UiT THE ARCTIC UNIVERSITY OF NORWAY

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# Predictors of exclusive breastfeeding at discharge, the Georgian Birth Registry

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## Abstract

**Background:** The World Health Organization recommends exclusive breastfeeding for six months. Breastfeeding is associated with many short and long-term advantages for both mother and child, such as protection against gastrointestinal and respiratory infections in children and breast cancer in women. Rates of exclusive breastfeeding are low in low and middle-income countries. Several determinants of breastfeeding have previously been identified in the literature, for example mother's age and social background, obstetric factors and newborn distress. Georgia has recently established a national birth registry, which includes information about early postpartum breastfeeding.

**Objective:** The objective of this master's thesis was to identify predictors of exclusive breastfeeding at discharge in Georgia, in term newborns.

**Material and methods:** The study population was extracted from the Georgian Birth Registry, and consisted of all births registered in November and December 2017. The newborns included were live singletons born at term, with a final study population of n = 7 134. The group of newborns that were exclusively breastfed at discharge was compared with the group that was not exclusively breastfed at discharge, and potential predictors were assessed with logistic regression analysis.

**Results:** The study identified several negative predictors of exclusive breastfeeding at discharge in Georgia in term newborns; maternal higher education compared to secondary education or less (OR 0.75 [0.59 – 0.97]), caesarean section (CS) compared to vaginal or assisted vaginal delivery (OR 0.47 [0.37 – 0.60]), low birth weight (<2500 grams) compared to a birth weight of 3000 – 3490 grams (OR 0.51 [0.27 – 0.97]), and admission to a neonatal intensive care unit after delivery (OR 0.02 [0.02 – 0.03]).

**Conclusion:** To the author's knowledge, this is the first time determinants of breastfeeding have been studied in Georgia. Several negative predictors were identified, most noteworthy delivery by CS and admission to neonatal intensive care unit. The findings are of importance to the national health authorities when setting new priorities in maternal and child health, and for non-governmental organizations working to improve breastfeeding practices.

**Keywords:** exclusive breastfeeding, patient discharge, caesarean section, neonatal intensive care units, social determinants of health, Georgia (Republic).

## List of abbreviations and terminology

| | |
|---|---|
| BFHI | Baby-Friendly Hospital Initiative |
| CS | Caesarean section |
| Early initiation of breastfeeding | When the newborn receives breast milk within one hour after birth |
| EBF | Exclusive breastfeeding<br>When the infant receives breast milk exclusively, with no other liquids or solids, not even water, except for oral rehydration solution, vitamins, minerals or medicines |
| Formula feeding | When the infant receives formula, manufactured food designed for infants, instead of or in addition to breast milk |
| GA | Gestational age |
| GBR | Georgian Birth Registry |
| HIV | Human immunodeficiency virus |
| IVF | In Vitro Fertilization |
| LMP | Last menstruation period |
| Mixed feeding | When the infant receives other liquids and/or solids in addition to breast milk |
| NCDC | National Centre for Disease Control and Public Health |
| NICU | Neonatal Intensive Care Unit |
| Parenteral feeding | When the infant receives nutrients intravenously |
| Parity | Number of births per woman (at or after gestational week 22), not including the current delivery |

| | |
|---|---|
| Postpartum period | Period lasting from birth to about six weeks after birth, often also referred to as the postnatal period |
| REC | Regional Committee for Medical and Health Research Ethics |
| UNICEF | United Nations Children's Fund |
| WHO | World Health Organization |

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# 1. Background

## 1.1 Breastfeeding – why is it important?

The World Health Organization (WHO) recommends exclusive breastfeeding (EBF) for six months from birth, defined as no other solids or liquids besides breast milk and essential vitamins or medicines (1). Additionally, WHO advocates continued breastfeeding as an important part of the child's diet for up to two years and beyond (1). To facilitate EBF, WHO promotes the support of immediate skin-to-skin contact between mother and newborn and early initiation of breastfeeding within the first hour after delivery (2).

Breastfeeding is associated with several short and long-term advantages for both the mother and child. The risk of neonatal mortality decreases with early initiation of breastfeeding in low and middle-income countries (3, 4). Early breastfeeding exposes the newborn to the maternal colostrum, "the first milk", which is rich in immune and non-immune substances that protects the newborn against infections and promotes intestinal maturation (3, 4). Breastfeeding has a protective effect against gastrointestinal and respiratory infections in infants and children below five years in both low and high-income countries (5), and a dose-response relationship between the duration of EBF and the risk of gastrointestinal infection is apparent (6). Breastfeeding, particularly exclusive, is also found to reduce the risk of acute middle ear infection in children below two years in high-income countries (7).

Long-term effects include protection against obesity and overweight in childhood and later life (8, 9). A reduced risk of type II diabetes mellitus is also suggested (8). A Lancet study from Brazil has found a relation between being breastfed for more than 12 months and better performance on intelligence tests, as well as having a higher level of education, 30 years later

(10). This finding is supported by a systematic review/meta-analysis, showing that any breastfeeding is associated with a higher score on intelligence tests in childhood and adolescence, even after controlling for maternal intelligence (11). For mothers, breastfeeding past 12 months is associated with a lower risk of breast cancer and ovarian cancer, and type II diabetes mellitus (12).

On average, 37% of infants under six months in low and middle-income countries are exclusively breastfed (13), despite the fact that breastfeeding is recognized as an important preventive measure in public health. Estimations show that 823 000 annual deaths in children under five years could be prevented in low and middle-income countries, if EBF practices in infants under six months and continued breastfeeding for up to two years were extended to near 100%. Furthermore, around 20 000 annual deaths from breast cancer in women worldwide could be prevented with a longer duration of breastfeeding for 1 – 2 years (13). Breastfeeding is also associated with economical gains for the society. One Lancet study has estimated that, when only considering the economic losses of reduced intelligence or cognitive capacity, the annual global loss of not reaching maximum levels of any breastfeeding at six months is around 302 billion US dollars (14).

## 1.2 Determinants of exclusive breastfeeding

There are several circumstances that may affect breastfeeding, which can be maternal, newborn or obstetric in nature and are often closely interlinked. Maternal age is one of them. Older age of the mother is positively associated with EBF at discharge in Canada (15), and EBF at 5.5 months after birth in Norway (16). A study from the USA suggests that the youngest mothers of ≤20 years have lower odds of EBF at six months compared to mothers ≥30 years (17). Possible explanations for why young mothers are less likely to breastfeed could be that they receive less targeted breastfeeding support at the maternity ward than older mothers (18), as well as other psychosocial factors related to young age (19).

The relation between maternal age and EBF might also be partly explained by parity (number of births per woman), although this link is more uncertain. Having previous children has been positively associated with EBF at two months and four months after birth in Sweden and Norway, respectively (20, 21). However, the association between parity and EBF found in this research is not consistent with previous studies. One study from Canada suggests that women with previous birth experience is less likely to exclusively breastfeed at discharge (15), whereas others again show no association between parity and EBF (22-24). Having a previous positive breastfeeding experience is associated with EBF (25), and this might be more influential on EBF than parity.

