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Past and current abuse is associated with early cessation of breastfeeding. Results from a large prospective cohort in Norway

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Abstract

Objective Breastfeeding provides a wide range of health benefits for both infants and mothers. Few studies have examined the impact of past and current abuse of women on breastfeeding behaviour. The aims of our study were to examine whether exposure to past and current emotional, sexual, or physical abuse was associated with early breastfeeding cessation, and to assess whether a potential association differed for known and unknown perpetrator.

Design Prospective cohort study.

Setting Norway, years 1999-2006.

Participants 53,934 mothers participating in the Norwegian Mother and Child Cohort Study. We included mothers with singleton pregnancy who had responded to three questionnaires (two in pregnancy and one 6 months postpartum) and had answered a minimum of one of the abuse questions.

Main outcome measure Odds ratios were estimated by binary logistic regression with cessation of any (all) breastfeeding before four months as the outcome, and abuse including subcategories of abuse, as the exposure.

Results Nearly all women initiated breastfeeding, but 12.1% ceased any breastfeeding before four months, and 38.9% ceased full breastfeeding before four months but continued partial breastfeeding. Overall, 19% of the women reported any adult abuse and 18% reported any child abuse.

The results showed the highest risk of any breastfeeding cessation before four months in women exposed to three types of adult abuse (emotional, sexual, or physical), with adjusted OR being 1.47 (95% CI: 1.23-1.76) compared with no abuse. Recent abuse and exposure from known perpetrator resulted in nearly 40% and 30% increased risk, respectively. The OR of any breastfeeding cessation for women exposed to any child abuse was 1.41 (95% CI: 1.32-1.50) compared with no abuse in childhood.

Conclusion Past and present abuse of women is strongly associated with early cessation of breastfeeding. Abused mothers comprise a key group to target for extra support and breastfeeding assistance.

Strengths and limitations of this study

- This is one of the largest studies to report an association between abuse of women and increased risk of early breastfeeding cessation. Our study provide new significant information about singular and combined types of abuse and breastfeeding (emotional, sexual and physical abuse), from one of the largest prospective population based pregnancy cohorts. It is an important contribution to the field, because it is one of the first to document the association between emotional abuse, as singular and combined groups, and breastfeeding cessation.
- The increased risk of early breastfeeding cessation among women who have experienced abuse was observed independently of prior depression, postpartum depression and other potential confounders and intermediate factors.
- Major strengths of this study include the prospective design; the large sample of women from all regions of Norway, including all age- and socioeconomic groups; and detailed information about experiences of abuse, including type of abuse, whether past or current abuse, and potential confounding factors.
- Since this study is observational, no causal implications can be drawn, and although confounding by other variables was carefully considered, residual confounding cannot be excluded.

Background

Breastfeeding has long been acknowledged as the optimal infant nutrition conferring beneficial short and long term health effects for both infants and mothers [1-5]. The World Health Organization (WHO) has since 2001 recommended exclusive breastfeeding for the first six months of life [6-8], and this is adopted by the Norwegian Health Authorities [9].

Abuse of women is common worldwide as one in three women during lifetime suffer partner or non-partner abuse [10]. There is an increasing body of research showing that current and past abusive experiences influences women's physical and mental health negatively, and have a negative impact on reproductive and postpartum health [11]. Adverse effects include adolescent and unintended pregnancies, miscarriage, sexually transmitted diseases, and postpartum depression [11-14], which all are barriers to breastfeeding.

Given the overwhelming evidence of the positive effects of breastfeeding, knowledge about factors influencing breastfeeding behaviour is essential. Factors that positively influence breastfeeding in Norway are higher educational level of the mother, higher maternal age, being married, and multi parity; whereas smoking and obesity has shown a negative impact [15-17]. There is a lack of knowledge about the impact of past and current abuse of women on breastfeeding behaviour. Only few studies have been published and the few existing are preliminary and inconclusive. Most studies have examined only one type of abuse, i.e. sexual or physical, although these often occur simultaneously, and studies that included perpetrators mostly focused on abuse from partner only [18 - 22]. The impact of emotional abuse on breastfeeding has rarely been studied [19 22]. Furthermore, studies are difficult to compare due to different designs and various definitions of both abuse and breastfeeding. The samples are often small, based on clinical cohorts and with a cross sectional design, hence not applicable to the broader population.

We explored the impact of abuse of women on breastfeeding behaviour in a large prospective population in Norway where the expectations to breastfeed are high, and breastfeeding is facilitated in the work regulations, e.g. paid leave for one year. The first aim of our study was to examine whether exposure to adult emotional, sexual, or physical abuse, as a singular or combined exposure was associated with early breastfeeding cessation. Secondly, we wanted to assess whether a potential association differed for known and unknown perpetrator. Thirdly, we wanted to examine the association between child abuse and early breastfeeding cessation.

Methods

Population and study design

The Norwegian Mother and Child Cohort Study (MoBa) is a prospective population-based pregnancy cohort conducted by the Norwegian Institute of Public Health [23]. The participants were recruited to the study through a postal invitation in connection with a routine ultra sound examination offered to all pregnant women in Norway. Participants were recruited from all over Norway from 1999-2008, and 40.6% of invited women consented to participate. The cohort now includes 114,500 children and 95,200 mothers. The women were asked to answer questionnaires at regular intervals during pregnancy and after birth. In the current study we used information from three questionnaires; the baseline questionnaire completed around week 18 of pregnancy, the questionnaire answered in gestational week 30, and the first follow-up questionnaire after delivery, completed at infant age six months (questionnaires available at www.fhi.no/moba). MoBa files are linked to pregnancy and birth records from the Norwegian Medical Birth Registry (NMBR). Written informed consent was obtained, and the MoBa study was approved by The Regional Committee for Medical and Health Research Ethics in South-Eastern Norway. The current study is based on version IV of the quality-assured data files including participants recruited in years 1999-2006. The research was performed in accordance with the Strobe guidelines [24]. An outline of the Strobe guidelines is added in the Supplemental files.

The inclusion of the study population is described in Figure 1. The source population study comprised women who had filled in all three questionnaires and were registered in NMBR (n=64,714). For women participating with more than one pregnancy, only information from the first pregnancy was included. Furthermore, we only included women with singleton pregnancies and those who had answered a minimum of one of the abuse questions, leaving a total of 53,934 for descriptive characteristics. For all adjusted analyses we included only women with complete information on the exposures and covariates.

Variables

Exposure variables – different abuse categories

The abuse questions and response options are shown in Supplemental files, Figure S1. These questions were part of the third MoBa questionnaire. The two questions about emotional abuse are similar to those in the Norvold Abuse Questionnaire [25], which measures mild and severe emotional abuse. We merged the responses to the two emotional abuse questions into

one variable. Women could respond "no never" to the various types of abuse, or "yes" as an adult (≥ 18 years) and/or as a child (< 18 years) to the various types of abuse. The question about sexual abuse with response options is a modified version of the sexual abuse question in the Abuse Assessment Screen (ASS) [26]. This screening tool is not validated, but has been used in other studies [27 28]. The question about physical abuse has been used in other studies, but is not validated [29 30]. Women who answered "yes" to at least one of the adult abuse questions were defined as having suffered from any adult abuse. Likewise, women responding "yes" to one or more of the child abuse questions were defined as having suffered from any child abuse. Information about child abuse was also categorized into "emotional and/or physical, not sexual" and "sexual and/or other". Women could also indicate whether or not they had been abused during the last 12 months, and we defined this as recent abuse.

Perpetrators

As part of the abuse questions, women were given the opportunity to reveal who committed the abuse: a stranger, family/relative, or other known (see supplemental Figure S1). The two latter categories were merged into known perpetrator. We categorized the responses about perpetrators in three groups; only known perpetrator, only unknown, and both known and unknown.

Outcome variables – breastfeeding

The breastfeeding data are based on three questions about infant nutrition in the questionnaire completed six months postpartum. The questions asked about what type of milk (breastfeeding or formula feeding) or other liquid the baby had been given in the first week of life and in monthly intervals up until and at the date of filling in the questionnaire (median 27 weeks/190 days). The women also reported the age (in months) of the infant at the time of introduction of semisolid or solid food. Full breastfeeding was defined as predominant breastfeeding without any formula or solids, but allowing water and vitamins. Any breastfeeding included both full and partial breastfeeding (i.e. breastfeeding with concomitant formula or solid foods given). The breastfeeding categories used in the present study are based on WHO definitions [31]. In the present study four dichotomous breastfeeding variables reflecting breastfeeding behaviour were used as outcome variables, i) cessation of any breastfeeding before four months, ii) cessation of full breastfeeding before four months, iii) cessation of any breastfeeding before six months, and iv) cessation of full breastfeeding before six months. We present descriptive data for all breastfeeding variables. As the main

outcome we present results only for the cessation of any breastfeeding before four months, while results for the other breastfeeding variables are reported as text.

Other variables

Characteristics associated with any adult abuse in our study population have been examined previously [29] and the following potential confounding variables were included based on this knowledge: being exposed to child abuse, civil status, maternal age, smoking, and alcohol intake. We also included as potential confounding variables the following maternal characteristics and risk factors for early cessation of full or any breastfeeding: maternal education, parity, body mass index (BMI), mode of delivery, preterm delivery, social support, prior depression, and postpartum depression.

Information about maternal age, education, civil status, pre-pregnant weight and height (for calculating of BMI), parity, prior depression, social support, alcohol intake and smoking in pregnancy, was retrieved from the baseline questionnaire. Information about postpartum depression was obtained from questionnaire four, whereas information about mode of delivery (caesarean section or vaginal delivery) and preterm delivery was retrieved from NMBR. The categorization of age, education, civil status, parity, smoking, and alcohol is shown in Table 1. BMI was calculated as weight in kg/height^2 (in m) and dichotomized into <25 (underweight and normal weight) and ≥25 (overweight and obese). Depression prior to current pregnancy was dichotomized into no or yes. Mode of delivery was categorized into vaginal birth or caesarean section. We defined preterm delivery as giving birth at <37th weeks of gestation on the basis of ultrasound measurements. In the few cases without ultrasound information (<2%), gestational age was calculated from the first day of last menstrual period. Social support was defined as having anyone other than partner to ask for support, and was dichotomized into no or yes. Postpartum depression was identified and dichotomized based on four questions from the Edinburgh Postpartum Depression Scale and a cut off score >6, which indicates a moderate level of postpartum depression symptoms. This variable has been described and examined previously in relation to adult exposure to abuse in MoBa [13].

Table 1. Characteristics of the study population by any adult abuse in the Norwegian Mother and Child Cohort Study. N=53,934

	Total		Any adult abuse		*P*[1]
	n	%	n	%	
All	53,934	100	10,442	19.4	
Breastfeeding (BF) initiation					
No	618	1.1	147	23.8	0.005

Yes	53,316	98.9	10295	19.3	
Full breastfeeding for 4 months					
No	20,991	38.9	4510	21.5	<0.001
Yes	32,325	59.9	5785	17.9	
No BF initiation	618				
Full breastfeeding for 6 months					
No	45,802	84.9	8896	19.4	0.102
Yes	7514	13.9	1399	18.6	
No BF initiation	618				
Any breastfeeding for 4 months					
No	6539	12.1	1588	24.3	<0.001
Yes	46,777	86.7	8707	18.6	
No BF initiation			147		
Any breastfeeding for 6 months					
No	10,341	19.2	2445	23.6	<0.001
Yes	42,945	79.7	7850	18.3	
No BF initiation	618		147		
Age in years					
14-19	693	1.3	101	14.6	<0.001
20-24	6423	11.9	1162	18.1	
25-29	19,628	36.4	3383	17.2	
30-34	21,945	40.7	4390	20.0	
≥35	5245	9.7	1406	26.8	
Education					
Primary (9 years)	1195	2.2	332	27.8	<0.001
Secondary (12 years)	15,902	29.5	3556	22.4	
Higher ≤4 years	31,432	58.3	5218	16.6	
Higher >4 years	3544	6.6	910	25.7	
Missing information	1861	3.5	426	22.9	
Civil status					
Married	26,572	49.3	4504	17.0	<0.001
Cohabiting	25,543	47.4	5289	20.7	
Not married/cohabiting	1523	2.8	578	38.0	
Missing information	296	0.5	71	24.0	
Child abuse					
No	44,064	81.7	7209	16.4	<0.001
Yes	9870	18.3	3233	32.8	
Parity					
0	27,666	51.3	5155	18.6	<0.001
+1	26,268	48.7	5287	20.1	
Mode of delivery					
Vaginal	50,296	93.3	9627	19.1	<0.001

C-section	3638	6.7	815	22.4	
Preterm delivery					
No (≥ 37 weeks)	51,258	95.0	9874	19.3	0.026
Yes (<37 weeks)	2472	4.6	521	21.1	
Missing information	204	0.4	47	23.0	
Smoking in pregnancy					
No	49,100	91.0	8954	18.2	<0.001
Yes	4834	9.0	1488	30.8	
Alcohol in pregnancy					
Never	38,931	72.2	7494	18.8	<0.001
Sometimes	7221	13.4	1628	22.5	
Daily	47	0.1	19	40.4	
Missing information	6705	12.4	1301	19.4	
BMI					
<25	35,389	66.5	6700	18.7	<0.001
≥ 25	16,552	30.7	3422	20.7	
Missing information	1490	2.8	320	21.5	
Postpartum depression					
No	47,349	87.8	8370	17.7	<0.001
Yes	5716	10.6	1897	33.2	
Missing information	869	1.6	175	20.1	

[1]P value calculated using Pearson's Chi square test (missing category not included)

Statistical analyses

Descriptive statistics of the study population by exposure to any adult abuse are presented in Table 1. For testing differences between categories we used Pearson's Chi-square test. We used binary logistic regression to examine the associations between adult abuse and early cessation of breastfeeding. The reference group for all analyses was no adult abuse. Crude and adjusted odds ratios (OR's) with 95% confidence intervals (CI) were presented and analysed for complete cases only. We included potential confounding variables based on previous knowledge of variables associated with either the exposure or the outcome. We identified potential confounders through directed acyclic graph (DAG) analysis. DAGs provide a method to identify potential confounders and decide which to adjust for. Many of the variables associated with both the exposure and the outcome in this study were intermediate variables rather than confounding variables. The minimal sufficient adjustment variables for estimating the total effect between adult abuse and breastfeeding behaviour were: maternal age, education, civil status, and child abuse (Supplemental Figure S2), and these variables

were included in all adjusted models. In addition, we evaluated the change in estimate when including intermediate variables: smoking, alcohol intake, parity, preterm delivery, social support, mode of delivery, BMI, preterm delivery, and depression prior to pregnancy. Finally, we conducted a sensitivity analysis in which we stratified women according postpartum depression to evaluate whether the association between adult abuse and breastfeeding behaviour was mediated primarily through postpartum depression. The data programme SPSS 22 (SPSS Inc, IBM Company, Chicago, Illinois, USA) was used to conduct all analyses. A significance level 0.05 was used.

Results

The majority of the women in the study population initiated breastfeeding (98.9%). Nearly 14% of the infants were fully breastfed up to six months postpartum, while almost 80% were still breastfed (Table 1). However, 12.1% of mothers ceased any breastfeeding before four months and 38.9% ceased full breastfeeding before four months. Overall, 19% of the 53,934 women reported exposure to any adult abuse, and the prevalence of abuse was significantly higher in women who did not initiate breastfeeding than in those who did. Likewise, any adult abuse was more prevalent in women who did not continue full or any breastfeeding for four or six months. Exposure to abuse was more prevalent in women who were older, not married, had been exposed to child abuse, were parous, had caesarean delivery, smoked, reported drinking alcohol in pregnancy, were overweight or obese, and in women with postpartum depression.

Adult abuse was significantly associated with early cessation of breastfeeding (Table 2). Women exposed to any adult abuse had 25% increased adjusted odds of cessation of any breastfeeding before four months compared to their counterparts (Table 2, Model 1). When the other breastfeeding variables were used as the outcome, we found significantly increased odds of full breastfeeding cessation before four months and of any breastfeeding cessation before six months, but not of full breastfeeding cessation before six months (data not shown).

In the analyses of singular or combined types of adult abuse we found that women reporting emotional abuse only (adjusted OR:1.28, 95% CI: 1.18-1.39), emotional and physical abuse (adjusted OR: 1.39, 95% CI: 1.18-1.62), emotional and sexual abuse (adjusted OR: 1.27, 95% CI: 1.02-1.58) or those reporting all three types of abuse; emotional, sexual and physical (adjusted OR: 1.47, 95% CI: 1.23-1.76) were more likely to stop any breastfeeding before four months than women without abuse (Table 2, Model 2).

Table 2. Logistic regression analyses of the association between types of adult abuse and cessation of any breastfeeding before four months (cessation of any BF <4 months). N=51,205

			Cessation of any BF<4months		Crude		Adjusted	
Abuse category	**n**	**(%)**	**n**	**(%)**	**OR**	**95% CI**	**OR**	**95% CI**
Model 1								
No adult abuse (reference)	41,396	80.8	4728	11.4	1.00		1.00	
Any adult abuse	9809	19.2	1511	15.4	1.41	(1.33-1.50)	1.25	(1.17-1.34)
Model 2 (abuse categories)								
No adult abuse (reference)	41,396	80.8	4728	11.4	1.00		1.00	
Physical only	567	1.1	65	11.5	1.00	(0.77-1.30)	0.96	(0.73-1.25)
Sexual only	976	1.9	107	11.0	0.96	(0.78-1.17)	0.94	(0.76-1.16)
Emotional only	5464	10.7	843	15.4	1.42	(1.31-1.53)	1.28	(1.18-1.39)
Physical+emotional	1149	2.2	210	18.3	1.73	(1.49-2.02)	1.39	(1.18-1.62)
Physical+sexual	189	0.4	24	12.7	1.13	(0.73-1.75)	0.95	(0.61-1.47)
Sexual+emotional	630	1.2	101	16.0	1.18	(1.19-1.84)	1.27	(1.02-1.58)
Sexual+physical+emotional	827	1.6	161	19.3	1.86	(1.56-2.21)	1.47	(1.23-1.76)

The adjusted model included the following variables: maternal age, education, civil status and, any child abuse. Analyzed for complete cases.

