Relationships between demographic factors and breastfeeding prevalence on the day of birth and after two weeks

An observational study in infants born from 2010 to 2015 of the Dutch area 'Hollands Midden'

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Abstract

Background: Breastfeeding is the most efficient food during the first months after birth. In comparison to other European countries, the prevalence of breastfeeding in the first months after birth in the Netherlands is relatively low. A target from the Department of Health and Human Services of the USA government is that by 2020, 81.9% of the USA infants to ever be breastfed. The aim of this study is to determine associations of demographical factors such as ethnicity, education level, maternal age, family composition and municipality of living with breastfeeding prevalence on the day of birth and in week 2-3 after birth, in the area of 'Hollands Midden" (HM), in the West of the Netherlands.
Methods: Data about 44 564 infants and their parents were available. This covers approximately 91% of the target population. The study population included 39 890 children who have had a standard visit at home approximately two weeks after birth by municipal health service HM from 2010 till 2015. The outcome variables are a child receiving partly or exclusively breast milk on the day of birth (T1) and exclusively breast milk in week 2-3 after birth (T2). Analyses were performed by chi-square tests and prediction models. Prediction models were a priori stratified by the mother's country of birth.
Results: 76.7% of the children received breast milk on T1. 60.6% received exclusively breast milk on T2. Mothers born in the Netherlands significantly less often fed their children with breast milk than mothers born in East-Europe, other Western countries, Morocco and other non-Western countries on both T1 and T2. Also, infants who were part of a multiple birth showed a significantly smaller odds' on receiving breast milk than infants of single births, especially on T2 [odds ratio (95% CI) for children with Dutch mothers: 0.32 (0.26 – 0.38)]. In general, second born children in the family have a smaller odds on receiving breast milk than first born children and children born in a family with two or more older children. Among infants of Dutch mothers, education level is strongly positively related to breastfeeding prevalence on both T1 and T2. Breastfeeding prevalence is significantly lower in the municipalities of Katwijk and Lisse on both T1 and T2.
Conclusions: In order to increase the breastfeeding prevalence in the area of HM, action is required. Mothers that were born in the Netherlands should be prioritised when it comes to education about breastfeeding, especially when they are expecting their second child in the family or when the parents have not been educated on a high level. Also pregnant women in the municipalities of Katwijk and Lisse and women who are expecting a multiple birth should be prioritised when it comes to education about the importance of breastfeeding, by the municipal health service of area HM.

Introduction

Prevalence and health benefits and of breastfeeding

The World Health Organisation (WHO) recommends to feed children exclusively with breast milk in the first six months after birth and to continue breastfeeding until the child is two years old, along with complementary foods (1). The WHO also recommends early initiation of breastfeeding. Mothers should feed their first milk within an hour after birth (2). Part of the Healthy People 2010 target was for 75% of the children born in the United States of America (USA) to be breastfed directly after birth (3). Part of the Healthy People 2020 target is for 81.9% of newly born babies in the USA to ever be breastfed (4).

In comparison to other European countries, the prevalence of breastfeeding in the first months after birth in the Netherlands is beneath average. In the Netherlands, at the age of three months, the amount of infants fed with breast milk is lower in only three out of fifteen other European countries (5). The biggest decline in breastfed infants occurs in the first two weeks after birth (5). In 2015, a decline from 80% of the infants that received breast milk on the day of birth to 59% two weeks after birth and 58% three weeks after birth was seen in a survey by TNO (5).

Research has shown that breastfeeding prevents the child of obesity, on short term and in later life (6; 7; 8; 9; 10). In Europe, prevalence of obesity is already three times as high as it was in the 1980s (11). Especially among children, prevalence rates are still growing fast (11). Moreover, breastfeeding has been associated with lower obesity prevalence among mothers (12; 13). Obesity increases the risk to develop diverse non-communicable diseases (11; 14; 15; 16; 17; 18). Non-communicable diseases have been negatively associated with health, on physical (17; 18; 16; 11) and psychological (16; 19; 11) level. Moreover, chronic diseases cost a community a lot of money (20; 11; 15). All in all, breastfeeding may be an effective strategy in the prevention of obesity on a large scale.

Next to obesity prevention, many more health benefits of breastfeeding are known, for both mother and child. Breast milk is the natural food for young infants and the most efficient food for healthy growth and development of body and brain during the first months after birth (13; 21). It delivers the child temporary immunity for the communicable diseases the mother is already immune for and lowers the risk of deaths due to infections (22). Moreover, protection against inflammation and allergic reactions (23), and asthma (24) is suggested. Adults in developed countries that have been breastfed as a child, have less hypertension (12; 8) and probably have a lower risk of developing diabetes mellitus type II (12; 8; 25). In developed countries, mothers who breastfeed, return faster to pre-pregnancy weight (12; 13) and have a lower risks of developing diabetes mellitus type II (25; 12), breast cancer (25; 12), and probably ovarian cancer (25; 12).

Research question & demographical factors

The research question is: *"What are the relationships between demographic factors and breastfeeding prevalence on the day of birth and in week 2-3 after birth, in infants that have had a standard visit at home of the youth department (JGZ) of the municipal health service (GGD) of the Dutch region 'Hollands Midden' from 2010 till 2015?"*

As demographical factors we will examine: sex of the child, the child being part of a multiple birth, the number of other children in the family, the mother's country of birth, age of the biological mother, highest education level among the caring parents, employment of the second parent, family composition, year of birth and municipality of living.

Hypotheses about the effects on breastfeeding are in line with literature. Factors that have been positively correlated with breastfeeding initiation in previous studies are a higher education level of the mother (26; 27; 28; 5) or both parents (29; 30), the baby not being part of a multiple birth (31; 32; 33), the baby being part of a two-parent family (34), higher maternal age (35; 32; 28; 36) and a smaller amount of other children in the family (30). We expect our variables to be related to

breastfeeding in the same way. According to earlier research of Kitano et al, the child's sex does not influence successful initiation of exclusive breastfeeding (36). The hypothesis is that sex will also not influence breastfeeding in this study. There is no consensus yet if employment is correlated positively or negatively with breastfeeding in the first weeks after birth. The mother being fulltime, part-time or unemployed has also been related to the breastfeeding prevalence in both directions (29; 37). No literature could be found about the effect of employment of the second parent on breastfeeding. However, we expect employment of the second caring parent to be negatively related with breastfeeding, since a working second caring parent will spend less time to supporting the mother. Support in breastfeeding by the second parent helps the mother to initiate and maintain providing breastfeeding (38). According to literature, more children are breastfed in rural than in urban areas, in different parts of the world (39; 40; 41). Thus, we expect breastfeeding prevalence to be lower in more urban municipalities of area HM. These are the municipalities of Leiden, Gouda and Alphen aan den Rijn. Breastfeeding prevalence often differs among different ethnic groups (35; 40; 42). There are examples for black mothers providing more breastfeeding (35) and examples for white mothers providing more breastfeeding (40). It has been suggested that cultural differences must be taken into account in developing interventions that aim to improve the overall health of babies (43) or breastfeeding practices (44; 45). It is also of interest to establish trends, since breastfeeding rates are dynamic (46; 42; 47). Breastfeeding percentages increased from 2008 to 2009 in the research area (42), when the economic crisis started. We expect that breastfeeding percentages continued developing in this direction from 2010 to 2015, next to the ongoing economic crisis.

Breastfeeding education

Municipal health services of area Hollands Midden (HM) does not organise educational programmes for future parents at the moment, but there are plans to start an educational programme this year (48). The programme will consist of four meetings during pregnancy (48). One of the meetings will be about breastfeeding, in presence of a lactation expert (48). The aim of the program is to improve breastfeeding initiation and health of children. It is not known yet how demographical factors influence breastfeeding initiation in the area of this study, exactly. Though, it is important to gain insight into which groups of mothers in the area, based on demographic factors, will probably not feed their children with breast milk. These mothers should be educated about breastfeeding. According to the WHO, accurate information and support of a mother's family, health care system and society put her in the position to provide breastfeeding (21). A meta analysis has shown that both education about - and professional support in breastfeeding increase the number of mothers initiating and maintaining breastfeeding in developed countries, but education had a bigger impact than support (3). It was most effective if the educational programme paid attention to benefits, principles, skills, myths, common problems and solutions in breastfeeding (3). A review of Hedberg et al. concluded that, according to mothers, lack of support was often seen as a barrier to breastfeed (4). So, it is of great importance that healthcare professionals support and educate mothers about breastfeeding (49; 3; 50; 51). By giving municipal health service personnel better insight in what determines initiation of breastfeeding for their clients, they will be able to optimise their guidance and education.

Methods

The study population consisted of children who have had a standard visit at home by municipal health service “Hollands Midden” in week 2 or 3 after birth. Demographical factors and their associations with breastfeeding prevalence on the day of birth (T1) and in week 2-3 after birth (T2) were analysed. Prediction models have been a priori stratified by the mother’s country of birth, since this modified the effect of other demographical factors on breastfeeding.

Design and study population

This observational study was performed in the area of municipal health service “Hollands Midden” (HM). This area is located in the West of the Netherlands. The area HM consists of nineteen municipalities; Noordwijk, Noordwijkerhout, Hillegom, Lisse, Teylingen, Katwijk, Oegstgeest, Leiden, Voorschoten, Zoeterwoude, Leiderdorp, Kaag en Braassem, Nieuwkoop, Alphen aan den Rijn, Waddinxveen, Bodegraven-Reeuwijk, Gouda, Zuidplas and Krimpenerwaard.
The research population consisted of the babies digitally registered in the municipal health service in the area of HM from 2010 till 2015. Data have been collected digitally, from exactly 44 564 infants. Birth rates in area HM are traceable until 2012. We compared the traceable birth rates with the number of children in care at the municipal health service; Approximately 91% of the children born in the area are in care and have had a standard visit at home, in 2012 to 2015 (52). We assume this percentage to be the same for 2010 and 2011. The municipal health service of area HM performs visits at home at around 8.000 babies per year.

Procedure

The municipal health service offers free, mostly preventive, health care to all children living in the area, on standardized moments. A visit at home usually is the second contact moment. It takes place approximately two weeks after birth. Only when parents accepted the offer of receiving municipal healthcare, data about their infant were available.

In the first days after birth, parents have to register their child at the municipality of residence, so that data on that child can be stored into the Dutch Basic Registration of Persons (BRP). A municipality must inform the municipal health service about new registrations. Also midwifes have the duty to inform the municipal health service about the birth of a new child.
The parents get informed about the possibility of receiving municipal healthcare, by a phone call from the municipal health service unit of the area they live in. If the parents agree on receiving municipal healthcare, a home visit will take place ideally in the second week after birth. The baby and at least one parent have to be at home during the visit. If this is not possible, for example when the baby is (still) in the hospital, the visit will take place at a later moment. During the home visit, the nurse administers a questionnaire orally. The data are entered in software called mICAS.

