



# The birth experience and subsequent maternal caregiving attitudes and behavior: a birth cohort study

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## Abstract

Optimal maternal caregiving is critical for children's healthy development, yet quality of maternal caregiving may be influenced by a negative birth experience. We examined whether the birth experience was associated with maternal caregiving attitudes and behavior throughout the first year. We conducted secondary analysis of the Avon Longitudinal Study of Parents and Children birth cohort on perinatal data. The birth experience was assessed using self-report data on level of support in labor. Maternal caregiving variables were self-report maternal attitudes at one and eight postnatal months, and observed maternal behavior at 12 postnatal months. Data were analyzed using multivariable logistic regression models adjusting for critical covariates at one ( $N = 4389$ ), eight ( $N = 4580$ ), and 12 ( $N = 842$ ) postnatal months. Feeling supported in labor was associated with a report of "immediately falling in love" with one's baby after birth, surveyed at 1 month (adjusted OR 1.41 [95% CI 1.20–1.65]), and with more positive parenting scores at 8 months (adjusted OR 1.56 [95% CI 1.36–1.79]), but not with more positive observed maternal behavior at 12 months. Additional risk factors were identified. Our findings suggest that we may be able to modify the risk of poor postnatal maternal caregiving by supporting women in labor and facilitating a positive birth experience.

**Keywords** Birth experience · Maternal attitude · Maternal behavior · Parenting · ALSPAC · Systematic review

## Introduction

Birth is a vulnerable period for mothers. Seven to 10% of women experience a negative birth based on population studies in Sweden, Canada, and the USA (Declercq et al. 2002; Smarandache et al. 2016; Waldenstrom et al. 2004). Up to 3% of women have a traumatic birth experience resulting in post-traumatic stress disorder (Alcorn et al. 2010) that can produce

profound feelings of maternal failure and the inability to feel connected to one's infant (Fenech and Thomson 2014; Grekin and O'Hara 2014). Women describe an association between the lack of empathy and support received during labor with a disruption in feeling attached towards their infant and a loss of confidence in their maternal caregiving (Moloney and Gair 2015). Broadly defined, maternal caregiving is how a mother feels about and behaves towards her infant. Infants thrive

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when maternal caregiving conveys love, responsiveness to infant cues, and synchronicity in mother-infant interaction. In contrast, maternal caregiving that is chronically intrusive, nonresponsive, or dyssynchronous adversely impacts children's development including insecure attachment, low empathy, irritability, cognitive deficits, and psychopathology (Feldman 2015; Leclere et al. 2014; National Research Council and Institute of Medicine 2009).

Beyond traumatic birth, less is known about the effect of a range of birth experiences on maternal caregiving. A recent systematic review concludes that a positive birth experience may facilitate maternal caregiving attitudes and behavior (Bell et al. 2018). The literature demonstrates wide variability in operational definitions of the birth experience and maternal caregiving (Bell et al. 2018). Birth experience measures commonly include overall birth satisfaction, support in labor, involvement in decision-making, confidence, and feeling safe. These characteristics are often reported as predictors of a positive birth experience, along with having birth expectations fulfilled (Christiaens and Bracke 2007; Hildingsson 2013; Hildingsson 2015; Karlstrom et al. 2015; Larkin et al. 2009; Lavender et al. 1999). Given that maternal caregiving is a broad construct, there is variation in how it is measured as evidenced by observational coding of video-recorded mother-infant interactions and self-report parenting surveys on maternal self-esteem, self-efficacy, sensitivity, and feelings towards the infant (Bell et al. 2018). Further research is warranted on whether the birth experience influences maternal caregiving, and studies should use measures with strong psychometrics; increase generalizability with variation in mode of birth, parity, and race/ethnicity; avoid assessing the birth experience within the first few days after birth; control for potential covariates; and conduct multivariate analyses with adequate statistical power.

We examined whether the birth experience is associated with maternal caregiving throughout the first postnatal year using secondary analysis of a large population database. Given that feeling supported in labor has a salient effect on women's birth experience, we hypothesized that women who felt less support in labor would demonstrate less positive maternal attitudes and behavior postnatally compared to women who felt well supported in labor.

