (Adj R2 = 0.36)	
	β (95% CI)	p	β (95% CI)	p
Maternal age; years	13 (9, 17)	<0.001	-	-
Para 0	Reference	<0.001[3]	Reference	<0.001[3]
Para 1 (n=820)	168 (126, 211)		161 (122, 200)	
Para 2 (n=267)	199 (137, 261)		195 (140, 250)	
Para 3 or more (n=76)	77 (-29, 183)		131 (34, 228)	
Education less than 12 years (n= 688)	Reference	<0.001[3]	Reference	0.001[3]
Education over 12 years	135 (93, 177)		67 (26, 109)	
Marital status; Co-living/married	Reference	<0.001[3]	-	-
Marital status; Unmarried/divorced	-162 (-245, -78)		-	-
Cigarette smoking (n=91)	-204 (-300, -107)	<0,001	-150 (-236, -64)	0.001
BMI; kg/m²	20 (15, 25)	<0.001	17 (12, 21)	<0,001
Multiple pregnancy; twins (n=23)	-742 (-940, -544)	<0.001	-348 (-514, -182)	<0.001
Gestational age; days	25 (24, 27)	<0.001	26 (24, 27)	<0.001
HG	- 103 (-229, 22)	0,107	-	-
Preeclampsia/ HELLP (n=49)	-389 (-524, -252)	<0.001	-163 (-278, -48)	0.006
Earlier CS (n=215)	138 (72, 205)	<0.001	90 (30, 149)	0.003
Immigrant groups, Norwegian (n=1529)	Reference	<0.001[3]	Reference	<0.001[3]
Latin America (n=27)	-60 (-240, 120)		37 (-117, 191)	
Asia (n= 189)	-216 (-298, -134)		-218 (-303, -133)	
Africa (n= 110)	-240 (-309, -171)		-156 (-219, -92)	
Eastern Europe (n= 181)	-60 (-132, 12)		-28 (-91, 36)	
Western Europe (n= 181)	-64 (-136, 8)		-35 (-97, 27)	

[1]Crude values; each independent variables relation to birth weight without adjusting for the other independent variables.
[2]The final multiple linear regression model. All variables included are statistic significant with significance level at $p \leq 0.05$, and explains 36% of the variation in birth weight.
[3] P-values of the entire variable in the regression model.
Because of missing in the variable BMI and the variable birth weight, the n in this model are reduced.

Table 19 shows the multiple linear regression model of birth weight. The final model gives an adjusted R2 at 0,36 which means that the model could explain 36% of the variation in birth weight in this study.

The factor that had the greatest influence on the baby's birth weight was being a twin which gave a reduction of 348gr. The strongest increase in birth weight of 195gr was associated with being Para 2 in reference to Para 0. Each unit increase in maternal pre-pregnancy BMI was associated with a 17gr increase in birth weight. Having over 12 years of education and previous CS were also associated with increased birth weight. Maternal cigarette smoking on the other hand was associated with a reduction of 150gr.

Looking at the variable immigrant groups, being from Asia reduces the baby's weight by 218gr, whilst coming from Africa by 156gr.

3.13. Summary of the results

Table 20 shows the OR with 95% CI and the p-value of each immigrant group of each of the perinatal complications or outcomes. It also shows the number of cases for each complication or outcome. For the outcome birth weight, the table shows ß-value with 95% CI. These values are the adjusted values after controlling for the independent variables. Looking at the total variable immigrant group, there was only twice that it was not statistic significant in the models. This was in the models induction of labour (Table 6) and transferred to NICU (Table 16). Even though some of the groups had statistically significant values, it was not enough to make the total variable significant.

The mothers from Western Europe were quite similar to the Norwegians. They were more often Para 3 or more and somewhat less educated. They had a lower mean BMI compared to the Norwegians and more often gynecological disorders. In the regression models the Western European group was different from the Norwegian group in two cases; they were less likely to have an episiotomy (OR 0,5, CI 0,3-0,8) and more likely to have an operative vaginal delivery (OR 1,6, CI 1,0-2,5).

The Eastern European mothers were at average four years younger than the Norwegian mothers. They were more often first time mothers, less educated and of lower mean BMI values compared to the Norwegians and had more underweight mothers. They also had a somewhat lower frequency of pulmonary-, psychological- and gynecological disorders than the Norwegian mothers. In the regression models the Eastern European mothers had only one significant difference in outcome compared to the Norwegian mothers. They were less likely to have an episiotomy (OR 0,5, CI 0,3-0,8) with reference to the Norwegian group.

Table 20. Odds Ratio for perinatal complications in the different immigrant groups with reference to the Norwegian group. Adjusted OR for covariates

Perinatal complication or outcome	Norwegian N = 1634*	Western Europe N = 202*		Eastern Europe N = 201*		Asia N = 221*		Africa N = 150*		Latin America N = 29*		Hosmer and Lemeshow Test
	[2]p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	[3]p
Induction of labour	0,186	0,9 (0,5-1,5)	0,697	0,7 (0,4-1,3)	0,278	**0,4 (0,2-0,8)**	**0,015**	0,9 (0,5-1,6)	0,707	0,5 (0,1-2,2)	0,341	*0,186*
No. of cases (%)	192 (11,8)	20 (9,9)		18 (9,0)		10 (4,5)		18 (12,0)		2 (6,9)		
Epidural analgesia	0,001	0,9 (0,7-1,3)	0,645	0,8 (0,6-1,1)	0,233	**0,7 (0,5-1,0)**	**0,054**	**0,4 (0,3-0,7)**	**<0,001**	1,9 (0,9-4,2)	0,1	*0,313*
No. of cases (%)	601 (36,8)	69 (34,2)		73 (36,3)		63 (28,5)		32 (21,3)		17 (58,6)		
Oxytocin infusion	0,048	0,9 (0,6-1,4)	0,797	1,1 (0,7-1,7)	0,586	**1,9 (1,2-2,8)**	**0,004**	1,6 (0,9-2,8)	0,098	2,2 (0,7-6,5)	0,164	*0,317*
No. of cases (%)	673 (41,2)	75 (37,1)		89 (44,3)		90 (40,7)		60 (40,0)		18 (62,1)		
Fetal distress	0,003	1,1 (0,7-1,7)	0,630	0,8 (0,5-1,2)	0,248	**1,7 (1,1-2,5)**	**0,008**	**2,2 (1,4-3,6)**	**0,002**	0,9 (0,4-2,3)	0,885	*0,865*
No. of cases (%)	310 (19,0)	38 (18,8)		33 (16,4)		49 (22,2)		36 (24,0)		7 (24,1)		
Meconium stained liquor	0,018	0,9 (0,6-1,3)	0,515	1,1 (0,7-1,6)	0,599	**1,8 (1,1-2,7)**	**0,012**	**1,6 (1,1-2,3)**	**0,01**	0,6 (0,2-2,2)	0,492	*0,748*
No. of cases (%)	299 (18,3)	32 (15,8)		40 (19,9)		58 (26,2)		46 (30,7)		3 (10,3)		
Episiotomy	0,001	**0,5 (0,3-0,8)**	**0,007**	**0,5 (0,3-0,8)**	**0,013**	1,2 (0,8-1,8)	0,472	**1,7 (1,0-3,0)**	**0,047**	0,6 (0,2-1,6)	0,284	*0,253*
No. of cases (%)	310 (19,0)	27 (13,4)		27 (13,4)		40 (18,1)		27 (18,0)		6 (20,7)		
Operative vaginal delivery	0,041	**1,6 (1,0-2,5)**	**0,035**	1,0 (0,6-1,7)	0,841	1,2 (0,7-2,0)	0,415	1,6 (0,8-3,2)	0,199	**3,2 (1,3-7,8)**	**0,009**	*0,867*
No. of cases (%)	214 (13,1)	36 (17,8)		31 (15,4)		27 (12,2)		21 (14,0)		9 (31,0)		
Elective CS	0,024	1,5 (0,8-2,8)	0,162	0,7 (0,3-1,6)	0,462	0,8 (0,4-1,6)	0,564	**0,1 (0,0-0,5)**	**0,003**	1,6 (0,5-5,2)	0,470	*0,584*
No. of cases (%)	121 (7,4)	21 (10,4)		9 (4,5)		14 (6,3)		3 (2,0)		6 (20,7)		
Acute CS	0,001	0,5 (0,2-1,2)	0,103	1,2 (0,7-2,3)	0,484	**2,0 (1,2-3,5)**	**0,01**	**3,0 (1,6-5,6)**	**<0,001**	1,1 (0,3-3,7)	0,925	*0,498*
No. of cases (%)	120 (7,3)	6 (3,0)		17 (8,5)		24 (10,9)		23 (15,3)		5 (17,2)		
Postpartum bleeding	0,002	1,5 (0,9-2,3)	0,082	1,0 (0,6-1,6)	0,900	1,2 (0,7-1,8)	0,501	1,4 (0,8-2,4)	0,233	**5,1 (2,2-11,4)**	**<0,001**	*0,902*
No. of cases (%)	193 (11,8)	32 (15,8)		25 (12,4)		32 (14,9)		25 (16,7)		13 (44,3)		
Transferred to NICU	0,117	1,0 (0,5-2,1)	0,880	1,1 (0,6-2,1)	0,742	**2,1 (1,3-3,5)**	**0,004**	1,0 (0,5-2,3)	0,913	1,5 (0,4-5,5)	0,555	*0,948*
No. of cases (%)	78 (4,8)	10 (5,0)		12 (6,0)		22 (10,0)		9 (6,0)		3 (10,3)		
Birth weight; gram	<0,001	[1]-35 (-97,27)		[1]-28 (-91,36)		**[1]-218 (-303,-133)**		**[1]-156 (-219,-92)**		[1]37 (-117,191)		