In high-income countries, higher education and high socioeconomic status are associated with increased rates of breastfeeding initiation and duration, for both EBF and any breastfeeding (16, 20, 26-28). In low and middle-income countries, on the other hand, the association between higher education and breastfeeding is shown to be inversed. In Ethiopia, higher maternal education is related to an early cessation of EBF before six months (29), and employed and single mothers are less likely to practice EBF than housewives and married mothers (30). These findings are confirmed by studies from Bangladesh (22), Pakistan (31), Saudi-Arabia (23) and Russia (32). The negative association between work and/or higher education and breastfeeding in low and middle-income countries might be explained by barriers to EBF for working mothers in the society. Paid maternity leave and a work environment that supports breastfeeding breaks is indicated to be effective measures to increase rates of EBF (14). Maternity protection legislation varies substantially worldwide, and according to the International Labour Organization, only 45% (74 out of 167 included countries) provide at least 14 weeks of paid maternity leave (payment of at least two-thirds of previous income). Overall, western countries, eastern Europe and central Asia offer the best coverage of maternity protection legislation (33).

Several studies show associations between maternal pre-pregnancy BMI and breastfeeding initiation and duration. In Norway, overweight and obese women have lower odds of successful initiation of breastfeeding, regardless of gestational weight gain (34), and lower odds of EBF at four months (20). A Danish study shows that severely obese women more often fail to initiate and sustain breastfeeding (35). A systematic review with studies from high-income countries, including one study from Russia, concludes the same. However, two of the studies from Denmark and Russia (that both displayed high initiation of breastfeeding rates), found no difference in breastfeeding duration in relation to maternal BMI (36). The association between high BMI and lower rates of breastfeeding might be related to latching difficulties, delayed or insufficient milk production after delivery, comorbidities, less intention to breastfeed and psychosocial factors like socio-economic status and body image dissatisfaction (36).

Caesarean section (CS), the surgical procedure of delivering the fetus through an incision of the mother's abdomen and uterus, could be life-saving if medically indicated. However, there are no evidence of benefits of CS for women or infants who do not need the procedure (37). Studies from both low and high-income countries indicate a negative association between CS and breastfeeding. CS reduces the likelihood of early initiation of breastfeeding (28, 38) and EBF at discharge (15, 39-41). The procedure is also associated with an early cessation of EBF within 2 months (21) and within 6 months (29), and a lower odds of EBF in infants less than six months (30). In addition to maternal and/or newborn distress, the effect of CS on early breastfeeding might be related to delayed onset of lactation, problems with newborn suckling, disrupted early skin-to-skin contact and mother-newborn interaction, and the postoperative hospital practice after a CS (41). Postoperative pain might also affect the mother's ability and intention to breastfeed (21). Nevertheless, if sufficient breastfeeding support is given to the mother, CS is not necessarily a barrier to early initiation of breastfeeding or EBF (14). One systematic review and meta-analysis found no association between CS and EBF at six months among the mothers that successfully initiated breastfeeding (41), indicating that adequate support to initiate breastfeeding is crucial in CS deliveries.

Studies from Canada and Australia suggest that reproductive assistance is negatively associated with EBF at discharge (15, 42). This might be related to a higher rate of planned CS in women that have undergone reproductive assistance (42). Maternal complications before or during delivery may also negatively affect initiation and duration of breastfeeding. Pregnancy and/or intrapartum complications is associated with lower odds of EBF at discharge in Canada (15). Furthermore, premature, distressed newborns and newborns with other moderate to severe morbidities are often transferred to a neonatal intensive care unit (NICU) after delivery to receive additional support, and initiation of breastfeeding is frequently delayed. In a study from the USA, low birth weight of $<1\ 500$ grams is associated with lower odds of EBF at six months compared to a birth weight of $\geq 2\ 500$ grams (17). An Italian study indicate low EBF rates at

NICU discharge (43), and in rural Australia, newborns admitted to a NICU have considerably lower odds of EBF at discharge (24).

In a systematic review of intervention studies, breastfeeding education and support increased the rates of EBF right after birth and up to five months after (44). Studies from Brazil and Germany show that prenatal information about the advantages of breastfeeding is positively associated with early initiation and any initiation of breastfeeding, respectively (26, 38). Having a prenatal intention to breastfeed is associated with EBF at discharge (39), and at four months after birth (42). Maternal satisfaction about the received breastfeeding support at the maternity ward is associated with higher odds of EBF at discharge in Australia (42), and mothers receiving breastfeeding support in Ethiopia are more likely to exclusively breastfeed for six months (29).

The Baby-Friendly Hospital Initiative (BFHI), a global initiative to promote and support breastfeeding, was launched in 1991 by WHO and UNICEF. To achieve status as baby-friendly, the maternity ward should implement the *Ten Steps to Successful Breastfeeding,* which includes (1) a written breastfeeding policy, (2) training of healthcare personnel, (3) breastfeeding information to pregnant women, (4) early initiation of breastfeeding, (5) breastfeeding support to mothers, (6) no in-hospital formula supplementation unless medically indicated, (7) practice of rooming-in (allow mothers and newborns to stay together 24 hours a day), (8) encouraging breastfeeding on demand, (9) no artificial teats or pacifiers to breastfeeding newborns, and (10) breastfeeding support groups (45). No in-hospital formula feeding is likely one of the most important steps, and any formula feeding within the first 48 hours after birth is associated with an earlier weaning of breastfeeding (46). The BFHI has shown to have a positive impact on both early initiation of breastfeeding, any breastfeeding and duration of EBF (47), and EBF at discharge (47, 48).

## 1.3 Healthcare and breastfeeding in Georgia


Figure 1. Map of Georgia.

Source and permission: The National Centre for Disease Control and Public Health, Tbilisi (49).

Located in the Caucasus region, Georgia is categorized as an upper-middle income developing country, ranked 70 of 188 countries in the 2015 Human Development Index (50). In 2017, the population of Georgia was about 3.7 million, mainly consisting of ethnic Georgians (87%) (51). Life expectancy at birth was 72.7 years in 2016 (49). Georgia introduced universal health care in 2013, which covers basic obstetric care, including at least four antenatal visits during pregnancy. In 2016, the total number of live births in the country was 56 569, and close to every Georgian woman delivers at a maternity ward with qualified healthcare personnel (99.9%) (49). The proportion of deliveries by CS in Georgia has increased considerably during the last decades, reaching 43.5% in 2016 (52). As opposed to European and neighboring countries, Georgia has more physicians than nurses, with a ratio of 0.8 nurse per physician (49).