Women reporting recent abuse (Table 3) had 40% increased odds (adjusted OR: 1.40, 95% CI: 1.24-1.58) of early cessation of any breastfeeding compared to non-exposed women, while non-recent exposure was also associated with any breastfeeding cessation (OR: 1.21, 95% CI: 1.12-1.30).

When abuse was grouped by type of perpetrator (Table 4), exposure from "known perpetrator only" was significantly associated with cessation of any breastfeeding before four months (adjusted OR: 1.28, 95% CI: 1.19-1.37). The result for "both known and unknown" perpetrator was significant in the crude model only, while exposure from "unknown perpetrator only" was not associated with cessation of any breastfeeding.

Compared with crude ORs, the adjusted ORs for the association between adult abuse and early breastfeeding cessation were attenuated to some degree, e.g. from 1.41 to 1.25 in Model 1, Table 2. Of the four confounding variables, maternal education resulted in the largest change in the estimate. Additional adjustment for smoking, alcohol intake, parity, preterm delivery, social support, mode of delivery, BMI, and depression prior to pregnancy, did not substantially change in the odds ratio of interest (<10%), suggesting that the effect of adult abuse on early breastfeeding cessation was not mediated through these.

We have previously shown an association between abuse history and risk of postpartum depression [13] and we were particularly interested in examining postpartum depression as an intermediate variable in the analysis of adult abuse and early cessation of any breastfeeding. The prevalence of breastfeeding cessation before four months was 19.3% among women with postpartum depression and 12.4% in those without postpartum depression. However, when stratifying women by postpartum depression the association between any adult abuse and cessation of any breastfeeding was evident and comparable in women with postpartum depression (adjusted OR: 1.21, 95% CI: 1.12-1.30) and in those without (adjusted OR: 1.23, 95% CI: 1.06-1.44) group. Accordingly, the association between exposure to abuse and early cessation of breastfeeding cannot be explained by postpartum depression, rather by the abuse.

Exposure to child abuse was by itself significantly associated with any breastfeeding cessation before four months; the OR for any child abuse was 1.41 (95% CI: 1.32-1.50). When child abuse was categorized into "emotional and/or physical, not sexual" and "sexual and/or other", the association with breastfeeding cessation was OR: 1.27 (95% CI: 1.17-1.37) for emotional and/or physical and OR: 1.66 (95% CI: 1.51-1.82) for sexual abuse. We had no available variables that could be considered confounders of child abuse. However, child abuse was still

Table 3. Logistic regression analyses of the association between time of adult abuse (recent/not recent) and cessation of any breastfeeding before four months (cessation of any BF <4 months). N=51,014

			Cessation of any BF <4months		Crude		Adjusted	
	n	(%)	n	(%)	OR	95% CI	OR	95% CI
No adult abuse (reference)	41,396	81.1	4728	11.4	1.00		1.00	
Any adult, but not recent	7495	14.7	1084	14.5	1.31	(1.22-1.41)	1.21	(1.12-1.30)
Any adult recent abuse	2123	4.2	394	18.6	1.77	(1.58-1.98)	1.40	(1.24-1.58)

The adjusted model included the following variables: maternal age, education, civil status, any child abuse. Analyzed for complete cases.

Table 4. Logistic regression analyses of the association between perpetrator of adult abuse and cessation of any breastfeeding before four months (cessation of any BF <4 months). N=51,101

			Cessation of any BF <4months		Crude		Adjusted	
Perpetrator	n	(%)	n	(%)	OR	95% CI	OR	95% CI
No adult abuse (reference)	41,396	81.0	4728	11.4	1.00		1.00	
Known only	7850	15.4	1232	15.7	1.44	(1.35-1.55)	1.28	(1.19-1.37)
Unknown only	861	1.7	99	11.5	1.01	(0.82-1.25)	1.09	(0.88-1.35)
Known and unknown	994	1.9	165	16.6	1.54	(1.30-1.83)	1.18	(0.99-1.41)

The adjusted model included the following variables: maternal age, education, civil status and, any child abuse. Analyzed for complete cases.

significantly associated with breastfeeding cessation in the adjusted models in Tables 2-4 (OR: 1.12, 95% CI: 1.05-1.20). This association was stronger for sexual and/or other abuse than for emotional and/or physical, not sexual with OR: 1.22 (95% CI: 1.11-1.65) and OR: 1.06 (95% CI: 0.98-1.15), respectively.

Discussion

The main finding in our study was that exposure to past and present abuse was strongly associated with early cessation of any breastfeeding. The strongest effect was seen for women exposed to three types of abuse (sexual, physical and emotional); with nearly 50% increased adjusted odds of any breastfeeding cessation before four months compared to the non-exposed women. Recent abuse and exposure from known perpetrator resulted in nearly 40% and 30% increased risk of any breastfeeding cessation before four months, respectively. Women who reported a history of child abuse were more likely of early breastfeeding cessation, independent of later adult abuse.

The theoretical causal pathway between adult abuse and breastfeeding behaviour is complex and it is challenging to disentangle which variables to use as confounders. We used a DAG approach and landed on including only maternal age, education, civil status and child abuse (Supplemental Figure S2). Of these, adjustment for maternal education resulted in the largest change of the estimate. Educational attainment has been shown to be strong indicator of socio-economic differences in Norway [32-34]. The DAG clarified how a number of the potential confounding variables were intermediate variables in the theoretical effect pathway and therefore not true confounders. Furthermore, the sensitivity analyses showed that the estimated effect of abuse exposure on breastfeeding cessation was not primarily mediated through the intermediate variables. Interestingly, the association between adult abuse and breastfeeding cessation was evident both in women with and without postpartum depression.

Strengths and limitations

The major strengths of our study include the large sample size representing women from all regions of Norway, the prospective design and comprehensive information about singular and combined types of abuse, as well as extensive information on breastfeeding. In addition, information about a wide range of potential confounding factors was available. The low participation rate in MoBa is a concern (40.4%), with underrepresentation of women less than 25 years, smokers and those living alone [35]. The potential selection bias in MoBa has been evaluated. Despite differences in prevalence estimates, associations between eight exposures

and outcomes did not differ between MoBa participants and a representative sample from the general pregnant population, indicating that selection bias did not affect the associations [35]. Retrospective reporting is a challenge, but difficult to avoid in this kind of studies. The women`s reporting of breastfeeding six months postpartum could be subject to recall error. However, studies have found that maternal recall of breastfeeding give accurate estimates shortly after delivery [37], and even 20 years after delivery as described in a recent Norwegian study [37]. Norway has one of the highest breastfeeding rates in the world and almost all mothers initiate breastfeeding [4 15 38 44].

Comparison with other studies

Previous studies have mainly investigated the associations between child sexual abuse, current intimate partner violence (IPV), or pregnancy related abuse and breastfeeding [18-22 39]. Our findings of abused women being significantly less likely to initiate breastfeeding, and significantly more likely of early cessation of breastfeeding, are in agreement with four other studies [18 19 40 41]. A study in 811 randomly selected women in five large primary health clinics in Brazil reported that severe physical IPV increased the risk of early breastfeeding cessation [18.] A cross-sectional study comprising 1200 Chinese women showed that those who did not experience IPV during pregnancy were significantly more likely to initiate breastfeeding than abused women [19]. A review of 800 medical records in one family practice in the US revealed an association between lack of breast-feeding and physical and sexual abuse of mothers or their children [40]. A longitudinal study in 296 adolescent females showed that participants who had experienced IPV ceased breastfeeding earlier than their counterparts [41]. Contrary to this, two studies found no differences in breastfeeding between abused and non-abused women [20 42]. An Australian cluster randomized controlled trial involving 2621 women from 80 maternal and child health centres found that breastfeeding rates did not significantly differ between women exposed to IPV and non-IPV groups [20]. Similar findings were reported in a US study with 212 low income women regarding past and present domestic violence and initiating and duration of breastfeeding [42]. The authors suggested that their findings may be explained by other factors such as e.g. maternal age, education levels, mode of delivery, or preterm birth. Finally, a large American population based study (n=118,579) found that women reporting IPV were less likely to initiate breastfeeding, and that those who did initiate were more likely to cease breastfeeding before 4 weeks then the non-abused women [21]. However, the results did not remain significant when adjusted for socio-demographics and current smoking. One

can argue that the low prevalence rates of IPV in two of the studies, at 6.3% [20] and 5.8% [21] respectively, may be underestimated and influence the results.

Emotional abuse and breastfeeding

Few studies have examined emotional abuse and breastfeeding [19 22], and to our knowledge no previous studies support the current finding of a significant association between emotional abuse as a singular or combined exposure and early cessation of any breastfeeding. A cross sectional study from Hong Kong (n=1200) found that women who experienced emotional or physical abuse during pregnancy were more likely to be found in the artificial feeding group, than in the breastfeeding or mixed feeding groups [19]. A study from the US in 1220 women from a nationally representative sample showed that childhood emotional and physical abuse was not significantly associated with breastfeeding, whereas childhood sexual abuse was [22]. The same study aimed to investigate a possible cumulative effect of abuse but was unable to assess these effects due to few women reporting multiple types of abuse. In the current study all abuse categories containing emotional abuse were significantly associated with cessation of any breastfeeding in the adjusted models; emotional abuse only, emotional and sexual abuse, emotional and physical abuse, and emotional, physical, and sexual abuse. This result is important and underpins that emotional abuse should be included when studying adverse health outcomes of past or current abuse.

Child abuse and breastfeeding

Child abuse was associated with both the exposure and the outcome in our study and was modelled as a confounder. Furthermore, we found that child abuse was significantly associated with increased risk of any breastfeeding cessation before four months, independent of adult abuse. This association was stronger for child sexual abuse than for physical and/or emotional abuse only. The few existing previous studies that examined associations between child abuse and breastfeeding have focused only on child sexual abuse have reported contradictory results [22 39 43]. The US study in 1220 nationally representative women mentioned above found that women with a history of self-reported child sexual abuse were twice as likely to initiate breastfeeding than their non-abused counterparts, whereas breastfeeding duration did not differ significantly [22]. A Canadian qualitative study found that the women`s experiences of child sexual abuse affected their breastfeeding decisions, with the breastfeeding experience possibly resulting in re-traumatization for some abused women and a healing effect in others [39]. A literature review concluded that women with a history of child sexual abuse was more likely to express desire to and initiate breastfeeding than their non-

abused counterparts, but that both past and current abuse could lead to breastfeeding cessation [43]. Our results showed a strong independent effect of child abuse, and in particular child sexual abuse, on breastfeeding cessation. This is an important finding and may indicate that sexual abuse early in life results in even worse adverse long term effects than do other types of abuse.

Public health implications

Breastfeeding prevalence is higher in Norway than in most European countries [4 44]. Mean breastfeeding duration is about ten months. Although, the majority of women in Norway breastfeed for at least six months, a large decline in full breastfeeding occur between three and four months, and some women also discontinue any breastfeeding within the first six months [15 45]. Baby friendly hospitals, free antenatal care follow up by community nurses, and favourable maternity leave in Norway are societal priorities to enhance breastfeeding duration. Early maternal return to work can be a barrier to both initiating and duration of breastfeeding [46 47]. Norway has a long parental leave of 57 weeks at 80% benefit, or 47 weeks at 100% benefit, which supports the possibility of breastfeeding the first year of life [48]. An Australian longitudinal cohort study showed that women qualified to paid maternity leave had significantly reduced odds of reporting combined physical and emotional IPV the first year postpartum compared to non-working women [49]. These findings indicate that paid maternity leave may have broader social effects beyond immediate financial benefits to women. The findings from our study should encourage care-givers to pay more attention to vulnerable groups including single mothers and others prone to abuse exposure. Recommendations urging to ask for abuse have recently been implemented in the antenatal care guidelines in Norway. More research is needed on how antenatal care providers can recognize or ask about abuse and which strategies to choose for support and breastfeeding assistance.

Conclusion

The current study shows that past and present abuse of women is strongly associated with early cessation of breastfeeding. Our results also underpins that emotional abuse should be included in studies of adverse health effect of abuse. Given the convincing evidence of the beneficial effects of breastfeeding both for the mother and the infant, it is crucial to promote high breastfeeding rates. Mothers with a history of past or current abuse comprise a key group to target for extra support and breastfeeding assistance.

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Contributors
MFS, HG and ML conceived the study and all authors contributed to the study design. MFS and ALB prepared the data and performed the statistical analyses. MFS drafted the manuscript. All authors contributed to the interpretation of the results and critically reviewed the manuscript. All authors read and approved the final manuscript.

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Competing interests
None.

Ethics approval
The Norwegian Mother and Child Cohort Study was approved by the Regional Committee for Ethics in Medical Research (REK nr S-97045 /S-95113) and the Data Inspectorate in Norway.

Data sharing statement
No additional data are available.

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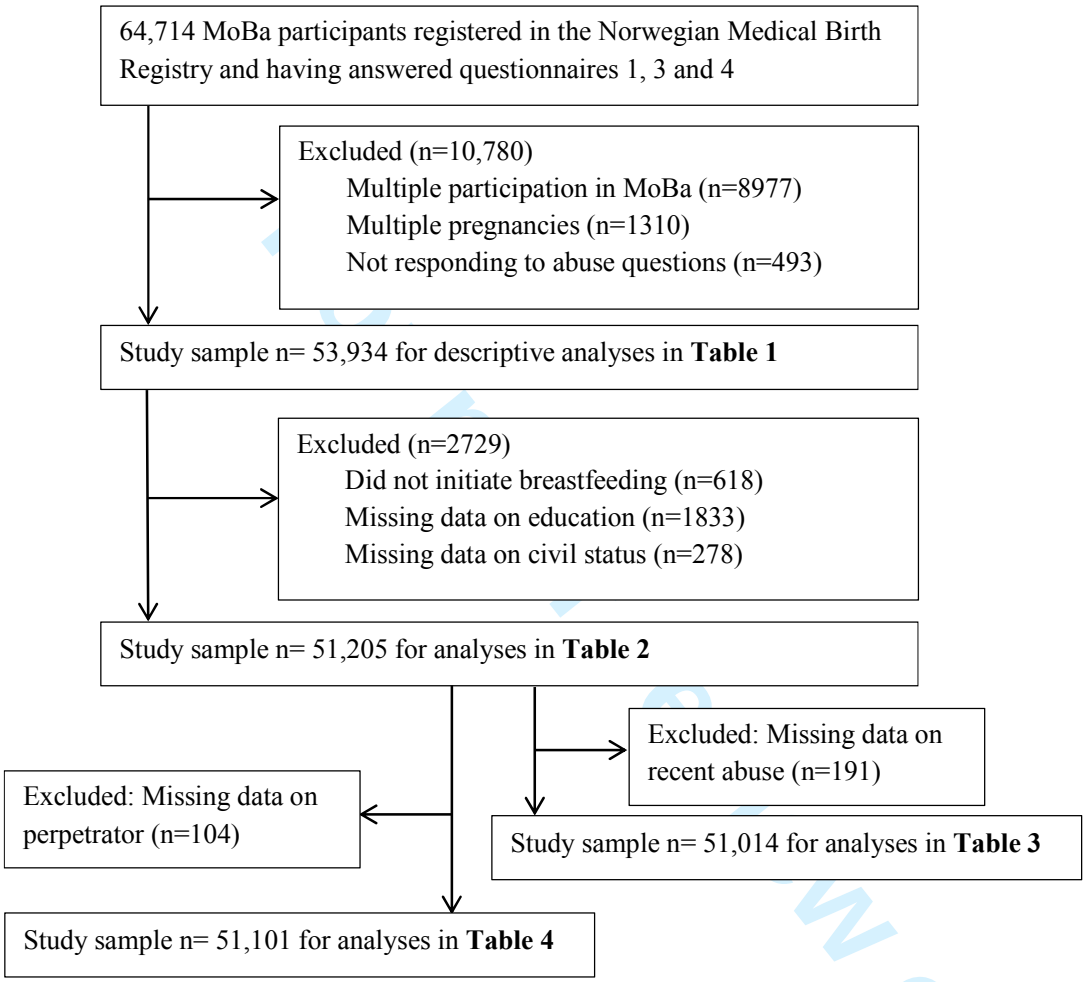
Figures

Figure 1. Flow-chart of inclusion



Supplemental Material:

Supplemental Figure S1

Figure Legend: Questions and response options on abuse and perpetrators in questionnaire 3 in the Norwegian
Mother and Child Cohort Study

Have you ever experienced any of the following? *(Fill in for each statement.)*

Supplemental Figure S2

Figure Legend: The directed acyclic graph (DAG) for this study as generated by dagitty.net. The green node indicates the exposure of interest (Adult abuse), the green lines the exposures effect pathways, and the blue node with the "I" indicates the outcome of interest (Breastfeeding behavior). The blue nodes without "I" are intermediate variables in the effect pathway. Red nodes are confounders that are adjusted for in the models. The minimal sufficient adjustment set for estimating the total effect of Adult abuse on Breastfeeding behavior was maternal age, education, child abuse, and civil status.

	No Never	Yes, as a child (under 18)	Yes, as an adult (over 18)	Who was responsible for this?			Has this occurred during the last year	
				A stranger	Family or relative	Another known person	No	Yes
Someone has over a long period of time systematically tried to subdue, degrade or humiliate you	☐	☐	☐	☐	☐	☐	☐	☐
Someone has threatened to hurt you or someone close to you	☐	☐	☐	☐	☐	☐	☐	☐
You have been subjected to physical abuse	☐	☐	☐	☐	☐	☐	☐	☐
You have been forced to have sexual intercourse	☐	☐	☐	☐	☐	☐	☐	☐

Figure Legend: Questions and response options on abuse and perpetrators in questionnaire 3 in the Norwegian
Mother and Child Cohort Study

Have you ever experienced any of the following? (Fill in for each statement.)