Significance level is set at p<0,05

*N in group varies in the different regression models because of missing values in some of the variables.

[1] Multiple linear regression; β (95% CI)

[2] P-value of the variable citizenship in the regression model after adjusting for covariates.

[3] Hosmer-Lemeshow Goodness of Fit Test. Well fit model when p>0,05.

The Asian mothers were on average three years younger than the Norwegians. They were more often Para 3 or more and less of the Asian women had more than 12 years of education compared to the Norwegian mothers. They were also more often underweight with 22 (10%) of the 221 women having a BMI-value under 18. They had a higher frequency of gestational diabetes and anemia with 19 (8,6%) of the Asian women having had hemoglobin values under nine during the pregnancy. They also had fewer postterm pregnancies than the Norwegians. In the regression models the Asian group had eight statistic significant values. They were more likely to have oxytocin infusion (OR 1,9, CI 1,2-2,8), fetal distress (OR 1,7, CI 1,1-2,5), meconium stained liquor (OR 1,8, CI 1,1-2,7), acute CS (OR 2,0, CI 1,2-3,5), and have their baby transferred to NICU (OR 2,1, CI 1,3-3,5) compared to the Norwegian group. They were less likely than the Norwegian group to have their labour induced (OR 0,4, CI 0,2-0,8) and to receive epidural analgesia (OR 0,7, CI 0,5-1,0). Their babies weighed less than the Norwegians with a reduction of 218gr (CI -302, -133).

The African mothers were on average three years younger than the Norwegians. They were more often of higher parity and of lower education. They were also more often single and had higher mean BMI compared to the Norwegian mothers. The African mothers were more often overweight and had higher frequency of anemia, other infections and postterm pregnancies. In the regression models the African group differed from the Norwegian group with seven statistically significant values. They were more likely to have fetal distress (OR 2,2, CI 1,4-3,7), meconium stained liquor (OR 1,6, CI 1,1-2,3), episiotomy (OR 1,7, CI 1,0-3,0) and acute CS (OR 3,0, CI 1,6-5,6). They were less likely to have epidural analgesia (OR 0,4, CI 0,3-0,7) and elective CS (OR 0,1, CI 0,0-0,5). The African baby’s weight was reduced by 156gr (CI -219, -92) compared to the Norwegians.

The group from Latin America was special since it included only 29 women. The Latin Americans were at average two years younger than the Norwegians and were more often primiparous. They were less educated in comparison to the Norwegian mothers and had a higher frequency of maternal health issues. Out of the nine women who had previously given birth, seven had had CS. In the regression models, this group had two statistic significant values. They were more likely than the Norwegian group to have an operative vaginal delivery (OR 3,2, CI 1,3-7,8) and of having a postpartum bleeding (OR 5,1, CI 2,2-11,4).

4. DISCUSSION

4.1. Discussion of the results

This study shows differences in background characteristics and perinatal outcomes between Norwegian mothers and immigrants from Asia, Africa and Latin-America. The Western and Eastern European mothers were very similar to the Norwegians.

The systematic review conducted by the ROAM Collaboration found that being a migrant is not a consistent marker for risk of poor perinatal health outcomes (32). However they reported that some migrant women, being from Asia and Africa, were at greater risk than their receiving-country women. Waterstone et al. (86) looked for predictors of severe obstetric morbidity in London and had ethnicity as a variable in their regression model. They identified that being black was a predictor of severe maternal morbidity compared to being white. Similar findings were reported by Guendelman et al. in California (87). In Norway and Scandinavia, several studies have shown disparities regarding perinatal mortality, complications during pregnancy and interventions during labour (35;53;57;58;88-91). Robertson et.al (90) examined foreign-born women in Sweden and their birth outcomes. They looked at ICD-codes to categorize the women to have had normal or non-normal childbirth and controlled for maternal age, parity, education and amount of antenatal care visits. They reported that the women from sub-Sahara Africa, Iran, Asia and Latin-America were of greater risk for non-normal childbirth compared to the Swedish women.

In the current study educational level varied between the different immigrant groups and the lowest number of higher education was found in the African and Asian groups at 7,3% and 31,7% respectively, compared to 79,9% of the women in the Norwegian group. Many of the Asian and African mothers were unemployed, staying home to take care of children as they traditionally would in their own countries. There were also more African mothers that were without a partner with 28,7% being divorced, widowed or unmarried at the time of birth compared to 4% of the Norwegian women. The immigrant women were first generation immigrants, meaning that they were not born in Norway and therefore they probably are not as well integrated in the Norwegian society as a second generation immigrant might be. Most of them had not gone to school in Norway and were not working, and their lifestyle was quite similar to that from their old country, but in different surroundings. The Asian and African groups may also contain women who were refugees from Iraq, Afghanistan, Somalia, Eritrea and other countries. The factors of low sosio-economic status, being in a new environment, perhaps alone, could all affect the outcomes of labour as several studies have shown (34;63;67;68). It is well known that the feeling of safety is an important factor for laboring women.

In the current study the Asian mothers had a reduced risk for having labour induced, compared to the Norwegian mothers. The mean pregnancy length was statistically significant reduced compared to the Norwegians, at an average of two days shorter, which was of no clinical importance. Postterm pregnancies are often an indication for induction of labour, along with the anticipation of a large baby, gestational diabetes and other medical conditions such as preeclampsia. There were only three postterm pregnancies in this group, which was statistically significant lower than in the Norwegian group. The Asian babies were smaller with a reduction in birth weight of 218 gr. These findings remove two of the important indications for induction of labour. The Asian mothers had on the other hand a higher prevalence of gestational diabetes. Vangen et al. (58) reported in their study that Somali women had increased risk for induced labour with an adjusted OR of 1,7. This was not the case in the present study.

The use of epidural analgesia differed between the immigrant groups in this study and the prevalence was also 5% higher compared to the prevalence in Oslo and Akershus counties (Table 5). Ekésus et al. (88) reported that the use of epidural analgesia during labour varied between different immigrant groups, and that country of origin had a bigger effect on the use than other sosio-economic factors. Somali women used less epidural than the Swedish women and women from Chile used more epidural compared to the Swedish women. The authors of this article suggest that this was due to different expectations of pain and help and that these expectations vary in different cultures. The women who had resided longer in Sweden and those who were married to Swedish men, were more likely to use epidural. Similar results was identified in the current study were Asian and African mothers were less likely to use epidural compared to the Norwegians. For the African woman, the use of epidural is also a matter of intervention, which they fear could lead to morbidity (59;77). A Norwegian study reported that women of Pakistani origin were more than three times less likely to receive analgesia during labour compared to Norwegian women (47). In this study only 9% of the Norwegian women did not receive analgesia compared to 30% of the Pakistani women.