## Methods

### Design and population

We conducted secondary data analysis of the Avon Longitudinal Study of Parents and Children (ALSPAC), an ongoing, UK population, birth cohort study investigating psychological, social, environmental, and biological influences on children's health (Boyd et al. 2013). Women were enrolled

if they expected to give birth between April 1, 1991, and December 31, 1992, in the Avon region. Demographic characteristics were comparable to the UK population (Fraser et al. 2013). ALSPAC methodology is published and readily available (<http://www.bristol.ac.uk/alspac/researchers/access/>) (Golding et al. 2001). ALSPAC Law and Ethics Committee and local research ethics committees provided ethical approval before study enrollment.

The initial number of pregnancies enrolled was 14,541. Of these initial pregnancies, there was a total of 14,676 fetuses, resulting in 14,062 live births and 13,988 children who were alive at 1 year of age. Birth data were available from 8295 medical records. We excluded multiple pregnancies ( $n = 184$ ), infants < 34 or > 42 gestational weeks ( $n = 214$ ), and neonatal deaths ( $n = 21$ ), resulting in 7876 potential participants. Analysis was further restricted to participants with complete data on self-reported maternal caregiving attitudes at one (97.4%) and eight (81.5%) postnatal months, and feelings about labor support (81.8%). Our final sample with self-reported maternal caregiving attitudes at one postnatal month was 4389 and at eight postnatal months was 4580, representing 55.7–58.2% of the overall study population with birth data. Additionally, within ALSPAC, there were 1000 mother-infant pairs with video-recorded maternal caregiving behavior at 1 year, from participants randomly selected for a sub-study called "Children in Focus." Of these participants, 842 women with complete data were included in analysis.

### Measures

The birth experience was measured at two postnatal months. Women were asked "How did you feel while you were having the baby?" Ratings were on a scale of neglected, just okay, or warmly supported. Women were also asked a global question: "Was the birth a wonderful experience for you?" Possible responses were yes, no, or not sure. Given that these questions are highly associated ( $\chi^2 = 214$ ,  $p < 0.0001$ ), and labor support is a strong predictor of birth experience satisfaction (Hildingsson 2013; Hodnett 2002), we report results of support in labor (a constructed binary variable) as neglected/just okay versus warmly supported.

Self-report maternal caregiving attitudes were measured two ways. One month after birth, women were asked "How long did it take you to fall in love with your baby?" Ratings were on a scale of immediately after birth, a little while, over a week, or not yet fully. To reflect suboptimal versus optimal responses, we created a binary variable of not immediately versus immediately falling in love with their baby. At eight postnatal months, women filled in the ALSPAC Parenting Questionnaire (eight items), shown to have good psychometrics (Waylen and Stewart-Brown 2010). Within ALSPAC, more positive parenting was associated with positive mother-infant interactions at 1 year ( $p = 0.024$ ) (Thomson

et al. 2014). Additionally, this questionnaire predicted parenting and child behavior at six, 47, and 81 months (Waylen and Stewart-Brown 2010). Parenting questions were designed to measure parental warmth, support, rejection, and control towards infants. Responses were on a scale of always, often, sometimes, or never. For example, warmth and support were assessed by how frequently they experienced enjoyment and confidence in caring for their infant. Rejection and control were assessed by whether they preferred not having the baby at the time they did, could not bear it when the baby cried, and disliked the mess around the baby. Scores were aggregated (range 13–32). A binary variable was constructed of lower (less warm/supportive and more rejection/control) vs. higher (more warm/supportive and less rejection/control) parenting scores based on whether the aggregate score was lower or higher than the median (29).