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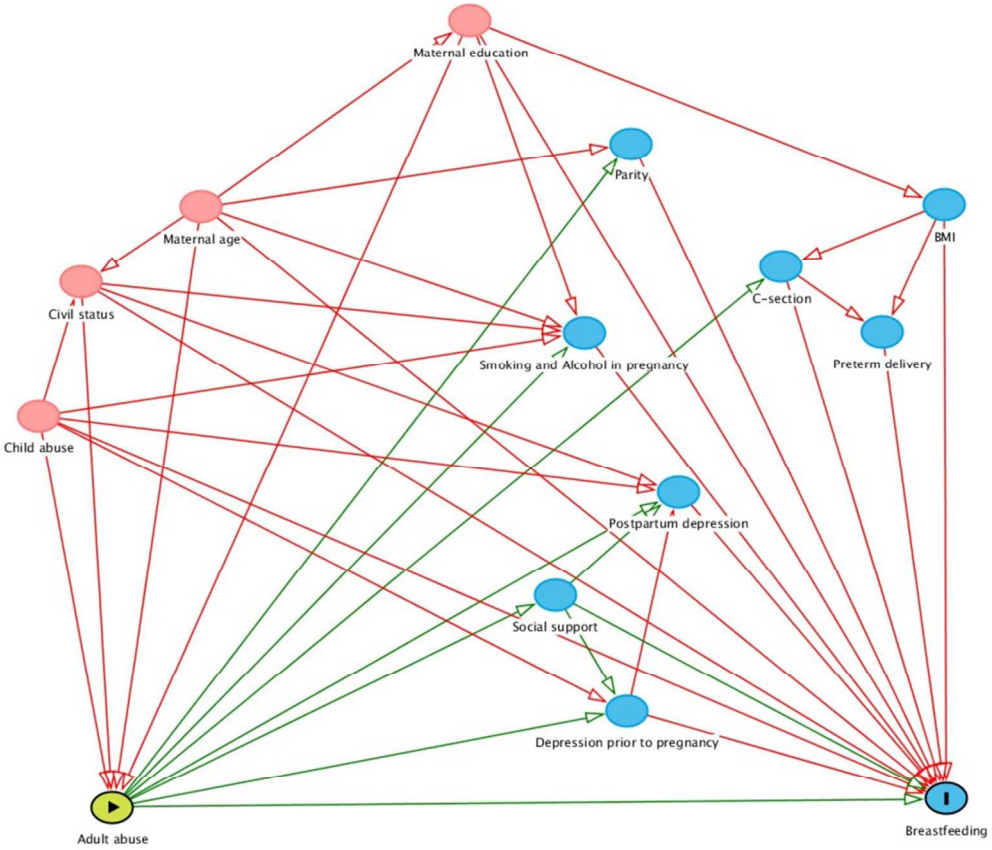

Figure Legend: The directed acyclic graph (DAG) for this study as generated by dagitty.net. The green node indicates the exposure of interest (Adult abuse), the green lines the exposures effect pathways, and the blue node with the "I" indicates the outcome of interest (Breastfeeding behavior). The blue nodes without "I" are intermediate variables in the effect pathway. Red nodes are confounders that are adjusted for in the models. The minimal sufficient adjustment set for estimating the total effect of Adult abuse on Breastfeeding behavior was maternal age, education, child abuse, and civil status.

256x238mm (96 x 96 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract The study design in mentioned in the title: Past and current abuse is associated with early cessation of breastfeeding. Results from a large prospective cohort in Norway. The study design is also stated in the abstract: Design: Prospective cohort study.	1 and 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found This is what we have aimed at providing in the abstract.	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Breastfeeding has long been acknowledged as the optimal infant nutrition conferring short and long term health effects for both mothers and infants. Abuse of women is common worldwide and is known to have detrimental consequences of women`s health and general life. Little is known about the impact of abuse of breastfeeding behaviour and more studies are needed. We had the possibility to investigate this in one of the largest prospective pregnancy cohorts worldwide. The rationale is outlined in the background.	4
Objectives	3	State specific objectives, including any prespecified hypotheses The objective of the study is stated on page 4.	4
Methods			
Study design	4	Present key elements of study design early in the paper This is a prospective study within the Norwegian Mother and Child Cohort (MoBa) study. The design is presented early in the method section, including description of the exposure and outcome variables, relevant covariates, and the statistical methods used.	5-8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection The setting of the study is given first in the abstract and further in the methods section. Time of collection is described in the methods section.	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up Recruitment and methods of selection of participants, and selection of the final study sample from the eligible women is described in the methods section on page 5. Selection of participants is also described in Figure 1 (flow chart).	5

		(*b*) For matched studies, give matching criteria and number of exposed and unexposed Not applicable.	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Exposure, outcome and potential confounders are described in the methods section, pages 5-7. Definitions used for the outcome (breastfeeding) are reported in the methods section, page 6.	5-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Sources of the data in the present study are specified in the methods section, pages 5-8. Please see an overview below. **The baseline questionnaire in the MoBa study answered in gestational weeks 15-18 (Q1):** Variables: Maternal age, education, civil status, smoking, alcohol use, child abuse exposure, parity, prior depression, social support, pre pregnant weight and height for calculation BMI. **The questionnaire responded to at gestational week 30 (Q3)** Variables: All abuse categories, types of abuse, time of abuse, and perpetrators, see page 6 **The first questionnaire after birth, six months postpartum (Q4)** Variable: Postpartum depression Information used for the breastfeeding variables were also reported in Q4 six months postpartum. The data are based on three questions about infant nutrition. The questions asked about what type of milk (breastfeeding of formula feeding) or other liquid the baby had been given in the first week of life in monthly intervals up until and at the date of filling in the questionnaire (median 27 weeks/190 days). The women also reported the age (in months) of the infant at the time of semisolid or solid food. Breastfeeding definitions are based on the WHO`s definitions, as described on pages 6 -7. **The Medical Birth Registry of Norway:** Information based on forms completed by the midwives or attending physician within 7 days after birth. Variables: Mode of delivery, (caesarean section or vaginal delivery) and gestational length (used to define preterm delivery, i.e. delivery before 37 completed gestational weeks.	
Bias	9	Describe any efforts to address potential sources of bias In the Norwegian Mother and Child Cohort Study as well as similar studies, selection bias and differences in the socio-economic status are the most serious concerns. Selection bias in this cohort was evaluated in a separate paper (Nilsen et al.,	8 and 10-11

		2009) which showed that non-representativeness of women in the cohort did not influence exposure-outcome association. This information is included in the discussion. Potential confounding has also been thoroughly addressed. Characteristics associated with any adult abuse in our study population have been examined previously (Sørbø MF, et al 2013) and potential confounder variables were based on this knowledge. We also included other potential confounding variables, as described in the first paragraph under "Other variables" in the methods section. We used directed acyclic graphs (DAGs) approach to clarify which variables were confounders and which variables were intermediate variables. This is described in methods section (statistical analyses) on page 8 and in discussion section on page 10-11. The variables identified by the DAG (maternal education, maternal age, child abuse, and civil status) were included in all adjusted analyses.	
Study size	10	Explain how the study size was arrived at The selection of the final study sample is described on page 5, and shown in Figure 1.	5 Figure 1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why The way in which quantitative variables (covariates) were divided into groups and why are described on page 6 (child abuse), and page 7 (maternal age, maternal education, and civil status), and shown in Table 1. How they were used are described in statistical analyses section (page 8), and in Supplemental Figure S2. The intermediate variables and how they were identified, are described on the same pages and in Tables 1 and Supplemental Figure S2.	7-8 Table 1 Figure S2
Statistical methods	12	(a)Describe all statistical methods, including those used to control for confounding Statistical methods are described on page 8. Odds ratios were estimated by binary logistic regression with cessation of breastfeeding as before four months as the outcome and abuse, including subcategories of abuse, as the exposure. Examination of and controlling for confounding is described in the methods section on page 8 and in the discussion section pages 10-11, and is shown in Figure S2.	7-8, Figure S2
		(*b*) Describe any methods used to examine subgroups and interactions We examined the exposure variable (abuse) as a dichotomous variable (any abuse yes/no) and by the subgroups a) emotional, sexual, and physical abuse, b) recent/not recent, c) grouped by perpetrators (known only, unknown only, known and unknown). The method used to examine subgroups is logistic regression as described in the Statistical methods. We did not examine potential interactions between the exposure and the confounders (maternal age, maternal education, child abuse, and civil status) due to small differences between crude and adjusted ORs for the associations studied.	
		(*c*) Explain how missing data were addressed Exclusion due to missing data is described in the methods section, page 8. All binary logistic regression analyses were performed for complete cases only. Descriptive statistics of the study population by exposure to any adult abuse are presented in Table 1. For testing differences	8

		between these categories we used Pearson`s Chi-square test, and participants grouped in a "missing category" were not included.	
		(*d*) If applicable, explain how loss to follow-up was addressed Not applicable.	
		(*e*) Describe any sensitivity analyses Sensitivity analyses (with regard to postpartum depression) have been described in the statistical section on page 8 and in the two last paragraphs in the results section on page 10.	8 and 10
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed The numbers of individuals potentially eligible, excluded at each stage, and finally included in the study populations are given on page 5. The numbers of participants included in each analysis are also shown in this paragraph, and shown in the flow chart in Figure 1.	5 Figure 1
		(b) Give reasons for non-participation at each stage Shown in text on page 5 and in Figure 1.	5 Figure 1
		(c) Consider use of a flow diagram See Figure 1.	5 Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Various characteristics of the participants, and information on the exposure and potential confounders, are described in the methods section on page 5, and in the results section on pages 8-10, and in Table 1.	5, 8-10 Table 1
		(b) Indicate number of participants with missing data for each variable of interest The number of participants on with missing data (descriptive data, risk and health factors) is shown in Table 1. In Tables 2-4 analyses were performed for complete cases only. The number with missing on the specific outcome variables is shown in the flow chart (Figure 1).	Table 1 Figure 1
		(c) Summarise follow-up time (eg, average and total amount) Not applicable.	
Outcome data	15*	Report numbers of outcome events or summary measures over time The number of participants reporting breastfeeding is presented in Table 1, in the text in the results section on page 8, and also in the abstract.	8 Table 1
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence	8-10, Figures 2-4

		interval). Make clear which confounders were adjusted for and why they were included Crude and adjusted estimates for the associations between abuse and cessation of breastfeeding are presented in Tables 2-4 and in the text on page 8 (statistical section) and page 10 -11 (discussions section). Adjusted results are also presented in the abstract. All analyses were adjusted for maternal age, maternal education, child abuse, and civil status. These covariates were the minimal sufficient adjustment variables for estimating the total effect between adult abuse and breastfeeding. We used DAG to help clarify which variables were intermediate factors rather than confounders. Table 2 presents crude and adjusted results of the association between any adult abuse, singular and combined types of adult abuse, respectively, and any breastfeeding cessation before 4 months. Table 3 presents crude and adjusted results of the association between time of adult abuse (recent/not recent) and cessation of any breastfeeding before 4 months. Table 3 presents crude and adjusted results of the association between the perpetrator (known only, unknown only, and, known and unknown) of abuse and cessation of any breastfeeding before 4 months	
		(*b*) Report category boundaries when continuous variables were categorized The only continuous variable grouped into categories in this study was maternal age. We divided into the following categories shown in Table 1. First category: 14-19 years Second category: 20-24 years Third category: 25-29 years Fourth category: 30-34 years Fifth category: ≥ 35 years Maternal BMI was included in Table 1 and for descriptive purpose and was divided into two groups based on the WHO categories; i) underweight and normal weight women (BMI<25) and ii) overweight and obese women (BMI>=25)	Table 1
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period In the present study the estimates are calculated as odds ratios, and to our understanding it is not relevant to calculate absolute risk.	8

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses Characteristics of the participants exposed to abuse versus non-abused are shown in Table 1 and are given on page 8 -9, under results. Sensitivity analyses regarding postpartum depression is described on page 8 (statistical section), on page 10 (results section), and on page 11 (discussion section). We did not perform analyses of interactions (see point 12 b).	7-8
Discussion			
Key results	18	Summarise key results with reference to study objectives The main results are stated in the Abstract page 2, in the beginning of the discussion section, page 10 and in the conclusion, page 14.	2, 10, 14
Limitations	19	Limitations of the study are discussed on page 11, under paragraph “Strengths and limitations”.	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Interpretation of the results is presented on pages 10-14. Our interpretation is cautious, in the form of possible, hypothetical explanations, recognising the limitations of associations based on epidemiological data.	10-14
Generalisability	21	Discuss the generalisability (external validity) of the study results The generalizability and representativeness of the study results is discussed under the discussion section, page 11.	11
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based The funding of the present project as well as the funding for the Norwegian Mother and Child Cohort Study is described on page 14, in the “Funding section”.	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Past and recent abuse is associated with early cessation of breastfeeding. Results from a large prospective cohort in Norway

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Past and recent abuse is associated with early cessation of breastfeeding. Results from a large prospective cohort in Norway

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Abstract

Objective: Breastfeeding provides a wide range of health benefits for both infants and mothers. Few studies have examined the impact of past and current abuse of women on breastfeeding behaviour. The aims of our study were to examine whether exposure to past and recent emotional, sexual, or physical abuse was associated with early breastfeeding cessation, and to assess whether a potential association differed for known and unknown perpetrator.

Design: Prospective cohort study.

Setting: Norway, years 1999-2006.

Participants: 53,934 mothers participating in the Norwegian Mother and Child Cohort Study. We included mothers with singleton pregnancy who had responded to three questionnaires (week 18 and 30 in pregnancy and 6 months postpartum) and had answered minimum one of the abuse questions in week 30.

Main outcome measure: Odds ratios were estimated by binary logistic regression with cessation of any (all) breastfeeding before four months as the outcome, and abuse including subcategories of abuse, as the exposure.

Results: Nearly all women initiated breastfeeding, but 12.1% ceased any breastfeeding before four months and 38.9% ceased full breastfeeding before four months but continued partial breastfeeding. Overall, 19% of the women reported any adult abuse and 18% reported any child abuse.

The highest risk of any breastfeeding cessation before four months was seen in women exposed to three types of adult abuse (emotional, sexual, or physical), with adjusted OR being 1.47 (95% CI: 1.23-1.76) compared with no abuse. Recent abuse and exposure from known perpetrator resulted in nearly 40% and 30% increased risk, respectively. The OR of any breastfeeding cessation for women exposed to any child abuse was 1.41 (95%CI: 1.32-1.50) compared with no abuse in childhood.

Conclusion: Past and recent abuse of women is strongly associated with early cessation of breastfeeding. Abused mothers comprise a key group to target for extra support and breastfeeding assistance.

Strengths and limitations of this study

- This is one of the largest studies to report an association between abuse of women and increased risk of early breastfeeding cessation. Our study provide new significant information about singular and combined types of abuse and breastfeeding (emotional, sexual and physical abuse), from one of the largest prospective population based pregnancy cohorts. It is an important contribution to the field, because it is one of the first to document the association between emotional abuse, as singular and combined groups, and breastfeeding cessation.
- The increased risk of early breastfeeding cessation among women who have experienced abuse was observed independently of prior depression, postpartum depression and other potential confounders and intermediate factors.
- Major strengths of this study include the prospective design; the large sample of women from all regions of Norway, including all age- and socioeconomic groups; and detailed information about experiences of abuse, including type of abuse, whether past or recent abuse, and potential confounding factors.
- Since this study is observational, no causal implications can be drawn, and although confounding by other variables was carefully considered, residual confounding cannot be excluded.

Background

Breastfeeding has long been acknowledged as the optimal infant nutrition conferring beneficial short and long term health effects for both infants and mothers [1-5]. The World Health Organization (WHO) has since 2001 recommended exclusive breastfeeding for the first six months of life [6-8] and this has been is adopted by the Norwegian Health Authorities [9].

Abuse of women is common worldwide, as one in three women during lifetime suffer partner or non-partner abuse [10]. There is an increasing body of research showing that recent and past abusive experiences influences women's physical and mental health negatively, and have a negative impact on reproductive and postpartum health [11]. Adverse effects include adolescent and unintended pregnancies, miscarriage, sexually transmitted diseases, and postpartum depression [11-14], which all are barriers to breastfeeding.

Given the overwhelming evidence of the positive effects of breastfeeding, knowledge about factors influencing breastfeeding behaviour is essential. Norway has one of the highest breastfeeding rates in the world and almost all mothers initiate breastfeeding [4 15 16]. Factors that positively influence breastfeeding in Norway are higher educational level of the mother, higher maternal age, being married, and multi parity; whereas smoking and obesity has shown a negative impact [15 17-18]. There is a lack of knowledge about the impact of past and recent abuse of women on breastfeeding behaviour. Only a few studies have been published and these are preliminary and inconclusive. Most studies have examined only one type of abuse, i.e. sexual or physical, although these often occur simultaneously and studies that included perpetrators mostly focused on abuse from partner only [19 - 23]. The impact of emotional abuse on breastfeeding has rarely been studied [20 23]. Furthermore, studies are difficult to compare due to different designs and various definitions of both abuse and breastfeeding. The samples are often small, based on clinical cohorts and with a cross sectional design, hence not applicable to the broader population.

We explored the impact of abuse of women on breastfeeding behaviour in a large prospective population in Norway where the expectations to breastfeed are high, and breastfeeding is facilitated in the work regulations, e.g. paid leave for one year. The first aim of our study was to examine whether exposure to adult emotional, sexual, or physical abuse, as a singular or combined exposure was associated with early breastfeeding cessation. Secondly, we wanted to assess whether a potential association differed for adult recent and non-recent abuse and for

known and unknown perpetrator. Thirdly, we wanted to examine the association between child abuse and early breastfeeding cessation.

Methods

Population and study design

The Norwegian Mother and Child Cohort Study (MoBa) is a prospective population-based pregnancy cohort conducted by the Norwegian Institute of Public Health [24]. The participants were recruited to the study through a postal invitation in connection with a routine ultra sound examination offered to all pregnant women in Norway. Participants were recruited from all over Norway from 1999 to 2008, and 40.6% of invited women consented to participate. The cohort now includes 114,500 children and 95,200 mothers. The women were asked to answer questionnaires at regular intervals during pregnancy and after birth. In the current study we used information from three questionnaires; the baseline questionnaire completed around week 18 of pregnancy (socio-demographics and risk factors), the questionnaire answered in gestational week 30 (abuse questions), and the first follow-up questionnaire after delivery (breastfeeding questions), completed at infant age six months (questionnaires available at www.fhi.no/moba). MoBa files are linked to pregnancy and birth records from the Norwegian Medical Birth Registry (NMBR). Written informed consent was obtained, and the MoBa study was approved by The Regional Committee for Medical and Health Research Ethics in South-Eastern Norway. The current study is based on version IV of the quality-assured data files including participants recruited in years 1999-2006. The research was performed in accordance with the Strobe guidelines [25]. An outline of the Strobe guidelines is added in the Supplemental files.