Questionnaire of the standard visit at home

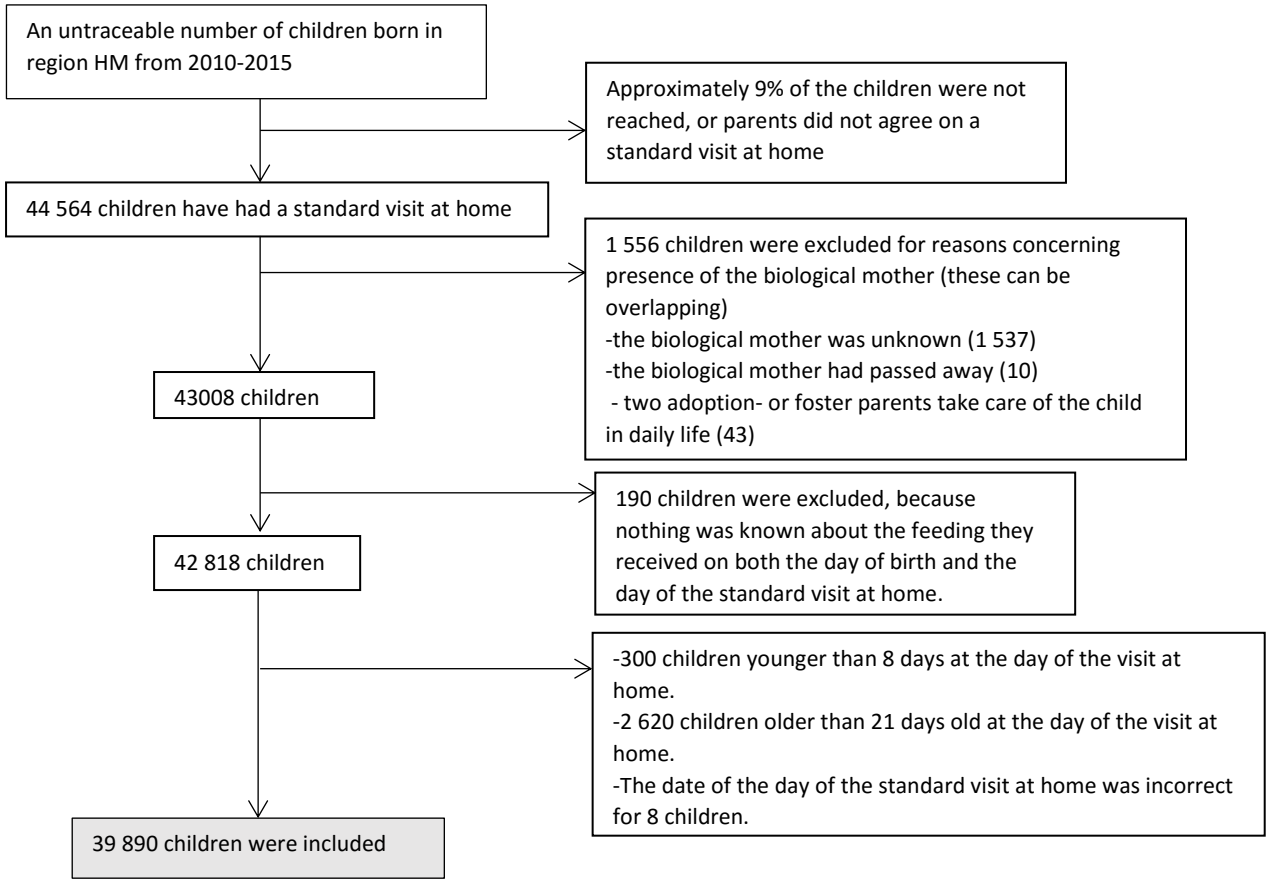
For the standard visits at home, a questionnaire is available **(see appendix I)**. The questionnaire contains 311 questions and covers subjects such as family composition and sociodemographic characteristics of the parents. Most of the questions and answer options are originating from ‘Basis Data Set’, an initiative for standard questions of doctors and nurses.

In- and exclusion criteria

Figure I visualises the exclusion criteria. The outcomes of this research will serve to specify education about breastfeeding. Therefore, only children for who chances on breastfeeding can possibly be

improved (by education and counselling), are the population of interest. Consequently, children without a biological mother were excluded (N= 1 556). Secondly, we excluded children for who nothing was known about the feeding they received on both the day of birth (T1) and the day of the standard visit at home (T2) (N=190). Thirdly, only children who had a home visit at the age of 8 up to and including 21 days (week 2 or 3) after birth, were included into research. Fourthly, some children were too young on the day of the standard visit at home (N=300) and some children were too old (N=2 620). Also children with an erroneous date of the visit at home were excluded from the research population (N=8).

Figure I: flow diagram



Statistical analysis

Relevant data were taken out of the mlCAS dossier and transported to excel and version 19 of SPSS (Statistical Package for Social Sciences). The transported data were anonymized.

The first outcome variable of this study was the baby being partly or exclusively fed with breastmilk on the day of birth (T1). This was a combination of the answer options exclusively breast milk, breast milk and additional feeding, mixed feeding and mixed feeding and additional feeding. The second outcome variable was the baby being exclusively fed with breastmilk on the day of the standard visit at home, in week 2-3 after birth (T2). Answer options in the questionnaire for the type of milk feeding on T1 and T2 were exclusively breast milk, breast milk and additional feeding, formula milk, formula milk and additional feeding, mixed milk feeding, mixed milk feeding and additional feeding and other (milk) feeding.

We included the following independent variables: sex of the child, the child being part of a multiple birth, the number of older children in the family, the mother's country of birth, age of the mother, highest education level among the parents, employment of the second parent, family composition and year of birth. Moreover, dichotomous variables were computed for the nineteen municipalities of the area. Apart from the continuous variable age of the mother, all variables are categorical.

In our study we did the following analyses.
1. We performed some descriptive statistics to present the baseline characteristics. Baseline characteristics will be depicted in the mean (SD) or in the percentage (N).
2. Secondly, to study to study which independent variables were related to the chance of children to be breastfed on T1 and on T2 we performed chi-square tests. In order to preform this analysis, we computed a categorical variable for age of the mother per five years. We analysed adjusted residuals to indicate whether categories within variables differed significantly from the mean (adj. res. >1.96).
3. To determine correlations between independent variables we performed chi-square tests. Again, we used the categorical variable for age of the mother per five years.
4. To predict which children may be retained from breast milk on T1 and on T2 we computed prediction models. Based on correlations between independent variables that were found by chi-square tests, the prediction models are a priori stratified by the five categories of the mother's country of birth. We used manual back-step procedures to compute the prediction models. A variable was part of the final prediction model, if it's p-value indicated significance. Within the prediction models, the reference categories of the categorical variables were the child being a boy, being a single birth, having no older children in the family, having at least one parent that has been educated on a high level, having a fulltime working second parent, being part of a two-parent family and being born in 2010. Afterwards, variables about the municipalities of living were added one by one (forward procedure), to examine significant differences in breastfeeding between the nineteen municipalities. The Hosmer and Lemeshow test visualised how well the prediction models fitted their data. If it's p-value is above 0.500, the belonging model was defined as fitting. If a prediction model did not fit, it's outcomes were ignored. P-values of chi-square tests and prediction models were defined as significant, if smaller than 0.05.

The results are described according to the numbers used above. Presented results did not include missing values.

Results

1. Participants

Baseline characteristics of the population are presented in **table I.** 84.5% of the infants had a mother that was born in the Netherlands, 3.5% in East-Europe, 3.0% in another Western country, 2.9% in Morocco and 6.1% in another non-Western country. Only 1% of the infants had parents with a low level of education and 59.6% of the infants had parents with a high education level. 43.4% of the infants were the first born child in the family, there was one older child in the families of 36.8% of the infants, 13.6% had two older children in the family and 6,2% were born in a family with already more than two older children. A high percentage of 94.8% of the families were two-parent families. Only 1.8% of the children were part of a multiple birth. **Appendix II** shows the baseline characteristics of the population before excluding participants.

In the research population, the type of milk children received on T1 was known for 38 779 children. 76.7% of these children (29 731) received partly or exclusively breast milk on T1. On T2, 60.6% of the children received exclusively breast milk (24 107 of 39 806). The difference in prevalence of the two outcome variables was 16.1%.

Table I: baseline characteristics of children born from 2010 to 2015 in the Dutch area of HM

Characteristics study population	Total (N=39 890)	Mean (±SD) / % (N)
Breastfeeding on T1	38 779	76.7% (29 731)
Breastfeeding on T2	39 806	60.6% (24 107)
Sex of the child	39 890	
boy		51.2% (20 431)
girl		48.8% (19 459)
Multiple birth	39 512	
yes		1.8% (729)
no		98.2% (38 783)
Number of older children in the family[1]	39 885	
first child		43.4% (17 308)
1 older child		36.8% (14 676)
2 older children		13.6% (5 443)
> 2 older children		6.2% (2 458)
Mother's country of birth[2]	39616	
the Netherlands		84.5% (33 495)
East-European country		3.5% (1 380)
other Western country[3]		3.0% (1 185)
Morocco		2.9% (1 141)
other non-Western country[4]		6.1% (2 415)
Age mother (years)	39 606	30.8 (±4,7)
<20		0.7% (277)
20-24		8.7% (3 444)
25-29		30.3% (12 008)
30-34		39.0% (15 430)
35-39		17.9% (7 076)
40-44		3.3% (1 325)
>44		0.1% (46)

Highest education level among parents[5, 7]	36 036	
high		59.6% (21 475)
middle high		32.9% (11 848)
middle low		6.6% (2 352)
low		1.0% (361)
Employment second parent[6, 7]	37 079	
fulltime		88.8% (32 943)
part-time		7.8% (2 880)
unemployed		3.4% (1 256)
Family composition	39 527	
two-parent family		94.8% (37 490)
one-parent family		2.4% (948)
otherwise[6]		2.8% (1 089)
Year of birth	39 890	
2010		10.1% (4 036)
2011		19.4% (7 727)
2012		18.2% (7 245)
2013		17.2% (6 879)
2014		18.1% (7 230)
2015		17.0% (6 769)
Municipality of living (child)	37 961	
Alphen aan den Rijn		14.9% (5 656)
Bodegraven-Reeuwijk		4.3% (1 649)
Gouda		9.2% (3 503)
Hillegom		2.5% (956)
Kaag en Braassem		3.3% (1 247)
Katwijk		10.3% (3 902)
Krimpenerwaard		6.5% (2 481)
Leiden		14.3% (5 446)
Leiderdorp		3.6% (1 356)
Lisse		2.8% (1 073)
Nieuwkoop		3.4% (1 274)
Noordwijk		3.0% (1 140)
Noordwijkerhout		1.9% (731)
Oegstgeest		3.0% (1 132)
Teylingen		4.5% (1 715)
Voorschoten		3.3% (1 241)
Waddinxveen		3.4% (1 275)
Zoeterwoude		0.8% (296)
Zuidplas		5.0% (1 888)

[1] Older children in the direct family may be full-, half-, adopted-, step- brothers and sisters, etcetera. Contact on regular basis determines if the older children are defined as 'in the family' of the infant.
[2] **Appendix III** shows why the mother's country of birth has been chosen to represent ethnicity.
[3] Other European countries, Japan, Indonesia, North-America and Oceania
[4] Turkey, Africa, Asia and Latin America
[5] Education level was based on that of parent or care giver who had the higher level of education. Education levels are divided into "low" (only primary school), "middle low" (lbo/mavo), "middle high" (mbo/havo/vwo) and "high"(hbo/wo)
[6] For instance co-parenting and blended families
[7] The second parent is a second care giver to the child, next to the biological mother. This is not necessarily the biological father, but might be a second mother or a new partner of the mother, for instance.

2. Relationships between demographic factors and breastfeeding on T1 and on T2

The variables for the number of older children in the family, the child being part of a multiple birth, the mother's country of birth, age of the mother, the highest education among the parents,

employment of the second parent and family composition had a significant relation with breastfeeding on both T1 and T2 **(see appendix IV).** Year of birth and sex of the child were not significantly related to breastfeeding on both T1 and T2.