Observed maternal caregiving behavior was measured at 12 postnatal months. A subset of 1000 ALSPAC mother-infant pairs were video recorded looking at a book together, and mothers were instructed to freely interact with their infants. The video recording ended when the mother decided the infant was finished with the book. Mother-infant interactions were rated in ALSPAC using the Thorpe Interactive Measure (TIM) (Thorpe et al. 2003), assessing parental teaching behavior and four categories assessing quality of parental communication and warmth. We utilized four categories (previously constructed in the ALSPAC dataset) of observed parental communication and warmth defined as physical proximity (distant, moderate, and close), non-verbal communication (negative, neutral, and positive), verbal communication (negative, neutral, and positive), and warmth of relationship (very cool, cool, neutral, warm, and very warm). To ensure equal weighting, standardized scores were used in calculation of aggregate scores. We constructed a binary variable of lower (less warmth and less positive communication) vs. higher (more warmth and more positive communication) observed maternal behavior scores based on whether the aggregate score was lower or higher than the median score of 1.0 (range -14.0–5.0).

The following variables were considered as covariates: type of birth categorized as medical intervention (cesarean surgery, intrapartum oxytocin induction or augmentation, labor pain medication excluding nitric oxide, or vaginal delivery with either forceps or vacuum extraction) versus physiological (vaginal birth without medical intervention but could include the commonly used nitric oxide); immediate postnatal complications categorized as 0 versus  $\geq 1$  (hemorrhage  $> 1000$  ml, blood transfusion, third or fourth degree genital lacerations, or infants admitted into neonatal intensive care); maternal age ( $\geq 35$ , 25–34, and  $< 25$  years); mother's parity (0,  $\geq 1$ ); history of psychiatric diagnosis (yes, no); elevated depressive symptoms from the Edinburgh Postnatal Depression Scale (EPDS)  $\geq 13$  at 32 antenatal weeks and at eight postnatal months (Heron et al. 2004); elevated anxiety symptoms from the

Crown-Crisp Experiential Index (CCEI)  $\geq 9$  at 32 antenatal weeks and at eight postnatal months (Heron et al. 2004); history of alcoholism or drug addiction (recent, past, never); antenatal smoking (yes, no); social network assessed by objective measures (10-items, 4-level Likert) of physical, emotional, and financial support with friends/family using the median value score cutoff ( $< 24$ ,  $\geq 24$ ); adverse childhood experiences (e.g., a parent's death, job loss, or legal trouble) using the median value cutoff ( $> 3$  events, 0–3 events); recent stressful life events (e.g., divorce, serious illness or accident, emotional or physical abuse) at 18 antenatal weeks and at eight postnatal months using the median value cutoff ( $> 3$  events, 0–3 events); and method of infant feeding (not exclusive versus exclusive breastfeeding during the first and sixth postnatal months, respectively). Education level was lower than advanced versus advanced and higher. Advanced and higher was A-level (a national assessment generally obtained at age 18 and required for university admission or degree) or university degree. All other education levels were classified as lower.

## Statistical analysis

Multivariable logistic regressions examined associations between support in labor and maternal caregiving measures (self-reported and observed) at one, eight, and 12 postnatal months. Manual backward selection procedure was used to assess for significant interactions using the likelihood ratio chi-square test. The Hosmer-Lemeshow test assessed goodness of fit in final models. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated using maximum likelihood estimates from the logistic regression models. Sensitivity analysis of birth experience variables were conducted, and results are reported in [supplementary tables](#) and in text. All  $p$  values are two-sided at a  $p < 0.05$  level of significance. Analyses were performed using SAS (version 9.3; SAS Institute Inc., Cary, NC, USA).

## Results

### Population characteristics

Table 1 displays sociodemographic characteristics of the study population ( $N = 7876$ ) and final sample ( $N = 4389$ – $4580$ ) related to outcomes at one and eight postnatal months. Data were available for 842 mother-infant interactions at 12 months. Maternal age ranged from 15 to 44 years [mean (SD), 27.76 (5.23)], and 59–61% had less than an advanced education. In our final sample, 971 (22.1%) women reported that they did not immediately fall in love with their baby after birth; 2271 (49.6%) women described less positive parenting attitudes at eight postnatal months; and 417 (49.5%) women demonstrated less positive observed maternal behavior at 12 postnatal months.