The inclusion of the study population is described in Figure 1. The source population study comprised women who had filled in all three questionnaires and were registered in NMBR (n=64,714). For women participating with more than one pregnancy, only information from the first pregnancy was included. Furthermore, we only included women with singleton pregnancies and those who had answered a minimum of one of the abuse questions, leaving a total of 53,934 for descriptive characteristics. For all adjusted analyses we included only women with complete information on the exposures and covariates.

Variables

Exposure variables – different abuse categories

The abuse questions and response options are shown in Supplemental files, Figure S1. These questions were part of the third MoBa questionnaire, which was responded to at gestational weeks 30. The two questions about emotional abuse are similar to those in the Norvold Abuse Questionnaire [26], which measures mild and severe emotional abuse. We merged the responses to the two emotional abuse questions into one variable. Women could respond "no never" to the various types of abuse, or "yes" as an adult (≥ 18 years) and/or as a child (< 18 years) to the various types of abuse. The question about sexual abuse with response options is a modified version of the sexual abuse question in the Abuse Assessment Screen (ASS) [27]. This screening tool is not validated, but has been used in other studies [28 29]. The question about physical abuse has been used in other studies, but is not validated [30 31]. Women who answered "yes" to at least one of the adult abuse questions, i.e. past or current adult abuse, were defined as having suffered from any adult abuse. Likewise, women responding "yes" to one or more of the child abuse questions were defined as having suffered from any child abuse. Information about child abuse was grouped into two non-overlapping categories: "emotional and/or physical, not sexual" and "sexual alone or in combination with emotional and/or physical". Women could also indicate whether or not they had been abused during the last 12 months, and we defined this as recent abuse. All analyses of recent abuse refer to adult recent abuse, not child abuse. Past abuse refers to both child abuse and non-recent adult abuse.

Perpetrators

As part of the abuse questions, women were given the opportunity to reveal who committed the abuse: a stranger, family/relative, or other known (see supplemental Figure S1). The two latter categories were merged into known perpetrator. We categorized the responses about perpetrators in three groups; only known perpetrator, only unknown, and both known and unknown.

Outcome variables – breastfeeding

The breastfeeding data are based on three questions about infant nutrition in the questionnaire completed six months postpartum. The questions asked about what type of milk (breastfeeding or formula feeding) or other liquid the baby had been given in the first week of life and in monthly intervals up until and at the date of filling in the questionnaire (median 27 weeks/190 days). The women also reported the age (in months) of the infant at the time of

introduction of semisolid or solid food. Full breastfeeding was defined as predominant breastfeeding without any formula or solids, but allowing water and vitamins. Any breastfeeding included both full and partial breastfeeding (i.e. breastfeeding with concomitant formula or solid foods given). The breastfeeding categories used in the present study are based on WHO definitions [32]. In the present study four dichotomous breastfeeding variables reflecting breastfeeding behaviour were used as outcome variables, i) cessation of any breastfeeding before four months, ii) cessation of full breastfeeding before four months, iii) cessation of any breastfeeding before six months, and iv) cessation of full breastfeeding before six months. We present descriptive data for all breastfeeding variables. As the main outcome we present results only for the cessation of any breastfeeding before four months, while results for the other breastfeeding variables are reported as text.

Other variables

Characteristics associated with any adult abuse in our study population have been examined previously [30] and the following potential confounding variables were included based on this knowledge: being exposed to child abuse, civil status, maternal age, smoking, and alcohol intake. We also included as potential confounding variables the following maternal characteristics and risk factors for early cessation of full or any breastfeeding: maternal education, parity, body mass index (BMI), mode of delivery, preterm delivery, social support, prior depression, and postpartum depression.

Information about maternal age, education, civil status, pre-pregnant weight and height (for calculating of BMI), parity, prior depression, social support, alcohol intake and smoking in pregnancy, was retrieved from the baseline questionnaire (week 18 in pregnancy). Information about postpartum depression was obtained from questionnaire four (6 months postpartum), whereas information about mode of delivery (caesarean section or vaginal delivery) and preterm delivery was retrieved from NMBR. The categorization of age, education, civil status, parity, smoking, and alcohol is shown in Table 1. BMI was calculated as weight in kg/height^2 (in m) and dichotomized into <25 (underweight and normal weight) and ≥25 (overweight and obese). Depression prior to current pregnancy was dichotomized into no or yes. Mode of delivery was categorized into vaginal birth or caesarean section. We defined preterm delivery as giving birth at <37th weeks of gestation on the basis of ultrasound measurements. In the few cases without ultrasound information (<2%), gestational age was calculated from the first day of last menstrual period. Social support was defined as having anyone other than partner to ask for support, and was dichotomized into no or yes. Postpartum

depression was identified and dichotomized based on four questions from the Edinburgh Postpartum Depression Scale and a cut off score >6, which indicates a moderate level of postpartum depression symptoms. This variable has been described and examined previously in relation to adult exposure to abuse in MoBa [13].

Table 1. Characteristics of the study population by any adult abuse in the Norwegian Mother and Child Cohort Study. N=53,934

	Total		Any adult abuse		*P*[1]
	n	%	n	%	
All	53,934	100	10,442	19.4	
Breastfeeding (BF) initiation					
No	618	1.1	147	23.8	0.005
Yes	53,316	98.9	10295	19.3	
Full breastfeeding for 4 months					
No	20,991	38.9	4510	21.5	<0.001
Yes	32,325	59.9	5785	17.9	
No BF initiation	618				
Full breastfeeding for 6 months					
No	45,802	84.9	8896	19.4	0.102
Yes	7514	13.9	1399	18.6	
No BF initiation	618				
Any breastfeeding for 4 months					
No	6539	12.1	1588	24.3	<0.001
Yes	46,777	86.7	8707	18.6	
No BF initiation			147		
Any breastfeeding for 6 months					
No	10,341	19.2	2445	23.6	<0.001
Yes	42,945	79.7	7850	18.3	
No BF initiation	618		147		
Age in years					
14-19	693	1.3	101	14.6	<0.001
20-24	6423	11.9	1162	18.1	
25-29	19,628	36.4	3383	17.2	
30-34	21,945	40.7	4390	20.0	
≥35	5245	9.7	1406	26.8	
Education					
Primary (9 years)	1195	2.2	332	27.8	<0.001
Secondary (12 years)	15,902	29.5	3556	22.4	
Higher ≤4 years	31,432	58.3	5218	16.6	
Higher >4 years	3544	6.6	910	25.7	
Missing information	1861	3.5	426	22.9	
Civil status					

Married	26,572	49.3	4504	17.0	<0.001
Cohabiting	25,543	47.4	5289	20.7	
Not married/cohabiting	1523	2.8	578	38.0	
Missing information	296	0.5	71	24.0	
Child abuse					
No	44,064	81.7	7209	16.4	<0.001
Yes	9870	18.3	3233	32.8	
Parity					
0	27,666	51.3	5155	18.6	<0.001
+1	26,268	48.7	5287	20.1	
Mode of delivery					
Vaginal	50,296	93.3	9627	19.1	<0.001
C-section	3638	6.7	815	22.4	
Preterm delivery					
No (≥ 37 weeks)	51,258	95.0	9874	19.3	0.026
Yes (<37 weeks)	2472	4.6	521	21.1	
Missing information	204	0.4	47	23.0	
Smoking in pregnancy					
No	49,100	91.0	8954	18.2	<0.001
Yes	4834	9.0	1488	30.8	
Alcohol in pregnancy					
Never	38,931	72.2	7494	18.8	<0.001
Sometimes	7221	13.4	1628	22.5	
Daily	47	0.1	19	40.4	
Missing information	6705	12.4	1301	19.4	
BMI					
<25	35,389	66.5	6700	18.7	<0.001
≥ 25	16,552	30.7	3422	20.7	
Missing information	1490	2.8	320	21.5	
Postpartum depression					
No	47,349	87.8	8370	17.7	<0.001
Yes	5716	10.6	1897	33.2	
Missing information	869	1.6	175	20.1	

[1]P value calculated using Pearson's Chi square test (missing category not included)

Statistical analyses

Descriptive statistics of the study population by exposure to any adult abuse are presented in Table 1. For testing differences between categories we used Pearson's Chi-square test. We used binary logistic regression to examine the associations between adult abuse and early

cessation of breastfeeding. The reference group for all analyses of adult abuse was no adult abuse and the reference group for child abuse was no child abuse. Crude and adjusted odds ratios (OR's) with 95% confidence intervals (CI) were presented and analysed for complete cases only. We included potential confounding variables based on previous knowledge of variables associated with either the exposure or the outcome. We identified potential confounders through directed acyclic graph (DAG) analysis. DAGs provide a method to identify potential confounders and decide which to adjust for [33]. Many of the variables associated with both the exposure and the outcome in this study were intermediate variables rather than confounding variables. The minimal sufficient adjustment variables for estimating the total effect between adult abuse and breastfeeding behaviour were: maternal age, education, civil status, and child abuse (Supplemental Figure S2), and these variables were included in all adjusted models. In addition, we evaluated the change in estimate when including intermediate variables: smoking, alcohol intake, parity, preterm delivery, social support, mode of delivery, BMI, preterm delivery, and depression prior to pregnancy. Finally, we conducted a sensitivity analysis in which we stratified women according postpartum depression to evaluate whether the association between adult abuse and breastfeeding behaviour was mediated primarily through postpartum depression. The data programme SPSS 22 (SPSS Inc, IBM Company, Chicago, Illinois, USA) was used to conduct all analyses. A significance level of 0.05 was used.

Results

The majority of the women in the study population initiated breastfeeding (98.9%). Nearly 14% of the infants were fully breastfed up to six months postpartum, while almost 80% were still breastfed (Table 1). However, 12.1% of mothers ceased any breastfeeding before four months and 38.9% ceased full breastfeeding before four months. Overall, 19% of the 53,934 women reported exposure to any adult abuse, and the prevalence of abuse was significantly higher in women who did not initiate breastfeeding than in those who did. Likewise, any adult abuse was more prevalent in women who did not continue full or any breastfeeding for four or six months. Exposure to abuse was more prevalent in women who were older, not married, had been exposed to child abuse, were parous, had caesarean delivery, smoked, reported drinking alcohol in pregnancy, were overweight or obese, and in women with postpartum depression.

Adult abuse was significantly associated with early cessation of breastfeeding (Table 2). Women exposed to any adult abuse had 25% increased adjusted odds of cessation of any breastfeeding before four months compared to their counterparts (Table 2, Model 1). When the other breastfeeding variables were used as the outcome, women who reported any adult abuse also had significantly increased odds of full breastfeeding cessation before four months and of any breastfeeding cessation before six months, respectively. However, no significant association was found between any adult abuse and full breastfeeding cessation before six months (data not shown).

In the analyses of singular or combined types of adult abuse we found that women reporting emotional abuse only (adjusted OR:1.28, 95% CI: 1.18-1.39), emotional and physical abuse (adjusted OR: 1.39, 95% CI: 1.18-1.62), emotional and sexual abuse (adjusted OR: 1.27, 95% CI: 1.02-1.58) or those reporting all three types of abuse; emotional, sexual and physical (adjusted OR: 1.47, 95% CI: 1.23-1.76) were more likely to stop any breastfeeding before four months than women without abuse (Table 2, Model 2).

Table 2. Logistic regression analyses of the association between types of adult abuse and cessation of any breastfeeding before four months (cessation of any BF <4 months). N=51,205

			Cessation of any BF<4months		Crude		Adjusted	
Abuse category	**n**	**(%)**	**n**	**(%)**	**OR**	**95% CI**	**OR**	**95% CI**
Model 1								
No adult abuse (reference)	41,396	80.8	4728	11.4	1.00		1.00	
Any adult abuse	9809	19.2	1511	15.4	1.41	(1.33-1.50)	1.25	(1.17-1.34)
Model 2 (abuse categories)								
No adult abuse (reference)	41,396	80.8	4728	11.4	1.00		1.00	
Physical only	567	1.1	65	11.5	1.00	(0.77-1.30)	0.96	(0.73-1.25)
Sexual only	976	1.9	107	11.0	0.96	(0.78-1.17)	0.94	(0.76-1.16)
Emotional only	5464	10.7	843	15.4	1.42	(1.31-1.53)	1.28	(1.18-1.39)
Physical+emotional	1149	2.2	210	18.3	1.73	(1.49-2.02)	1.39	(1.18-1.62)
Physical+sexual	189	0.4	24	12.7	1.13	(0.73-1.75)	0.95	(0.61-1.47)
Sexual+emotional	630	1.2	101	16.0	1.18	(1.19-1.84)	1.27	(1.02-1.58)
Sexual+physical+emotional	827	1.6	161	19.3	1.86	(1.56-2.21)	1.47	(1.23-1.76)

The adjusted model included the following variables: maternal age, education, civil status and, any child abuse. Analyzed for complete cases.

Women reporting recent abuse (Table 3) had 40% increased odds (adjusted OR: 1.40, 95% CI: 1.24-1.58) of early cessation of any breastfeeding compared to non-exposed women, while those reporting non-recent adult abuse had 21% increased odds of early breastfeeding cessation (adjusted OR: 1.21, 95% CI: 1.12-1.30).

When abuse was grouped by type of perpetrator (Table 4), exposure from "known perpetrator only" was significantly associated with cessation of any breastfeeding before four months (adjusted OR: 1.28, 95% CI: 1.19-1.37). The result for "both known and unknown" perpetrator was significant in the crude model only, while exposure from "unknown perpetrator only" was not associated with cessation of any breastfeeding.

Compared with crude ORs, the adjusted ORs for the association between adult abuse and early breastfeeding cessation were attenuated to some degree, e.g. from 1.41 to 1.25 in Model 1, Table 2. Of the four confounding variables, maternal education resulted in the largest change in the estimate. Additional adjustment for smoking, alcohol intake, parity, preterm delivery, social support, mode of delivery, BMI, and depression prior to pregnancy, did not substantially change in the odds ratio of interest (<10%), suggesting that the effect of adult abuse on early breastfeeding cessation was not mediated through these.

We have previously shown an association between abuse history and risk of postpartum depression [13] and we were particularly interested in examining postpartum depression as an intermediate variable in the analysis of adult abuse and early cessation of any breastfeeding. The prevalence of breastfeeding cessation before four months was 19.3% among women with postpartum depression and 12.4% in those without postpartum depression. However, when stratifying women by postpartum depression the association between any adult abuse and cessation of any breastfeeding was evident and comparable in women with postpartum depression (adjusted OR: 1.21, 95% CI: 1.12-1.30) and in those without (adjusted OR: 1.23, 95% CI: 1.06-1.44) group. Accordingly, the association between exposure to abuse and early cessation of breastfeeding cannot be explained by postpartum depression, rather by the abuse.

Exposure to child abuse was by itself significantly associated with any breastfeeding cessation before four months; the OR for any child abuse was 1.41 (95% CI: 1.32-1.50). When child abuse was categorized into "emotional and/or physical, not sexual" and "sexual alone or in combination with emotional and/or physical", the association with breastfeeding cessation was OR: 1.27 (95% CI: 1.17-1.37) for emotional and/or physical and OR: 1.66 (95% CI: 1.51-1.82) for sexual abuse. We had no available variables that could be considered confounders of

child abuse. However, child abuse was still significantly associated with early breastfeeding cessation in the adjusted models including adult abuse, maternal age, education and civil status (Tables 2-4) with OR for any child abuse: 1.12 (95% CI: 1.05-1.20). This association was stronger for sexual (sexual only or combined with other abuse) than for emotional and/or physical, not sexual with OR: 1.22 (95% CI: 1.11-1.65) and OR: 1.06 (95% CI: 0.98-1.15), respectively.

Table 3. Logistic regression analyses of the association between time of adult abuse (recent/not recent) and cessation of any breastfeeding before four months (cessation of any BF <4 months). N=51,014

			Cessation of any BF <4months		Crude		Adjusted	
	n	(%)	n	(%)	OR	95% CI	OR	95% CI
No adult abuse (reference)	41,396	81.1	4728	11.4	1.00		1.00	
Any adult, but not recent	7495	14.7	1084	14.5	1.31	(1.22-1.41)	1.21	(1.12-1.30)
Any adult recent abuse	2123	4.2	394	18.6	1.77	(1.58-1.98)	1.40	(1.24-1.58)

The adjusted model included the following variables: maternal age, education, civil status, any child abuse. Analyzed for complete cases.

Table 4. Logistic regression analyses of the association between perpetrator of adult abuse and cessation of any breastfeeding before four months (cessation of any BF <4 months). N=51,101

			Cessation of any BF <4months		Crude		Adjusted	
Perpetrator	n	(%)	n	(%)	OR	95% CI	OR	95% CI
No adult abuse (reference)	41,396	81.0	4728	11.4	1.00		1.00	
Known only	7850	15.4	1232	15.7	1.44	(1.35-1.55)	1.28	(1.19-1.37)
Unknown only	861	1.7	99	11.5	1.01	(0.82-1.25)	1.09	(0.88-1.35)
Known and unknown	994	1.9	165	16.6	1.54	(1.30-1.83)	1.18	(0.99-1.41)

The adjusted model included the following variables: maternal age, education, civil status and, any child abuse. Analyzed for complete cases.

Discussion

The main finding in our study was that exposure to past and recent abuse was strongly associated with early cessation of any breastfeeding. The strongest effect was seen for women exposed to three types of abuse (sexual, physical and emotional); with nearly 50% increased adjusted odds of any breastfeeding cessation before four months compared to the non-exposed women. Recent abuse and exposure from known perpetrator resulted in nearly 40% and 30% increased risk of any breastfeeding cessation before four months, respectively. Women who reported a history of child abuse were more likely to stop breastfeeding before four months than women who had not experienced child abuse. This was independently of later exposure to adult abuse. The theoretical causal pathway between adult abuse and breastfeeding behaviour is complex and it is challenging to disentangle which variables to use as confounders. We used a DAG approach and landed on including only maternal age, education, civil status and child abuse (Supplemental Figure S2). Of these, adjustment for maternal education resulted in the largest change of the estimate. Educational attainment has been shown to be strong indicator of socio-economic differences in Norway [34-36]. The DAG clarified how a number of the potential confounding variables were intermediate variables in the theoretical effect pathway and therefore not true confounders [33]. Furthermore, the sensitivity analyses showed that the estimated effect of abuse exposure on breastfeeding cessation was not primarily mediated through the intermediate variables. Interestingly, the association between adult abuse and breastfeeding cessation was evident both in women with and without postpartum depression.