A contradictory finding in the current study was that the Asian mothers were at increased risk for receiving an oxytocin infusion during labour, despite their lower risk for induction of labour. Similarly controversial findings could not be found in the literature. Vangen et al. (57) reported that the Pakistani population had lower prevalence of prolonged labour compared to the Norwegian women and that the Filipino women had a higher prevalence. Both of these originating countries are in the same Asian group in the current study. The fear of poor contractions when delivering a large baby may be a possible explanation for this increased augmentation of the Asian mothers. Asian women generally have a shorter stature than Norwegian women, making the pregnant abdomen appear large. Midwives may misinterpret this characteristic and draw the assumption of a large baby. Mixed relationships may also be a cause of concern to the midwife, as a Scandinavian partner may produce a genetically larger baby than a partner from the Philippines.

In the current study, the Asian and African mothers had a higher risk for fetal distress and meconium stained liquor compared to the Norwegian mothers. The African mothers were more often overweight with one-third of the 150 African women having a BMI over 25, which gave an increased risk for meconium stained liquor. The African mothers had the highest frequency of postterm pregnancies which is a known cause of increased risks for fetal complications and reduced placental function (92). Postterm pregnancy increased the risks for both fetal distress and meconium stained liquor in the current study. There was also a higher prevalence of infections and anemia in these two groups, which are complications that can compromise the fetus (93). Meconium stained liquor may be a sign that the baby has suffered one or more episodes of reduced oxygenation during pregnancy or labour (93). The psychological stress associated with living as refugee or immigrant in a different country, as well as the social, financial and integration difficulties, often caused by little education and a poor social network, might have a negative effect on the pregnancy.

The African mothers in the current study, were mainly from the Horn of Africa, and 61 mothers out of the total 150 Africans originated from Somalia. In an American study (94) they found that Somali women were over six times more likely to have meconium stained liquor than US-born white women and three times more likely to have fetal distress. Qualitative studies (59;77) have found that many Somali women starve themselves during the pregnancy, fearing that delivering big babies will lead to an obstructed labour with resulting morbidity and mortality for the mother. However not thinking that the baby might get a reduced flow of nutrition as needed to grow and be healthy, which can result in fetal distress and meconial release.

Belonging to the Asian and African groups had a strong correlation with having less than 12 years of education, and this was the independent variable that made the groups significant in the regression model examining fetal distress. The frequency of fetal distress was quite high in the present study at 19% for the Norwegian group. Vangen et.al (57) have used data in their study from the MBRN for the period 1986-1995, and have looked at the frequency of several outcomes in different immigrant groups and examined the frequency of CS more closely. They reported the frequency of fetal distress at 4,8% in the Norwegian group. Their comparison study of Somali women (58) showed the frequency was 5,8% in the Norwegian group and 11,8% in the Somalia group. This large disparity can be due to differences in the registration of fetal distress. In the current study data was gathered from patient's journals. A diagnosis of fetal distress was recorded if used as indication for a vacuum or foreceps delivery, CS, the use of episiotomy and if it was identified by the use of CTG. Fetal distress is usually registered as an isolated complication and can therefore be less apparent in the MBRN form the delivery wards send in (95).

In the current study, the African mothers were also found to have an increased risk for episiotomy. Less than half of the episiotomies were related to fetal distress, which was the lowest figure when compared to all of the other immigrant groups. This suggests that there was a different indication for performing an episiotomy on the African mothers. Since the African group mainly consisted of mothers from the Horn of Africa, it was likely that many of them were circumcised, therefore requiring an episiotomy. Similar findings were also reported in an Australian study (96) where African-born mothers were 1.3 times more likely to have an episiotomy compared to Australia-born mothers. In the current study, the Eastern European mothers proved to have reduced risk for episiotomy. Most of the episiotomies performed on this group of mothers were in relation to fetal distress, leaving a small number due to other indications. It was also surprising to find that the Western European mothers were less likely to have an episiotomy considering that they were found to be at an increased risk for operative vaginal delivery, which proved to be the strongest predictor for episiotomy. Few studies have examined the differences in episiotomy rates between immigrant groups.

The Western European and Latin American mothers had a higher risk for operative vaginal delivery in the current study compared to the Norwegian mothers. The Latin American group consisted of only 29 mothers and their results must be interpreted with care. They had a higher incidence of maternal health issues, and of the nine mothers who had previously given birth seven had an earlier CS. This might explain some of the high percentages of complications in this group. Latin American mothers were found to be three times more likely to have an operative vaginal delivery. Out of the 29 women in the study, there were nine who ended with an operative vaginal delivery, the same number that had a normal vaginal delivery. Other studies describing similar or conflicting results have not been found.

In the current study the African mothers had reduced risk for elective CS compared to the Norwegian mothers. This was despite the fact that there were more African mothers who had previous CS, which was the strongest predictor for elective CS. African mothers were more often of higher parity and had a lower education, both of which reduced the likelihood of an elective CS. Qualitative studies (59;77) researching women from Somalia indicated the perception of CS as something to fear as it could potentially lead to higher morbidity and mortality for the women. CS is therefore something these women would rather avoid if they have the opportunity to do so. On the other hand the current study showed that African and Asian mothers had increased risk for acute CS. The ROAM Collaboration (97) have looked at the Somali women post migration and they also reported that they were more at risk for having CS and for giving birth to stillborn babies compared to the receiving-country women. They were however less likely to give birth prematurely and to have LBW babies. This review includes a Norwegian study performed by Vangen et.al (58). The goal of this study was to investigate the risk of perinatal complications in ethnic Somali women due to the high frequency of female genital mutilation (FGM). The conclusion was that Somali women more often experienced perinatal complications in comparison to ethnic Norwegians. These complications included induction of labour, fetal distress, secondary arrest of labour, prolonged second stage of labour, operative delivery and perinatal death. The highest elevated odds ratio was found for fetal distress (2.6, CI 2.2-3.0) and emergency CS (3.0, CI 2.6-3.4). These were almost identical to the findings among the African mothers in the current study, a group where 40% of the women were from Somalia. Similar findings was also reported by in a study from the United States (94). Their findings highlight that Somali women are a high risk subgroup of immigrants. This higher frequency of CS among women with African origin is also reported in several other studies from many different countries. A study from the Maltese Islands reported that women from sub-Saharan Africa compared to the general population had lower obstetric intervention, but higher operative deliveries (98). In Finland, Malin and Gissler (89) reported that women from Africa and Latin-America had the highest frequency of CS compared to the Finnish women. An English study identified that the African women had increased risk for CS with an OR of 2,8 (CI 2,4-3,1) compared to Caucasian women in London (99). They also found that several groups from Asia had increased risk for CS. Merten et.al (100) reported higher prevalence of CS in the women from Africa, Asia and Latin-America that gave birth in Swiss Baby-Friendly Hospitals. Vangen et al. (61) have also looked at the Filipino women in Norway and found that the adjusted excess risk for CS between the Filipino and the Norwegian group was 7,9%. It has been suggested that FGM can be the reason for prolonged labour, fetal distress and more operative delivery in the African population abroad (58). The practice of FGM is most common in the western, eastern, and north-eastern regions of Africa. Essén (101) reported that prolonged labour did not seem to be associated to FGM in societies with high standards of obstetric care. WHO (102) performed a prospective study in six African countries comparing obstetric outcomes of women who had FGM and not and to what degree the FGM was. They found that the women that had FGM were significantly more likely than those without FGM to have adverse obstetric outcomes. Risks seemed to increase with increasingly degree of FGM. The results are partly confirmed by a case-control study from Switzerland by Wuest and colleagues (103) that also reported that FGM patients had significantly more often an emergency CS. These findings indicate that this is a complex phenomenon and women who have FGM are at risk for obstetric complications. The Norwegian study (60) of healthcare workers experience of encounters with infibulated women showed amongst other findings that negative emotions related to FGM created an emotional detachment. It caused the healthcare worker to distance themselves personally from the women who then became stigmatized rather than being treated as an individual. The healthcare workers viewed the African women as victims of an oppressive culture of which infibulations were the most

extreme sign. Johansen concludes that infibulations may be an indirect cause of the increased health risks infibulated women experience in exile countries because of the way it negatively affects healthcare workers procedures. This is partly confirmed by the Norwegian study which reported that healthcare workers were sometimes uncertain about procedures for infibulated women in labour and therefore CS was performed instead of defibulation (59). The same uncertainty is reported by Widmark et al. (104) from focus group interviews amongst 26 midwives in three different labour wards in Sweden.
In Vangen and colleagues study (57) on CS among immigrants, they reported a higher frequency amongst the women from the Horn of Africa and Latin America. The prevalence of CS for the women from the Horn of Africa was at 20,5% compared to 12,4% in the Norwegian group, giving them a 2,7% increased risk for CS. The women from Chile and Brazil had a frequency of 24,3% and 10% was elective CS, giving them an increased risk of 6,4%. In the study on Somali women, Vangen et al. (58) reported that this group had a frequency of 19% whereas 15,4% was emergency CS and the Norwegian women still had a frequency of 12,4%. The frequency of CS in the total population is higher in the current study. This development can be seen throughout most of the world and is therefore to be expected. The prevalence in the current study was lower than in Oslo and Akershus in 2008 as shown in Table 5. This can be due to the delivery ward at Bærum hospital already have a selected group of women who are past 35 weeks gestation and in general are expecting healthy babies. The prevalence of CS varies between the different immigrant groups which is similar to Vangen and colleagues findings.