**Table 1** Distribution of birth variables and socio-demographic variables

	Study population <sup>a</sup>		Final sample <sup>b</sup>		
			Self-report maternal attitudes		Observed maternal behavior
	<i>N</i> <sup>a</sup>	<i>n</i> (%)	1 month <i>N</i> = 4389 <i>n</i> (%)	8 months <i>N</i> = 4580 <i>n</i> (%)	12 months <i>N</i> = 842 <i>n</i> (%)
Support in labor	6445				
Neglected/just ok		1871 (29.0)	1241 (28.3)	1262 (27.6)	205 (24.4)
Warm support		4574 (71.0)	3148 (71.7)	3318 (72.4)	637 (75.6)
Type of birth	7601				
Medical intervention		6645 (87.4)	3801 (86.6)	3961 (86.5)	696 (82.7)
Physiological		956 (12.6)	588 (13.4)	619 (13.5)	146 (17.3)
Immediate postnatal complications	7045				
≥ 1		1590 (22.6)	890 (20.3)	965 (21.1)	114 (13.5)
None		5455 (77.4)	3499 (79.7)	3615 (78.9)	728 (86.5)
Maternal age <sup>c</sup>	7876				
< 25 years		2020 (25.6)	811 (18.5)	824 (18.0)	103 (12.2)
25–34 years		5062 (64.3)	3095 (70.5)	3257 (71.1)	646 (76.7)
≥ 35 years		794 (10.1)	483 (11.0)	499 (10.9)	93 (11.1)
Marital status	7417				
Married		4949 (66.7)	3133 (71.4)	3298 (72.0)	637 (75.7)
Unmarried		2468 (33.3)	1256 (28.6)	1282 (28.0)	205 (24.3)
Education level <sup>d</sup>	7154				
CSE/None		1433 (20.0)	649 (14.7)	652 (14.2)	104 (12.4)
Vocational		713 (10.0)	422 (9.6)	439 (9.6)	81 (9.6)
Ordinary		2460 (34.4)	1609 (36.7)	1674 (36.6)	310 (36.8)
Advanced		1635 (22.8)	1104 (25.2)	1171 (25.6)	222 (26.4)
Degree		913 (12.8)	605 (13.8)	644 (14.1)	125 (14.9)
Parity	7332				
0		3739 (51.0)	2221 (50.6)	2364 (51.6)	405 (48.1)
1+		3593 (49.0)	2168 (49.4)	2216 (48.4)	437 (51.9)
Social network	6926				
Low		3348 (48.4)	2006 (45.7)	2097 (45.8)	371 (44.1)
High		3577 (51.6)	2383 (54.3)	2483 (54.2)	471 (55.9)
Ethnicity	7102				
Caucasians		6900 (97.2)	4280 (98.0)	4474 (98.2)	825 (98.3)
Non-Caucasians		202 (2.8)	85 (2.0)	82 (1.8)	14 (1.7)

<sup>a</sup> Study population size was 7876. *N* varies among the socio-demographic variables because of missing data

<sup>b</sup> Final sample: participants with no missing data in any variables used in the final models

<sup>c</sup> Range of participants' age at birth was 15–44 years; mean age was 27.8 years

<sup>d</sup> See description of education levels in covariate measures section

### “How long did it take you to fall in love with your baby?”

In adjusted analysis (Table 2), women who reported a lower level of labor support (neglected or just okay) were more likely to not immediately fall in love with their babies after birth (OR = 1.41). Results were nearly identical for unadjusted analysis (OR = 1.41, 95% CI 1.21–1.64,  $p < 0.001$ ). History of psychiatric diagnoses, higher childhood adversity, advanced

education, a first-time mother, 25–34 years of age, and not exclusively breastfeeding within the first month were each associated with not immediately falling in love with their babies.