Strengths and limitations

The major strengths of our study include the large sample size representing women from all regions of Norway, the prospective design and comprehensive information about singular and combined types of abuse, as well as extensive information on breastfeeding. In addition, information about a wide range of potential confounding factors was available. The low participation rate in MoBa is a concern (40.4%), with underrepresentation of women less than 25 years, smokers and those living alone [37]. The potential selection bias in MoBa has been evaluated. Despite differences in prevalence estimates, associations between eight exposures and outcomes did not differ between MoBa participants and a representative sample from the general pregnant population, indicating that selection bias did not affect the associations [37]. Retrospective reporting is a challenge, but difficult to avoid in this kind of study. The women`s reporting of breastfeeding six months postpartum could be subject to recall error.

However, studies have found that maternal recall of breastfeeding give accurate estimates shortly after delivery [38] and even 20 years after delivery, as described in a recent Norwegian study [39].

Comparison with other studies

Previous studies have mainly investigated the associations between child sexual abuse, current intimate partner violence (IPV), or pregnancy related abuse and breastfeeding [19-23 40]. Our findings of abused women being significantly less likely to initiate breastfeeding, and significantly more likely of early cessation of breastfeeding, are in agreement with four other studies [19 20 41 42]. A study in 811 randomly selected women in five large primary health clinics in Brazil reported that severe physical IPV increased the risk of early breastfeeding cessation [19.] A cross-sectional study comprising 1200 Chinese women showed that those who did not experience IPV during pregnancy were significantly more likely to initiate breastfeeding than abused women [20]. A review of 800 medical records in one family practice in the US revealed an association between lack of breast-feeding and physical and sexual abuse of mothers or their children [41]. A longitudinal study in 296 adolescent females showed that participants who had experienced IPV ceased breastfeeding earlier than their counterparts [42]. Contrary to this, three studies found no differences in breastfeeding between abused and non-abused women [21 22 43]. An Australian cluster randomized controlled trial involving 2621 women from 80 maternal and child health centres found that breastfeeding rates did not significantly differ between women exposed to IPV and non-IPV groups when other factors like maternal age and education were taken into account [21]. Likewise, no association between abuse and breastfeeding was reported in an American case control study with 212 low income women receiving food vouchers [43]. The women were interviewed about past and present domestic abuse and classification of either breastfeeding or formula feeding was determined by the type of food voucher the women received postpartum. Duration of breastfeeding was assessed as the number of months women received the vouchers. Finally, a large American population based study (n=118,579) found crude results similar to our study, but no significant associations between abuse and breastfeeding in the adjusted analyses [22]. The results indicated that smoking and socio-demographics were more important predictors of breastfeeding duration than abuse. Early cessation of breastfeeding was defined as any period less than four weeks, whereas in our study cessation of any breastfeeding was measured at 4 and 6 months, respectively, making direct comparison difficult. Other explanations of why results from the three studies differed from ours are differences in assessment of abuse questions/time periods

of breastfeeding, sample size and study design. Further, one can argue that the low prevalence rates of IPV in two of the studies, at 6.3% [21] and 5.8% [22] may be underestimated and influence the results. In comparison with other studies, our study has a large sample size, a prospective design and clearly defined exposure and outcome variables, which corroborates the scientific evidence that past and recent abuse is negatively associated with breastfeeding.

Emotional abuse and breastfeeding

Few studies have examined emotional abuse and breastfeeding [20 23], and to our knowledge no previous studies support the current finding of a significant association between emotional abuse as a singular or combined exposure and early cessation of any breastfeeding. A cross sectional study from Hong Kong (n=1200) found that women who experienced emotional or physical abuse during pregnancy were more likely to be found in the artificial feeding group, than in the breastfeeding or mixed feeding groups [20]. A study from the US in 1220 women from a nationally representative sample showed that childhood emotional and physical abuse was not significantly associated with breastfeeding, whereas childhood sexual abuse was [23]. The same study aimed to investigate a possible cumulative effect of abuse but was unable to assess these effects due to few women reporting multiple types of abuse. In the current study all abuse categories containing emotional abuse were significantly associated with cessation of any breastfeeding in the adjusted models; emotional abuse only, emotional and sexual abuse, emotional and physical abuse, and emotional, physical, and sexual abuse. This result is important and underpins that emotional abuse should be included when studying adverse health outcomes of past or current abuse.

Child abuse and breastfeeding

Child abuse was associated with both the exposure and the outcome in our study and was modelled as a confounder. Furthermore, we found that child abuse was significantly associated with increased risk of any breastfeeding cessation before four months, independent of adult abuse. This association was stronger for child sexual abuse than for physical and/or emotional abuse only. The few existing previous studies that examined associations between child abuse and breastfeeding have focused only on child sexual abuse have reported contradictory results [23 40 44]. The US study in 1220 nationally representative women, mentioned above, found that women with a history of self-reported child sexual abuse were twice as likely to initiate breastfeeding as their non-abused counterparts, whereas breastfeeding duration did not differ significantly [23]. A Canadian qualitative study found that the women`s experiences of child sexual abuse affected their breastfeeding decisions, with the

breastfeeding experience possibly resulting in re-traumatization for some abused women and a healing effect in others [40]. A literature review concluded that women with a history of child sexual abuse was more likely to express desire to and initiate breastfeeding than their non-abused counterparts, but that both past and current abuse could lead to breastfeeding cessation [44]. Our results showed a strong independent effect of child abuse, and in particular child sexual abuse, on breastfeeding cessation. This is an important finding and may indicate that sexual abuse early in life results in even worse adverse long term effects than do other types of abuse.

Public health implications

Breastfeeding prevalence is higher in Norway than in most European countries [4 16]. Mean breastfeeding duration is about ten months. Although, the majority of women in Norway breastfeed for at least six months, a large decline in full breastfeeding occurs between three and four months, and some women also discontinue any breastfeeding within the first six months [15 45]. Baby friendly hospitals, free antenatal care follow up by community nurses and favourable maternity leave in Norway are societal priorities to enhance breastfeeding duration. Early maternal return to work can be a barrier to both initiating and duration of breastfeeding [46 47]. Norway has a long parental leave of 57 weeks at 80% benefit, or 47 weeks at 100% benefit, which supports the possibility of breastfeeding throughout the first year of life [48]. An Australian longitudinal cohort study showed that women qualified for paid maternity leave had significantly reduced odds of reporting combined physical and emotional IPV the first year postpartum compared to non-working women [49]. These findings indicate that all women need to be screened for abuse during pregnancy because of its impact on maternal and child health. Recommendations urging caregivers to ask women about past and present abuse have recently been implemented in the revised antenatal care guidelines in Norway. However, more research is needed on how antenatal care providers can recognize or ask about abuse and which strategies to choose for support and breastfeeding assistance.

Conclusion

The current study shows that past and recent abuse of women is strongly associated with early cessation of breastfeeding. Our results also underpin the need for emotional abuse to be included in studies of the adverse health effect of abuse. Given the convincing evidence of the beneficial effects of breastfeeding both for the mother and the infant, it is crucial to promote high breastfeeding rates. Mothers with a history of past or current abuse comprise a key group to target for extra support and breastfeeding assistance.

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Contributors
MFS, HG and ML conceived the study and all authors contributed to the study design. MFS and ALB prepared the data and performed the statistical analyses. MFS drafted the manuscript. All authors contributed to the interpretation of the results and critically reviewed the manuscript. All authors read and approved the final manuscript.

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Competing interests
No, there are no competing interests.

Ethics approval
The Norwegian Mother and Child Cohort Study was approved by the Regional Committee for Ethics in Medical Research (REK nr S-97045 /S-95113) and the Data Inspectorate in Norway.

Data sharing statement
No additional data are available.

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Figures

Figure 1

Figure Legend: Flow-chart of inclusion. Questionnaire 1 was answered in gestational week 18, questionnaire 3 in gestational week 30 and questionnaire 4 was answered 6 months postpartum.

Supplemental Material:

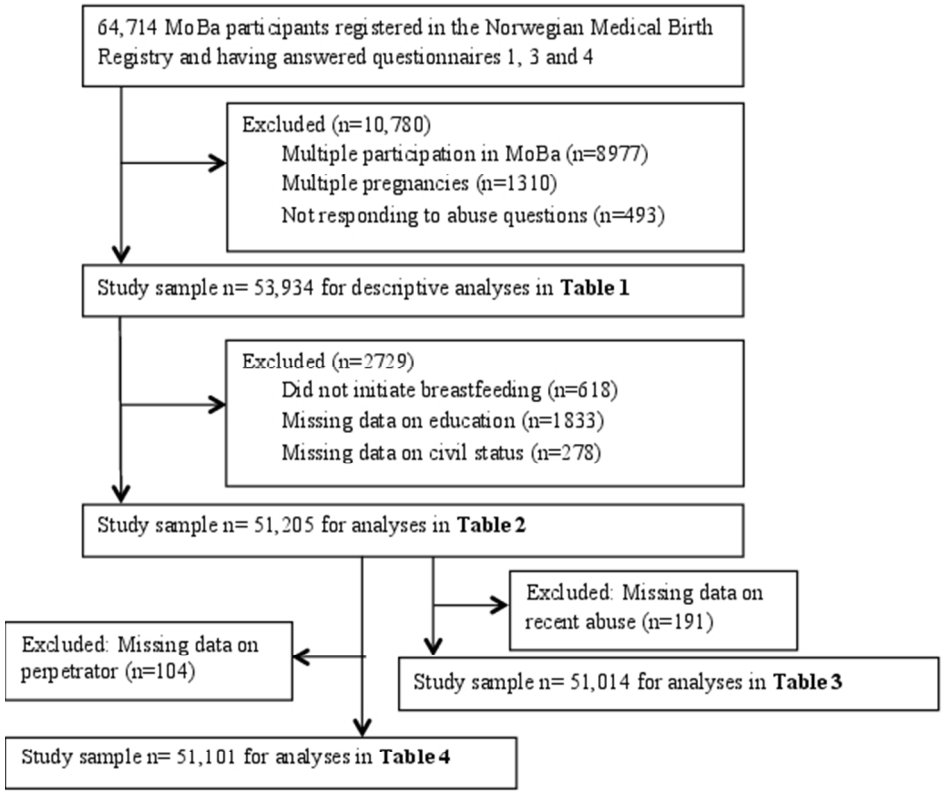
Supplemental Figure S1

Figure Legend: Questions and response options on abuse and perpetrators in questionnaire 3 answered in gestational week 30 in the Norwegian Mother and Child Cohort Study

Have you ever experienced any of the following? *(Fill in for each statement.)*

Supplemental Figure S2

Figure Legend: The directed acyclic graph (DAG) for this study as generated by dagitty.net. The green node indicates the exposure of interest (Adult abuse), the green lines the exposures effect pathways, and the blue node with the "I" indicates the outcome of interest (Breastfeeding behavior). The blue nodes without "I" are intermediate variables in the effect pathway. Red nodes are confounders that are adjusted for in the models. The minimal sufficient adjustment set for estimating the total effect of Adult abuse on Breastfeeding behavior was maternal age, education, child abuse, and civil status.



Flow-chart of inclusion, Questionnaire 1 was answered in gestational week 18, questionnaire 3 in gestational week 30 and questionnaire 4 was answered 6 months postpartum
174x151mm (96 x 96 DPI)

	No Never	Yes, as a child (under 18)	Yes, as an adult (over 18)	Who was responsible for this?			Has this occurred during the last year	
				A stranger	Family or relative	Another known person	No	Yes
Someone has over a long period of time systematically tried to subdue, degrade or humiliate you	☐	☐	☐	☐	☐	☐	☐	☐
Someone has threatened to hurt you or someone close to you	☐	☐	☐	☐	☐	☐	☐	☐
You have been subjected to physical abuse	☐	☐	☐	☐	☐	☐	☐	☐
You have been forced to have sexual intercourse	☐	☐	☐	☐	☐	☐	☐	☐

Figure Legend: Questions and response options on abuse and perpetrators in questionnaire 3 answered in gestational week 30 in the Norwegian Mother and Child Cohort Study

Have you ever experienced any of the following? (Fill in for each statement.)

1587x1190mm (96 x 96 DPI)

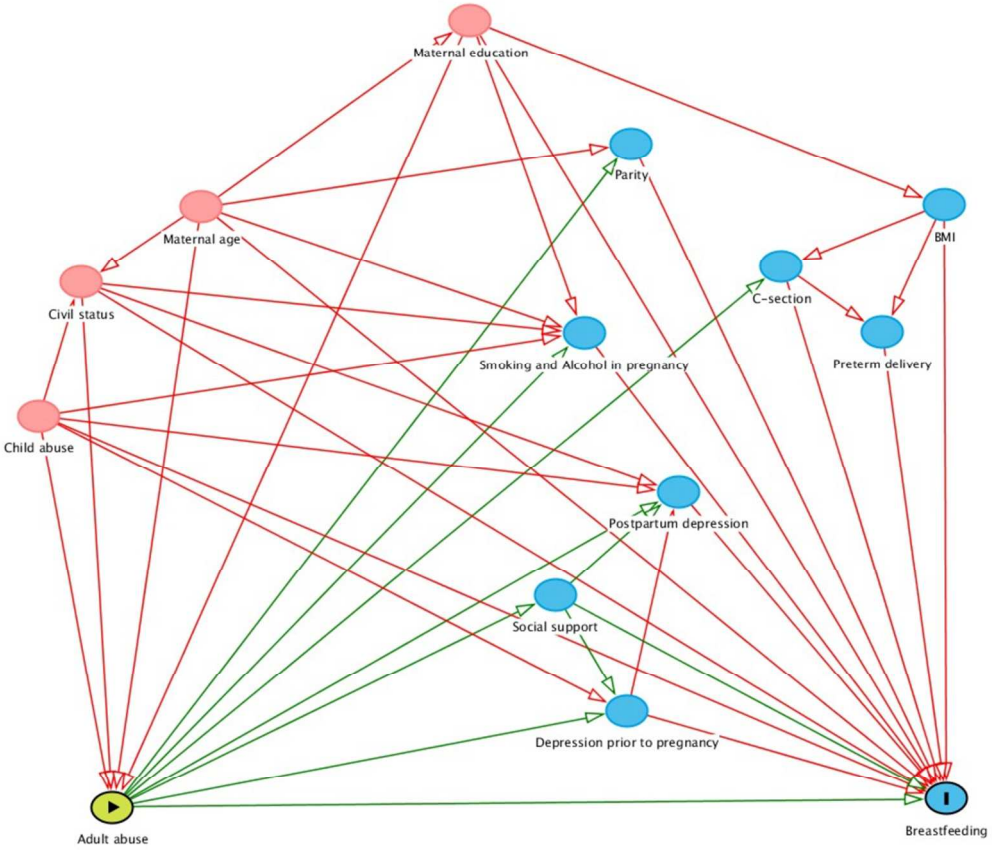


Figure Legend: The directed acyclic graph (DAG) for this study as generated by dagitty.net. The green node indicates the exposure of interest (Adult abuse), the green lines the exposures effect pathways, and the blue node with the "I" indicates the outcome of interest (Breastfeeding behavior). The blue nodes without "I" are intermediate variables in the effect pathway. Red nodes are confounders that are adjusted for in the models. The minimal sufficient adjustment set for estimating the total effect of Adult abuse on Breastfeeding behavior was maternal age, education, child abuse, and civil status.

256x238mm (96 x 96 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract The study design in mentioned in the title: Past and recent abuse is associated with early cessation of breastfeeding. Results from a large prospective cohort in Norway. The study design is also stated in the abstract: Design: Prospective cohort study.	1 and 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found This is what we have aimed at providing in the abstract.	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Breastfeeding has long been acknowledged as the optimal infant nutrition conferring short and long term health effects for both mothers and infants. Abuse of women is common worldwide and is known to have detrimental consequences of women`s health and general life. Little is known about the impact of abuse of breastfeeding behaviour and more studies are needed. We had the possibility to investigate this in one of the largest prospective pregnancy cohorts worldwide. The rationale is outlined in the background.	4
Objectives	3	State specific objectives, including any prespecified hypotheses The objective of the study is stated on page 4.	4
Methods			
Study design	4	Present key elements of study design early in the paper This is a prospective study within the Norwegian Mother and Child Cohort (MoBa) study. The design is presented early in the method section, including description of the exposure and outcome variables, relevant covariates, and the statistical methods used.	5-8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection The setting of the study is given first in the abstract and further in the methods section. Time of collection is described in the methods section.	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up Recruitment and methods of selection of participants, and selection of the final study sample from the eligible women is described in the methods section on page 5. Selection of participants is also described in Figure 1 (flow chart).	5

		(*b*) For matched studies, give matching criteria and number of exposed and unexposed Not applicable.	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Exposure, outcome and potential confounders are described in the methods section, pages 5-7. Definitions used for the outcome (breastfeeding) are reported in the methods section, page 6.	5-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Sources of the data in the present study are specified in the methods section, pages 5-8. Please see an overview below. **The baseline questionnaire in the MoBa study answered in gestational weeks 15-18 (Q1):** Variables: Maternal age, education, civil status, smoking, alcohol use, child abuse exposure, parity, prior depression, social support, pre pregnant weight and height for calculation BMI. **The questionnaire responded to at gestational week 30 (Q3)** Variables: All abuse categories, types of abuse, time of abuse, and perpetrators, see page 6 **The first questionnaire after birth, six months postpartum (Q4)** Variable: Postpartum depression Information used for the breastfeeding variables were also reported in Q4 six months postpartum. The data are based on three questions about infant nutrition. The questions asked about what type of milk (breastfeeding of formula feeding) or other liquid the baby had been given in the first week of life in monthly intervals up until and at the date of filling in the questionnaire (median 27 weeks/190 days). The women also reported the age (in months) of the infant at the time of semisolid or solid food. Breastfeeding definitions are based on the WHO`s definitions, as described on pages 6 -7. **The Medical Birth Registry of Norway:** Information based on forms completed by the midwives or attending physician within 7 days after birth. Variables: Mode of delivery, (caesarean section or vaginal delivery) and gestational length (used to define preterm delivery, i.e. delivery before 37 completed gestational weeks.	
Bias	9	Describe any efforts to address potential sources of bias In the Norwegian Mother and Child Cohort Study as well as similar studies, selection bias and differences in the socio-economic status are the most serious concerns. Selection bias in this cohort was evaluated in a separate paper (Nilsen et al.,	8 and 10-11