The Latin American mothers were at increased risk for postpartum bleeding in the current study. Guendelman and colleagues (87) found no increase in OR for postpartum hemorrhage with the Latina population in their study in comparison to white Americans. In the current study the Latin Americans had high prevalence of earlier CS, and a Norwegian study (105) reported that women who had a previous CS were at increased risk for postpartum hemorrhage. The same authors also reported that women from South-East Asia were at increased risk for postpartum hemorrhage and that the risk was lower for women of Middle Eastern ethnicity (62).

The current study found that children born of Asian women were at increased risk for being transferred to NICU. The reasons for transfer have not been examined. Women in the Asian group had a higher frequency of anemia during pregnancy which could possibly lead to intra uterine growth restriction (IUGR) and LBW of the infant (93). The mean birth weight of infants born to Asian mothers was statistically significant lower compared to the Norwegian infants, but there was no significant difference in LBW infants between Asian and Norwegian mothers. The Asian mothers also had an increased risk for fetal distress and meconium stained liquor, which can be symptoms for possible fetal or maternal infections, which can lead to the need for medical treatment for the baby. A Swiss study reported that children born to women from Africa and Asia were more frequently transferred to NICU compared to children born of Swiss women (100). They discovered that their findings were influenced by the level of education, since the women had large variations in their educational level in the different immigrant groups. This was also a factor in the current study.

In the current study, being born of Asian and African mothers gave a reduction in the baby's birth weight. Norwegian studies which examined the women of Pakistani origin living in Norway, reported amongst other complications that children born of Pakistani women more often had IUGR (53;91). It was also found that when birth weight was adjusted to their own ethnic group, there were no correlation between the LBW and mortality in the Pakistani group. Doornbos et al. (106) analyzed birth weights of children born in Amsterdam and found that the Asian babies, when controlled for the maternal height, did no longer differ in mean birth weights from the Dutch. These results confirmed that the birth weight standards used are inappropriate for detection of deviant weight in non-Dutch groups in the Netherlands. They concluded that children of Asian mothers were smaller only because the Asian mothers were smaller. This indicates that the findings of lower birth weight among the babies born to Asian mothers in the current study, could possibly be a natural phenomenon and that ethnicity and maternal height should be considered when assessing the baby's birth weight.

In Guendelman and colleagues study (29) examining birth outcomes of immigrants in three different countries, they reported that those babies born to North-African mothers who gave birth in France and Belgium had higher mean birth weights than the women from France and Belgium. The African mothers in the current study, which are mainly from the Horn of Africa, might have a different behavior because of the difference in culture. It is known from qualitative studies (59;77) as mentioned earlier, that many Somali women limit their calorie intake during pregnancy because they fear delivering large babies. It has also been suggested and examined a relationship between maternal chewing of the narcotic plant khat and the influence it has on the baby's birth weight (107). Khat is a drug which is said to cause amongst other effects loss of appetite and is frequently used in East-Africa and southwestern part of the Arabian Peninsula. Studies have shown a higher frequency of LBW amongst babies born to women who chews khat (108;109).

4.2. Methodological discussion

In order to answer the research question in the current study, the selected method is appropriate but it has its limitations. The regression models only describe a limited amount of variation in the perinatal outcome. Many unknown factors and uncontrolled variables like genetics, lifestyle and psychosocial factors are therefore not examined and could possibly alter the effect of being immigrant women on the different perinatal outcomes examined. The study population is also rather small and of less numbers than previous power calculation estimate which showed that the number needed was 350 women in each group.

Comparing the women in the study with women giving birth in Oslo and Akershus counties also showed that there were some maternal health differences. The women in the current study had more often registered maternal anemia, UTI and pulmonary disorders. This could be due to a more thorough registration of data in the current study, which was collected directly from the women's journals, in comparison to searching a large database such as the MBRN. The MBRN contains data based on UTI as a recurrent infection only and asthma is registered as a specific disorder and not generalized as a pulmonary disorder. The lower frequency of preeclampsia, twin pregnancy induction of labour and LBW can be due to the study's selective group of women past 35 weeks gestation and expecting a healthy baby. There was a higher amount of interventions during labour in the current study when compared to the women from Oslo and Akershus counties. There was found to be a higher frequency of episiotomy, operative vaginal delivery, oxytocin infusion and epidural analgesia in the current study. There are of course differences in culture and practice between different hospitals with regard to intervention during labour and the attitude of individual healthcare workers toward interventions can vary. Bærum

Hospital has good anesthesia coverage and epidural analgesia during labour is available to almost all women who wish for it. A Cochrane review from 2005 was updated in 2010 (110), showed that women who used epidural were more likely to have a longer second stage of labour and to need their labour contractions stimulated. They were also at increased risk of having an instrumental delivery. This high epidural frequency may therefore explain this higher frequency of interventions at Bærum Hospital when compared to the women from Oslo and Akershus counties in 2008. The frequency of postpartum hemorrhage and meconium stained liquor women was another difference between the two groups. The women delivering at Bærum hospital were found to have a higher frequency of meconium stained liquor, but a lower frequency of postpartum hemorrhage, when compared to the women from Oslo and Akershus counties. The reason for this is difficult to explain. Perhaps it again is due to the difference in registration of data obtained in the current study versus data obtained from the MBRN.

Some of the perinatal outcomes registered when sampling the data had not enough observations in order to proceed with analyses. These outcomes were Apgar score of less than 7 after 5 minutes and third and fourth degrees of perineal tear. The original experience that founded the aim of this study was based on the observation that several of the immigrant babies had a lower Apgar score at 1 minute compared to the Norwegian babies. There are no studies examining 1 minute Apgar score as a perinatal outcome and therefore the Apgar score at 5 minutes was more appropriate to examine, only the number in this study was too low to analyze. This type of analyses would be possible with a bigger study population. Being that the Latin American group was a lot smaller than the other immigrant groups also caused difficulties with interpretation of results. This was also a group with high morbidity and the results for this group should be interpreted with care.

Some of the multiple logistic regression models contained many of the independent variables, and perhaps some of the models should be reduced in order to produce more reliable estimates. When there is a small sample size with a large number of variables, the results can be unreliable. However, the numbers of independent variables are within 10% of the cases in the dependent variables as recommended (83).

In the regression models the Asian and African groups had only a few statistically significant values before the adjustment of the independent variables. Belonging to these groups had a strong correlation with level of educational and this was the independent variable that made the groups significant in the regression model for fetal distress (Table 9). It also caused significance within the Asian group in the regression model for acute CS (Table 14) and within the African group in the regression model for episiotomy (Table 11). No multicollinearity was found between these variables and it is safe to say that they do not measure the same variable. Since the level of education was very different in these groups compared to the Norwegian group, these variables do correlate. In the regression model for oxytocin infusion (Table 8) the Asian group showed to be at increased risk for needing infusion during labour, despite the almost similar frequency when compared to the Norwegian group. This was explained by the strong predictor of epidural analgesia and the much lower use of it amongst the Asian mothers. The results of the immigrant groups in the regression models should therefore be interpreted with some caution and consideration to the low number of cases should be made.