In 1999, Georgia implemented a law of protection and promotion of breastfeeding as a response to low breastfeeding rates in the country (53, 54). The legislation is based on the WHO

*International Code of Marketing of Breast-milk Substitutes;* a set of recommendations to regulate the infant formula market and to promote breastfeeding (55). During the early 2000s, awareness increased about the advantages of breastfeeding in both the public and the Georgian health authorities. In 2004, 14 out of 78 maternity wards in the country had earned status as baby-friendly through the BFHI program (53). However, today there are no baby-friendly hospitals left in Georgia due to lack of follow-up on the initiative, and breastfeeding support after discharge is lacking at primary healthcare level [Personal communication, T. Ugulava, UNICEF Georgia, Oct 12$^{st}$ 2017].

Data concerning previous breastfeeding practice in Georgia is limited to national surveys that present inconsistent numbers. One survey from 2010 showed that 20% initiated breastfeeding within the first hour after delivery (56), whilst another survey from the same year found the amount to be 66% (57). According to a survey from 2005, only 11% of children under six months were exclusively breastfed (58), whereas in 2010 the proportion was reported to be as much as 55% (57).

With the newly established birth registry (from January 1$^{st}$ 2016), national data on maternal and perinatal health is available, including information about early postpartum breastfeeding. The Georgian Birth Registry (GBR) is the first national digital birth registry ever established in a developing country. The register includes prenatal, delivery and postnatal information, as well as information about abortions (52).

## 1.4 Objective

This master's thesis is a register-based study using data from the GBR. The objective is to identify predictors of exclusive breastfeeding at discharge in Georgia in term newborns.

# 2. Material and methods

## 2.1 The Georgian Birth Registry (GBR)

The GBR collects medical data from antenatal visits during pregnancy, the delivery and the postpartum period until discharge from the maternity ward, in addition to maternal and paternal characteristics. The registry is mandatory for all pregnant women in the country. In 2016, the first year of operation, the GBR registered 93.9% of the total amount of births in the country (52), and in 2017 the completeness of the registry reached 99.1%. Data entry is mainly performed by obstetricians and pediatricians. The GBR is based on the same structure as the Medical Birth Registry of Norway. Data storage, administration and quality control of the registry are provided by the National Centre for Disease Control and Public Health (NCDC), Tbilisi. The healthcare personnel responsible for registration receive formal training by the NCDC. The quality of selected core variables in the registry have been assessed and found satisfactory (52).

## 2.2 Study population

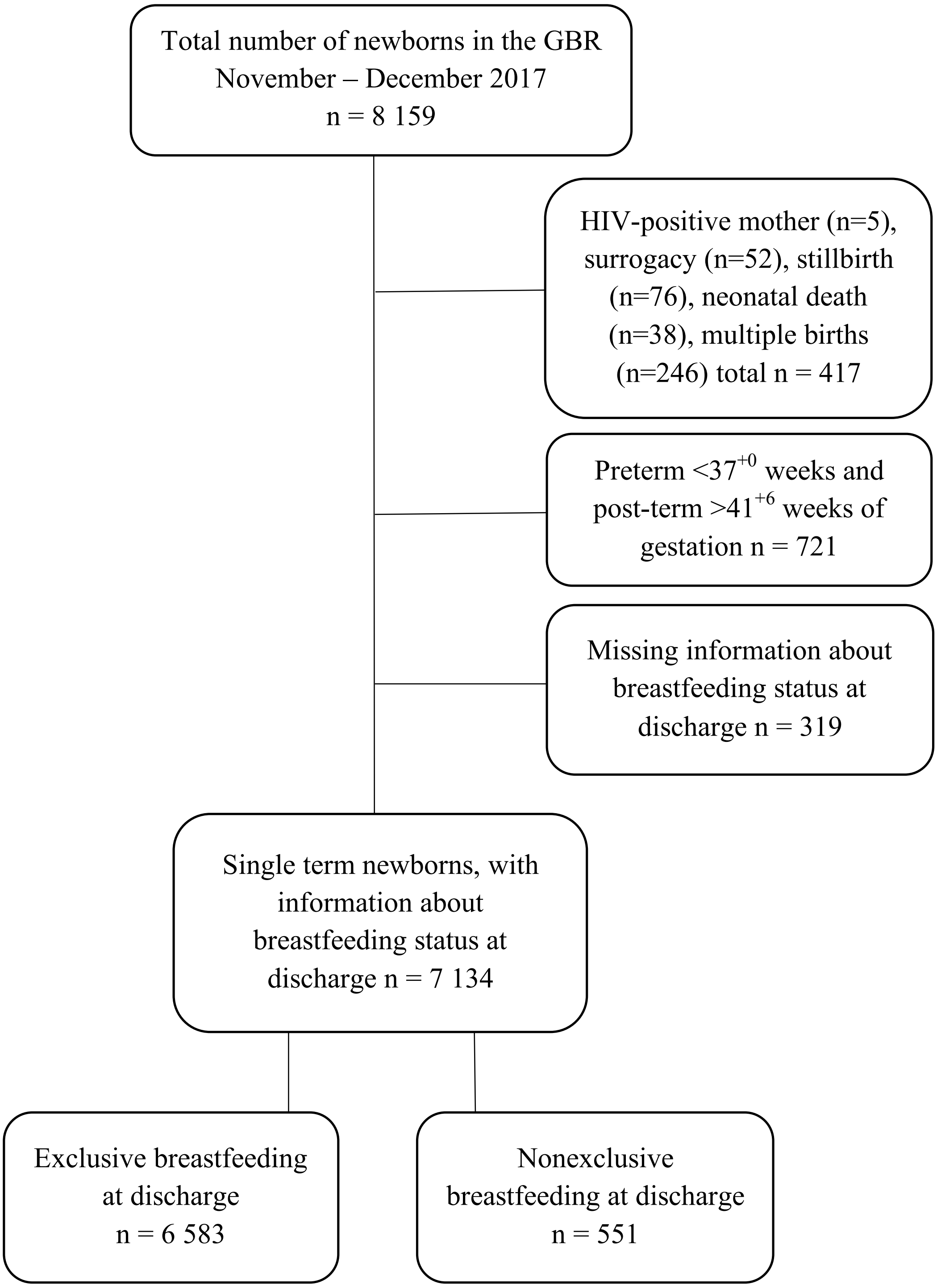
The study population consisted of all births registered from November 1st to December 31st 2017 in the GBR (n = 8 159 newborns). Data was only extracted from the two last months of 2017 because important changes to the breastfeeding variable were made in October 2017.

The study included newborns at term, born between $37^{+0}$ weeks and $41^{+6}$ weeks of gestation, in line with the standard definition of a term delivery (59). The gestational age (GA) was estimated by the first day of the last menstruation period (LMP) or by ultrasound screening. In the study sample, 70.1% of the GA-values were estimated by LMP, and the rest by ultrasound. The preferred way of estimating GA in Georgia is with a certain LMP, but if the LMP is missing or uncertain, ultrasound estimation is used.