### Self-report parenting questionnaire

In adjusted analysis (Table 2), women who reported a lower level of labor support (neglected or just okay) were more likely to have lower (less optimal) self-report parenting scores

**Table 2** Final adjusted models for less positive maternal caregiving attitudes and behavior

Variables	Did not immediately fall in love with baby at birth asked at 1 month <i>N</i> = 4389 OR (95%CI)	Lower self-report parenting score at 8 months <i>N</i> = 4580 OR (95%CI)	Lower observed maternal behavior score at 12 months <i>N</i> = 842 OR (95%CI)
Support in labor			
Neglected/just ok vs. warm support	1.41 (1.20–1.65)***	1.56 (1.36–1.79)***	0.88 (0.64–1.22)
Type of birth			
Medical intervention vs. physiological	1.16 (0.92–1.47)	0.89 (0.74–1.07)	0.95 (0.65–1.38)
Immediate postnatal complications			
≥ 1 vs. none	1.17 (0.98–1.39)	0.93 (0.80–1.08)	1.08 (0.72–1.62)
Elevated symptoms of depression (EPDS) <sup>b, d</sup>			
Elevated vs. not elevated	0.99 (0.78–1.26)	1.86 (1.42–2.44)***	0.94 (0.48–1.84)
Elevated symptoms of anxiety (CCEI) <sup>c, d</sup>			
Elevated vs. not elevated	1.17 (0.93–1.48)	2.86 (2.21–3.71)***	1.26 (0.69–2.31)
History of psychiatric disorder			
History vs. no history	1.41 (1.02–1.95)*	1.16 (0.85–1.59)	1.77 (0.84–3.76)
Stressful childhood life events			
> 3 vs. 0–3 events	1.22 (1.05–1.42)**	1.14 (1.01–1.30)*	0.77 (0.58–1.02)
Stressful antenatal/postnatal life events <sup>d</sup>			
> 3 vs. 0–3 events	1.12 (0.96–1.30)	1.35 (1.19–1.52)***	0.94 (0.71–1.25)
Social network			
Low vs. high	1.11 (0.96–1.29)	1.34 (1.18–1.51)***	0.90 (0.68–1.20)
Maternal age (vs. 25–34 years)			
< 25 years	0.78 (0.63–0.96)*	0.67 (0.57–0.80)***	1.08 (0.70–1.67)
≥ 35 years	0.97 (0.76–1.23)	0.93 (0.76–1.14)	1.24 (0.79–1.96)
Education level			
< advanced vs. advanced	0.58 (0.50–0.68)***	0.67 (0.58–0.76)***	1.41 (1.04–1.91)*
Parity			
0 vs. 1+	1.83 (1.56–2.14)***	0.95 (0.83–1.08)	0.82 (0.61–1.09)
Breastfeeding <sup>e</sup>			
Not exclusive vs. exclusive	1.17 (1.00–1.37)*	0.97 (0.85–1.12)	1.46 (1.06–2.01)*

<sup>a</sup> See analysis section for model building

<sup>b</sup> Edinburgh Postnatal Depression Scale scores ≥ 13 indicated elevated symptoms

<sup>c</sup> Anxiety subsection of the Crown-Crisp Experiential Index scores ≥ 9 indicated elevated symptoms

<sup>d</sup> Stressful life events assessed at 32 antenatal weeks was a covariate in the maternal outcome at one postnatal month, and stressful life events assessed at eight postnatal months was a covariate in maternal outcomes at 8 and 12 months

<sup>e</sup> Breastfeeding: not exclusive vs. exclusive in the first postnatal month for the 1-month outcome, and in the first six postnatal months for the 8- and 12-month outcomes

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

at eight postnatal months (OR = 1.56). Results were similar for unadjusted analysis (OR = 1.63, 95% CI 1.43–1.86,  $p < 0.001$ ). Elevated symptoms of depression or anxiety, higher childhood adversity, higher stressful life events after birth, lower social support, 25–34 years of age, and advanced education were each associated with lower self-report parenting scores at eight postnatal months.

### Observed maternal caregiving behavior

Support in labor was not associated with observed maternal caregiving behavior at 12 months in both unadjusted (OR = 0.96, 95% CI 0.70–1.32) and adjusted (Table 2) analyses. However, not having an advanced education and not exclusively breastfeeding within the first 6 months

were each associated with less positive observed maternal caregiving behavior at 12 months.