There were also some missing values in BMI which resulted in smaller numbers in the regression models were BMI was included as an independent variable. This could have affected the result since mostly the pre-pregnancy weight was the value missing, often because of the women's recent arrival in Norway and lack of antenatal check-ups. Many of these women would perhaps offer valuable information to the regression models.

The current study also has a few strengths. The ROAM collaboration and EURO-PERISTAT concluded in their Delphi-consensus (111) that the essential indicators to be used in comparison of migration and perinatal health should be maternal country of birth, divided into groups of region defined by the UN. The next indicator should be time since arrival in the hosting country and other information such as immigration status, ethnicity and language fluency. This study's registration of maternal country of origin is therefore within the Delphi-consensus agreement. To strengthen the study further, information on time since arrival to Norway, immigration status, ethnicity and language fluency could be collected. This would on the other hand have influenced the data collection process and resulted in an even smaller study population in the current study.

Many of the former studies on the same subject have used information from the MBRN. The information in the current study is more reliable than the information from MBRN since the data has been collected directly from the patients journals. This study has a smaller population, but more reliable information on this population.

The diversity of country of origin of the immigrant women in the current study reflects the distribution of country of origin of immigrants in Norway according to Statistics Norway (2). It is therefore nothing unique with the immigrant population in the current study.

Since the study was performed at a low risk hospital, with a selected group of women past 35 weeks gestation, and expecting healthy babies, this population is a better candidate to examine differences between immigrants and Norwegians and gets us closer to the truth about country of origin. The study also contained many background variables and therefore many factors have been controlled for in the analyses. This can be both an advantage and a disadvantage since on one hand the effect estimated is closer to the real effect of being immigrant woman, but many independent variables can also interfere with the estimates. The variables in the model are all statistically significant and entered in the models for obvious reasons. There is absence of multicollinearity in these models, which supports the decision of using many independent variables.

4.3. Significance for clinical practice

The result of the analyses indicates that the immigrant mothers from Asia and Africa are at the most risk for adverse pregnancy outcomes when compared to the Norwegian mothers. These women had the lowest level of education and many of them are refugees. Zeitlin et al. (112) reported that all of the sosio-demographic variables which were included in their analyses were related to an increased risk for perinatal mortality. These variables were maternal age, parity, marital status, educational level, occupation and maternal birth place. These are factors that we as a healthcare system are unable to influence. Zeitlin et al.(112) suggested that there were also other explanations for the apparent perinatal differences and mentioned the factors of diet, physical activity and prenatal care. They argue that the quality of maternal care may differ depending on the women’s different background. Immigrant women may not fully comprehend medical advice due to linguistic barriers and often different expectations of the care process. The prenatal care program in Norway exists in order to enhance the women's health and prevent disease and involves teaching the women about healthy nutrition and physical activity (113). According to the national guidelines for prenatal care (113) published in 2005, the prenatal care program should contribute in reducing social inequality with regard to good health. It is therefore vital that prenatal care providers are able to communicate with all women. It is also important that women are able to express their problems and can understand all the information they receive. In addition it is worth mentioning that certain cultural perceptions of what is best for the women during the perinatal period can be very different from our knowledge of what actually is best practice. Research has so far shown that interpreters are not routinely used and immigrants receive fare less information than women from the receiving country (52;77). Seeing the overwhelming research on the effect of using an interpreter, it is to believe that the use of a trained interpreter would enhance the quality of the communication and better the perinatal outcome for immigrant women. It would also be favorable if healthcare workers were trained in communicating through an interpreter. This would perhaps increase the immigrant woman's understanding of the healthcare service and lead to more satisfactory use and as a result, decrease the differences in perinatal outcomes. According to the national standards (12), providing interpretation is the responsibility of the healthcare worker and a greater effort should be made in order to acquire a trained interpreter routinely, when needed.

Another aspect to consider is the lack of written health information available to the immigrant women in this study. The hospital information folder, containing information about the maternity clinic, labour and what the hospital can offer, is only available in the Norwegian language. There is otherwise information on breastfeeding available in several languages. The immigrant women also have limited access to the health education program since the only prenatal class available is held in Norwegian. There is reason to think that this is not the only hospital with limited resources regarding information and health education for immigrants. Written information and access to health education program in a native language should also be offered to the immigrant population. Increased cultural awareness could also better the healthcare workers understanding of immigrant women and their behavior. And since giving birth is surrounded by cultural characteristics, efforts should be made in order to facilitate important cultural practices at the maternity clinics.

5. CONCLUSION

This study shows differences in background characteristics and perinatal outcomes between immigrant groups and Norwegians. Women from Asia and Africa were at the most at risk for adverse perinatal outcomes and these findings are similar to previous studies. There is evidence to suggest that removing linguistic barriers would perhaps improve the outcomes for these women. Immigrant women are entitled to the same information and healthcare as native Norwegian women, but this is not the present case. There are also cultural aspects to consider as giving birth is closely surrounded by cultural characteristics. Better understanding of immigrants cultural believes, and increasing cultural awareness among healthcare workers can also better the immigrant women’s perinatal outcomes. Immigrant women are a vulnerable group with a desperate need for attention and targeted help, since they also more often are of inadequate resources and poor sosio-economic status.

6. FUTURE RESEARCH

This study will be enlarged in sample size in order to produce more reliable results. Dividing the immigrant women in different groups, regarding their immigrant status to be a refugee or labour immigrant, can give more information than the geographical division which was used in the current study.

In order to examine the reasons for differences in perinatal outcomes between different immigrant groups more information is needed. Information about language fluency and time since arrival to the host country can be helpful data. Likewise more sosio-economic variables could be useful.

It would also be interesting to do an intervention study to examine the effect of an interpreter present during delivery and how this is perceived by healthcare workers and the immigrant women.

Reference List

(1) United Nations PD. International Migrant Stock: The 2008 Revision. 2011. 14-2-2011. Ref Type: Online Source

(2) Statistics Norway. Immigration and immigrants. 1-1-2010. 5-1-2011. Ref Type: Online Source

(3) The Norwegian Institute of Public Health. Sosial ulikhet i helse. En faktarapport [Social inequalities in health. A report of facts.][Norwegian]. Nydalen: Nasjonalt folkehelseinstitutt; 2007. Report No.: 1.

(4) Thorud E, Haagensen E, Jølstad FO. International Migration 2008-2009. SOPEMI-report for Norway. Ministry of Justice, Ministry of Children and Equality and the Ministry of Labour.; 2009 Dec 22.

(5) Ahlberg N, Vangen S. Svangerskap og fødsel i et flerkulturelt Norge [Pregnancy and birth in multicultural Norway][Norwegian]. Tidsskr Nor Laegeforen 2005 Mar 3;125(5):586-8.

(6) Bakhta Y, Lee RH. A survey of Russian women regarding the presence of a companion during labor. International Journal of Gynecology & Obstetrics 2010 Jun;109(3):201-3.

(7) Wiklund H, Aden AS, H÷gberg U, Wikman M, Dahlgren L. Somalis giving birth in Sweden: a challenge to culture and gender specific values and behaviours. Midwifery 2000 Jun;16(2):105-15.

(8) Darvill R, Skirton H, Farrand P. Psychological factors that impact on women's experiences of first-time motherhood: a qualitative study of the transition. Midwifery 2010 Jun;26(3):357-66.

(9) Migrant Friendly Hospitals. European Recommendations: The Amsterdam Declaration Towards Migrant Friendly Hospitals in an ethno-culturally diverse Europe. 2004. 7-1-2011. Ref Type: Online Source

(10) World Health Organization. Health of migrants: the way forward - report of a global consultation, Madrid, Spain, 3-5 March 2010. France: World Health Organization; 2010.

(11) Bischoff A. Caring for Migrant and Minority Patients in European Hospitals: A Review of Effective Interventions. Neuchâtel and Basel: Swiss Forum for Migration and Population Studies; 2003 Aug 12.

(12) Norwegian Directorate of Health. Migrasjon og helse - utfordringer og utviklingstrekk [Migration and health - challanges and developments][Norwegian]. 2009 May.

(13) Stronks K, Ravelli AC, Reijneveld SA. Immigrants in the Netherlands: equal access for equal needs? J Epidemiol Community Health 2001 Oct;55(10):701-7.

(14) Newbold KB, Danforth J. Health status and Canada's immigrant population. Soc Sci Med 2003 Nov;57(10):1981-95.