		2009) which showed that non-representativeness of women in the cohort did not influence exposure-outcome association. This information is included in the discussion. Potential confounding has also been thoroughly addressed. Characteristics associated with any adult abuse in our study population have been examined previously (Sørbø MF, et al 2013) and potential confounder variables were based on this knowledge. We also included other potential confounding variables, as described in the first paragraph under "Other variables" in the methods section. We used directed acyclic graphs (DAGs) approach to clarify which variables were confounders and which variables were intermediate variables. This is described in methods section (statistical analyses) on page 8 and in discussion section on page 10-11. The variables identified by the DAG (maternal education, maternal age, child abuse, and civil status) were included in all adjusted analyses.	
Study size	10	Explain how the study size was arrived at The selection of the final study sample is described on page 5, and shown in Figure 1.	5 Figure 1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why The way in which quantitative variables (covariates) were divided into groups and why are described on page 6 (child abuse), and page 7 (maternal age, maternal education, and civil status), and shown in Table 1. How they were used are described in statistical analyses section (page 8), and in Supplemental Figure S2. The intermediate variables and how they were identified, are described on the same pages and in Tables 1 and Supplemental Figure S2.	7-8 Table 1 Figure S2
Statistical methods	12	(a)Describe all statistical methods, including those used to control for confounding Statistical methods are described on page 8. Odds ratios were estimated by binary logistic regression with cessation of breastfeeding as before four months as the outcome and abuse, including subcategories of abuse, as the exposure. Examination of and controlling for confounding is described in the methods section on page 8 and in the discussion section pages 10-11, and is shown in Figure S2.	7-8, Figure S2
		(*b*) Describe any methods used to examine subgroups and interactions We examined the exposure variable (abuse) as a dichotomous variable (any abuse yes/no) and by the subgroups a) emotional, sexual, and physical abuse, b) recent/not recent, c) grouped by perpetrators (known only, unknown only, known and unknown). The method used to examine subgroups is logistic regression as described in the Statistical methods. We did not examine potential interactions between the exposure and the confounders (maternal age, maternal education, child abuse, and civil status) due to small differences between crude and adjusted ORs for the associations studied.	
		(*c*) Explain how missing data were addressed Exclusion due to missing data is described in the methods section, page 8.	8

		All binary logistic regression analyses were performed for complete cases only. Descriptive statistics of the study population by exposure to any adult abuse are presented in Table 1. For testing differences between these categories we used Pearson`s Chi-square test, and participants grouped in a "missing category" were not included.	
		(*d*) If applicable, explain how loss to follow-up was addressed Not applicable.	
		(*e*) Describe any sensitivity analyses Sensitivity analyses (with regard to postpartum depression) have been described in the statistical section on page 8 and in the two last paragraphs in the results section on page 10.	8 and 10
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed The numbers of individuals potentially eligible, excluded at each stage, and finally included in the study populations are given on page 5. The numbers of participants included in each analysis are also shown in this paragraph, and shown in the flow chart in Figure 1.	5 Figure 1
		(b) Give reasons for non-participation at each stage Shown in text on page 5 and in Figure 1.	5 Figure 1
		(c) Consider use of a flow diagram See Figure 1.	5 Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Various characteristics of the participants, and information on the exposure and potential confounders, are described in the methods section on page 5, and in the results section on pages 8-10, and in Table 1.	5, 8-10 Table 1
		(b) Indicate number of participants with missing data for each variable of interest The number of participants on with missing data (descriptive data, risk and health factors) is shown in Table 1. In Tables 2-4 analyses were performed for complete cases only. The number with missing on the specific outcome variables is shown in the flow chart (Figure 1).	Table 1 Figure 1
		(c) Summarise follow-up time (eg, average and total amount) Not applicable.	
Outcome data	15*	Report numbers of outcome events or summary measures over time The number of participants reporting breastfeeding is presented in Table 1, in the text in the results section on page 8, and	8 Table 1

		also in the abstract.	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included Crude and adjusted estimates for the associations between abuse and cessation of breastfeeding are presented in Tables 2-4 and in the text on page 8 (statistical section) and page 10 -11 (discussions section). Adjusted results are also presented in the abstract. All analyses were adjusted for maternal age, maternal education, child abuse, and civil status. These covariates were the minimal sufficient adjustment variables for estimating the total effect between adult abuse and breastfeeding. We used DAG to help clarify which variables were intermediate factors rather than confounders. Table 2 presents crude and adjusted results of the association between any adult abuse, singular and combined types of adult abuse, respectively, and any breastfeeding cessation before 4 months. Table 3 presents crude and adjusted results of the association between time of adult abuse (recent/not recent) and cessation of any breastfeeding before 4 months. Table 3 presents crude and adjusted results of the association between the perpetrator (known only, unknown only, and, known and unknown) of abuse and cessation of any breastfeeding before 4 months	8-10, Figures 2-4
		(*b*) Report category boundaries when continuous variables were categorized The only continuous variable grouped into categories in this study was maternal age. We divided into the following categories shown in Table 1. First category: 14-19 years Second category: 20-24 years Third category: 25-29 years Fourth category: 30-34 years Fifth category: ≥ 35 years Maternal BMI was included in Table 1 and for descriptive purpose and was divided into two groups based on the WHO categories; i) underweight and normal weight women (BMI<25) and ii) overweight and obese women (BMI>=25)	Table 1

		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period In the present study the estimates are calculated as odds ratios, and to our understanding it is not relevant to calculate absolute risk.	8
Other analyses	17	Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses Characteristics of the participants exposed to abuse versus non-abused are shown in Table 1 and are given on page 8 -9, under results. Sensitivity analyses regarding postpartum depression is described on page 8 (statistical section), on page 10 (results section), and on page 11 (discussion section). We did not perform analyses of interactions (see point 12 b).	7-8
Discussion			
Key results	18	Summarise key results with reference to study objectives The main results are stated in the Abstract page 2, in the beginning of the discussion section, page 10 and in the conclusion, page 14.	2, 10, 14
Limitations	19	Limitations of the study are discussed on page 11, under paragraph “Strengths and limitations”.	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Interpretation of the results is presented on pages 10-14. Our interpretation is cautious, in the form of possible, hypothetical explanations, recognising the limitations of associations based on epidemiological data.	10-14
Generalisability	21	Discuss the generalisability (external validity) of the study results The generalizability and representativeness of the study results is discussed under the discussion section, page 11.	11
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based The funding of the present project as well as the funding for the Norwegian Mother and Child Cohort Study is described on page 14, in the “Funding section”.	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Past and recent abuse is associated with early cessation of breastfeeding. Results from a large prospective cohort in Norway

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Past and recent abuse is associated with early cessation of breastfeeding. Results from a large prospective cohort in Norway

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Abstract

Objective: Breastfeeding provides a wide range of health benefits for both infants and mothers. Few studies have examined the impact of past and recent abuse of women on breastfeeding behaviour. The aims of our study were to examine whether exposure to past and recent emotional, sexual, or physical abuse was associated with early breastfeeding cessation, and to assess whether a potential association differed for known and unknown perpetrator.

Design: Prospective cohort study.

Setting: Norway, years 1999-2006.

Participants: 53,934 mothers participating in the Norwegian Mother and Child Cohort Study. We included mothers with singleton pregnancy who had responded to three questionnaires (week 18 and 30 in pregnancy and 6 months postpartum) and had answered minimum one of the abuse questions in week 30.

Main outcome measure: Odds ratios were estimated by binary logistic regression with cessation of any (all) breastfeeding before four months as the outcome, and abuse including subcategories of abuse, as the exposure.

Results: Nearly all women initiated breastfeeding, but 12.1% ceased any breastfeeding before four months and 38.9% ceased full breastfeeding before four months but continued partial breastfeeding. Overall, 19% of the women reported any adult abuse and 18% reported any child abuse.

The highest risk of any breastfeeding cessation before four months was seen in women exposed to three types of adult abuse (emotional, sexual, or physical), with adjusted OR being 1.47 (95% CI: 1.23-1.76) compared with no abuse. Recent abuse and exposure from known perpetrator resulted in nearly 40% and 30% increased risk, respectively. The OR of any breastfeeding cessation for women exposed to any child abuse was 1.41 (95%CI: 1.32-1.50) compared with no abuse in childhood.

Conclusion: Past and recent abuse of women is strongly associated with early cessation of breastfeeding. Abused mothers comprise a key group to target for extra support and breastfeeding assistance.

Strengths and limitations of this study

- This is one of the largest studies to report an association between abuse of women and increased risk of early breastfeeding cessation. Our study provide new significant information about singular and combined types of abuse and breastfeeding (emotional, sexual and physical abuse), from one of the largest prospective population based pregnancy cohorts. It is an important contribution to the field, because it is one of the first to document the association between emotional abuse, as singular and combined groups, and breastfeeding cessation.
- The increased risk of early breastfeeding cessation among women who have experienced abuse was observed independently of prior depression, postpartum depression and other potential confounders and intermediate factors.
- Major strengths of this study include the prospective design; the large sample of women from all regions of Norway, including all age- and socioeconomic groups; and detailed information about experiences of abuse, including type of abuse, whether past or recent abuse, and potential confounding factors.
- Since this study is observational, no causal implications can be drawn, and although confounding by other variables was carefully considered, residual confounding cannot be excluded.

Background

Breastfeeding has long been acknowledged as the optimal infant nutrition conferring beneficial short and long term health effects for both infants and mothers [1-5]. The World Health Organization (WHO) has since 2001 recommended exclusive breastfeeding for the first six months of life [6-8] and this has been is adopted by the Norwegian Health Authorities [9].

Abuse of women is common worldwide, as one in three women during lifetime suffer partner or non-partner abuse [10]. There is an increasing body of research showing that recent and past abusive experiences influences women's physical and mental health negatively, and have a negative impact on reproductive and postpartum health [11]. Adverse effects include adolescent and unintended pregnancies, miscarriage, sexually transmitted diseases, and postpartum depression [11-14], which all are barriers to breastfeeding.

Given the overwhelming evidence of the positive effects of breastfeeding, knowledge about factors influencing breastfeeding behaviour is essential. Norway has one of the highest breastfeeding rates in the world and almost all mothers initiate breastfeeding [4 15 16]. Factors that positively influence breastfeeding in Norway are higher educational level of the mother, higher maternal age, being married, and multi parity; whereas smoking and obesity has shown a negative impact [15 17-18]. There is a lack of knowledge about the impact of past and recent abuse of women on breastfeeding behaviour. Only a few studies have been published and these are preliminary and inconclusive. Most studies have examined only one type of abuse, i.e. sexual or physical, although these often occur simultaneously and studies that included perpetrators mostly focused on abuse from partner only [19 - 23]. The impact of emotional abuse on breastfeeding has rarely been studied [20 23]. Furthermore, studies are difficult to compare due to different designs and various definitions of both abuse and breastfeeding. The samples are often small, based on clinical cohorts and with a cross sectional design, hence not applicable to the broader population.

We explored the impact of abuse of women on breastfeeding behaviour in a large prospective population in Norway where the expectations to breastfeed are high, and breastfeeding is facilitated in the work regulations, e.g. paid leave for one year. The first aim of our study was to examine whether exposure to adult emotional, sexual, or physical abuse, as a singular or combined exposure was associated with early breastfeeding cessation. Secondly, we wanted to assess whether a potential association differed for adult recent and non-recent abuse and for

known and unknown perpetrator. Thirdly, we wanted to examine the association between child abuse and early breastfeeding cessation.

Methods

Population and study design

The Norwegian Mother and Child Cohort Study (MoBa) is a prospective population-based pregnancy cohort conducted by the Norwegian Institute of Public Health [24]. The participants were recruited to the study through a postal invitation in connection with a routine ultra sound examination offered to all pregnant women in Norway. Participants were recruited from all over Norway from 1999 to 2008, and 40.6% of invited women consented to participate. The cohort now includes 114,500 children and 95,200 mothers. The women were asked to answer questionnaires at regular intervals during pregnancy and after birth. In the current study we used information from three questionnaires; the baseline questionnaire completed around week 18 of pregnancy (socio-demographics and risk factors), the questionnaire answered in gestational week 30 (abuse questions), and the first follow-up questionnaire after delivery (breastfeeding questions), completed at infant age six months (questionnaires available at www.fhi.no/moba). MoBa files are linked to pregnancy and birth records from the Norwegian Medical Birth Registry (NMBR). Written informed consent was obtained, and the MoBa study was approved by The Regional Committee for Medical and Health Research Ethics in South-Eastern Norway. The current study is based on version IV of the quality-assured data files including participants recruited in years 1999-2006. The research was performed in accordance with the Strobe guidelines [25]. An outline of the Strobe guidelines is added in the Supplemental files.

The inclusion of the study population is described in Figure 1. The source population study comprised women who had filled in all three questionnaires and were registered in NMBR (n=64,714). For women participating with more than one pregnancy, only information from the first pregnancy was included. Furthermore, we only included women with singleton pregnancies and those who had answered a minimum of one of the abuse questions, leaving a total of 53,934 for descriptive characteristics. For all adjusted analyses we included only women with complete information on the exposures and covariates.

Variables

Exposure variables – different abuse categories

The abuse questions and response options are shown in Supplemental files, Figure S1. These questions were part of the third MoBa questionnaire, which was responded to at gestational weeks 30. The two questions about emotional abuse are similar to those in the Norvold Abuse Questionnaire [26], which measures mild and severe emotional abuse. We merged the responses to the two emotional abuse questions into one variable. Women could respond "no never" to the various types of abuse, or "yes" as an adult (≥ 18 years) and/or as a child (< 18 years) to the various types of abuse. The question about sexual abuse with response options is a modified version of the sexual abuse question in the Abuse Assessment Screen (ASS) [27]. This screening tool is not validated, but has been used in other studies [28 29]. The question about physical abuse has been used in other studies, but is not validated [30 31]. Women who answered "yes" to at least one of the adult abuse questions, i.e. past or recent adult abuse, were defined as having suffered from any adult abuse. Likewise, women responding "yes" to one or more of the child abuse questions were defined as having suffered from any child abuse. Information about child abuse was grouped into two non-overlapping categories: "emotional and/or physical, not sexual" and "sexual alone or in combination with emotional and/or physical". Women could also indicate whether or not they had been abused during the last 12 months, and we defined this as recent abuse. All analyses of recent abuse refer to adult recent abuse, not child abuse. Past abuse refers to both child abuse and non-recent adult abuse.

Perpetrators

As part of the abuse questions, women were given the opportunity to reveal who committed the abuse: a stranger, family/relative, or other known (see supplemental Figure S1). The two latter categories were merged into known perpetrator. We categorized the responses about perpetrators in three groups; only known perpetrator, only unknown, and both known and unknown.

Outcome variables – breastfeeding

The breastfeeding data are based on three questions about infant nutrition in the questionnaire completed six months postpartum. The questions asked about what type of milk (breastfeeding or formula feeding) or other liquid the baby had been given in the first week of life and in monthly intervals up until and at the date of filling in the questionnaire (median 27 weeks/190 days). The women also reported the age (in months) of the infant at the time of

introduction of semisolid or solid food. Full breastfeeding was defined as predominant breastfeeding without any formula or solids, but allowing water and vitamins. Any breastfeeding included both full and partial breastfeeding (i.e. breastfeeding with concomitant formula or solid foods given). The breastfeeding categories used in the present study are based on WHO definitions [32]. In the present study four dichotomous breastfeeding variables reflecting breastfeeding behaviour were used as outcome variables, i) cessation of any breastfeeding before four months, ii) cessation of full breastfeeding before four months, iii) cessation of any breastfeeding before six months, and iv) cessation of full breastfeeding before six months. We present descriptive data for all breastfeeding variables. As the main outcome we present results only for the cessation of any breastfeeding before four months, while results for the other breastfeeding variables are reported as text.

Other variables

Characteristics associated with any adult abuse in our study population have been examined previously [30] and the following potential confounding variables were included based on this knowledge: being exposed to child abuse, civil status, maternal age, smoking, and alcohol intake. We also included as potential confounding variables the following maternal characteristics and risk factors for early cessation of full or any breastfeeding: maternal education, parity, body mass index (BMI), mode of delivery, preterm delivery, social support, prior depression, and postpartum depression.

Information about maternal age, education, civil status, pre-pregnant weight and height (for calculating of BMI), parity, prior depression, social support, alcohol intake and smoking in pregnancy, was retrieved from the baseline questionnaire (week 18 in pregnancy). Information about postpartum depression was obtained from questionnaire four (6 months postpartum), whereas information about mode of delivery (caesarean section or vaginal delivery) and preterm delivery was retrieved from NMBR. The categorization of age, education, civil status, parity, smoking, and alcohol is shown in Table 1. BMI was calculated as weight in kg/height^2 (in m) and dichotomized into <25 (underweight and normal weight) and ≥25 (overweight and obese). Depression prior to current pregnancy was dichotomized into no or yes. Mode of delivery was categorized into vaginal birth or caesarean section. We defined preterm delivery as giving birth at <37th weeks of gestation on the basis of ultrasound measurements. In the few cases without ultrasound information (<2%), gestational age was calculated from the first day of last menstrual period. Social support was defined as having anyone other than partner to ask for support, and was dichotomized into no or yes. Postpartum

depression was identified and dichotomized based on four questions from the Edinburgh Postpartum Depression Scale and a cut off score >6, which indicates a moderate level of postpartum depression symptoms. This variable has been described and examined previously in relation to adult exposure to abuse in MoBa [13].