Stillbirths and neonatal deaths were excluded from the study. Newborns with HIV-positive mothers were excluded since these women are not recommended to breastfeed in Georgia. Even if the number of new HIV-cases are increasing, Georgia is still considered a low prevalence HIV/AIDS country (49), and the current WHO guidelines for breastfeeding with HIV is intended mainly for countries with high prevalence (60). Newborns with a surrogate mother, which is allowed in Georgia, were also excluded, as these mothers are not likely to initiate breastfeeding. Multiple births were excluded because it is well established that mothers with twins or higher order multiples struggle more to initiate and continue breastfeeding their infants than mothers with singletons (15, 61). Lastly, newborns with missing information about breastfeeding status or unknown breastfeeding status at discharge were excluded. In total, 1 025 newborns were excluded. The final study population consisted of 7 134 live singletons born at term, with information about breastfeeding at discharge (Figure 1).

Figure 2. Flow chart of exclusion criteria and numbers excluded in the study population

Excluded numbers may not add up because some newborns were identified within more than one exclusion criteria.



## 2.3 Variables

### 2.3.1 Outcome variable

The outcome variable of interest was EBF at discharge, defined as if the newborn only received breast milk at the time of discharge. EBF was coded as 1, and nonexclusive breastfeeding was coded as 0 and included the registrations of mixed feeding, formula feeding and parenteral feeding. Unknown feeding was coded as missing and excluded from the study population (Figure 1).

### 2.3.2 Predictor variables

Potential predictor variables included in the study were maternal age, civil status, education level, body mass index (BMI), parity, reproductive assistance with In Vitro Fertilization (IVF), mode of delivery, maternal intrapartum complications, newborn gender, birth weight and admission to NICU. The variables were selected on the basis of existing literature.

Mother's age at the delivery date was given in years and used in a continuous form in the regression analysis. To display demographics, mother's age was further categorized in five groups; <20, 20 – 24, 25 – 29, 30 – 34 and ≥35 years old. The youngest age in the study sample was 14 years and the oldest was 52 years, which is biologically plausible, and no cut-offs were applied. Civil status was categorized into the three groups: single, which included a small number of divorced women (n = 2), married (reference group) and unknown. Education level was categorized into the three groups: completed secondary education or less (reference group), higher education and unknown. BMI was computed by dividing the mother's weight in kilograms at first antenatal visit (before week 12 of pregnancy) by the mother's height in meters squared. If the weight was not measured before week 12, the mother's self-reported pre-pregnancy weight was used. BMI was further categorized in four weight groups in accordance with the WHO classification system (62); underweight (<18.5 kg/m$^2$), normal weight (18.5 – <25 kg/m$^2$), overweight (25 – <30 kg/m$^2$) and obese (≥30 kg/m$^2$). Normal weight was set as the reference category, and extreme BMI-values were excluded (<15 and ≥60 kg/m$^2$) (63). Parity, the total number of births (live births and stillbirths) per woman, was categorized into four groups; 0, 1, 2 and ≥3 births. Three or more births were merged into one group because of low numbers. The current birth was not included in this variable. Reproductive assistance with IVF for the current birth was included as a dichotomous variable (yes/no).

Mode of delivery was categorized as a dichotomous variable. CS was coded as 1 and included both elective and emergency CS, and vaginal delivery was coded as 0 and included assisted delivery with forceps or vacuum, manual handling at breech delivery and cases of episiotomy. Maternal intrapartum complications that may affect breastfeeding were constructed as a dichotomous variable (yes/no) and coded as yes if the mother experienced at least one of the following conditions: (1) placenta praevia, (2) placental abruption, (3) meconium in amniotic fluid, (4) umbilical cord prolapse, (5) shoulder dystocia, (6) uterine rupture, (7) eclampsia during labor, (8) retained placenta, (9) uterine atony, or (10) hemorrhage with total amount of bleeding >500 ml.

Gender of the newborn was included as a dichotomous variable, where female was coded as 0 and male was coded as 1. Birth weight of the newborn right after delivery was measured in grams and further divided into five categories: <2 500 g, 2 500 – 2 990 g, 3 000 – 3 490 g, 3 500 – 3 990 g and ≥4 000 g. Extreme values of <500 g and >7 000 g was excluded. The group which included the mean value (3 000 – 3 490 g) was set as the reference category. Newborn admission to a NICU after delivery was included as a dichotomous variable (yes/no). Unknown NICU was coded as missing because of small numbers of unknown in the sample (n = 129).

## 2.4 Statistical analysis

All statistical analysis was conducted using the software environment R version 3.4.3. Demographic characteristics of the mothers and their newborns according to breastfeeding status at discharge (EBF or non-EBF) were compared using independent t-test, Wilcoxon rank-sum test (for BMI because normality was not assumed) or chi-square test, and presented with mean/median and measures of variance, proportions and total numbers.

Logistic regression was used to assess the potential predictors of EBF at discharge. The analyses were performed in accordance to the model building strategy described in Veierød et al. (64). At first, univariable models were fitted to test for significance between each predictor variable and EBF at discharge. The predictor variables significant at the 0.25 level in the univariable model were initially selected for inclusion in the multivariable model. Stepwise elimination was applied, and the full and reduced model were compared using the likelihood ratio test if more than one variable was removed. The change in the coefficients (ß) of the remaining variables were computed to test if the removed variable(s) were needed to adjust for others in the model. If one coefficient changed by more than 20%, the variable was kept as a confounder in the final model. These steps were repeated until all variables left in the model were either significant or important confounders of other variables in the model. Only subjects without missing values on the predictor variables in the final model were included (n = 6 993).

Plausible interactions were tested between maternal age and parity, education level and parity, education level and delivery mode, maternal age and delivery mode, parity and delivery mode, and NICU and birth weight. Case-wise diagnostics were examined with residual and influence statistics, and multicollinearity were checked with the variance inflation factor (VIF) and tolerance values. The final model was tested for overall goodness-of-fit using the Hosmer-

Lemeshow test. The results are presented with odds ratios (OR) and confidence intervals (CI), using significance level 0.05.

## 2.5 Missing data

A total number of 319 newborns were excluded from the study because of missing information about breastfeeding status or unknown breastfeeding status at discharge. When manually exploring these cases, 184 of the newborns would already have been excluded because of other exclusion criteria such as prematurity. Of the 135 newborns that were excluded because of missing or unknown information about breastfeeding, 50.3% were delivered by CS compared to 42.7% in the study sample, and more of them were transferred to a NICU (13.3% compared to 4.4%). In addition, a lower proportion of the women where nulliparous before the current birth (34.8% compared to 40.1%).

All predictor variables in the study sample had less than 0.1% missing data except BMI with 13.1% missing. BMI was a constructed variable of the mother's height and weight, and the missing component was mainly weight. If the woman did not measure her weight at first antenatal visit (before week 12 of pregnancy), or did not give information about pre-pregnancy weight, the BMI was coded as missing. The subjects with missing BMI values did not differ from the ones with information about BMI.

## 2.6 Ethical considerations

Registration in the GBR is mandatory for pregnant women and newborns in Georgia. The mothers and their newborns are anonymized in the registry before data export; names and identification numbers have been deleted and replaced with running numbers and codes. There is no key available that can restore the data to the original form.