### Sensitivity analysis of birth experience variables

Importantly, sensitivity analyses demonstrated that patterns of associations did not change when replacing labor support with the global birth experience variable, nor with a composite birth experience score (Supplemental Tables 2a, 2b, and 3). All birth experience variables were associated with maternal caregiving attitudes at 1 and 8 months, but not with maternal caregiving behavior at 12 months. The composite score allowed for three combinations of variables: women reporting both a *wonderful* experience and a *warm* level of labor support; either a *not wonderful/not sure* experience or a *neglected/just okay* level of labor support; and both a *not wonderful/not sure* experience and a *neglected/just okay* level of labor support. Compared to adjusted analyses with the labor support variable, women reporting a *not wonderful/not sure* birth experience demonstrated higher odds (OR 3.39 at 1 month, OR 1.95 at 8 months) of lower maternal caregiving attitudes (Supplemental Table 2a), and a composite birth experience score demonstrated even higher odds (OR 3.47 at 1 month, OR 2.48 at 8 months) of lower maternal caregiving attitudes (Supplemental Table 2b). Analyses with the composite birth experience variable also demonstrated a dose response: the lower the score, the less positive outcomes of maternal caregiving.

### Discussion

Our findings suggest that women who feel supported in labor and report a positive birth experience demonstrate more optimal maternal caregiving attitudes at one and eight postnatal months. Our results are supported by a recent systematic review showing that women's birth experiences were linked to their postnatal caregiving attitudes and behaviors in eight out of 12 studies using quantitative methods and in all three studies using qualitative methods (Bell et al. 2018).

Our null finding that maternal caregiving behavior at 12 postnatal months was not associated with the birth experience could be influenced by poor psychometrics of the ALSPAC's observed maternal caregiving measure (TIM). There is limited evidence of the reliability/validity of TIM, and the static camera angle causes limited facial visibility (Puckering et al. 2014; Thorpe et al. 2003). Alternatively, the birth experience may exert less of an effect on maternal caregiving over time. In a well-designed study, Durik et al. (2000) reported that a more positive birth experience buffered the negative effect of an emergency cesarean on observed maternal caregiving in women with low neuroticism at four postnatal months, whereas no differences were found at 12 postnatal months. Bryanton et al. (2008) reported an association between the birth experience and

parenting self-efficacy the first postnatal day, but no association at one postnatal month. In contrast, Reisz et al. (2015) reported that associations between the birth experience and women's description of their infant were consistent over time in data collected between 4 days and 12 postnatal months. Effects of the birth experience over time on maternal caregiving may depend upon the quality of the birth experience. In three studies using qualitative methods where women described traumatic birth and difficulty bonding with their infant, data were collected up to 3 to 10 years after birth (Ballard et al. 1995; Moloney and Gair 2015; Nicholls and Ayers 2007). Additionally, in women with a positive or mixed view of their birth experience, the memory of pain severity declined over time, while women with a negative birth experience retained their long-term memory of birth pain (Stadlmayr et al. 2006; Waldenstrom 2004; Waldenstrom and Schytt 2009).

There is wide variability in operational definitions of the birth experience (in studies with maternal caregiving) ranging from a global question of satisfaction to indices of specific dimensions of the birth experience (with inconsistency in reporting psychometrics) (Bell et al. 2018). Specific dimensions are similar to predictors of a positive birth experience and include fulfillment of birth experience expectations, involvement in decision-making, in-control of one's environment or behavior, self-confidence, safety, respect, relaxation, and feeling supported in labor by staff and/or partner (Bell et al. 2018; Christiaens and Bracke 2007; Hildingsson 2013; Hildingsson 2015; Karlstrom et al. 2015; Larkin et al. 2009; Lavender et al. 1999). While variability in birth experience measures is a historical methodological weakness (Bell and Andersson 2016; Bell et al. 2018), the strength of evidence leans towards a positive association with maternal caregiving, and we report similar findings when the birth experience is assessed using three methods: labor support, a global measure of satisfaction, and a composite score considering both labor support and satisfaction. A limitation is that the ALSPAC labor support variable did not specify support from midwives, doctors, staff, partner, and/or friends. Another limitation is that the measurement of antenatal expectations was not available in the dataset. ALSPAC assessed how *important* it is for women to have a wonderful birth; however, we did not include that variable because women might feel that their anticipated birth experience is valuable but not expecting to have the birth experience they desire.