Table 1. Characteristics of the study population by any adult abuse in the Norwegian Mother and Child Cohort Study. N=53,934

	Total		Any adult abuse		*P*[1]
	n	%	n	%	
All	53,934	100	10,442	19.4	
Breastfeeding (BF) initiation					
No	618	1.1	147	23.8	0.005
Yes	53,316	98.9	10295	19.3	
Full breastfeeding for 4 months					
No	20,991	38.9	4510	21.5	<0.001
Yes	32,325	59.9	5785	17.9	
No BF initiation	618				
Full breastfeeding for 6 months					
No	45,802	84.9	8896	19.4	0.102
Yes	7514	13.9	1399	18.6	
No BF initiation	618				
Any breastfeeding for 4 months					
No	6539	12.1	1588	24.3	<0.001
Yes	46,777	86.7	8707	18.6	
No BF initiation			147		
Any breastfeeding for 6 months					
No	10,341	19.2	2445	23.6	<0.001
Yes	42,945	79.7	7850	18.3	
No BF initiation	618		147		
Age in years					
14-19	693	1.3	101	14.6	<0.001
20-24	6423	11.9	1162	18.1	
25-29	19,628	36.4	3383	17.2	
30-34	21,945	40.7	4390	20.0	
≥35	5245	9.7	1406	26.8	
Education					
Primary (9 years)	1195	2.2	332	27.8	<0.001
Secondary (12 years)	15,902	29.5	3556	22.4	
Higher ≤4 years	31,432	58.3	5218	16.6	
Higher >4 years	3544	6.6	910	25.7	
Missing information	1861	3.5	426	22.9	
Civil status					

Married	26,572	49.3	4504	17.0	<0.001
Cohabiting	25,543	47.4	5289	20.7	
Not married/cohabiting	1523	2.8	578	38.0	
Missing information	296	0.5	71	24.0	
Child abuse					
No	44,064	81.7	7209	16.4	<0.001
Yes	9870	18.3	3233	32.8	
Parity					
0	27,666	51.3	5155	18.6	<0.001
+1	26,268	48.7	5287	20.1	
Mode of delivery					
Vaginal	50,296	93.3	9627	19.1	<0.001
C-section	3638	6.7	815	22.4	
Preterm delivery					
No (≥ 37 weeks)	51,258	95.0	9874	19.3	0.026
Yes (<37 weeks)	2472	4.6	521	21.1	
Missing information	204	0.4	47	23.0	
Smoking in pregnancy					
No	49,100	91.0	8954	18.2	<0.001
Yes	4834	9.0	1488	30.8	
Alcohol in pregnancy					
Never	38,931	72.2	7494	18.8	<0.001
Sometimes	7221	13.4	1628	22.5	
Daily	47	0.1	19	40.4	
Missing information	6705	12.4	1301	19.4	
BMI					
<25	35,389	66.5	6700	18.7	<0.001
≥ 25	16,552	30.7	3422	20.7	
Missing information	1490	2.8	320	21.5	
Postpartum depression					
No	47,349	87.8	8370	17.7	<0.001
Yes	5716	10.6	1897	33.2	
Missing information	869	1.6	175	20.1	

[1]P value calculated using Pearson's Chi square test (missing category not included)

Statistical analyses

Descriptive statistics of the study population by exposure to any adult abuse are presented in Table 1. For testing differences between categories we used Pearson's Chi-square test. We used binary logistic regression to examine the associations between adult abuse and early

cessation of breastfeeding. The reference group for all analyses of adult abuse was no adult abuse and the reference group for child abuse was no child abuse. Crude and adjusted odds ratios (OR's) with 95% confidence intervals (CI) were presented and analysed for complete cases only. We included potential confounding variables based on previous knowledge of variables associated with either the exposure or the outcome. We identified potential confounders through directed acyclic graph (DAG) analysis. DAGs provide a method to identify potential confounders and decide which to adjust for [33]. Many of the variables associated with both the exposure and the outcome in this study were intermediate variables rather than confounding variables. The minimal sufficient adjustment variables for estimating the total effect between adult abuse and breastfeeding behaviour were: maternal age, education, civil status, and child abuse (Supplemental Figure S2), and these variables were included in all adjusted models. In addition, we evaluated the change in estimate when including intermediate variables: smoking, alcohol intake, parity, preterm delivery, social support, mode of delivery, BMI, preterm delivery, and depression prior to pregnancy. Finally, we conducted a sensitivity analysis in which we stratified women according postpartum depression to evaluate whether the association between adult abuse and breastfeeding behaviour was mediated primarily through postpartum depression. The data programme SPSS 22 (SPSS Inc, IBM Company, Chicago, Illinois, USA) was used to conduct all analyses. A significance level of 0.05 was used.

Results

The majority of the women in the study population initiated breastfeeding (98.9%). Nearly 14% of the infants were fully breastfed up to six months postpartum, while almost 80% were still breastfed (Table 1). However, 12.1% of mothers ceased any breastfeeding before four months and 38.9% ceased full breastfeeding before four months. Overall, 19% of the 53,934 women reported exposure to any adult abuse, and the prevalence of abuse was significantly higher in women who did not initiate breastfeeding than in those who did. Likewise, any adult abuse was more prevalent in women who did not continue full or any breastfeeding for four or six months. Exposure to abuse was more prevalent in women who were older, not married, had been exposed to child abuse, were parous, had caesarean delivery, smoked, reported drinking alcohol in pregnancy, were overweight or obese, and in women with postpartum depression.

Adult abuse was significantly associated with early cessation of breastfeeding (Table 2). Women exposed to any adult abuse had 25% increased adjusted odds of cessation of any breastfeeding before four months compared to their counterparts (Table 2, Model 1). When the other breastfeeding variables were used as the outcome, women who reported any adult abuse also had significantly increased odds of full breastfeeding cessation before four months and of any breastfeeding cessation before six months, respectively. However, no significant association was found between any adult abuse and full breastfeeding cessation before six months (data not shown).

In the analyses of singular or combined types of adult abuse we found that women reporting emotional abuse only (adjusted OR:1.28, 95% CI: 1.18-1.39), emotional and physical abuse (adjusted OR: 1.39, 95% CI: 1.18-1.62), emotional and sexual abuse (adjusted OR: 1.27, 95% CI: 1.02-1.58) or those reporting all three types of abuse; emotional, sexual and physical (adjusted OR: 1.47, 95% CI: 1.23-1.76) were more likely to stop any breastfeeding before four months than women without abuse (Table 2, Model 2).

Table 2. Logistic regression analyses of the association between types of adult abuse and cessation of any breastfeeding before four months (cessation of any BF <4 months). N=51,205

			Cessation of any BF<4months		Crude		Adjusted	
Abuse category	**n**	**(%)**	**n**	**(%)**	**OR**	**95% CI**	**OR**	**95% CI**
Model 1								
No adult abuse (reference)	41,396	80.8	4728	11.4	1.00		1.00	
Any adult abuse	9809	19.2	1511	15.4	1.41	(1.33-1.50)	1.25	(1.17-1.34)
Model 2 (abuse categories)								
No adult abuse (reference)	41,396	80.8	4728	11.4	1.00		1.00	
Physical only	567	1.1	65	11.5	1.00	(0.77-1.30)	0.96	(0.73-1.25)
Sexual only	976	1.9	107	11.0	0.96	(0.78-1.17)	0.94	(0.76-1.16)
Emotional only	5464	10.7	843	15.4	1.42	(1.31-1.53)	1.28	(1.18-1.39)
Physical+emotional	1149	2.2	210	18.3	1.73	(1.49-2.02)	1.39	(1.18-1.62)
Physical+sexual	189	0.4	24	12.7	1.13	(0.73-1.75)	0.95	(0.61-1.47)
Sexual+emotional	630	1.2	101	16.0	1.18	(1.19-1.84)	1.27	(1.02-1.58)
Sexual+physical+emotional	827	1.6	161	19.3	1.86	(1.56-2.21)	1.47	(1.23-1.76)

The adjusted model included the following variables: maternal age, education, civil status and, any child abuse. Analyzed for complete cases.

Women reporting recent abuse (Table 3) had 40% increased odds (adjusted OR: 1.40, 95% CI: 1.24-1.58) of early cessation of any breastfeeding compared to non-exposed women, while those reporting non-recent adult abuse had 21% increased odds of early breastfeeding cessation (adjusted OR: 1.21, 95% CI: 1.12-1.30).

When abuse was grouped by type of perpetrator (Table 4), exposure from "known perpetrator only" was significantly associated with cessation of any breastfeeding before four months (adjusted OR: 1.28, 95% CI: 1.19-1.37). The result for "both known and unknown" perpetrator was significant in the crude model only, while exposure from "unknown perpetrator only" was not associated with cessation of any breastfeeding.

Compared with crude ORs, the adjusted ORs for the association between adult abuse and early breastfeeding cessation were attenuated to some degree, e.g. from 1.41 to 1.25 in Model 1, Table 2. Of the four confounding variables, maternal education resulted in the largest change in the estimate. Additional adjustment for smoking, alcohol intake, parity, preterm delivery, social support, mode of delivery, BMI, and depression prior to pregnancy, did not substantially change in the odds ratio of interest (<10%), suggesting that the effect of adult abuse on early breastfeeding cessation was not mediated through these.

We have previously shown an association between abuse history and risk of postpartum depression [13] and we were particularly interested in examining postpartum depression as an intermediate variable in the analysis of adult abuse and early cessation of any breastfeeding. The prevalence of breastfeeding cessation before four months was 19.3% among women with postpartum depression and 12.4% in those without postpartum depression. However, when stratifying women by postpartum depression the association between any adult abuse and cessation of any breastfeeding was evident and comparable in women with postpartum depression (adjusted OR: 1.21, 95% CI: 1.12-1.30) and in those without (adjusted OR: 1.23, 95% CI: 1.06-1.44) group. Accordingly, the association between exposure to abuse and early cessation of breastfeeding cannot be explained by postpartum depression, rather by the abuse.

Exposure to child abuse was by itself significantly associated with any breastfeeding cessation before four months; the OR for any child abuse was 1.41 (95% CI: 1.32-1.50). When child abuse was categorized into "emotional and/or physical, not sexual" and "sexual alone or in combination with emotional and/or physical", the association with breastfeeding cessation was OR: 1.27 (95% CI: 1.17-1.37) for emotional and/or physical and OR: 1.66 (95% CI: 1.51-1.82) for sexual abuse. We had no available variables that could be considered confounders of

child abuse. However, child abuse was still significantly associated with early breastfeeding cessation in the adjusted models including adult abuse, maternal age, education and civil status with OR for any child abuse: 1.12 (95% CI: 1.05-1.20). This association was stronger for sexual (sexual only or combined with other abuse) than for emotional and/or physical, not sexual with OR: 1.22 (95% CI: 1.11-1.65) and OR: 1.06 (95% CI: 0.98-1.15), respectively.

Table 3. Logistic regression analyses of the association between time of adult abuse (recent/not recent) and cessation of any breastfeeding before four months (cessation of any BF <4 months). N=51,014

			Cessation of any BF <4months		Crude		Adjusted	
	n	(%)	n	(%)	OR	95% CI	OR	95% CI
No adult abuse (reference)	41,396	81.1	4728	11.4	1.00		1.00	
Any adult, but not recent	7495	14.7	1084	14.5	1.31	(1.22-1.41)	1.21	(1.12-1.30)
Any adult recent abuse	2123	4.2	394	18.6	1.77	(1.58-1.98)	1.40	(1.24-1.58)

The adjusted model included the following variables: maternal age, education, civil status, any child abuse. Analyzed for complete cases.

Table 4. Logistic regression analyses of the association between perpetrator of adult abuse and cessation of any breastfeeding before four months (cessation of any BF <4 months). N=51,101

			Cessation of any BF <4months		Crude		Adjusted	
Perpetrator	n	(%)	n	(%)	OR	95% CI	OR	95% CI
No adult abuse (reference)	41,396	81.0	4728	11.4	1.00		1.00	
Known only	7850	15.4	1232	15.7	1.44	(1.35-1.55)	1.28	(1.19-1.37)
Unknown only	861	1.7	99	11.5	1.01	(0.82-1.25)	1.09	(0.88-1.35)
Known and unknown	994	1.9	165	16.6	1.54	(1.30-1.83)	1.18	(0.99-1.41)

The adjusted model included the following variables: maternal age, education, civil status and, any child abuse. Analyzed for complete cases.

Discussion

The main finding in our study was that exposure to past and recent abuse was strongly associated with early cessation of any breastfeeding. The strongest effect was seen for women exposed to three types of abuse (sexual, physical and emotional); with nearly 50% increased adjusted odds of any breastfeeding cessation before four months compared to the non-exposed women. Recent abuse and exposure from known perpetrator resulted in nearly 40% and 30% increased risk of any breastfeeding cessation before four months, respectively. Women who reported a history of child abuse were more likely to stop breastfeeding before four months than women who had not experienced child abuse. This was independently of later exposure to adult abuse. The theoretical causal pathway between adult abuse and breastfeeding behaviour is complex and it is challenging to disentangle which variables to use as confounders. We used a DAG approach and landed on including only maternal age, education, civil status and child abuse (Supplemental Figure S2). Of these, adjustment for maternal education resulted in the largest change of the estimate. Educational attainment has been shown to be strong indicator of socio-economic differences in Norway [34-36]. The DAG clarified how a number of the potential confounding variables were intermediate variables in the theoretical effect pathway and therefore not true confounders [33]. Furthermore, the sensitivity analyses showed that the estimated effect of abuse exposure on breastfeeding cessation was not primarily mediated through the intermediate variables. Interestingly, the association between adult abuse and breastfeeding cessation was evident both in women with and without postpartum depression.

Strengths and limitations

The major strengths of our study include the large sample size representing women from all regions of Norway, the prospective design and comprehensive information about singular and combined types of abuse, as well as extensive information on breastfeeding. In addition, information about a wide range of potential confounding factors was available. The low participation rate in MoBa is a concern (40.4%), with underrepresentation of women less than 25 years, smokers and those living alone [37]. The potential selection bias in MoBa has been evaluated. Despite differences in prevalence estimates, associations between eight exposures and outcomes did not differ between MoBa participants and a representative sample from the general pregnant population, indicating that selection bias did not affect the associations [37]. Retrospective reporting is a challenge, but difficult to avoid in this kind of study. The women`s reporting of breastfeeding six months postpartum could be subject to recall error.

However, studies have found that maternal recall of breastfeeding give accurate estimates shortly after delivery [38] and even 20 years after delivery, as described in a recent Norwegian study [39].

Comparison with other studies

Previous studies have mainly investigated the associations between child sexual abuse, intimate partner violence (IPV), or pregnancy related abuse and breastfeeding [19-23 40]. Our findings of abused women being significantly less likely to initiate breastfeeding, and significantly more likely of early cessation of breastfeeding, are in agreement with four other studies [19 20 41 42]. A study in 811 randomly selected women in five large primary health clinics in Brazil reported that severe physical IPV increased the risk of early breastfeeding cessation [19.] A cross-sectional study comprising 1200 Chinese women showed that those who did not experience IPV during pregnancy were significantly more likely to initiate breastfeeding than abused women [20]. A review of 800 medical records in one family practice in the US revealed an association between lack of breast-feeding and physical and sexual abuse of mothers or their children [41]. A longitudinal study in 296 adolescent females showed that participants who had experienced IPV ceased breastfeeding earlier than their counterparts [42]. Contrary to this, three studies found no differences in breastfeeding between abused and non-abused women [21 22 43]. An Australian cluster randomized controlled trial involving 2621 women from 80 maternal and child health centres found that women exposed to IPV were less likely to initiate breastfeeding than non-abused women, but rates of any breastfeeding did not differ significantly between non-exposed women and those exposed to IPV when other factors like maternal age and education were taken into account [21]. Women in this study were older and had higher educational level than the general pregnant population, which are factors that may promote higher breastfeeding rates and underestimate abuse prevalence. Likewise, a large American population-based study (n=118,579), found no significant association between recent IPV and any breastfeeding initiation or cessation during the first month postpartum[22.] The results indicated that smoking and socio-demographic factors were more important predictors of breastfeeding duration than abuse[22]. Finally, no association was found between abuse and initiation and duration of breastfeeding in a case control study with 212 low income women in two cities in the US[43]. The women were interviewed about past and recent domestic abuse and classification of either breastfeeding or formula feeding was determined by the type of food voucher the women received postpartum. The duration of breastfeeding was assessed by the number of months the women received the vouchers. Important

limitations of the study include the small sample size and possible sample bias. The authors discussed the possibility that women who had decided to breastfeed were more likely to participate in the study than those who planned to bottlefeed.

There are different reasons why results from the three studies differed from ours. One important factor is the differences in methodology and time frame of abuse as well as breastfeeding.They also differ with regard to sample size and study design, which may influence prevalence rates of both abuse and breastfeeding, respectively. Accordingly, one could argue that the low prevalence rates of IPV in two of the studies, i.e. 6.3% [21] and 5.8% [22], may be underestimated and influence the results. In comparison with other studies, our study has a large sample size, a prospective design and clearly defined exposure and outcome variables, which corroborates the scientific evidence that past and recent abuse is negatively associated with breastfeeding.

Emotional abuse and breastfeeding

Few studies have examined emotional abuse and breastfeeding [20 23], and to our knowledge no previous studies support the current finding of a significant association between emotional abuse as a singular or combined exposure and early cessation of any breastfeeding. A cross sectional study from Hong Kong (n=1200) found that women who experienced emotional or physical abuse during pregnancy were more likely to be found in the artificial feeding group, than in the breastfeeding or mixed feeding groups [20]. In the current study all abuse categories containing emotional abuse were significantly associated with cessation of any breastfeeding in the adjusted models; emotional abuse only, emotional and sexual abuse, emotional and physical abuse, and emotional, physical, and sexual abuse. This result is important and underpins that emotional abuse should be included when studying adverse health outcomes of past or recent abuse.

Child abuse and breastfeeding

Child abuse was associated with both the exposure and the outcome in our study and was modelled as a confounder. Furthermore, we found that child abuse was significantly associated with increased risk of any breastfeeding cessation before four months, independent of adult abuse. This association was stronger for child sexual abuse than for physical and/or emotional abuse only. The few existing previous studies that examined associations between child abuse and breastfeeding have focused only on child sexual abuse have reported contradictory results [23 40 44]. The US study in 1220 nationally representative women, mentioned above, found that women with a history of self-reported child sexual abuse were

twice as likely to initiate breastfeeding as their non-abused counterparts, whereas breastfeeding duration did not differ significantly [23]. A Canadian qualitative study found that the women`s experiences of child sexual abuse affected their breastfeeding decisions, with the breastfeeding experience possibly resulting in re-traumatization for some abused women and a healing effect in others [40]. A literature review concluded that women with a history of child sexual abuse was more likely to express desire to and initiate breastfeeding than their non-abused counterparts, but that both past and recent abuse could lead to breastfeeding cessation [44]. A study from the US in 1220 women from a nationally representative sample showed that childhood emotional and physical abuse was not significantly associated with breastfeeding, whereas childhood sexual abuse was [23]. The same study aimed to investigate a possible cumulative effect of abuse but was unable to assess these effects due to few women reporting multiple types of abuse. Our results showed a strong independent effect of child abuse, and in particular child sexual abuse, on breastfeeding cessation. This is an important finding and may indicate that sexual abuse early in life results in even worse adverse long term effects than do other types of abuse.