The Regional Committee for Medical and Health Research Ethics (REC) of Northern Norway have concluded that no permission from them is necessary (2017/404/REK Nord). In addition, the legal department at UiT the Arctic University of Norway has concluded that no further permissions from the National Centre for Research Data is needed. No burden will befall the mothers or newborns in the registry as part of this project.

# 3. Results

## 3.1 Demographic characteristics

The study population consisted of 7 134 singletons born at term and registered in the GBR between November 1st and December 31st 2017. The mother-newborn pairs were divided into two groups in accordance with breastfeeding status at discharge; EBF (n = 6 583) or non-EBF (mixed/formula/parenteral feeding) (n = 551). As such, 92.3% of the newborns were exclusively breastfed at discharge.

The mean age of the mothers at delivery was 27.5 years (±5.65), and the mothers who exclusively breastfed their newborn at discharge was on average 1 year younger than the ones who did not. Around half of the mothers in the study were married (50.4%) and had an education level of secondary school or less (56.0%). However, significantly more mothers in the non-EBF group had higher education (45.6% compared to 34.9%). There was no difference in BMI between the two groups, with a median BMI of 22.9 in the total sample. Significantly more women who did not exclusively breastfeed at discharge expected their first child (43.0% compared to 39.8%). Additionally, there were significantly more CS deliveries in the non-EBF group (53.8% compared to 41.7%). Newborns who were not exclusively breastfed at discharge weighed on average 90 grams less (3 274 g compared to 3 364 g), and they were more likely to have been admitted to a NICU after delivery (43.7% compared to 1.8%). Pregnancies conceived by IVF, maternal intrapartum complications and the newborn gender distribution did not differ significantly between the two groups. However, there was a slightly higher proportion of IVF pregnancies and intrapartum complications among the mothers that did not exclusively breastfeed at discharge. The demographic characteristics are presented in Table 1.

Table 1. Demographic characteristics of the mothers and newborns according to breastfeeding status at discharge. The Georgian Birth Registry, November – December 2017 (n = 7 134).

| | Exclusive breastfeeding | Nonexclusive breastfeeding | p value | Both groups combined | Total N† |
|---|---|---|---|---|---|
| N (mother-newborn pairs) | 6583 | 551 | | 7134 | |
| **Mothers** | | | | | |
| Age, mean (sd) | 27.4 (5.63) | 28.4 (5.75) | **<0.001** | 27.5 (5.65) | |
| Age % | | | **0.003** | | |
| <20 | 6.8 | 5.3 | | 6.7 | 475 |
| 20 - 24 | 26.4 | 21.4 | | 26.0 | 1855 |
| 25 - 29 | 33.2 | 33.9 | | 33.3 | 2373 |
| 30 - 34 | 21.8 | 22.9 | | 21.9 | 1560 |
| ≥35 | 11.8 | 16.5 | | 12.2 | 871 |
| Civil status % | | | 0.13 | | |
| Single | 13.1 | 11.3 | | 13.0 | 924 |
| Married | 50.1 | 54.4 | | 50.4 | 3598 |
| Unknown | 36.8 | 34.3 | | 36.6 | 2612 |
| Education % | | | **<0.001** | | |
| Secondary school or less | 56.7 | 48.5 | | 56.0 | 3996 |
| Higher education | 34.9 | 45.6 | | 35.8 | 2551 |
| Unknown | 8.4 | 6.0 | | 8.2 | 586 |
| BMI, median (25th - 75th percentile) | 22.9 (20.5 - 26.0) | 23.2 (20.8 - 26.6) | 0.14 | 22.9 (20.6 - 26.1) | |
| BMI % | | | 0.23 | | |
| <18.5 | 7.5 | 7.0 | | 7.5 | 465 |
| 18.5 - <25 | 60.3 | 59.5 | | 60.3 | 3735 |
| 25 - <30 | 21.6 | 20.0 | | 21.5 | 1334 |
| ≥30 | 10.5 | 13.4 | | 10.7 | 663 |
| Parity % | | | **0.03** | | |
| 0 | 39.8 | 43.0 | | 40.1 | 2860 |
| 1 | 38.4 | 32.5 | | 37.9 | 2707 |
| 2 | 16.9 | 18.0 | | 17.0 | 1210 |
| 3 and above | 4.9 | 6.5 | | 5.0 | 357 |
| In Vitro Fertilization % | 0.7 | 0.9 | 0.42 | 0.7 | 48 |
| **Delivery** | | | | | |
| Mode of delivery % | | | **<0.001** | | |
| Vaginal delivery | 58.3 | 46.2 | | 57.3 | 4089 |
| Caesarean section | 41.7 | 53.8 | | 42.7 | 3041 |
| Maternal intrapartum complications % | 4.8 | 5.4 | 0.58 | 4.9 | 347 |
| **Newborns** | | | | | |
| Newborn gender % | | | 0.88 | | |
| Female | 48.3 | 48.7 | | 48.3 | 3447 |
| Male | 51.7 | 51.3 | | 51.7 | 3685 |
| Birth weight in grams, mean (sd) | 3364 (426.5) | 3274 (516.9) | **<0.001** | 3357 (434.8) | |
| Birth weight in grams % | | | **<0.001** | | |
| <2500 | 1.5 | 5.1 | | 1.8 | 125 |
| 2500 - 2990 | 15.4 | 19.2 | | 15.7 | 1121 |
| 3000 - 3490 | 44.0 | 41.9 | | 43.9 | 3127 |
| 3500 - 3990 | 30.5 | 26.1 | | 30.1 | 2148 |
| ≥ 4000 | 8.6 | 7.6 | | 8.5 | 606 |
| Admission to NICU % | 1.8 | 43.7 | **<0.001** | 4.4 | 308 |

Sd=standard deviation, BMI=Body Mass Index, NICU=neonatal intensive care unit.

†For some variables, the numbers do not add up to the total (n=7134) because of missing values: education n= 7133, BMI n=6197, delivery mode n=7130, newborn gender n=7132, birth weight n=7127 and NICU n=7005.

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## 3.2 Logistic regression

In the univariable analyses, older age of the mother, higher education, delivery by CS, low birth weight and admission to NICU were all negatively associated with EBF at discharge. Having one previous birth compared to being nulliparous was positively associated with EBF at discharge.

After adjusting for other variables in the multivariable analysis, maternal age and parity was no longer significantly associated with EBF at discharge. Education, mode of delivery, birth weight and admission to NICU after delivery were identified as predictor variables for EBF at discharge. Mothers with higher education were 25% less likely to exclusively breastfeed their newborn at discharge compared to mothers with secondary education or less (OR 0.75 [95% confidence interval 0.59 – 0.97]). Newborns delivered by CS were 53% less likely to be exclusively breastfed at discharge compared to newborns with a vaginal or assisted vaginal delivery (OR 0.47 [0.37 – 0.60]). The newborns with the lowest birth weight (<2 500 grams) had 49% lower odds of EBF at discharge compared to newborns weighing 3 000 – 3 490 grams (OR 0.51 [0.27 – 0.97]). In addition, admission to a NICU after delivery was strongly associated with non-EBF at discharge. Newborns admitted to NICU were 98% less likely to be exclusively breastfed at discharge compared to newborns who were not (OR 0.02 [0.02 – 0.03]). None of the tested interaction terms were significant. The results from the univariable and multivariable analyses are presented in Table 2.