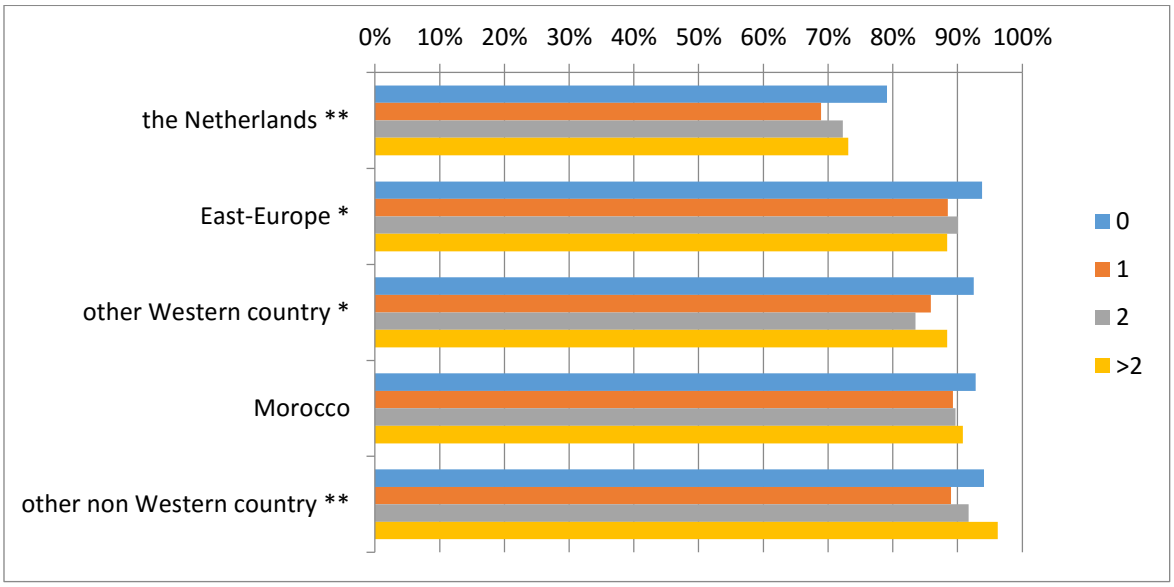
3. Relationships between demographic factors

Chi-square values of correlations between the independent variables are shown in **appendix V**. The mother's country of birth highly correlated with some other variables. Strong correlations were found for the mother's country of birth with the number of older children in the family and for the mother's country of birth with highest education level among the parents (see **appendix V)**.

The effect from the mother's country of birth and the number of older children in the family on breastfeeding

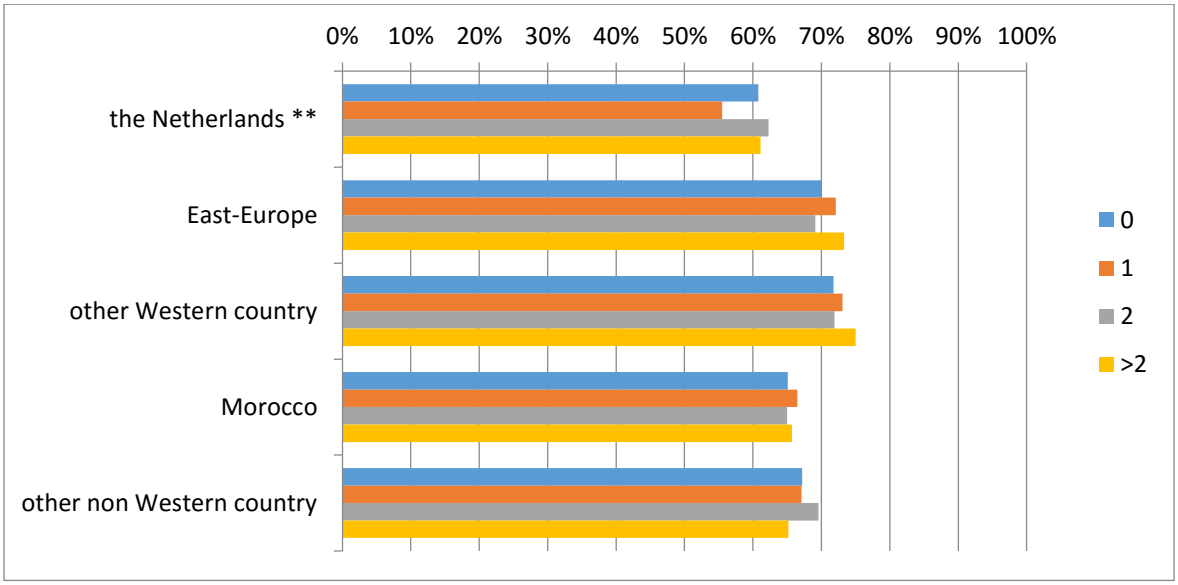
The outcomes for the different countries of birth from the mother and the number of older children in the family are illustrated in **figure II and III and in appendix V**. Among Dutch mothers, breastfeeding percentages were the lowest if there is one older child in the family (68.9% on T1 and 55.5% on T2). First born children had the highest breastfeeding percentage on T1, if their mother is born in East-Europe or another Western country (respectively 93.8% and 92.5%). For children of mothers from other non-Western countries, the highest percentage of breastfeeding on T1 is for children with more than two older children in the family (96.1%).

Figure II: proportions of breastfed children on T1 for the number of older children in their family and the mother's county of birth, who had a visit at home of the municipal health service from 2010-2015 in the Dutch area of HM



* p<0.05 ** p<0.001

Figure III: proportions of breastfed children on T2 for the number of older children in their family and the mother's county of birth, who had a visit at home of the municipal health service from 2010-2015 in the Dutch area of HM

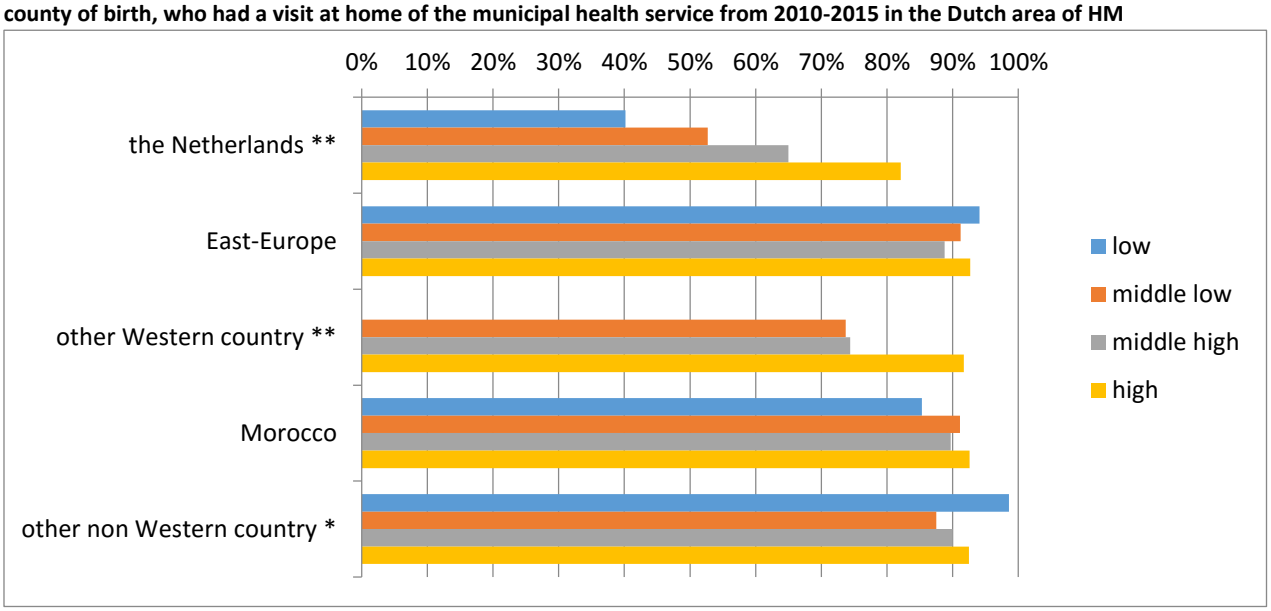


* p<0.05 ** p<0.001

<u>The effect from the mother's country of birth and highest education level among the parents on breastfeeding</u>

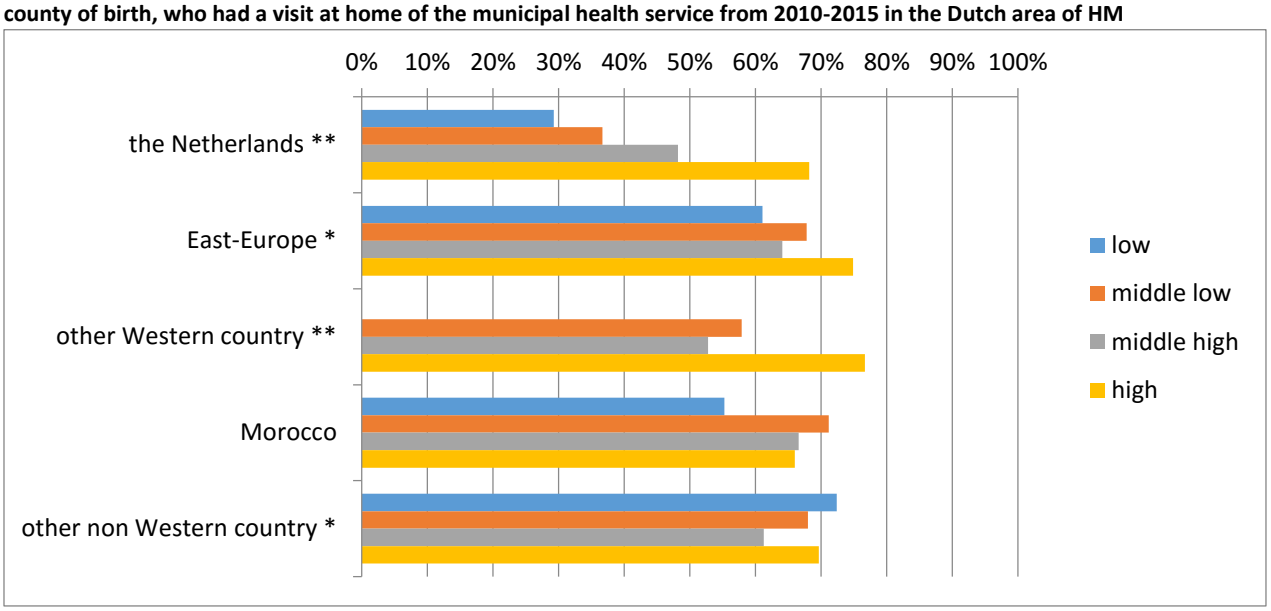
The outcomes for the different countries of birth from the mother and the highest education level among the parents are illustrated in **figure IV and V and appendix V**. For children of mothers born in the Netherlands or in another Western country, the percentage of children that received breast milk was higher if parents had been educated on a higher level, on both T1 (p=0.000 and p=0.000) and T2 (p=0.000 and p=0.000). For children of mothers who were born in another non-Western country, on T1, the highest percentage of children that received breast milk is for children of parents with a low education level (98.6%). On T2, children with parents who had been educated on a high level had the highest chance on receiving breast milk (69.7%). Education level and breastfeeding prevalence were not significantly correlated among children of mothers that were born in Morocco.