Public health implications

The last decades several interventions to promote breastfeeding in Norway has been implemented, and breastfeeding rates are higher in Norway than in most European countries [4 16]. Baby friendly hospitals, free antenatal care, free follow up by community nurses and favourable maternity leave in Norway are societal priorities to enhance breastfeeding duration. Early maternal return to work can be a barrier both to initiating and duration of breastfeeding [45 46]. Norway has a long parental leave which supports the possibility of breastfeeding throughout the first year of life [47]. Mean breastfeeding duration in Norway is about ten months. Although, the majority of women in Norway breastfeed for at least six months, a large decline in full breastfeeding occurs between three and four months, and some women also discontinue any breastfeeding within the first six months [15 48]. An Australian longitudinal cohort study showed that women qualified for paid maternity leave had significantly reduced odds of reporting combined physical and emotional IPV the first year postpartum compared to non-working women [49]. The current study showed that despite high breastfeeding rates and a favourable breastfeeding policy in Norway, past and recent abuse of women increased the prevalence of early breastfeeding cessation. These findings indicate that all women need to be screened for abuse during pregnancy because of its impact on maternal and child health. Recommendations urging caregivers to ask women about past and recent

abuse have recently been implemented in the revised antenatal care guidelines in Norway. However, more research is needed on how antenatal care providers can recognize or ask about abuse and which strategies to choose for support and breastfeeding assistance.

Conclusion

The current study shows that past and recent abuse of women is strongly associated with early cessation of breastfeeding. Our results also underpin the need for emotional abuse to be included in studies of the adverse health effect of abuse. Given the convincing evidence of the beneficial effects of breastfeeding both for the mother and the infant, it is crucial to promote high breastfeeding rates. Mothers with a history of past or recent abuse comprise a key group to target for extra support and breastfeeding assistance.

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Contributors

MFS, HG and ML conceived the study and all authors contributed to the study design. MFS and ALB prepared the data and performed the statistical analyses. MFS drafted the manuscript. All authors contributed to the interpretation of the results and critically reviewed the manuscript. All authors read and approved the final manuscript.

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Competing interests

No, there are no competing interests.

Ethics approval

The Norwegian Mother and Child Cohort Study was approved by the Regional Committee for Ethics in Medical Research (REK nr S-97045 /S-95113) and the Data Inspectorate in Norway.

Data sharing statement

No additional data available.

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Figures

Figure 1

Figure Legend: Flow-chart of inclusion. Questionnaire 1 was answered in gestational week 18, questionnaire 3 in gestational week 30 and questionnaire 4 was answered 6 months postpartum.

Supplemental Material:

Supplemental Figure S1

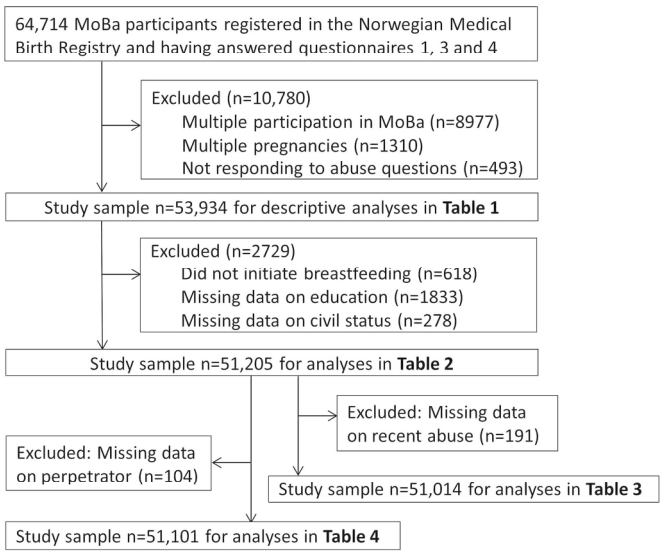
Figure Legend: Questions and response options on abuse and perpetrators in questionnaire 3 answered in gestational week 30 in the Norwegian Mother and Child Cohort Study

Have you ever experienced any of the following? *(Fill in for each statement.)*

Supplemental Figure S2

Figure Legend: The directed acyclic graph (DAG) for this study as generated by dagitty.net.

The green node indicates the exposure of interest (Adult abuse), the green lines the exposures effect pathways, and the blue node with the "I" indicates the outcome of interest (Breastfeeding behavior). The blue nodes without "I" are intermediate variables in the effect pathway. Red nodes are confounders that are adjusted for in the models. The minimal sufficient adjustment set for estimating the total effect of Adult abuse on Breastfeeding behavior was maternal age, education, child abuse, and civil status.



Flow-chart of inclusion, Questionnaire 1 was answered in gestational week 18, questionnaire 3 in gestational week 30 and questionnaire 4 was answered 6 months postpartum.

190x142mm (300 x 300 DPI)

	No Never	Yes, as a child (under 18)	Yes, as an adult (over 18)	Who was responsible for this?			Has this occurred during the last year	
				A stranger	Family or relative	Another known person	No	Yes
Someone has over a long period of time systematically tried to subdue, degrade or humiliate you	☐	☐	☐	☐	☐	☐	☐	☐
Someone has threatened to hurt you or someone close to you	☐	☐	☐	☐	☐	☐	☐	☐
You have been subjected to physical abuse	☐	☐	☐	☐	☐	☐	☐	☐
You have been forced to have sexual intercourse	☐	☐	☐	☐	☐	☐	☐	☐

190x142mm (300 x 300 DPI)

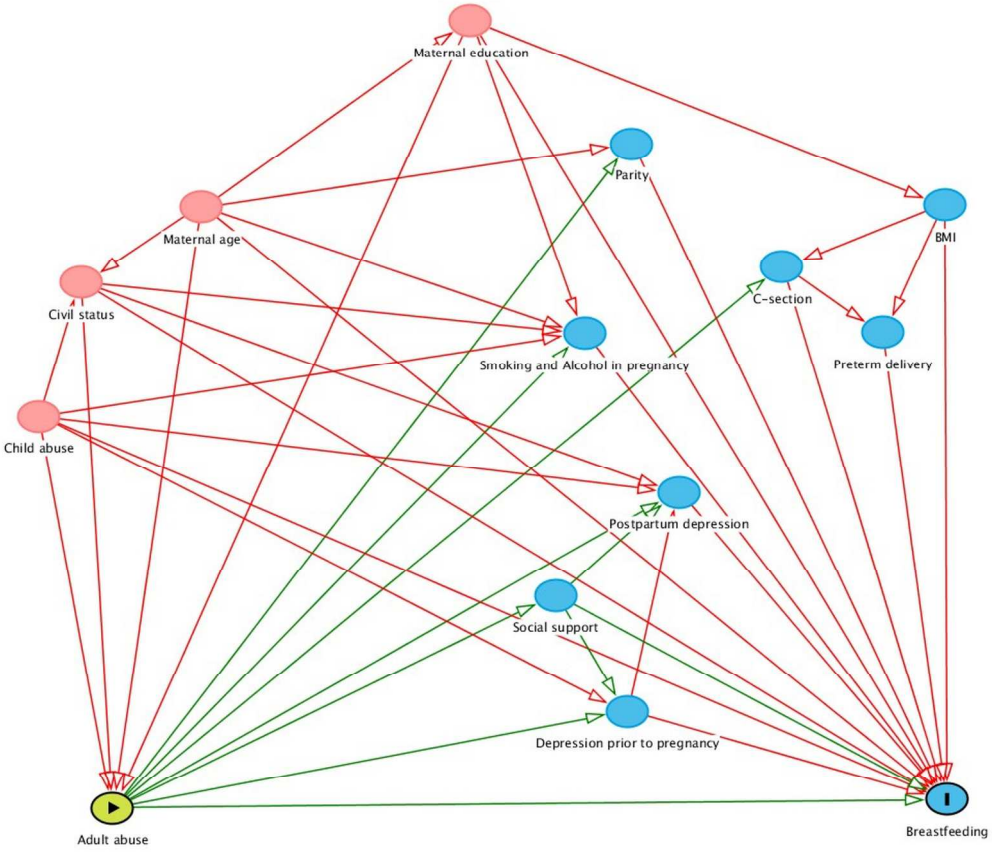


Figure Legend: The directed acyclic graph (DAG) for this study as generated by dagitty.net. The green node indicates the exposure of interest (Adult abuse), the green lines the exposures effect pathways, and the blue node with the "I" indicates the outcome of interest (Breastfeeding behavior). The blue nodes without "I" are intermediate variables in the effect pathway. Red nodes are confounders that are adjusted for in the models. The minimal sufficient adjustment set for estimating the total effect of Adult abuse on Breastfeeding behavior was maternal age, education, child abuse, and civil status.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract The study design in mentioned in the title: Past and recent abuse is associated with early cessation of breastfeeding. Results from a large prospective cohort in Norway. The study design is also stated in the abstract: Design: Prospective cohort study.	1 and 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found This is what we have aimed at providing in the abstract.	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Breastfeeding has long been acknowledged as the optimal infant nutrition conferring short and long term health effects for both mothers and infants. Abuse of women is common worldwide and is known to have detrimental consequences of women`s health and general life. Little is known about the impact of abuse of breastfeeding behaviour and more studies are needed. We had the possibility to investigate this in one of the largest prospective pregnancy cohorts worldwide. The rationale is outlined in the background.	4
Objectives	3	State specific objectives, including any prespecified hypotheses The objective of the study is stated on page 4.	4
Methods			
Study design	4	Present key elements of study design early in the paper This is a prospective study within the Norwegian Mother and Child Cohort (MoBa) study. The design is presented early in the method section, including description of the exposure and outcome variables, relevant covariates, and the statistical methods used.	5-8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection The setting of the study is given first in the abstract and further in the methods section. Time of collection is described in the methods section.	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up Recruitment and methods of selection of participants, and selection of the final study sample from the eligible women is described in the methods section on page 5. Selection of participants is also described in Figure 1 (flow chart).	5

		(*b*) For matched studies, give matching criteria and number of exposed and unexposed Not applicable.	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Exposure, outcome and potential confounders are described in the methods section, pages 5-7. Definitions used for the outcome (breastfeeding) are reported in the methods section, page 6.	5-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Sources of the data in the present study are specified in the methods section, pages 5-8. Please see an overview below. **The baseline questionnaire in the MoBa study answered in gestational weeks 15-18 (Q1):** Variables: Maternal age, education, civil status, smoking, alcohol use, child abuse exposure, parity, prior depression, social support, pre pregnant weight and height for calculation BMI. **The questionnaire responded to at gestational week 30 (Q3)** Variables: All abuse categories, types of abuse, time of abuse, and perpetrators, see page 6 **The first questionnaire after birth, six months postpartum (Q4)** Variable: Postpartum depression Information used for the breastfeeding variables were also reported in Q4 six months postpartum. The data are based on three questions about infant nutrition. The questions asked about what type of milk (breastfeeding of formula feeding) or other liquid the baby had been given in the first week of life in monthly intervals up until and at the date of filling in the questionnaire (median 27 weeks/190 days). The women also reported the age (in months) of the infant at the time of semisolid or solid food. Breastfeeding definitions are based on the WHO`s definitions, as described on pages 6 -7. **The Medical Birth Registry of Norway:** Information based on forms completed by the midwives or attending physician within 7 days after birth. Variables: Mode of delivery, (caesarean section or vaginal delivery) and gestational length (used to define preterm delivery, i.e. delivery before 37 completed gestational weeks.	
Bias	9	Describe any efforts to address potential sources of bias In the Norwegian Mother and Child Cohort Study as well as similar studies, selection bias and differences in the socio-economic status are the most serious concerns. Selection bias in this cohort was evaluated in a separate paper (Nilsen et al.,	8 and 10-11

		2009) which showed that non-representativeness of women in the cohort did not influence exposure-outcome association. This information is included in the discussion. Potential confounding has also been thoroughly addressed. Characteristics associated with any adult abuse in our study population have been examined previously (Sørbø MF, et al 2013) and potential confounder variables were based on this knowledge. We also included other potential confounding variables, as described in the first paragraph under "Other variables" in the methods section. We used directed acyclic graphs (DAGs) approach to clarify which variables were confounders and which variables were intermediate variables. This is described in methods section (statistical analyses) on page 8 and in discussion section on page 10-11. The variables identified by the DAG (maternal education, maternal age, child abuse, and civil status) were included in all adjusted analyses.	
Study size	10	Explain how the study size was arrived at The selection of the final study sample is described on page 5, and shown in Figure 1.	5 Figure 1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why The way in which quantitative variables (covariates) were divided into groups and why are described on page 6 (child abuse), and page 7 (maternal age, maternal education, and civil status), and shown in Table 1. How they were used are described in statistical analyses section (page 8), and in Supplemental Figure S2. The intermediate variables and how they were identified, are described on the same pages and in Tables 1 and Supplemental Figure S2.	7-8 Table 1 Figure S2
Statistical methods	12	(a)Describe all statistical methods, including those used to control for confounding Statistical methods are described on page 8. Odds ratios were estimated by binary logistic regression with cessation of breastfeeding as before four months as the outcome and abuse, including subcategories of abuse, as the exposure. Examination of and controlling for confounding is described in the methods section on page 8 and in the discussion section pages 10-11, and is shown in Figure S2.	7-8, Figure S2
		(*b*) Describe any methods used to examine subgroups and interactions We examined the exposure variable (abuse) as a dichotomous variable (any abuse yes/no) and by the subgroups a) emotional, sexual, and physical abuse, b) recent/not recent, c) grouped by perpetrators (known only, unknown only, known and unknown). The method used to examine subgroups is logistic regression as described in the Statistical methods. We did not examine potential interactions between the exposure and the confounders (maternal age, maternal education, child abuse, and civil status) due to small differences between crude and adjusted ORs for the associations studied.	
		(*c*) Explain how missing data were addressed Exclusion due to missing data is described in the methods section, page 8. All binary logistic regression analyses were performed for complete cases only. Descriptive statistics of the study population by exposure to any adult abuse are presented in Table 1. For testing differences	8

		between these categories we used Pearson`s Chi-square test, and participants grouped in a “missing category” were not included.	
		(*d*) If applicable, explain how loss to follow-up was addressed Not applicable.	
		(*e*) Describe any sensitivity analyses Sensitivity analyses (with regard to postpartum depression) have been described in the statistical section on page 8 and in the two last paragraphs in the results section on page 10.	8 and 10
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed The numbers of individuals potentially eligible, excluded at each stage, and finally included in the study populations are given on page 5. The numbers of participants included in each analysis are also shown in this paragraph, and shown in the flow chart in Figure 1.	5 Figure 1
		(b) Give reasons for non-participation at each stage Shown in text on page 5 and in Figure 1.	5 Figure 1
		(c) Consider use of a flow diagram See Figure 1.	5 Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Various characteristics of the participants, and information on the exposure and potential confounders, are described in the methods section on page 5, and in the results section on pages 8-10, and in Table 1.	5, 8-10 Table 1
		(b) Indicate number of participants with missing data for each variable of interest The number of participants on with missing data (descriptive data, risk and health factors) is shown in Table 1. In Tables 2-4 analyses were performed for complete cases only. The number with missing on the specific outcome variables is shown in the flow chart (Figure 1).	Table 1 Figure 1
		(c) Summarise follow-up time (eg, average and total amount) Not applicable.	
Outcome data	15*	Report numbers of outcome events or summary measures over time The number of participants reporting breastfeeding is presented in Table 1, in the text in the results section on page 8, and also in the abstract.	8 Table 1
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence	8-10, Figures 2-4

		interval). Make clear which confounders were adjusted for and why they were included Crude and adjusted estimates for the associations between abuse and cessation of breastfeeding are presented in Tables 2-4 and in the text on page 8 (statistical section) and page 10 -11 (discussions section). Adjusted results are also presented in the abstract. All analyses were adjusted for maternal age, maternal education, child abuse, and civil status. These covariates were the minimal sufficient adjustment variables for estimating the total effect between adult abuse and breastfeeding. We used DAG to help clarify which variables were intermediate factors rather than confounders. Table 2 presents crude and adjusted results of the association between any adult abuse, singular and combined types of adult abuse, respectively, and any breastfeeding cessation before 4 months. Table 3 presents crude and adjusted results of the association between time of adult abuse (recent/not recent) and cessation of any breastfeeding before 4 months. Table 3 presents crude and adjusted results of the association between the perpetrator (known only, unknown only, and, known and unknown) of abuse and cessation of any breastfeeding before 4 months	
		(*b*) Report category boundaries when continuous variables were categorized The only continuous variable grouped into categories in this study was maternal age. We divided into the following categories shown in Table 1. First category: 14-19 years Second category: 20-24 years Third category: 25-29 years Fourth category: 30-34 years Fifth category: ≥ 35 years Maternal BMI was included in Table 1 and for descriptive purpose and was divided into two groups based on the WHO categories; i) underweight and normal weight women (BMI<25) and ii) overweight and obese women (BMI>=25)	Table 1
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period In the present study the estimates are calculated as odds ratios, and to our understanding it is not relevant to calculate absolute risk.	8

Other analyses	17	Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses Characteristics of the participants exposed to abuse versus non-abused are shown in Table 1 and are given on page 8 -9, under results. Sensitivity analyses regarding postpartum depression is described on page 8 (statistical section), on page 10 (results section), and on page 11 (discussion section). We did not perform analyses of interactions (see point 12 b).	7-8
Discussion			
Key results	18	Summarise key results with reference to study objectives The main results are stated in the Abstract page 2, in the beginning of the discussion section, page 10 and in the conclusion, page 14.	2, 10, 14
Limitations	19	Limitations of the study are discussed on page 11, under paragraph “Strengths and limitations”.	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Interpretation of the results is presented on pages 10-14. Our interpretation is cautious, in the form of possible, hypothetical explanations, recognising the limitations of associations based on epidemiological data.	10-14
Generalisability	21	Discuss the generalisability (external validity) of the study results The generalizability and representativeness of the study results is discussed under the discussion section, page 11.	11
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based The funding of the present project as well as the funding for the Norwegian Mother and Child Cohort Study is described on page 14, in the “Funding section”.	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.