Table 2. Odds ratios with 95% confidence intervals of exclusive breastfeeding at discharge. The Georgian Birth Registry, November – December 2017 (n = 7 134).

| | | Univariable analysis† | Multivariable analysis‡ |
|---|---|---|---|
| Mother's age | | **0.97 [0.96 - 0.98]** | 0.98 [0.96 - 1.00] |
| Civil status | | | |
| | Single | 1.26 [0.96 - 1.69] | - |
| | Married | Reference | - |
| | Unknown | 1.17 [0.97 - 1.41] | - |
| Education | | | - |
| | Secondary school or less | Reference | Reference |
| | Higher education | **0.66 [0.55 - 0.79]** | **0.75 [0.59 - 0.97]** |
| | Unknown | 1.20 [0.84 - 1.77] | 1.28 [0.82 - 2.09] |
| BMI | | | |
| | <18.5 | 1.06 [0.74 - 1.56] | - |
| | 18.5 - <25 | Reference | - |
| | 25 - < 30 | 1.06 [0.84 - 1.36] | - |
| | ≥30 | 0.77 [0.58 - 1.03] | - |
| Parity | | | |
| | 0 | Reference | Reference |
| | 1 | **1.28 [1.04 - 1.56]** | 1.13 [0.86 - 1.47] |
| | 2 | 1.01 [0.80 - 1.30] | 0.89 [0.64 - 1.26] |
| | 3 and above | 0.81 [0.56 - 1.18] | 0.81 [0.49 - 1.37] |
| In Vitro Fertilization | | 0.72 [0.31 - 2.08] | - |
| Mode of delivery | | | |
| | Vaginal delivery | Reference | Reference |
| | Caesarean section | **0.61 [0.52 - 0.73]** | **0.47 [0.37 - 0.60]** |
| Maternal intrapartum complications | | 0.88 [0.61 - 1.32] | - |
| Newborn gender | | | |
| | Female | Reference | - |
| | Male | 1.02 [0.85 - 1.21] | - |
| Birth weight in grams | | | |
| | <2500 | **0.28 [0.18 - 0.44]** | **0.51 [0.27 - 0.97]** |
| | 2500 - 2990 | **0.76 [0.60 - 0.97]** | 0.83 [0.61 - 1.14] |
| | 3000 - 3490 | Reference | Reference |
| | 3500 - 3990 | 1.11 [0.90 - 1.38] | 1.17 [0.88 - 1.55] |
| | ≥4000 | 1.07 [0.77 - 1.53] | 1.18 [0.78 - 1.86] |
| Admission to NICU | | **0.02 [0.02 - 0.03]** | **0.02 [0.02 - 0.03]** |

BMI=Body Mass Index, NICU=neonatal intensive care unit.

†Complete case analysis: education n=7133, BMI n=6197, delivery mode n=7130, newborn gender n=7132, birth weight n=7127 and NICU n=7005.

‡Complete case analysis: n=6993.

# 4. Discussion

## 4.1 Main findings

The study identified several negative predictors of EBF at discharge; higher education of the mother compared to secondary education or less, delivery by CS compared to vaginal delivery, low birth weight <2 500 grams compared to 3 000 – 3 490 grams, and admission to NICU.

### 4.1.1 Maternal predictors

In line with research from other low and middle-income countries (22, 23, 29, 31, 32), the current study showed that mothers with higher education were less likely to exclusively breastfeed their newborns at discharge. This finding is the opposite of what is seen in most high-income countries (16, 20, 26-28).

The association between education and EBF in Georgia might be related to the work situation of the mothers. Even if the study did not include work as a predictor variable, highly educated mothers are probably more likely to have a good job with a decent salary than less educated mothers. Furthermore, breastfeeding, and particularly exclusive, for working mothers with higher education are related to the prospective of paid maternity leave and breastfeeding breaks during work hours. The International Labour Organization states that the goal of maternity protection legislation is to enable women to combine the maternal role with work, without being discriminated in the workplace (33). According to the Labour code of Georgia, the mother is entitled to 183 days (~26 weeks) of paid maternity leave financed by the state, where the paid leave is a maximum of 1 000 Georgian Lari in total (65), equalling around 338 EUR. Furthermore, it is stated in the legislation that employers and employees could agree on additional benefits (65). In the public sector, the amount of maternity leave pay is usually closer to the mother's salary before birth because of additional benefits. Conversely, the private sector in general does not provide these benefits [Personal communication, T. Manjavidze, Mar 15st 2018]. By only receiving approximately 338 EUR for the whole maternity leave period, highly educated mothers working in the private sector may face more pressure to go early back to work for financial reasons, and hence not prioritize EBF to begin with.

If the mother decides to go back to work early, the Labour code of Georgia states that working mothers with infants may get an additional break of at least one hour per day for breastfeeding, and that this break should be paid (65). However, it is not socially acceptable to breastfeed in public in Georgia [Personal communication, T. Manjavidze, Mar 15st 2018], and finding an appropriate spot to breastfeed at work may be challenging.

Before adjusting for other variables, younger age of the mother was positively associated with EBF at discharge; in contrast to what is found in several high-income countries (15-17, 19). The association between older age and breastfeeding might be related to parity and previous breastfeeding experience (19, 25). Having one previous birth compared to being nulliparous was positively associated with EBF at discharge in the univariable analysis as well, even if this study did not separate between live births and previous stillbirths. To be able to explain why younger mothers were more likely to exclusively breastfeed, one may have to consider the maternity protection legislation in Georgia. Younger mothers are more likely to be students, and with the maternity leave in Georgia in mind, studies would likely be easier to combine with EBF than work for many women.

### 4.1.2 Mode of delivery

Newborns delivered by CS were less likely to be exclusively breastfed at discharge compared to newborns by vaginal or assisted vaginal delivery. This finding is in accordance with other studies (15, 39-41). The proportion of CS deliveries is noticeably higher in Georgia (43.5% in 2016) (52) compared to the mean in European countries (25.2% in 2010) (66). Considering the high CS rates in Georgia, the negative association with early postpartum EBF compared to vaginal delivery is of particular interest. Excessive use of CS is associated with several short and long term health risks for the mother and newborn (37), and a lower odds of EBF at discharge adds to the list of risks.