Figure IV: proportions of breastfed children on T1 for the highest education level among their parents and the mother's county of birth, who had a visit at home of the municipal health service from 2010-2015 in the Dutch area of HM



* p<0.05 ** p<0.001

Figure V: proportions of breastfed children on T2 for the highest education level among their parents and the mother's county of birth, who had a visit at home of the municipal health service from 2010-2015 in the Dutch area of HM



* p<0.05 ** p<0.001

4. Prediction models

Table II presents which variables were part of the prediction models for T1. **Table III** presents which variables were part of the prediction models for T2. Based on previous chi-square tests, the prediction models were a priori stratified by the mother's country of birth. We depicted odds ratio's (OR's) with belonging 95% confidence intervals (95% CI). For the five categories of the mother's country of birth and two outcome variables, nine prediction models were computed; A prediction model for children of Moroccan mothers on T1 could not be computed, since none of the demographic factors significantly predicted breastfeeding. For children of mothers born in Morocco on T2, the demographical factors explain less than 50% of the variance in breastfeeding on the day of the visit at home (p=0.19). The p-values of the Hosmer and Lemeshow tests of the other eight prediction models are above 0.5.

Table II: Breastfeeding on T1, OR (95% CI) of significant (p<0.05) variables in the prediction models for breastfeeding on T1, for 39 616 children who had a visit at home of the municipal health service from 2010-2015 in the Dutch area of HM

	Mother's country of birth				
	the Netherlands	East-European country	other Western country	Morocco	other non-Western country
N	**33 495**	**1 380**	**1 185**	**1 141**	**2 415**
Demographic factors (reference category)					
Sex of the child (boy)	x	x	x	x	1
girl					0.61 (0.43 – 0.87)*
Multiple birth (no)	1	x	x	x	x
yes	0.43 (0.36 – 0.52)*				
Number of older children in the family					
(0)	1	1	1	x	x
one	0.55 (0.52 – 0.59)*	0.51 (0.33– 0.78)*	0.46 (0.29 – 0.73)*		
two	0.65 (0.59 – 0.71)*	0.605 (0.31 – 1.18)	0.39 (0.22 – 0.72)*		
more than two	0.73 (0.64 – 0.83)*	0.506 (0.19 – 1.35)	0.78 (0.22 – 2.73)		
Age mother	1.01 (1,00 – 1,02)*	x	x	x	0.94 (0.91 – 0.97)*
Highest education level among parents					
(high)	1	x	1	x	1
low	0.13 (0.08 – 0.22)*		-		5.00 (1.21– 20.63)*
middle low	0.25 (0.23 – 0.28)*		0.29 (0.10 – 0.89)*		0.50 (0.26 – 0.97)*
middle high	0.42 (0.39 – 0.44)*		0.25 (0.08 – 0.77)*		0.60 (0.40 – 0.91)*
Employment second parent (fulltime)	1	x	x	x	x
part-time	1.36 (1.21 – 1.52)*				
unemployed	1.29 (1.07 – 1.56)*				
Family composition	x	x	x	x	x
Year of birth	x	x	x	x	x
constant	1.49 (OR 4.45)	2.71 (OR: 15.02)	1.65 (OR:5.23)	-	4.84 (OR:126.34)
p-value Hosmer and Lemeshow	0.70	1.00	0.96	-	0.54

*p-value<0.05 1: reference category x: variables not part of the prediction model

Table III: Breastfeeding on T2, OR (95% CI) of significant (p<0.05) variables in the prediction models for breastfeeding on T2, for 39 616 children who had a visit at home of the municipal health service from 2010-2015 in the Dutch area of HM

	Mother's country of birth				
	the Netherlands	**East-European country**	**other Western country**	**Morocco**	**other non-Western country**
N	**33 495**	**1 380**	**1 185**	**1 141**	**2 415**
Demographic factor (reference category)					
Sex of the child (boy)	x	x	x	x	x
Multiple birth (no)	1	1	x	1	
yes	0.32 (0.26 – 0.38)*	0.33 (0.13 – 0.86)*		0.14 (0.04 – 0.51)*	0.26 (0.10 – 0.64)*
Number of older children in the family					
(0)	1	x	x	x	x
one	0.80 (0.76 – 0.84)*				
two	1.09 (1.01 – 1.17)*				
more than two	1.19 (1.06 – 1.34)*				
Age mother	x	0.95 (0.92 – 0.98)*	0.97 (0.94 – 1.00)*	0.96 (0.933 – 0.98)*	0.96 (0.94 – 0.99)*
Highest education level among parents					
(high)	1	1	1	x	1
low	0.19 (0.12 – 0.32)*	0.43 (0.16 – 1.16)	-		0.77 (0.49 – 1.21)
middle low	0.27 (0.24 – 0.30)*	0.59 (0.38 – 0.92)*	0.39 (0.15 – 1.05)		0.72 (0.45 – 1.15)
middle high	0.44 (0.42 – 0.46)*	0.52 (0.39 – 0.70)*	0.30 (0.11 – 0.80)*		0.62 (0.48 – 0.79)*
Employment second parent (fulltime)	1	x	x	x	1
part-time	1.27 (1.16 – 1.39)*				0.98 (0.66 – 1.44)
unemployed	1.08 (0.92 – 1.28)				1.75 (1.21 – 2.53)*
Family composition (two-parent family)	1	x	x	x	x
one-parent family	0.89 (0.63 – 1.27)				
otherwise composed family	0.77 (0.65 – 0.90)*				
Year of birth	X	X	X	X	X
constant	0.84 (OR:2.32)	2.69 (OR: 14.71)	1.07 (OR: 2.91)	2.12 (OR: 8.37)	1.97 (OR: 7.19)
p-value Hosmer and Lemeshow	0.72	0.82	0.74	0.19	0.73

*p-value<0.05 1: reference category x: variables not part of the prediction model

Children of mothers born in the Netherlands

For children of mothers born in the Netherlands, the following demographic factors were part of the prediction model for breastfeeding on T1. Children that were part of a multiple birth had a smaller odds on receiving breast milk and so had children of younger mothers. Children who were the first child in the family had the biggest odds on receiving breast milk. Infants with one, two or more than two older children in their family had smaller odds' on receiving breast milk on T1. The higher the highest education level among the caring parents, the bigger the odds on receiving breast milk was. Moreover, employment of the second caring parent affected the odds on breastfeeding on T1, for children of mothers born in the Netherlands. The odds for receiving breast milk was the highest if the second parent worked part-time and second highest if he/she was unemployed. For children of mothers born in the Netherlands, the prediction model for breast milk on T2 is slightly different. Here, the odds for multiple births was lower. The odds ratio's for the number of older children in the family were the lowest if the infant was the second child in the family. Family composition was part of this model. Infants who were not part of a two-parent family had a lower odds on receiving breast milk. Even as on T1, the higher the highest education level, the higher the odds on receiving breast milk. Lastly, the odds on receiving breast milk was high for children of a part-time working second parents, compared to the odds for children of unemployed and fulltime working second parents.

Children of mother's born in an East-European country

The demographic factor that predicts receiving breast milk on T1 for children of mothers who were born in an East-European country was the number of older children in the family. First born children in the family had a higher odds on receiving breast milk than infants with one older child in the family. The odds on receiving breast milk did not differ significantly from the odds of the reference group, if there are two or more than two older children in the family. On T2, the child being part of a multiple birth, higher age of the mother and a lower highest education level among the parents were negatively related to the odds on receiving breast milk for children of mothers who were born in an East-European country,.

Children of mothers born in another Western country

To predict which children with a mother who was born in another Western country will receive breast milk on T1, the number of older children in the family and the highest education level among the parents must be taken into account. Infants with two older children in the family had the lowest odds on receiving breast milk, compared to children with one older child – and for children with more than two older children in the family. If the highest education level in the family was middle low or middle high, the odds on breast milk was lower than if at least one of the parents had been educated on high level. On T2, younger age of mothers positively affected the odds on receiving breast milk for children of mothers born in another Western country. The odds on receiving breast milk was lower, if the highest education level was middle high, compared to high.

Children of mothers born in another non-Western country

The prediction model for children of mothers who were born in another non-Western country on T1 was the only model with sex of the child being part of it. Within this group, also younger mothers provided breast milk more often. The odds on receiving breast milk was the high if the parent were educated on a low level. Children had a lower odds on receiving breast milk when the highest

education level among the parents was middle low or middle high, compared to children that had parents among who the highest education level was high. In the prediction model for breast milk on T2, children that were part of a multiple birth and children with older mothers had low odds' receiving breast milk. The odds on receiving breast milk was also low if the highest education level among the parents was middle high. On the other hand, the odds on receiving breast milk was higher for infants with an unemployed second parent.

Year of birth

Year of birth did not interact significantly with breastfeeding on either T1 or T2 **(see appendix IV**).

Municipalities

In the overall study population, the percentage of children that received breast milk on T1 were significantly higher than average (76.7%) in the municipalities of Oegstgeest (84.9%), Gouda (81.6%), Leiden (81.1%), Nieuwkoop (80.2%), Bodegraven-Reeuwijk (79.6%), Voorschoten (79.1%) and Teylingen (78.6%). Significantly less children received breastfeeding on T1 in the municipalities of, Krimpenerwaard (73.5%), Lisse (70.9%) and Katwijk (62.3%).
Percentages of breastfed children on T2 were significantly higher in the municipalities of Oegstgeest (69.3%), Zoeterwoude (66.6%), Voorschoten (65.7%), Leiden (65.2%), Nieuwkoop (64.7%), Bodengraven-Reeuwijk (64.5%) and Gouda (63.2%) (**see appendix IV**). On T2, children living in the municipalities of Alphen aan den Rijn (57.5%), Hillegom (56.5%), Lisse (55.5%) and Katwijk (49.4%) were significantly less often fed with breast milk than the overall study population (60.6%). (**see appendix IV)**

The p-values of the variables per municipality that were added one by one to the prediction models, are presented in **appendix VI**. These were never significant for the municipalities of Hillegom, Kaag en Braassem, Leiderdorp, Noordwijk, Teylingen, Voorschoten and Waddinxveen. The variable for the municipality of Katwijk most often had a significant p-value.

Discussion

Children of Dutch mothers and children that are part of a multiple birth had low odds' on receiving breast milk. Within the group of children with Dutch mothers, especially children of parents who are not educated on a high level and children with one older child in the family had a low odds on receiving breast milk. Moreover, breastfeeding prevalence was lower in the municipalities of Katwijk and Lisse, compared to the area of Hollands Midden as a whole.

Strengths and limitations

This study had a number of strengths. Firstly, differences in baseline characteristics before and after excluding participants were small. The only relevant difference was the percentage multiple births (2,5% before excluding and 1,8% after excluding participants). However, this this may be due to the range in days of the visit at home (day 8 – day 21 after birth). Twins and mothers of twins have birth complications more often than single births (53), so they may stay longer in the hospital and have their home visit later. Breastfeeding prevalence before and after excluding differed less than 1% for both T1 and T2. Secondly, this observational study will not be influenced by recall bias. Parents were asked about the type of milk that was fed on the day of the visit at home itself and about the type of milk on the day of birth. This is a memorable day in their lives and only one to three weeks ago. Thirdly, data about approximately 91% of the target population were available. This means that we included a large study population (39 890 children) with sufficient statistical power.