There is also heterogeneity in maternal caregiving measures in studies on the birth experience (with inconsistency in reporting psychometrics). For example, self-report measures include parenting self-efficacy (i.e., belief of their capability to parent a child), what being a parent is like, choosing positive or negative adjectives to describe the infant, level of accepting the infant, attentiveness towards the infant, and feelings towards the infant (Bell et al. 2018). Thus, while we cannot report the validity or reliability of ALSPAC's question at one postnatal month "How long did it take for you to fall in love with your

child?”, it does share a similar domain with other assessments in the literature on maternal feelings towards and acceptance of the infant. Alternatively, ALSPAC’s self-report parenting measure at eight postnatal months (assessing parental warmth, support, rejection, and control towards the infant) demonstrates strong psychometrics (Thomson et al. 2014; Waylen and Stewart-Brown 2010). Examples of observed maternal caregiving behavior in the literature include maternal sensitivity to infant cues, reciprocity, responsiveness to infant distress, mutual mother-infant gaze, and maternal affect (Bell et al. 2018). The ALSPAC measure of observed maternal behavior focused on four domains (physical proximity, quality of verbal and non-verbal communication, and warmth of the relationship) but may not have possessed adequate validity. There may also be a difference in the ability of self-report versus observed maternal caregiving to detect an association with the birth experience; however, in eight quantitative studies demonstrating significant associations, five studies used self-report measures, one study used observation measures, and two studies used both self-report and observation measures (Bell et al. 2018). As secondary analysis of an existing dataset, a limitation of our study was the inability to measure self-report and observed maternal caregiving at the same time. Limitations also include correlational analyses using an older dataset that was primarily made up of British Caucasian mothers.

A frequent risk of bias in studies on the birth experience and maternal caregiving is the omission of important covariates, such as previous and current mental health and antenatal expectations of the birth experience (Bell et al. 2018). Other frequent risks of bias include a lack of advanced data analysis, inadequate statistical power, and assessment of the birth experience 1–2 days after the birth when mothers may be unable to separate the joy and relief of a healthy baby with feelings about the actual experience (Britton 2012; Hodnett 2002). Strengths of the ALSPAC database allowed us to avoid many of these risks of bias by using a large sample size, measuring the birth experience at two postnatal months, and accessing numerous potential covariates (e.g., mode of birth, postnatal complications, previous and current mental health, social support, stress, age, parity, education, and infant feeding method) controlled for in our multivariable analyses. However, further research is warranted in a current population cohort with women of varied racial/ethnic backgrounds. For meta-analytic studies to impact maternity care policy, a gold standard birth experience instrument is needed.

## Conclusion

Our findings have implications for practice and future research. We may be able to improve maternal caregiving by supporting women in labor and facilitating a positive birth experience. Optimal maternal caregiving demonstrating

attachment, warmth, and sensitivity is critical in promoting synchronous mother-infant interaction, a strong predictor of children’s development. If further research determines a clear link between mothers vulnerable to a negative birth experience and subsequent poor maternal caregiving, then maternity care policies supporting women to feel safe, respected, and confident are a small investment in contributing to children’s developmental well-being.

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**Authors’ contribution** AFB, JMD, JJC, and CSC contributed to study conception and design. AFB supervised the project with senior mentoring from CSC. AFB, LHR, and OA drafted the manuscript. LHR and OA managed the dataset and performed statistical analyses. All authors contributed to interpretation of results and manuscript editing.

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## Compliance with ethical standards

**Conflict of interests** The authors declare that they have no conflicts of interest.

**Ethical approval** The ALSPAC Law and Ethics Committee and local Research Ethics Committees granted ethical approval for the study. For further details see <http://www.bristol.ac.uk/alspac/researchers/research-ethics>

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