Today, there are no baby-friendly hospitals in Georgia. One of the *Ten steps to Successful Breastfeeding* in the BFHI is immediate skin-to-skin contact and early initiation of breastfeeding. This also applies to CS deliveries with regional anesthesia, since the mother is awake during the procedure. For CS with general anesthesia, skin-to-skin contact should happen as soon as the mother is responsive and alert (45). Without the baby-friendly accreditation, Georgian hospitals and maternity wards are likely not focusing enough on early initiation of breastfeeding in the operating theatres after a CS. In the study sample, 19.1% of the newborns delivered by CS did not initiate breastfeeding within one hour after birth, whereas for vaginal deliveries this proportion was 3.2% (data not shown in tables). One systematic review suggests that adequate breastfeeding support after a CS reduces the negative association between CS and early initiation of breastfeeding entirely (14). Another review found that amongst the ones that successfully initiated breastfeeding, there was no difference in EBF at six months between CS and vaginal delivery (41). These findings indicate that a supportive breastfeeding environment after a CS delivery, with proper postoperative pain management, could substantially improve both rates of EBF at discharge and later in the postpartum period.

An association between anesthesia during delivery and breastfeeding has been proposed. One Turkish study indicate that CS with general anesthesia delays the onset of lactation compared to CS with spinal or epidural anesthesia (67). When only looking at the CS group in the study sample, 18.1% of the mothers that received spinal or epidural anesthesia did not initiate breastfeeding within one hour, compared to 25.5% of the mothers that received general anesthesia. However, no significant difference was observed between the groups for EBF at discharge (data not shown in tables). This finding suggests that mothers receiving general anesthesia needs additional time to recover before starting to breastfeed their newborn, but that during the hospital stay they manage to breastfeed at the same rate as mothers who had CS with spinal or epidural anesthesia.

CS was not further divided into emergency and elective CS, and the rationale behind this decision is discussed in section 4.2.1.

### 4.1.3 Newborn predictors

Newborn admission to a NICU had a large negative impact on EBF at discharge, a finding which is in line with other studies (24, 43). This is an expected finding, as EBF often cannot be prioritized in an intensive care setting. However, even if the present study excluded premature newborns, the association between NICU admission and EBF at discharge was very strong (OR 0.02 [0.02 – 0.03]). Additionally, newborns with low birth weight (<2 500 grams) were less likely to be exclusively breastfed at discharge compared to newborns weighing 3 000 – 3 490 grams. Low birth weight is associated with lower odds of EBF in previous studies as well (17).

An expansion of the BFHI has been developed for use in NICUs, where the *Ten Steps to Successful Breastfeeding* are adapted for preterm and sick newborns. The steps include early and prolonged mother-newborn skin-to-skin contact, also known as Kangaroo Mother Care, and support to establish early breastfeeding with newborn physiological stability as the only criterion – not newborn age, weight or other criteria (68). This is important, as early initiation of breastfeeding reduces the risk of neonatal mortality, also among the low birth weight newborns (3). In the present study, 44.2% of the newborns admitted to a NICU and 24.8% of the newborns with low birth weight did not initiate breastfeeding within 24 hours after birth, compared to 13.1% of all the newborns staying in maternity wards (data not shown in tables). The numbers suggest that more resources could be directed to support early breastfeeding in the NICU and for low birth weight newborns in Georgia.

The BFHI expansion to neonatal intensive care recommends that human donor milk should be the second-best option when mother's own milk is not obtainable, considering that sick newborns receive particular benefits from human milk like host protection (68). There is no tradition for donor milk in Georgia, but the mothers are able to keep their own milk in a refrigerator at the NICU. Additionally in the BFHI expansion, rooming-in, where mothers and newborns are staying together in the NICU, is proposed as a step to facilitate continuous breastfeeding (68). Rooming-in at NICUs may not be feasible in all settings, but the mother should then get the opportunity to stay close to the NICU. In Georgia, the mother-newborn interaction at the NICU are regulated by visiting hours, which are decided by each hospital and often limited to 1 – 2 hours a day. In cases where the newborn needs to be transferred to another hospital with an operating NICU, the newborn is often separated from their mother for a longer period of time, and to stay close to the newborn the mother has to pay out-of-pocket.

Although the expansion of the BFHI to NICUs is not widespread yet, some countries, like Norway, have developed their own BFHI guidelines for NICUs (69). Research from one hospital in the USA suggest that interventions from the BFHI have significantly increased rates of breastfeeding at the NICU (70). The BFHI with an expansion to the NICUs in the country is a great opportunity for Georgia to increase the rates of EBF and any breastfeeding in newborns requiring intensive care.

## 4.2 Strengths and limitations

The GBR collects information about close to all births in the country of Georgia (99.1% in 2017), and the response rate is not an issue because participation in the registry is mandatory. Therefore, the study is not prone to volunteer or selection bias. The healthcare personnel who collected the data were blinded, in the sense that they did not know the purpose of this single study, and neither did the mothers. Most of the variables, including EBF at discharge, delivery and newborn characteristics, were based on observation by healthcare personnel, and not based on self-reporting from the mothers.

Even if the study comprised a relatively large sample size (n = 7 134), the group of newborns that was not exclusively breastfed at discharge was comparably small (n = 551) to the EBF at discharge group (n = 6 583). This may have led to larger CIs than if the groups were more equal in size or the sample size was bigger.

There is no follow-up after discharge in the GBR, meaning the study does not have access to data about breastfeeding for more than 3 – 5 days postpartum. According to UNICEF Georgia, the rate of EBF drops rapidly after discharge [Personal communication, T. Ugulava, UNICEF Georgia, Oct 12st 2017], which also is indicated by one national survey (58). UNICEF Georgia is currently establishing a child follow-up program to improve primary healthcare provision for children, which includes home visits and breastfeeding counselling for mothers and infants. Hence, it would be interesting to study prevalence and predictors of EBF in Georgia at for instance two months and six months after birth, using data from the child follow-up program linked with the GBR.

### 4.2.1 Confounding

The study adjusted for several confounders. However, the study did not include gestational age (GA) as a confounder. Even if the study population only consisted of newborns at term, important differences between a GA at $37^{+0}$ weeks and a GA at $41^{+6}$ weeks would still exist. GA is in particular closely interlinked with the newborn predictors birth weight and admission to NICU, and including GA as a confounder would likely have rendered these estimates to be more conservative than the presented results.

Furthermore, the study did not include maternal smoking as a potential predictor and confounder because of missing information in the GBR on the smoking variable. Maternal smoking is a voluntary variable in the GBR, thus it is prone to underreporting. In addition, smoking is not common among young women in Georgia. Nevertheless, maternal smoking is identified as a negative predictor of EBF and breastfeeding duration in several studies from other countries (15, 16, 26, 28). Maternal smoking is associated with other social determinants of health, as well as low birth weight and other complications related to pregnancy and childbirth (71). Hence, smoking could have adjusted the effect of a number of included predictor variables in the study like education level, birth weight, maternal intrapartum complications and admission to NICU.