Also, this study had a number of limitations. Firstly, for practical reasons, this study included data with a maximum of two caring parents per child. If more than two caring parents had been filled in, new partners of the biological parents and parents with an unknown relation to the child were not included into analysis. Their demographic factors possibly were related to the outcome variables, but we expect that these third and fourth parents did not decide over the type of milk, in most cases. Secondly, the data contained many missing values. These have been completed, if the information was available somewhere else. Unfortunately, possible missing values in the variables about multiple births and other children in the family could not be completed. Therefore, results might have been misinterpreted. We recommend the municipal health service to analyse which values are missing and to complete these data for future research. Thirdly, according to literature, next to demographical factors, delivering by caesarean section influences breastfeeding initiation (50; 54). This has not been analysed for the area HM in this study. That is recommended for future research. Fourthly, because we stratified by the mother's country of birth, groups sizes became small. This may have affected statistical power negatively. It was not possible to compute useful prediction models for the chances on breastfeeding for children of Moroccan mothers. This means that the demographical factors in these study are not the factors that influence breastfeeding among Moroccan mothers or that the size of this group was to small. However, the group of children with Moroccan mothers still consisted of 1 141 children. Future research may detect other factors that do influence breastfeeding among Moroccan mothers. Fifthly, next to the mother's country of birth, maternal age strongly correlated with some other variables. In this study population, groups would have become (too) small for analysis, if we would have a priori stratified for both. It would be interesting for future research to a priori stratify results by maternal age. Lastly, we had to be careful in comparing results of T1 and T2. On the day of birth, the decision to breastfeed is most likely based on if the mother planned to do so, in advance. If this is exclusively or partly breastfeeding, depends on how fast milk production is increasing (55; 56). Exclusivity of breastfeeding is the best variable to indicate motivation to breastfeed, 2-3 weeks after birth. Feeding the child both breast milk and formula milk may indicates the transition from feeding breastmilk to feeding formula milk. We must be aware of the fact that the outcome variables were defined differently. Comparing these outcome variables would

overestimate the decline in children that receive breast milk, because the number of children that received exclusively breastmilk (T2) will already be lower than the number of children that receive exclusively or partly breast milk (T1).

Results and the context of other literature

One of our important findings was that mothers who were born in the Netherlands are less likely to feed their children with breast milk than mothers who were born in East-Europe, another Western country, Morocco or another non-Western country. This was not one of our hypotheses. However, we described in the introduction that it has been suggested before that cultural differences must be taken into account in interventions about breastfeeding (44; 45). Among children of Dutch mothers, especially second born children and children who have no parents educated on high level, had a high odds on being retained from breast milk. Our hypothesis about education level being positively related to breastfeeding prevalence even as in earlier research (29; 30) was confirmed. In accordance with literature, we expected the number of older children in the family to be positively related to breastfeeding prevalence (30), but this was not found. If there was one older child in the family, the infant received breast milk the least often. Higher percentages of first children and children with more than one older child in the family received breast milk. A presumable explanation is that the mother has to learn how the divide her attention over more than one child.
Another important finding of this study was that being part of a multiple birth did not affect the odds on receiving partly breastfeeding (T1), but does negatively affect the chance on receiving exclusively breastfeeding (T2). According to literature, children that are part of a multiple have lower odds' on partly or exclusively being fed with breast milk (31; 32). However, it is plausible that especially the odds on exclusively breast milk is affected, because the milk must be shared and may not be enough for more than one child.
In an area that covered fourteen of the municipalities of our interest, trends in duration of breastfeeding had been seen before (42). However, in our study year of birth did not lead to other results with respect to likelihood to give breastfeeding on T1 and T2. Therefore, the outcomes of this study are not able to confirm the hypothesis that breastfeeding prevalence increased from 2010 to 2015. Since there has been no trend, breastfeeding prevalence will only increase if action will be taken to do so.
Part of the Healthy People target of 2020 is for 81.9% of infants to ever be breastfed (4). The Healthy People targets also focus on a developed country; the USA, so we recommend the municipal health service to adopt this target for 2020. In the study population 78.1% of the children received any breastfeeding on either the day of birth or the day of the standard visit at home. We assume that this percentage was a close approximation of the percentage of children ever being breastfed in the study population. So, the Healthy People target of 2020 is not reached yet.
In previous research TNO established a decline from 80% of the infants that received partly or exclusively breast milk on the day of birth to 59-58% that exclusively received breast milk two-three weeks after birth (5). In this study we found percentages of 76.7% for the day of birth and 60.6% in week 2-3 after birth. Breastfeeding prevalence on the day of birth was lower in this research than in the study of TNO. This may be explained by the focus of this study on the area of HM, where strictly religious people are overrepresented, especially in the municipalities of Katwijk and Lisse (57). We found that breastfeeding percentages were significantly lower than average on both T1 and T2, in these two municipalities. Strict religion may be the missing factor in the prediction models. It may also be the reason for significant variables of these municipalities in prediction models (**appendix VI**). Being religious has been negatively associated with breastfeeding prevalence before (58), but a study of Burdette visualised a positive interaction between breastfeeding and adhering a religion (59). It may be a good idea for future research to study the influence of religion on breastfeeding rates in

the area of HM. In the introduction we described that breastfeeding prevalence would probably be lower in the urban municipalities of Alphen aan den Rijn, Gouda and Leiden, compared to more rural areas. This hypothesis was only confirmed in the municipality of Alphen aan den Rijn. It may be that other factors, such as level of education intervenes with the effect of urbanity. However, more research is needed.

Conclusion

The Healthy People 2020 target has not been reached yet in the area of HM. On top of that, there had been no trend in breastfeeding in this area for the last five years. Thus, action is required. It has previously been mentioned that education is a good way to increase breastfeeding prevalence. We recommend to organise educational meetings about the importance of breastfeeding. In general, the municipal health service should focus on educating parents who are expecting a multiple birth and on pregnant women who were born in the Netherlands (and their partners).
Within the group of pregnant women that were born in the Netherlands, the focus should be especially on parents who are both not educated on high level and on parents with one older child in the family. Especially in the municipalities of Lisse and Katwijk breastfeeding prevalence should be increased.

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Reflection

This section will reflect on the four months of my internship at the headquarters of the municipal health services of the Dutch area of Hollands Midden. It is described below, if I completed the learning goals that I defined in advance. In what way the goals were completed, is explained by some experiences that I gained, during this internship. This is followed by a conclusion.

The first learning goal that has been formulated in advance is evolvement of my cleverness in analysing data in SPSS software. I completed this goal. Analysis of data in SPSS was also one of the conditions set by the 'Vrije Universiteit Amsterdam' that had to be met during the internship[1]. I have learned to exclude participants with the help of data that were available (or missing). With the help of my daily mentor, missing and erroneous data have been corrected as good as possible. This was a new and instructive process for me. It took a lot of time, but it really made the data more reliable an the research more valuable. I computed a lot of new variables myself. This was not new to me, but this internship I became more clever and seasoned with it. I was already familiar with prediction models and chi-square tests, but I learned about the use and interpretation of adjusted residuals and Hosmer and Lemeshow tests, during this internship. My daily supervisor Irma Paijmans taught me about adjusted residuals and a read about Hosmer and Lemeshow tests in my book[2]. Besides learning new skills, the most important reason for me to consider the first learning goal as completed, is that I really became more routinized in handling a big dataset. Irma Paijmans has made it possible for me to complete this learning goal and the statistical analyses of my study.
The second learning goal that I formulated in advance, was that I wanted to learn how to communicate with colleagues and business contacts. I have experienced what it is work in an office with all types of colleagues. Overall, people in the staff office of the municipal health service of the area of HM are very dedicated to their work. It is in line with their working field that they have a heart for helping others and doing good. However, I think that the nice atmosphere between colleagues is related to this. I attended couple of meetings between colleagues. These gave me a better insight into the tasks of the organisation and individuals within the organisation. Unfortunately, I was not able to really participate in discussions during meetings, beause I did not have enough knowledge about the organisation and the topics that were discussed. I had a couple of feedback sessions with both my daily mentor Irma Paijmans and my university mentor dr. Janne de Ruyter. I did not experience difficulties in dealing with feedback. I think I would enjoy the job itself of being epidemiologists in municipal health services even more than the internship, because they more often have to collaborate with each other. One experience that I remember really well, is the interview I did with a nurse who works at one of the centres for youth and family in the area of HM. We had a nice conversation about similarities between what I found in my study and what she experienced in the visits at home she performs. This gave me insight in possible explanations for some of my findings. It also gave me an idea of which results of my study may be relevant in practice. This conversation taught me that it is important that people within an organisation communicate with each other to make sure that you understand different points of view. In conclusion, the second learning goal has been completed during the internship, but on a lower scale than the first learning goal.
The third learning goal, writing a research report in English. This was also the main instruction that the 'Vrije Universiteit Amsterdam' formulated for completing an internship[1]. Of course, this goal has been completed. However, it was harder than I expected it to be. It took a lot of time to get the report in it's current form. It was really a process of writing and rewriting, with the help of my mentors. I learned a lot in this process and I am very happy that I experienced it. I think the knowledge and experience that a gained in writing a research report will be very useful in my master programme next year. I did not expect so in advance, but completing this learning goal taught me the

most. The support dr Janne de Ruyter has been helpful in completing this learning goal.
The last learning goal that I wanted to complete, was taking care of the planning of a project that runs over a couple of months. This goal has been completed, but I could have been more conscious about keeping to a planning in the beginning. This internship has been my first experience with a project that runs over a couple of months. During the first month, I had no idea how much time writing a report would take. In the end, I have been able to make all the deadlines, but it was a bit stressful during the last month. Keeping to a time schedule from the beginning is something that I learned.

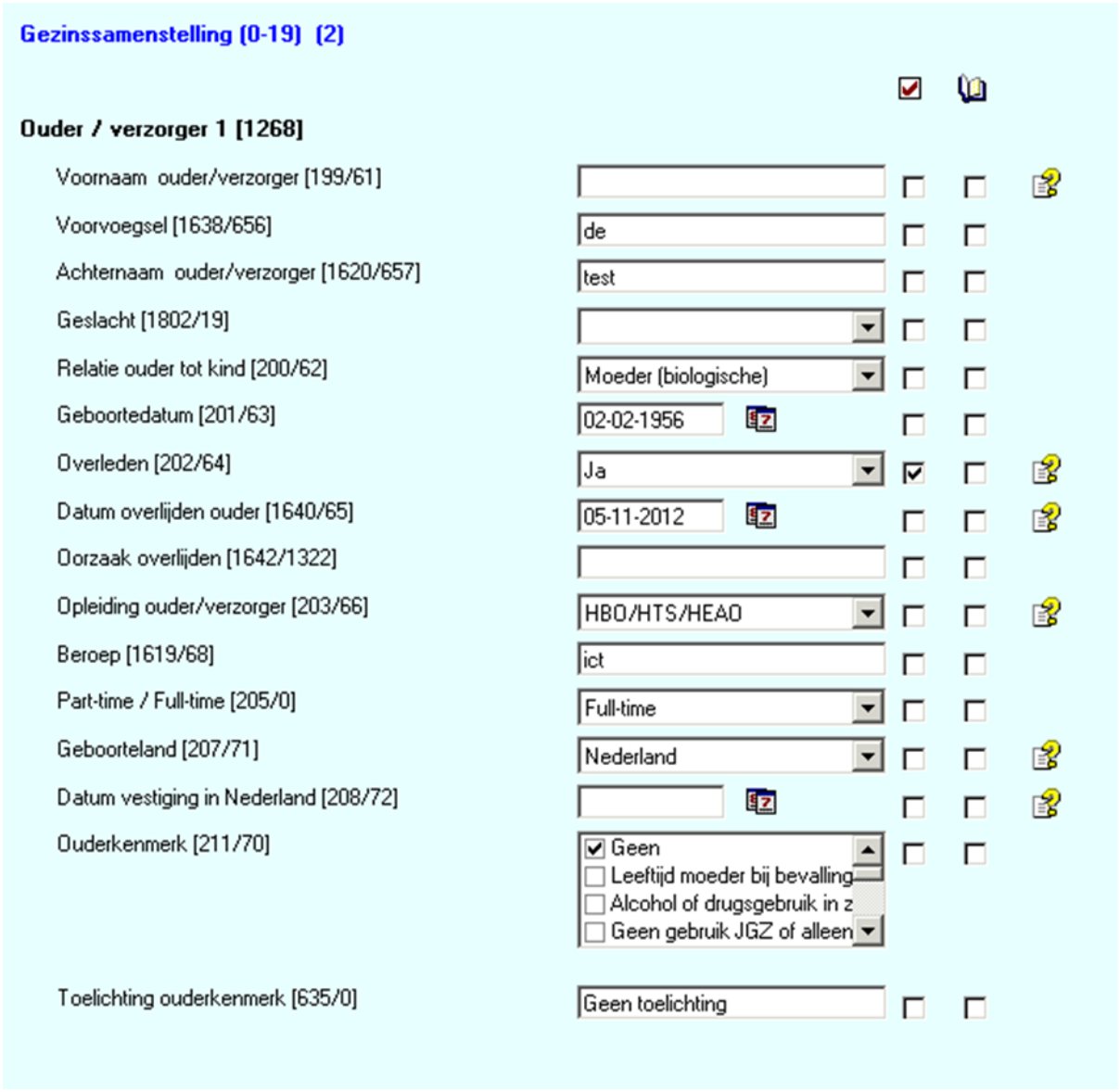
All in all, the last four months have been a valuable period in development of my academic skills. Especially preparing, planning and writing a research report are processes in which I have grown. For the future, I hope to take these experiences with me and I hope to be able to collaborate in other studies.
I would like to thank the municipal health service of area HM, but especially Irma Paijmans, for giving this experience to me. I would like to thank dr. Janne de Ruyter for being my university mentor.