(15) Wiking E, Johansson SE, Sundquist J. Ethnicity, acculturation, and self reported health. A population based study among immigrants from Poland, Turkey, and Iran in Sweden. J Epidemiol Community Health 2004 Jul;58(7):574-82.

(16) Williams DR, Mohammed SA, Leavell J, Collins C. Race, socioeconomic status, and health: complexities, ongoing challenges, and research opportunities. Ann N Y Acad Sci 2010 Feb;1186:69-101.

(17) Syed HR, Vangen S. Health and Migration: A review. NAKMI Papers 2003;2003(2).

(18) Trask JW. The significance of the mortality rates of the colored population of the United States. Am J Public Health (N Y) 1916 Mar;6(3):254-9.

(19) Nielsen SS, Krasnik A. Poorer self-perceived health among migrants and ethnic minorities versus the majority population in Europe: a systematic review. Int J Public Health 2010 Oct;55(5):357-71.

(20) Syed HR, Dalgard OS, Hussain A, Dalen I, Claussen B, Ahlberg NL. Inequalities in health: a comparative study between ethnic Norwegians and Pakistanis in Oslo, Norway. Int J Equity Health 2006;5:7.

(21) McKeigue PM. Mapping genes that underlie ethnic differences in disease risk: methods for detecting linkage in admixed populations, by conditioning on parental admixture. Am J Hum Genet 1998 Jul;63(1):241-51.

(22) Nazroo JY. The structuring of ethnic inequalities in health: economic position, racial discrimination, and racism. Am J Public Health 2003 Feb;93(2):277-84.

(23) Bennett SA. Inequalities in risk factors and cardiovascular mortality among Australia's immigrants. Aust J Public Health 1993 Sep;17(3):251-61.

(24) Nierkens V, de VH, Stronks K. Smoking in immigrants: do socioeconomic gradients follow the pattern expected from the tobacco epidemic? Tob Control 2006 Oct;15(5):385-91.

(25) Agyemang C, Addo J, Bhopal R, Aikins AG, Stronks K. Cardiovascular disease, diabetes and established risk factors among populations of sub-Saharan African descent in Europe: a literature review. Global Health 2009;5:7.

(26) Agyemang C, Kunst AE, Stronks K. Ethnic inequalities in health: does it matter where you have migrated to? Ethn Health 2010 Jun;15(3):216-8.

(27) Razum O, Zeeb H, Rohrmann S. The 'healthy migrant effect'--not merely a fallacy of inaccurate denominator figures. Int J Epidemiol 2000 Feb;29(1):191-2.

(28) Kennedy S, McDonald J.T, Biddle N. The Healthy Immigrant Effect and Immigrant Selection: Evidence from Four Countries. SEDAP Reseach Program: McMaster University; 2006 Dec. Report No.: SEDAP Research Paper No. 164.

(29) Guendelman S, Buekens P, Blondel B, Kaminski M, Notzon FC, Masuy-Stroobant G. Birth outcomes of immigrant women in the United States, France, and Belgium. Matern Child Health J 1999 Dec;3(4):177-87.

(30) Lustig SL, Kia-Keating M, Knight WG, Geltman P, Ellis H, Kinzie JD, et al. Review of child and adolescent refugee mental health. J Am Acad Child Adolesc Psychiatry 2004 Jan;43(1):24-36.

(31) ROAM Collaboration. Reproductive Outcomes and Migration: an International Research Collaboration (ROAM). 2010. 13-1-2011. Ref Type: Online Source

(32) Gagnon AJ, Zimbeck M, Zeitlin J, Alexander S, Blondel B, Buitendijk S, et al. Migration to western industrialised countries and perinatal health: a systematic review. Soc Sci Med 2009 Sep;69(6):934-46.

(33) Urquia ML, Glazier RH, Blondel B, Zeitlin J, Gissler M, Macfarlane A, et al. International migration and adverse birth outcomes: role of ethnicity, region of origin and destination. J Epidemiol Community Health 2010 Mar;64(3):243-51.

(34) Gissler M, Alexander S, Macfarlane A, Small R, Stray-Pedersen B, Zeitlin J, et al. Stillbirths and infant deaths among migrants in industrialized countries. Acta Obstet Gynecol Scand 2009;88(2):134-48.

(35) Essén B, Hanson BS, Ostergren PO, Lindquist PG, Gudmundsson S. Increased perinatal mortality among sub-Saharan immigrants in a city-population in Sweden. Acta Obstet Gynecol Scand 2000 Sep;79(9):737-43.

(36) Essén B, Bödker B, Sjöberg NO, Langhoff-Roos J, Greisen G, Gudmundsson S, et al. Are some perinatal deaths in immigrant groups linked to suboptimal perinatal care services? BJOG 2002 Jun;109(6):677-82.

(37) Ekéus C, Cnattingius S, Essén B, Hjern A. Stillbirth among foreign-born women in Sweden. Eur J Public Health 2011 Jan 11.

(38) Statistics Norway. Fruktbarhet blandt innvandrerkvinner: 1 av 5 nyfødte har foreldre som har innvandret [Fertility among immigrantwomen: 1 out of 5 newborn have immigrant parents][Norwegian]. Statistics Norway [SSP 4/2006]. 10-10-2006. 1-3-0011. Ref Type: Online Source

(39) Eskild A, Helgadottir LB, Jerve F, Qvigstad E, Stray-Pedersen S, Loset A. Provosert abort blant kvinner med fremmedkulturelle bakgrunn i Oslo [Induced abortion among women with foreign cultural background in Oslo][Norwegian]. Tidsskr Nor Laegeforen 2002 May 30;122(14):1355-7.

(40) Eskild A, Nesheim BI, Busund B, Vatten L, Vangen S. Childbearing or induced abortion: the impact of education and ethnic background. Population study of Norwegian and Pakistani women in Oslo, Norway. Acta Obstet Gynecol Scand 2007;86(3):298-303.

(41) Vangen S, Eskild A, Forsen L. Termination of pregnancy according to immigration status: a population-based registry linkage study. BJOG 2008 Sep;115(10):1309-15.

(42) Holan S, Vangen S, Hanssen K, Stray-Pedersen B. Diabetes hos gravide født i Asia, Afrika og Norge. [Pregnancy in diabetes among Asian, African and Norwegian women][Norwegian]. Tidsskr Nor Laegeforen 2008 May 29;128(11):1289-92.

(43) Vangen S, Stoltenberg C, Holan S, Moe N, Magnus P, Harris JR, et al. Outcome of pregnancy among immigrant women with diabetes. Diabetes Care 2003 Feb;26(2):327-32.

(44) Bjerke SE, Vangen S, Nordhagen R, Ytterdahl T, Magnus P, Stray-Pedersen B. Postpartum depression among Pakistani women in Norway: prevalence and risk factors. J Matern Fetal Neonatal Med 2008 Dec;21(12):889-94.

(45) Bjerke SE, Holter E, Vangen S, Stray-Pedersen B. Sexually transmitted infections among Pakistani pregnant women and their husbands in Norway. Int J Womens Health 2010;2:303-9.

(46) Bjerke SE, Vangen S, Holter E, Stray-Pedersen B. Infectious immune status in an obstetric population of Pakistani immigrants in Norway. Scand J Public Health 2011 Feb 21.

(47) Vangen S, Stoltenberg C, Schei B. Ethnicity and use of obstetrical analgesia: do Pakistani women receive inadequate pain relief in labour? Ethn Health 1996 May;1(2):161-7.

(48) Stoltenberg C, Magnus P, Lie RT, Daltveit AK, Irgens LM. Birth defects and parental consanguinity in Norway. Am J Epidemiol 1997 Mar 1;145(5):439-48.

(49) Stoltenberg C, Magnus P, Lie RT, Daltveit AK, Irgens LM. Influence of consanguinity and maternal education on risk of stillbirth and infant death in Norway, 1967-1993. Am J Epidemiol 1998 Sep 1;148(5):452-9.

(50) Stoltenberg C, Magnus P, Skrondal A, Lie RT. Consanguinity and recurrence risk of stillbirth and infant death. Am J Public Health 1999 Apr;89(4):517-23.

(51) Stoltenberg C, Magnus P, Skrondal A, Lie RT. Consanguinity and recurrence risk of birth defects: a population-based study. Am J Med Genet 1999 Feb 19;82(5):423-8.