Several studies suggest a difference in breastfeeding outcomes between emergency and elective CS (15, 41, 72). In this study, emergency CS was a stronger negative predictor for EBF at discharge than elective CS, both compared to vaginal delivery [Adjusted OR 0.40 (0.31 – 0.51) and 0.70 (0.50 – 0.99), respectively)] (data not shown in tables). However, CS deliveries by subgroup was not included in the study because of misclassification of the variable in the GBR. In an aggregated study of European countries, the median proportion of emergency CS was

12.9% compared to 10.7% for elective CS for all births (66). In Georgia, the proportion of emergency CS was recorded to be remarkably higher than the proportion of elective CS, considering the European aggregated proportions. In the initial population of this study, 30.8% of all births were emergency CS and 14.3% were elective CS (data not shown in tables), suggesting a considerable amount of misclassification in favor of emergency CS. Had reliable data been available, separating the CS group into planned and emergency CS would be important to adjust for related variables like reproductive assistance, maternal intrapartum complications and birth weight.

There are additional variables that could be included in the study, but they were not recorded in the GBR and hence not available for inclusion. The GBR does not collect information about the women's *intention to breastfeed* before birth, which could be an important predictor and/or confounder. Previous studies have found a strong positive association between prenatal intention to breastfeed and later EBF (39, 42, 73). In addition, information about the amount of breastfeeding information and support the woman received in antenatal and postnatal care, and previous breastfeeding experience (positive or negative) was not available. Previous positive breastfeeding experience might be more influential on current EBF practice than parity (25), and breastfeeding information and support is positively associated with EBF (29, 42, 44).

### 4.2.2 Bias

A considerable proportion of the term newborns in the study were exclusively breastfed at discharge (92.3%). This high proportion raise the concern of reporting bias by the healthcare personnel on the breastfeeding variable. Potential misclassification of type of newborn feeding at discharge by the healthcare personnel cannot be ruled out. However, before applying the exclusion criteria, 85.0% of all newborns were exclusively breastfed at discharge. Prevalence figures of EBF at discharge in other countries varies substantially, from 61.6% in Canada (only term newborns) (15), 82.7% in rural Western Australia (24), 86.9% - 93.1% in the Czech Republic (48), to 93.5% in rural China (only healthy singletons) (74). A national survey from Statistics Norway in 2013 revealed that 84% of the mothers were exclusively breastfeeding at two weeks after birth (75). The prevalence of EBF in other countries at discharge and in Norway at two weeks supports that the high EBF prevalence at discharge in Georgia is a plausible finding.

The GBR was launched in 2016, and it takes time to establish good practices for proper reporting (52). This is evident for some variables, for instance maternal intrapartum complications. Even if the variable was a merge of several complications the mother can experience during delivery, the prevalence of maternal intrapartum complications in the study was low (4.9%), indicating a considerable underreporting of complications in the GBR. This underreporting could have masked a potential effect of maternal intrapartum complications on EBF at discharge.

Additionally, the register data is collected from maternity wards all over the country, indicating that the healthcare personnel have different training in how to assess certain conditions of the mother and newborn. The variable maternal intrapartum complications are particularly subject to this, because many of the complications included in the variable are based on the judgement of the healthcare personnel attending the particular birth. Register data is also vulnerable to data entry errors. Both of these problems could potentially introduce bias, but we do not know to which extent.

Of the 8 159 newborns in the initial sample, 135 were excluded because of missing or unknown breastfeeding status at discharge. The excluded cases were compared to the study sample (n = 7 134), and the newborns excluded experienced a higher proportion of CS and admission to NICU. Both CS and admission to NICU were negative predictors of EBF at discharge, suggesting that there was a higher proportion of non-EBF at discharge in the excluded cases. Hence, missing information on the main outcome variable could possibly have rendered the odds ratios of CS and NICU to be conservative estimates of the true effect.

Some of the included predictor variables had missing data; however, all variables had less than 0.1% missing, except for BMI with 13.1% missing. As described in section 2.5, the missing values on BMI were mainly because of missing information on maternal weight before gestational week 12 or missing pre-pregnancy weight. In comparison, the Medical Birth Registry of Norway started recording maternal height and weight at first antenatal visit in 2006, and missing information on BMI is still substantial. In a study using registry data from 2009 – 2012, 53.2% of the pregnancies had missing information on maternal height and/or weight (76). The cases with missing maternal BMI in this study were compared against the included cases, and they did not differ significantly. Thus, the assumption is that the exclusion of these cases did not bias the effect estimates.

EBF at discharge denoted newborn discharge, but the newborns could potentially be discharged without their mother. If the mother experienced severe complications during or after delivery, the maternal discharge would likely be delayed. The study did not make any distinction here, and the assumption that newborns who were not discharged at the same time as their mother would have the same access to breastfeeding might be incorrect.

### 4.2.3 External validity

Because the study sample is based on national register data, the results could be generalized to the country of Georgia. The registry does not include out-of-clinic deliveries; hence the results could not be generalized to this group. However, there is no tradition for home deliveries in Georgia, making up only around 0.1% of all deliveries in 2016 (49). The results could to some extent be generalized to neighboring countries with the same cultural or religious background and human development. In Georgia, 87% of the population is of Georgian origin, and the other large groups are from the neighbor countries Azerbaijan (6.3%) and Armenia (4.5%) (51). However, Azerbaijan is a predominantly Muslim country, as opposed to Georgia and Armenia which are Orthodox countries. The results could have validity in countries with high CS rates and similar health system structure as Georgia.

## 5. Conclusion

This master's thesis aimed to investigate potential predictors of EBF at discharge in Georgia in term newborns, using data from the GBR. The study identified maternal higher education, delivery by CS, low birth weight and admission to NICU as negative predictors of EBF at discharge. Mothers with higher education were 25% less likely to exclusively breastfeed at discharge compared to mothers with secondary education or less. This finding implies that the maternity protection legislation in Georgia has potential for improvements with regards to increasing the prospect of EBF for highly educated mothers. Newborns delivered by CS were 53% less likely to be exclusively breastfed compared to vaginal delivered newborns. This finding is important, as the amount of CS in Georgia increases every year, reaching 43.5% in 2016 (52). Hence, CS affects a considerable number of newborns in the country, and early postpartum breastfeeding will benefit if the trend is reversed. Newborns with low birth weight (<2 500 grams) were 49% less likely to be exclusively breastfed compared to newborns with a birth weight of 3 000 – 3 490 grams, and newborns admitted to a NICU after delivery were 98% less likely to be exclusively breastfed compared to newborns staying in the maternity ward. The strong association between admission to NICU and EBF is of particular concern, revealing that more resources and effort has to be directed to support breastfeeding in the NICU.

To the author's knowledge, this is the first time EBF has been studied in Georgia, and certainly for the first time using national birth registry data. The research will be valuable for the national health authorities when developing guidelines and setting new priorities in maternal and child health, as well as for non-governmental organizations working with breastfeeding. Hopefully, this thesis will also help increase awareness about breastfeeding in maternity wards and hospitals all over Georgia.

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