[1] Stagehandleiding 2015-2016 Gezondheid en Leven, Vrije Universiteit Amsterdam, september 2015.

[2] (2014) Kwaliteit van een multiple logistisch regressiemodel. In Prof. dr. J.W.R. Twisk, Inleiding in de toegepaste biostatistiek (third edition, Reed Business Education, pp. 265-273). Amsterdam.

Appendix I: Questionnaire of the standard visit at home

version of 17th November 2015



Gezinssamenstelling (0-19) (3)

Ouder / Verzorger 2 [578]

Voornaam ouder/verzorger [212/61]	
Voorvoegsel [1653/656]	
Achternaam ouder/verzorger [1621/657]	Ruijgrok
Geslacht ouder 2 [1803/19]	Man
Relatie ouder tot kind [579/62]	Vader (biologische)
Geboortedatum [580/63]	26-09-1959
Overleden [581/64]	
Datum overlijden ouder [1641/65]	
Oorzaak overlijden [1643/1322]	
Opleiding ouder/verzorger [582/66]	HBO/HTS/HEAO
Beroep [1630/68]	administrateur
Part-time / Full-time [584/0]	Full-time
Geboorteland ouder [586/71]	Nederland
Datum vestiging in Nederland [587/72]	
Ouderkenmerk [590/70]	☑ Geen ☐ Leeftijd moeder bij bevalling ☐ Alcohol of drugsgebruik in z ☐ Geen gebruik JGZ of alleen
Toelichting Ouderkenmerk 2: [636/0]	Geen toelichting

Gezinssamenstelling (0-19) (4)

Ouder / Verzorger 3 [1652]

Voornaam ouder/verzorger [1448/61]	Bep
Voorvoegsel [1655/656]	
Achternaam ouder/verzorger [1654/657]	Knol
Geslacht ouder 3 [1804/19]	Man
Relatie ouder tot kind [1449/62]	
Geboortedatum [1450/63]	24-05-1964
Overleden [1451/64]	
Datum overlijden ouder [1656/65]	
Oorzaak overlijden [1658/1322]	
Opleiding ouder/verzorger [1452/66]	
Beroep [1663/68]	
Part-time / Full-time [1665/0]	Part-time
Geboorteland [1453/71]	
Datum vestiging in Nederland [1668/72]	
Ouderkenmerk [1672/70]	Geen Leeftijd moeder bij bevalling Alcohol of drugsgebruik in z Geen gebruik JGZ of alleen
Toelichting Ouderkenmerk 3: [1673/0]	

Ouder / verzorger 4 [1634]

Voornaam Ouder/verzorger [1454/61]	Aat
Voorvoegsel [1678/656]	
Achternaam ouder/verzorger [1635/657]	theater
Geslacht ouder 4 [1805/19]	Man
Relatie ouder tot kind [1455/62]	Partner/vriend van vader/moe
Geboortedatum [1456/63]	11-01-1953
Overleden [1457/64]	
Datum overlijden ouder [1679/65]	
Oorzaak overlijden [1681/1322]	
Opleiding ouder/verzorger [1458/66]	
Beroep [1682/68]	
Part-time / Full-time [1683/0]	
Geboorteland [1459/71]	
Datum vestiging in NL [1688/72]	
Ouderkenmerk [1691/70]	☐ Geen ☐ Leeftijd moeder bij bevalling ☐ Alcohol of drugsgebruik in z ☐ Geen gebruik JGZ of alleen
Toelichting Ouderkenmerk 4: [1692/0]	

Gezinssamenstelling (0-19) (5)

Gezinssamenstelling vervolg [2906]

Gezinssamenstelling [1651/0]	Co-ouderschap
Zijn er bijzonderheden mbt gezinssamenstelling? [2007/1190]	
Gezinssamenstelling woonverband [822/607]	Gezinsverband
Indicatie gezag minderjarige [1541/631]	Ouder 1 heeft gezag
Woonsituatie [223/0]	goed
Spreektaal met kind [209/0]	Nederlands

Kinderen in gezin (0-19) (6)

Kinderen in gezin [1274]

Kind 1 [214]

Geboortedatum [216/1372]	02-02-2002
Voornaam [213/1368]	Wim
Achternaam [592/1370]	de Bruin
Geslacht broer/zus [215/75]	Mannelijk
Relatie tot broer/zus [1531/74]	Stiefbroer/zus
Bijzonderheden kind 1 [218/1374]	geen
Overleden [1961/0]	Nee
Overlijdensdatum [1963/0]	

Kind 2 [217]

Geboortedatum [593/1372]	17-02-1986
Voornaam [594/1368]	Mitchell
Achternaam [595/1370]	Ruijgrok
Geslacht broer/zus [596/75]	Mannelijk
Relatie tot broer/zus [1532/74]	Broer/zus (biologisch)
Bijzonderheden kind 2 [597/1374]	
Overleden [1965/0]	
Overlijdensdatum [1966/0]	

Kind 3 [598]

Geboortedatum [602/1372]	15-05-1988
Voornaam [606/1368]	Kelvin
Achternaam [610/1370]	Ruijgrok
Geslacht broer/zus [614/75]	Mannelijk
Relatie broer/zus [1533/74]	Broer/zus (biologisch)
Bijzonderheden kind 3 [618/1374]	
Overleden [1967/0]	
Datum overlijden [1968/0]	

Kinderen in gezin (0-19) (7)

Kind 4 [599]

Geboortedatum [605/1372]	19-03-1991
Voornaam [607/1368]	Tiffany
Achternaam [611/1370]	Ruijgrok
Geslacht broer/zus [615/75]	Vrouwelijk
Relatie tot broer/zus [1534/74]	Broer/zus (biologisch)
Bijzonderheden kind 4 [619/1374]	
Overleden [1969/0]	
Datum overlijden [1970/0]	

Kind 5 [600]

Geboortedatum [603/1372]	02-02-2001
Voornaam [608/1368]	
Achternaam [612/1370]	
Geslacht broer/zus [616/75]	
Relatie tot broer/zus [1535/74]	
Bijzonderheden kind 5 [620/1374]	
Overleden [1971/0]	
Datum overlijden [1972/0]	

Kind 6 [601]

Geboortedatum [722/1372]	02-02-2001
Voornaam [723/1368]	
Achternaam [613/1370]	
Geslacht broer/zus [617/75]	
Relatie tot broer/zus [1536/74]	
Bijzonderheden kind 6 [621/1374]	
Overleden [1973/0]	
Datum overlijden [1974/0]	

Kinderen in gezin (0-19) (8)

Kind 7 [721]

Geboortedatum [604/1372]	02-02-2001
Voornaam [609/1368]	
Achternaam [724/1370]	
Geslacht broer/zus [725/75]	
Relatie tot broer/zus [1537/74]	
Bijzonderheden kind 7 [726/1374]	
Overleden [1975/0]	
Datum overlijden [1977/0]	

Kind 8 [727]

Geboortedatum [728/1372]	02-02-2001
Voornaam [729/1368]	
Achternaam [730/1370]	
Geslacht broer/zus [731/75]	
Relatie tot broer/zus [1538/74]	
Bijzonderheden kind 8 [732/1374]	
Overleden [1978/0]	
Datum overlijden [1979/0]	

Kind 9 [733]

Geboortedatum [734/1372]	02-02-2001
Voornaam [735/1368]	
Achternaam [736/1370]	
Geslacht broer/zus [737/75]	
Relatie tot broer/zus [1539/74]	
Bijzonderheden kind 9 [738/1374]	
Overleden [1983/0]	
Datum overlijden [1984/0]	

Kind 10 [1105]

Geboortedatum [1108/1372]	02-02-2001	☐	☐	
Voornaam [1106/1368]		☐	☐	
Achternaam [1107/1370]		☐	☐	
Geslacht broer/zus [1109/75]		☐	☐	
Relatie tot broer/zus [1540/74]		☐	☐	
Bijzonderheden kind 10 [2009/1374]		☐	☐	
Overleden [1980/0]		☐	☐	
Datum overlijden [1981/0]		☐	☐	
Meer dan 10 kinderen [2008/0]		☐	☐	

Voorgeschiedenis (14)

Bevalling [542]

Kleur vruchtwater [545/103]		☐	☐	
Wijze van geboorte [547/0]		☐	☐	
Stuitligging in het laatste trimester [640/0]		☐	☐	
Ligging bij geboorte [548/100]		☐	☐	
Bijzonderheden bevalling? [543/106]	Ja		☐	
Toelichting bijzonderheden bevalling [549/106]		☐	☑	

Pasgeborene [242]

Meerling [1711/108]		☐	☐	
Apgarscore na 1 minuut [551/129]		☐	☐	
Apgarscore na 5 minuten [1604/130]		☐	☐	
Geboortegewicht [179/110]	2200 gr	☐	☐	
Dysmatuur [3297/115]		☐	☐	
Geboortelengte [243/112]	cm	☐	☐	
Laagste gewicht [244/111]	gr	☐	☐	
Hoofdomtrek bij geboorte [245/113]	cm	☐	☐	
Bijzonderheden pasgeborene en eerste levensweken [550/0]	Ja		☐	
Aangeboren afwijkingen [552/131]		☐	☐	
Eerste levensuur [553/0]		☐	☐	
Eerste levensdagen [554/0]		☐	☐	
Bijzonderheden temperatuurverloop [555/133]		☐	☐	
Bijzonderheden ademhaling [556/134]		☐	☐	
Overige bijz. voorgeschiedenis [559/0]		☐	☐	
Behandeld voor geelzien [560/142]	Ja		☑	
Therapie [561/0]		☐	☐	
Oorzaak geel zien [562/140]		☐	☐	