(52) Saastad E, Vangen S, Frøen JF. Suboptimal care in stillbirths - a retrospective audit study. Acta Obstet Gynecol Scand 2007;(86):444-50.

(53) Vangen S, Stoltenberg C, Skjaerven R, Magnus P, Harris JR, Stray-Pedersen B. The heavier the better? Birthweight and perinatal mortality in different ethnic groups. Int J Epidemiol 2002 Jun;31(3):654-60.

(54) Vikanes A, Grjibovski AM, Vangen S, Magnus P. Length of residence and risk of developing hyperemesis gravidarum among first generation immigrants to Norway. Eur J Public Health 2008 Oct;18(5):460-5.

(55) Vikanes A, Grjibovski AM, Vangen S, Magnus P. Variations in prevalence of hyperemesis gravidarum by country of birth: a study of 900,074 pregnancies in Norway, 1967-2005. Scand J Public Health 2008 Mar;36(2):135-42.

(56) Grjibovski AM, Vikanes A, Stoltenberg C, Magnus P. Consanguinity and the risk of hyperemesis gravidarum in Norway. Acta Obstet Gynecol Scand 2008;87(1):20-5.

(57) Vangen S, Stoltenberg C, Skrondal A, Magnus P, Stray-Pedersen B. Cesarean section among immigrants in Norway. Acta Obstet Gynecol Scand 2000 Jul;79(7):553-8.

(58) Vangen S, Stoltenberg C, Johansen REB, Sundby J, Stray-Pedersen B. Perinatal complications among ethnic Somalis in Norway. Acta Obstetricia et Gynecologica Scandinavica 2002 Jan 1;81(4):317-22.

(59) Vangen S, Johansen RE, Sundby J, Traeen B, Stray-Pedersen B. Qualitative study of perinatal care experiences among Somali women and local health care professionals in Norway. Eur J Obstet Gynecol Reprod Biol 2004 Jan 15;112(1):29-35.

(60) Johansen RE. Care for infibulated women giving birth in Norway: an anthropological analysis of health workers' management of a medically and culturally unfamiliar issue. Med Anthropol Q 2006 Dec;20(4):516-44.

(61) Vangen S, Stray-Pedersen B, Skrondal A, Magnus P, Stoltenberg C. High risk of cesarean section among ethnic Filipinos: an effect of the paternal contribution to birthweight? Acta Obstet Gynecol Scand 2003 Feb;82(2):192-3.

(62) Al-Zirqi I, Vangen S, Forsen L, Stray-Pedersen B. Prevalence and risk factors of severe obstetric haemorrhage. BJOG 2008 Sep;115(10):1265-72.

(63) Ericson A, riksson M, allen B, etterstrom R. Socio-economic variables and pregnancy outcome. Acta Paediatr Scand 1990 Nov;79(11):1009-16.

(64) Aalandslid V, Tronstad KR. Familieinnvandring, kjønn og sysselsetting [Family immigration, gender and work][Norwegian]. Oslo: Statistics Norway; 2010 May.

(65) Bhuller M, Aaberge R. Vedvarende økonomisk fattigdom blant innvandrere [Persistant financial poverty among immigrants][Norwegian]. Oslo: Statistics Norway; 2010 Jun.

(66) Hirsch AA. Sosialhjelpsmottakere blant innvandrere [Social assistance recipients among immigrants][Norwegian]. Oslo: Statistics Norway; 2010 Aug.

(67) Arntzen A, Nybo Andersen AM. Social determinants for infant mortality in the Nordic countries, 1980-2001. Scand J Public Health 2004;32(5):381-9.

(68) Arntzen A, Samuelsen SO, Bakketeig LS, Stoltenberg C. Socioeconomic status and risk of infant death. A population-based study of trends in Norway, 1967-1998. Int J Epidemiol 2004 Apr;33(2):279-88.

(69) Bischoff A, Schneider M, Denhaerynck K, Battegay E. Health and ill health of asylum seekers in Switzerland: an epidemiological study. Eur J Public Health 2009 Jan;19(1):59-64.

(70) Collins CH, Zimmerman C, Howard LM. Refugee, asylum seeker, immigrant women and postnatal depression: rates and risk factors. Arch Womens Ment Health 2010 Dec 14.

(71) Thomas PE, Beckmann M, Gibbons K. The effect of cultural and linguistic diversity on pregnancy outcome. Aust N Z J Obstet Gynaecol 2010 Oct;50(5):419-22.

(72) Urquia ML, Frank JW, Moineddin R, Glazier RH. Immigrants' duration of residence and adverse birth outcomes: a population-based study. BJOG 2010 Apr;117(5):591-601.

(73) Bollini P, Stotzer U, Wanner P. Pregnancy outcomes and migration in Switzerland: results from a focus group study. Int J Public Health 2007;52(2):78-86.

(74) Bollini P, Pampallona S, Wanner P, Kupelnick B. Pregnancy outcome of migrant women and integration policy: a systematic review of the international literature. Soc Sci Med 2009 Feb;68(3):452-61.

(75) Bischoff A, Bovier PA, Rrustemi I, Gariazzo F, Eytan A, Loutan L. Language barriers between nurses and asylum seekers: their impact on symptom reporting and referral. Soc Sci Med 2003 Aug;57(3):503-12.

(76) Essén B. Gravide invandrerkvinder i Skandinavien [Pregnant immigrant women in Scandinavia] [Danish]. Ugeskr Laeger 2003 Nov 10;165(46):4425-8.

(77) Essén B, Johnsdotter S, Hovelius B, Gudmundsson S, Sjöberg NO, Friedman J, et al. Qualitative study of pregnancy and childbirth experiences in Somalian women resident in Sweden. BJOG 2000 Dec;107(12):1507-12.

(78) Rizzo N, Ciardelli V, Gandolfi CG, Bonavita B, Parisio C, Farina A, et al. Delivery and immigration: the experience of an Italian hospital. Eur J Obstet Gynecol Reprod Biol 2004 Oct 15;116(2):170-2.

(79) Lansakara N, Brown SJ, Gartland D. Birth outcomes, postpartum health and primary care contacts of immigrant mothers in an Australian nulliparous pregnancy cohort study. Matern Child Health J 2010 Sep;14(5):807-16.

(80) Small R, Rice P, Yelland J, Lumley J. Mothers in a New Country: The Role of Culture and Communication in Vietnamese, Turkish and Filipino Women's Experiences of Giving Birth in Australia. Women & Health 1999;28(3):77-101.

(81) Bischoff A, Perneger TV, Bovier PA, Loutan L, Stalder H. Improving communication between physicians and patients who speak a foreign language. Br J Gen Pract 2003 Jul;53(492):541-6.

(82) Norwegian Institute of Public Health. The Medical Birth Registry of Norway, Statistical database. http://mfr-nesstar uib no/mfr/ 2010 [cited 2010 Dec 17];

(83) Altman DG. Practical statistics for medical research. London: Chapman and Hall; 1991.

(84) Pallant J. SPSS survival manual: a step by step guide to data analysing using SPSS for Windows. Maidenhead: McGraw-Hill ; Open University Press; 2007.

(85) Lovdata. LOV 1999-07-02 nr 64: Lov om helsepersonell m.v. (helsepersonelloven). [Act of 2nd July 1999, no 64 relating to health personnel etc. (The Health Personnel Act)][Norwegian]. Available from: http://www.lovdata.no/all/hl-19990702-064.html.Cited:15.06.2010 . 11-6-2010. Ref Type: Online Source

(86) Waterstone M, Bewley S, Wolfe C, Murphy JD. Incidence and predictors of severe obstetric morbidity: case-control study. BMJ 2001 May 5;322(7294):1089-94.

(87) Guendelman S, Thornton D, Gould J, Hosang N. Obstetric complications during labor and delivery: assessing ethnic differences in California. Womens Health Issues 2006 Jul;16(4):189-97.

(88) Ekéus C, Cnattingius S, Hjern A. Epidural analgesia during labor among immigrant women in Sweden. Acta Obstet Gynecol Scand 2010;89(2):243-9.

(89) Malin M, Gissler M. Maternal care and birth outcomes among ethnic minority women in Finland. BMC Public Health 2009;9:84.