Opname kinderafdeling [563/0]	Ja		☐	
Opname kinderafdeling [564/143]	dagen	☐	☐	
Reden opname ziekenhuis [683/150]		☐	☐	
Melkvoeding op geboortedag [502/747]		☐	☐	
Toelichting melkvoeding [686/0]		☐	☐	
Vitamine K toegediend/voorgeschreven [505/137]		☐	☐	

Anamnese huisbezoek (16)

Melkvoeding op dit moment [503/496]		☐	☐
Vitamine K [506/1337]		☐	☐
Vitamine D [507/1338]		☐	☐
Bijzonderheden spugen/krampjes [2834/0]		☐	☐
Bijzonderheden voeding/eetgedrag [1717/323]		☐	☐
Bijzonderheden uitscheiding [1991/0]		☐	☐
Zijn er bijzonderheden t.a.v. de slaaphouding? [565/0]	Ja	☐	☐
Bijzonderheden slaaphouding [566/0]	☐ Buikligging ☐ Zijligging ☐ Fixatie ☐ In ouderlijk bed	☐	☐
Conclusie slaaphouding [1899/0]		☐	☐

Appendix II: Baseline characteristics of the population before exclusion criteria (biological parents)

Characteristics of the population before respondents were excluded from the study population (about the child and biological parents)

Characteristics study population before excluding	Total (N=44 564)	Mean (±SD) / % (N)
Breastfeeding on T1	41 448	76.6% (31 757)
Breastfeeding on T2	42 681	59.7% (25 501)
Sex	44 564	
boys		51.2% (22 804)
girls		48.8% (21 760)
Number of older children in the family[1]	44 564	
first child		44.4% (19 786)
1 older child		36.0% (16 025)
2 older children		13.5% (6 007)
> 2 older children		6.1% (2 739)
Part of multiple birth	42 341	
yes		2.5% (1 041)
no		95.7% (41 300)
Mother's country of birth	42 348	
the Netherlands		83.5% (35 373)
East-European country		3.6% (1 545)
other Western country[2]		3.2% (1 369)
Morocco		3.0% (1 265)
non-Western country[3]		6.6% (2 796)
Age mother (years)	42 687	30.8 (± 4,8)
<20		0.8% (328)
20-24		8.8% (3 739)
25-29		30.2% (12 848)
30-34		38.7% (16 459)
35-39		17.9% (7 615)
40-44		3.4% (1 438)
>44		0.1% (60)
Highest education level of biological parents[4]	39 133	
high		59.6% (23 354)
middle high		32.8% (12 805)
middle low		6.7% (2 606)
low		1.1% (420)
Employment biological father	40 570	
fulltime		88.7% (35 979)
part-time		7.7% (3 107)
unemployed		3.7% (1 484)
Family composition	43 799	
two-parent family		94.5% (41 372)
one-parent family		2.7% (1 167)
otherwise[5]		2.9% (1 260)
Year of birth	44 564	
2009		0.3%(133)
2010		10.6% (4 732)
2011		19.0% (8 457)
2012		18.0% (8 042)
2013		17.4% (7 772)
2014		18.0% (8 034)
2015		16.6% (7 394)
Municipality of living (child)	42 165	
Alphen aan den Rijn		14.9% (6 279)
Bodegraven-Reeuwijk		4.2% (1 778)
Gouda		9.3% (3 933)
Hillegom		2.5% (1 049)
Kaag en Braassem		3.2% (1 340)
Katwijk		10.3% (4 335)
Krimpenerwaard		6.4% (2 696)
Leiden		14.7% (6 217)
Leiderdorp		3.5% (1 471)
Lisse		2.8% (1 184)
Nieuwkoop		3.3% (1 394)
Noordwijk		2.9% (1 240)
Noordwijkerhout		1.9% (794)
Oegstgeest		3.2% (1 337)
Teylingen		4.4% (1 876)
Voorschoten		3.2% (1 355)
Waddinxveen		3.4% (1 436)
Zoeterwoude		0.9% (371)
Zuidplas		4.9% (2 080)

[1]Older children in the direct family may be full-, half-, adopted-, step- brothers and sisters, etcetera. Contact on regular basis determines if the older children are defined as 'in the family' of the infant.
[2]other European countries, Japan, Indonesia, North-America and Oceania
[3] Turkey, Africa, Asia and Latin America
[4]Education level was based on that of the biological parent who had the higher level of education. Education levels are divided into "low" (only primary school), "middle low" (lbo/mavo), "middle high" (mbo/havo/vwo) and "high"(hbo/wo)
[5]for instance co-parenting and blended families

Appendix III: Breastfeeding percentages for ethnic background

It is not useful to take the ethnicity of the child into account, since the caring parents (who are not necessarily the biological parents) may have another ethnicity. The caring parents decide if breastfeeding is provided, so only their background should be taken into account.

for at least 99,1% of the children it was correct to only take the mother's country of birth into account: For most children, the mother and second parent are born in the same country (88.7%). For 10.4% of the infants, one parent was Dutch and one parent had another ethnicity. Within this group, children of Dutch mothers and immigrant second parents receive less breastfeeding than children of Dutch second parents and immigrant mothers (on both T1 and T2). In the overall study population, Dutch parents provide less breastfeeding than immigrant parents. So, percentages for children with one immigrant and one Dutch born parent are always closer to the breastfeeding percentages of children with two parents from the mother's country of birth. The mother's country of birth has the bigger influence on breastfeeding in these 10.4% of the children. In the remaining 0.9% of the children, the parents have two different non Dutch countries of birth.

Combinations of countries of birth, within parent couples

mother's country of birth	**2nd caring parent's country of birth**					
	the Netherlands	East-European country	other Western country	Morocco	other non-Western country	**total**
the Netherlands	80.0% (30 764)	0.3% (101)	1.2% (477)	1.4% (526)	2.1% (806)	**85.0% (32 674)**
East-European country	1,2% (444)	1.9% (745)	0.1% (47)	0.0% (6)	0.2% (71)	**3.4% (1 313)**
Other Western country	1.7% (641)	0.0% (12)	1.0% (402)	0.0% (14)	0.1% (44)	**2.9% (1 113)**
Morocco	0.4% (148)	0.0% (2)	0.0%(6)	2.4%(921)	0.1% (35)	**2.9% (1 112)**
other non-Western country	2.2% (848)	0.0% (14)	0.2% (64)	0.0% (9)	3.4% (1 298)	**5.8% (2 233)**
Total	**85.4%(32 845)**	**2.3% (874)**	**2.6% (996)**	**3.8% (1476)**	**5.9% (2 254)**	**100% (38 445)**

percentage of children that received breast milk on T1, per combination of country of birth categories within parent couples

breastfeeding percentage (N) on T1				
Total (31 794)**	two Dutch caring parents	Dutch mother & immigrant 2nd parent	immigrant mother & Dutch 2nd parent	2 immigrant parents (same country of birth)
the Netherlands	73.5% * (22 018/29 938)			
East-European country		76.8% (76/99)	88.6%* (381/430)	93.1%* (678/728)
other Western country		84.1%* (392/466)	84.9%* (535/630)	93.1%* (364/391)
Morocco		87.5%* (448/512)	87.4%* (125/143)	90.9%* (812/893)
other non-Western country		82.5%* (643/779)	90.5%* (751/830)	93.5%* (1 166/1 247)

*p-value<0.05 **p-value<0.001

Percentage of children that received breast milk on T2, per combination of country of birth categories within parent couples

Breastfeeding percentage (N) on T2				
Total (32 611)**	two Dutch caring parents	Dutch mother & immigrant 2nd parent	immigrant mother & Dutch 2nd parent	2 immigrant parents (same country of birth)
the Netherlands	59.0% * (18 109/30 705)			
East-European country		57.4% (58/101)	70.9%* (315/444)	68.9%* (512/743)
other Western country		66.4%* (316/476)	68.9% (440/639)*	79.6%* (317/398)
Morocco		60.0% (315/525)	66.2% (98/148)	64.8%* (594/916)
other non-Western country		63.8% (513/804)	66.7%* (565/847)	68.0%* (880/1 294)

*p-value<0.05 **p-value<0.001

Appendix IV: overview table percentages of breastfeeding per demographical factor

Percentages of children that received breast milk for categories of demographic factors

Demographic factors	Breastfeeding: percentage (N/total)	
	T1	**T2**
Total	**76.7%** (29 731/38 779)	**60.6%** (24 107/ 39 806)
Sex	P=0,313 (38 779)	P=0.782 (39 806)
Boys	76.9% (15 246/19 831)	60.5% (12 331/20 3834)
Girls	76.4% (14 485/18 948)	60.6% (11 776/ 19 422)
Day of the visit at home (days after birth)	P=0.700 (38 779)	P=0.064 (39 806)
Week of the visit at home	P=0.046*	P=0.470
week 2 (day 8-14)	76.4%* (23 518/30 763)	60.7% (19 106/31 501
week 3 (day 15-21)	77.5%* (6 213/8 016)	60.2% (5 001/8 305)
Number of older children in the family	P=0.000** (38 774)	P=0.000** (39 801)
first child	81.1%* (13 647/16 818)	62.0%* (10 705/17 272)
1 older child	71.7%* (10 237/14 280)	57.5%* (8 427/14 646)
2 older children	75.2%* (3 973/5 285)	63.3%* (3 437/5 432)
> 2 older children	78.2% (1 869/2 391)	62.6%* (1535/2 451)
Multiple birth	P=0.000** (38 410)	P=0.000** (39 429)
Yes	63.0%* (447/709)	34.3%* (249/727)
No	77.0%* (29 032/ 37 701)	62.2%* (23 689/38 702)
Mother's country of birth	P=0.000** (38 522)	P=0.000** (39 532)
the Netherlands	74.1%* (24 136/32 589)	59.1%* (19 745/33 431)
East-European country	91.5%*(1 229/1 343)	70.7%* (974/1 377)
other Western country	88.7%* (1 023/1 153)	72.4%* (854/1 179)
Morocco	90.6%* (1 000/1 104)	65.6%* (744/1 135)
other non-Western country	92.1%* (2 148/2 333)	67.3%* (1 622/2 410)
Age mother/5 years	P=0.000** (38 506)	P=0.000** (39 522)
<20	72.2% (195/270)	52.9%* (146/276)
20-24	72.2%* (2 402/3 327)	54.5%* (1 870/3 431)
25-29	75.1%* (8 777/11 680)	59.2%* (7 096/11 986)
30-34	77.9%* (11 683/14 998)	62.7%* (9 662/15 404)
35-39	77.9%* (5 374/6 901)	61.7%* (4 353/7 057)
40-44	81.1%* (1 041/1 284)	59.4% (785/1 322)
>45	80.4% (37/46)	50.0% (23/46)
Highest education parents	P=0.000** (35 716)	P=0.000** (36 598)
High	83.5%* (18 169/21 757)	68.9%* (15 357/22 305)
middle high	67.4%* (7 796/11 565)	49.7%* (5 881/11 827)
midle low	58.5%* (1 197/2 046)	41.9%* (882/2 107)
Low	80.7% (281/348)	57.1% (205/359)
Employment second parent	P=0.000** (36 112)	P=0.000** (37 003)
full-time	75.7%* (24 291/32 081)	59.8%* (19 650/32 874)
part-time	83.6%* (2 345/2 806)	67.9%* (1 954/2 877)
unemployed	82.0%* (1 005/1 225)	62.6% (784/1 252)
Family composition	P=0.000** (38 437)	P=0.000** (39 257)
two-parent family	76.9%* (28 033/36 461)	61.0%* (22 817/37 413)
one-parent family	74.6% (685/918)	55.1%* (521/946)
other family composition	71.6%* (758/1 058)	52.8%* (574/1 087)

Year of birth	P=0.736 (38 779)	P=0.466 (39 806)
2009	75.0% (3/4)	-
2010	76.1% (2 996/3 935)	61.7% (2 478/4 017)
2011	76.6% (5 728/7 479)	60.6% (4 674/7 710)
2012	76.3% (5 372/7 040)	60.3% (4 357/7 228)
2013	77.3% (5 126/6 635)	60.9% (4 186/6 871)
2014	76.5% (5 415/7 081)	59.7% (4 307/7 220)
2015	77.1% (5 094/6 605)	60.7% (4 105/6 760)
Municipality of living	P=0.000** (36 916)	P=0.000** (37 880)
Alphen aan den Rijn	75.7% (4 205/5 556)	57.5%* (3 245/5 640)
Bodegraven-Reeuwijk	79.6%* (1 277/1 604)	64.5%* (1 062/1 646)
Gouda	81.6%* (2 736/3 354)	63.2%* (2 211/3 500)
Hillegom	76.1% (722/949)	56.5%* (540/955)
Kaag en Braassem	76.9% (923/1 200)	61.4% (764/1 245)
Katwijk	62.3%* (2 340/3 759)	49.4%* (1 927/3 902)
Krimpenerwaard	73.5%* (1 797/2 444)	58.3% (1 445/2 479)
Leiden	81.1%* (4 253/5 246)	65.2%* (3 530/5 418)
Leiderdorp	78.1% (1 035/1 325)	62.2% (841/1 353)
Lisse	70.9%* (744/1 049)	55.5%* (595/1 073)
Nieuwkoop	80.2%* (1 005/1 253)	64.7%* (824/1 273)
Noordwijk	74.9% (843/1 125)	60.7% (692/1 140)
Noordwijkerhout	74.8% (542/725)	58.2% (425/730)
Oegstgeest	84.9%* (935/1 101)	69.3%* (778/1 123)
Teylingen	78.6%* (1 337/1 701)	61.2% (1 049/1 714)
Voorschoten	79.1%* (937/1 184)	65.7%* (812/1 236)
Waddinxveen	75.3% (934/1 241)	60.4%(769/1 273)
Zoeterwoude	80.5% (198/246)	66.6%* (197/296)
Zuidplas	75.1% (1 392/1 854)	59.9% (1 128/1 884)

*p-value<0.05 or adjusted residual>1,96 **p-value<0.001

Appendix V: Interactions between independent variables

Chi-square values of interactions between demographical factors

	Multiple birth	**older children**	**Mother's country o.b.**	**Age boil. mother /5y's**	**Highest educ. among parents**	**Employment 2nd parent**	**Family composition**	**Year of birth**
Sex	1.022	1.055	2.078	7.086	3.030	0.872	0.274	0.872
multiple birth	x	15.591*	4.358	22.323*	3.454	2.132	4.136	6.682
older children		x	**1419.625****	5018.745**	473.890**	180.809**	1247.620**	23.706
mother's country of birth			x	593.996**	**2884.776****	1465.917**	529.977**	58.937**
age boil. mother/5y's				x	3312.510**	372.198**	2603.774**	57.021
highest educ. parents					X	1759.348**	418.596**	128.272**
employment 2nd parent						x	401.178**	63.379**
family composition							x	32.803

fat are the interactions that have been chosen to analyse more into detail

*p-value<0.05 **p-value<0.001

effect of the number of older children in the family on breastfeeding, per category of the mother's country of birth

mother's country of birth	**Number of older children in the family**	**prevalence** percentage (N)	**breastfeeding on T1** percentage (N)	**breastfeeding on T2** percentage (N)
	0	43.9% (14 715)	79.1%* (11 308/14 299)	60.8%* (8 932/14 686)
	1	37.3% (12 506)	68.9%* (8 395/12 177)	55.5%* (6 932/12 482)
the	2	13.4% (4 484)	72.3%* (3 153/4 362)	62.3%* (2 788/4 477)
Netherlands	>2	5.3% (1 787)	73.1% (1 277/1 748)	61.1% (1 090/1 783)
	Total	**100% (33 492)**	**74.1%****	**59.1%****
			(24 133/32 586)	**(19 742/33 428)**
	0	54.6% (754)	93.8%* (691/737)	70.0% (526/751)
	1	33.2% (458)	88.5%* (391/442)	72.1% (330/458)
East-	2	8.9% (123)	90.1% (109/121)	69.1% (85/123)
European	>2	3.3% (45)	88.4% (38/43)	73.3% (33/45)
country	**total**	**100% (1 380)**	**91.5%* (1 229/1 343)**	**70.7% (974/1 377)**
	0	45.7% (541)	92.5%* (490/530)	71.8% (387/539)
	1	38.8% (460)	85.9%* (384/447)	73.1% (334/457)
other	2	11.8% (140)	83.5%* (111/133)	71.9% (100/139)
Western	>2	3.7% (44)	88.4% (38/43)	75.0% (33/44)
country	**total**	**100% (1 185)**	**88.7%* (1 023/1 153)**	**72.4% (854/1 179)**
	0	21.2% (242)	92.8% (219/236)	65.1% (157/241)
Morocco	1	24.2% (276)	89.3% (241/270)	66.5% (183/275)
	2	26.8% (305)	89.7% (261/291)	65.0% (197/303)
	>2	27.8% (317)	90.8% (278/306)	65.7% (207/315)
	total	**100% (1 140)**	**90.6% (999/1 103)**	**65.6% (744/1 134)**
	0	38.2% (923)	94.1%* (840/893)	67.2% (620/922)
	1	36.6% (883)	89.0%* (762/856)	67.1% (591/881)
other non-	2	14.9% (360)	91.7% (320/349)	69.6% (250/359)
Western	>2	10.3% (248)	96.2%* (225/234)	65.2% (161/247)
country	**total**	**100% (2 414)**	**92,1%** (2 147/2 332)**	**67.3% (1 622/2 409)**

*p-value<0.05 or adjusted residual>1.96 **p-value<0.001

effect of the highest education level among the caring parents on breastfeeding, per category of the mother's country of birth

mother's country of birth	highest education among the caring parents	prevalence percentage(N)	breastfeeding on T1 percentage (N)	breastfeeding on T2 percentage (N)
	low	0.3% (83)	40.2%* (33/82)	29.3%* (24/82)
the Netherlands	middle low	5.6% (1 762)	52.7%* (900/1 708)	36.7%* (645/1 756)
	middle high	33.5% (10 577)	65.0%* (6 715/10 329)	48.2%* (5 091/10 558)
	high	60.7% (19 195)	82.1%* (15 344/18 686)	68.2%* (13 076/19 162)
	Total	**100% (31 617)**	**74.6%** (22 992/30 805)**	**59.7%** (18 836/31 558)**
	low	1.6% (18)	94.1% (16/17)	61.1% (11/18)
East European country	middle low	10.7% (118)	91.2% (104/114)	67.8% (80/118)
	middle high	32.8% (362)	88.8%* (310/349)	64.1%* (232/362)
	high	54.8% (604)	92.7% (549/592)	74.9%* (450/601)
	total	**100% (1 102)**	**91.3% (979/1 072)**	**70.3%* (733/1 099)**
	low	0.0% (0)	-	-
other Western country	middle low	1.7% (19)	73.7%* (14/19)	57.9% (11/19)
	middle high	11.6% (127)	74.4%* (93/125)	52.8%* (67/127)
	high	86.7% (953)	91.7%* (852/929)	76.7%* (726/947)
	total	**100% (1 099)**	**89.4%** (959/1 073)**	**73.6%** (804/1 093)**
	low	12.2% (104)	85.3% (87/102)	55.3%* (57/103)
Morocco	middle low	12.3% (105)	91.1%% (92/101)	71.2% (74/104)
	middle high	38.0% (324)	89.7% (286/319)	66.6% (215/323)
	high	37.5% (320)	92.6% (288/311)	66.0% (210/318)
	total	**100% (853)**	**90.4% (753/833)**	**65.6% (556/848)**
	low	8.6% (156)	98.6%* (145/147)	72.4% (113/156)
other non-Western country	middle low	5.5% (100)	87.5% (84/96)	68.0% (68/100)
	middle high	23.1% (422)	90.0% (369/410)	61.3%* (258/421)
	high	62.8% (1 146)	92.5% (1 030/1 114)	69.7%* (798/1 145)
	total	**100% (1 824)**	**92.1%* (1 628/1 767)**	**67.9%* (1 237/1 822)**

*p-value<0.05 or adjusted residual>1.96
**p-value<0.001

Appendix VI: Completeness of prediction models per municipality

prediction models completeness per municipality: p-values of variables for municipalities per prediction model

	breastfeeding on T1					**breastfeeding on T2**				
mother's country of birth	the Netherlands	East-European	other Western	Morocco[1]	other non-Western	the Netherlands	East-European	other Western	Morocco	other non-Western
Alpen aan den Rijn	0,738	0,969	0,009*	-	0,221	0,016*	0,396	0,177	0,961	0,073
Bodegraven-Reeuwijk	0,000**	0,998	0,370	-	0,715	0,000**	0,699	0,296	0,489	0,041*
Gouda	0,000**	0,234	0,230	-	0,677	0,001*	0,725	0,331	0,920	0,110
Hillegom	0,662	0,302	0,203	-	0,529	0,056	0,779	0,257	0,946	0,532
Kaag en Braassem	0,246	0,175	0,483	-	0,398	0,132	0,941	0,848	0,067	0,755
Katwijk	0,000**	0,002*	0,520	-	0,013*	0,000**	0,214	0,102	0,753	0,586
Krimpenerwaard	0,739	0,285	0,005*	-	0,741	0,754	0,113	0,009*	0,048*	0,725
Leiden	0,268	0,809	0,025*	-	0,622	0,005*	0,717	0,011*	0,763	0,422
Leiderdorp	0,301	0,225	0,619	-	0,365	0,662	0,187	0,641	0,681	0,776
Lisse	0,000**	0,101	0,292	-	0,534	0,001*	0,722	0,085	-[2]	0,292
Nieuwkoop	0,000**	0,379	0,999	-	0,413	0,000**	0,454	0,130	0,864	0,933
Noordwijk	0,105	0,437	0,523	-	0,370	0,758	0,834	0,887	0,115	0,942
Noordwijkerhout	0,939	0,485	0,252	-	0,657	0,654	0,954	0,776	-[2]	0,313
Oegstgeest	0,000**	0,485	0,557	-	0,749	0,001*	0,077	0,627	-[2]	0,470
Teylingen	0,245	0,654	0,168	-	0,175	0,367	0,686	0,182	0,445	0,256
Voorschoten	0,269	0,871	0,760	-	0,251	0,283	0,099	0,252	0,677	0,381
Waddinxveen	0,607	0,803	0,152	-	0,173	0,281	0,853	0,421	0,784	0,245
Zoeterwoude	0,052	0,999	-[2]	-	0,999	0,008*	0,469	-[2]	-[2]	0,460
Zuidplas	0,646	0,614	0,202	-	0,205	0,645	0,888	0,042*	0,907	0,735

*p-value<0.05 **p-value<0.001

[1]It was not possible to produce prediction models for breastfeeding on the day of birth among Moroccan mothers, since none of the variables included in this study, effects this significantly.

[2]Prediction models have not been formed, if the group did not exist of more than 9 children.