(90) Robertson E, Malmström M, Johansson SE. Do foreign-born women in Sweden have an increased risk of non-normal childbirth? Acta Obstet Gynecol Scand 2005 Sep;84(9):825-32.

(91) Vangen S, Stoltenberg C, Stray-Pedersen B. Complaints and Complications in Pregnancy: A study of ethnic Norwegian and ethnic Pakistani Women in Oslo. Ethnicity & Health 1999;4(1):19-28.

(92) Heimstad R, Romundstad PR, Eik-Nes SH, Salvesen KA. Outcomes of pregnancy beyond 37 weeks of gestation. Obstet Gynecol 2006 Sep;108(3 Pt 1):500-8.

(93) Brunstad A, Tegnander E. Jordmorboka [Textbook for midwife students][Norwegian]. 1 ed. Oslo: Akribe AS; 2010.

(94) Johnson EB, Reed SD, Hitti J, Batra M. Increased risk of adverse pregnancy outcome among Somali immigrants in Washington state. Am J Obstet Gynecol 2005 Aug;193(2):475-82.

(95) The Medical Birth Registry of Norway. Melding om avsluttet svangerskap etter 12.uke [Report on completed pregnancy after 12 weeks] [Norwegian]. 11-5-2007. 14-1-2011. Ref Type: Online Source

(96) Ma J, Bauman A. Obstetric profiles and pregnancy outcomes of immigrant women in New South Wales, 1990-1992. Aust N Z J Obstet Gynaecol 1996 May;36(2):119-25.

(97) Small R, Gagnon A, Gissler M, Zeitlin J, Bennis M, Glazier R, et al. Somali women and their pregnancy outcomes postmigration: data from six receiving countries. BJOG 2008 Dec;115(13):1630-40.

(98) Savona-Ventura C, Buttigieg GG, Gatt M. Obstetric outcomes in immigrants of African nationality. International Journal of Risk & Safety in Medicine 2009;21:147-52.

(99) Ibison JM. Ethnicity and mode of delivery in 'low-risk' first-time mothers, East London, 1988-1997. Eur J Obstet Gynecol Reprod Biol 2005 Feb 1;118(2):199-205.

(100) Merten S, Wyss C, Ackermann-Liebrich U. Caesarean sections and breastfeeding initiation among migrants in Switzerland. Int J Public Health 2007;52(4):210-22.

(101) Essén B, Sjöberg NO, Gudmundsson S, Östergren PO, Lindqvist PG. No association between female circumcision and prolonged labour: a case control study of immigrant women giving birth in Sweden. Eur J Obstet Gynecol Reprod Biol 2005 Aug 1;121(2):182-5.

(102) Banks E, Meirik O, Farley T, Akande O, Bathija H, Ali M. Female genital mutilation and obstetric outcome: WHO collaborative prospective study in six African countries. Lancet 2006 Jun 3;367(9525):1835-41.

(103) Wuest S, Raio L, Wyssmueller D, Mueller MD, Stadlmayr W, Surbek DV, et al. Effects of female genital mutilation on birth outcomes in Switzerland. BJOG 2009 Aug;116(9):1204-9.

(104) Widmark C, Tishelman C, Ahlberg BM. A study of Swedish midwives' encounters with infibulated African women in Sweden. Midwifery 2002 Jun;18(2):113-25.

(105) Al-Zirqi I, Vangen S, Forsen L, Stray-Pedersen B. Effects of onset of labor and mode of delivery on severe postpartum hemorrhage. Am J Obstet Gynecol 2009 Sep;201(3):273-9.

(106) Doornbos JP, Nordbeck HJ, Van Enk AE, Muller AS, Treffers PE. Differential birthweights and the clinical relevance of birthweight standards in a multiethnic society. Int J Gynaecol Obstet 1991 Apr;34(4):319-24.

(107) Alem A, Kebede D, Kullgren G. The prevalence and socio-demographic correlates of khat chewing in Butajira, Ethiopia. Acta Psychiatr Scand Suppl 1999;397:84-91.

(108) Ghani AN., ERIKSSON M, Kristiansson B, Qirbi A. The influence of khat-chewing on birth-weight in full-term infants. Soc Sci Med 1987;24(7):625-7.

(109) Eriksson M, Ghani NA, Kristiansson B. Khat-chewing during pregnancy-effect upon the off-spring and some characteristics of the chewers. East Afr Med J 1991 Feb;68(2):106-11.

(110) Anim-Somuah M, Smyth R, Howell C. Epidural versus non-epidural or no analgesia in labour. Cochrane Database Syst Rev 2005;(4):CD000331.

(111) Gagnon AJ, Zimbeck M, Zeitlin J. Migration and perinatal health surveillance: an international Delphi survey. Eur J Obstet Gynecol Reprod Biol 2010 Mar;149(1):37-43.

(112) Zeitlin J, Combier E, De CF, Papiernik E. Socio-demographic risk factors for perinatal mortality. A study of perinatal mortality in the French district of Seine-Saint-Denis. Acta Obstet Gynecol Scand 1998 Sep;77(8):826-35.

(113) Norwegian Directorate of Health. Retningslinjer for svangerskapsomsorgen [Guidelines for prenatal care] [Norwegian]. http://www.helsedirektoratet.no/vp/multimedia/archive/00002/Retningslinjer_for_sv_2674a.pdf . 2005. The Norwegian Directorate of Health. 20-2-2011.
Ref Type: Online Source

Appendix 1.

List of country of origin divided in the 6 groups

Norway (n=1634)

Nordic, Western-Europe, USA, Canada and Australia (n=202)

1. Sweden **77**
2. Denmark **24**
3. Finland **14**
4. Iceland **6**
5. England **22**
6. Irland **1**
7. France **8**
8. Germany **12**
9. Spain **9**
10. Portugal **3**
11. Austria **1**
12. Belgium **1**
13. Netherlands **5**
14. Italy **3**
15. USA **10**
16. Canada **3**
17. Australia **2**

Eastern-Europe and the Balkans (n=201)

18. Lithuania **13**
19. Latvia **6**
20. Estonia **5**
21. Poland **89**
22. Romania **6**
23. Hungary **3**
24. Bulgaria **5**
25. Slovakia **2**
26. Czech Republic **3**
27. Russia **28**
28. Bosnia and Herzegovina **5**
29. Belarus **3**
30. Croatia **1**
31. Republic of Serbia **9**
32. Ukraine **6**
33. Macedonia **3**
34. Albania **7**
35. Kosovo **7**
36. Moldova **1**

Asia (n=221)

37. Afghanistan **26**
38. Burma **2**
39. Philippines **27**
40. India **5**
41. Indonesia **5**
42. Iraq **30**
43. Iran **19**
44. Israel **1**
45. Japan **3**
46. China **15**
47. Kyrgyzstan **1**
48. Korea **3**
49. Kuwait **1**
50. Lebanon **3**
51. Malaysia **2**
52. Jordan **2**
53. Mongolia **2**
54. Nepal **1**
55. Pakistan **41**
56. Palestine **3**
57. Saudi Arabia **1**
58. Singapore **1**
59. Sri Lanka **5**
60. Turkmenistan **1**
61. Turkey **3**
62. Uzbekistan **1**
63. Vietnam **7**
64. Thailand **10**

Africa (n=150)

65. Algeria **2**
66. Angola **1**
67. Burundi **3**
68. Egypt **3**
69. Eritrea **14**
70. Ethiopia **15**
71. Gambia **4**
72. Ghana **6**
73. Cameroon **1**
74. Kenya **5**
75. Democratic Republic of the Congo **5**
76. Morocco **8**
77. Liberia **1**
78. Libya **1**
79. Nairobi **1**
80. Niger **1**
81. Nigeria **5**
82. Rwanda **3**
83. Somalia **61**
84. Sudan **2**
85. South-Africa **1**
86. Syria **1**
87. Tanzania **1**
88. Uganda **3**
89. Zimbabwe **1**

Latin- and South-America (n=29)

90. Bolivia **2**
91. Brazil **8**
92. Chile **4**
93. Costa Rica **1**
94. Dominican Republic **1**
95. Ecuador **1**
96. Colombia **1**
97. Mexico **5**
98. Nicaragua **1**
99. Peru **2**
100. Trinidad and Tobago **1**
101. Uruguay **1**
102. Venezuela **1**