



Marital status disparities in maternal smoking during pregnancy, breastfeeding and maternal depression

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Abstract

One of the dramatic recent changes in family life in Western nations has been the rise in non-marital childbearing. Much of this increase is attributable to the growth in cohabitation. But in some countries, notably the UK (and the USA) this is much less the case with significant proportions of children being born to parents who are not living together. This study uses data from the Millennium Cohort Study, a British birth cohort established in 2001, to examine whether the closeness of the tie between parents, as assessed by their partnership status at birth, is related to smoking during pregnancy, breastfeeding and maternal depression. Four sets of parents are distinguished representing a hierarchy of bonding or connectedness: married and cohabiting parents, and two groups of solo mothers, those closely involved with the father at the time of the birth and those not in a relationship.

Smoking in pregnancy, breastfeeding and maternal depression tests for trend, adjusted for socio-demographic factors, showed that there was a statistically increased risk of adverse health and health behaviours by degree of parental connectedness. There were also consistent and statistically significant differences between married and non-married mothers. Particularly noteworthy was the finding that cohabiting mothers have greater risk of adverse outcomes than married women. Among the non-married set, there were also differences in risk of adverse outcomes. For smoking in pregnancy, the key difference for continuing to smoke throughout the pregnancy lay between mothers involved with partners and those lacking an intimate relationship. For breastfeeding, stronger parental bonds were associated with initiation of breastfeeding, with a clear difference between cohabiting mothers compared to solo mothers. There was also an increased risk of maternal depression with looser parental bonding, and among non-married groups this increased risk was most noticeable among cohabiting mothers when compared with solo mothers.

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Introduction

There have been major changes in the demography of family life in recent decades with one of the

most dramatic being the rise in non-marital childbearing. In UK, for example, the proportion of births occurring outside of marriage was 12 per cent in 1981, 30 per cent in 1991 and in 2004 stood at 42 per cent (ONS, 2005). Similar developments have occurred across many Western nations, with most of the rise in non-marital childbearing being attributable to the growth in cohabitation (Andersson, 2002, Kiernan, 1999). However, this is much

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less the case in Britain and the USA, where there have been notable increases in children being born to parents who are not living together at the time of the birth (Kiernan, 2004a).

Little is known about these developments in family life and particularly whether new parents who are more loosely bonded differ in their behaviours and experiences during pregnancy and post-birth. In UK it is estimated from the Millennium Cohort Study that children born in 2000–2001, 60 per cent of children were born to married couples, 25 per cent to cohabiting couples and 15 per cent to solo mothers (Kiernan & Smith, 2003). The absence of the legal bond of marriage among cohabiting couples may represent less economic or emotional security, which may lie behind the higher dissolution rates invariably found among cohabiting parents compared with married parents (Bumpass & Lu, 2000; Kiernan, 1999). Solo mothers are the most socio-economically disadvantaged of parents and are less likely to have the support of a partner (Kiernan, 2002; Marsh & Perry, 2003).

From pregnancy, through birth, and into infancy the health-related behaviour of the child's mother, as well as broader aspects of the family environment, matter for the long- and short-term healthy development of the child. In this study we focus on three aspects of maternal health and health-related behaviour that have important implications for child development: (1) maternal smoking during pregnancy, (2) breastfeeding and (3) maternal depression. Foetal exposure to cigarette smoke during pregnancy is associated with multiple deleterious short-term outcomes, including medical complications of pregnancy and birth (Castles, Adams, Melvin, Kelsch, & Boulton, 1999), intrauterine foetal growth retardation (Horta, Victora, Menezes, Halpern, & Barros, 1997), preterm delivery (Shah & Bracken, 2000), low birth weight, (Walsh, 1994), infant mortality (DiFranza & Lew, 1995) and negative temperament in early childhood (Brook, Brook, & Whiteman, 2000). While some of these short-term outcomes themselves exert a long-term impact on child health and development, foetal exposure to maternal smoking during pregnancy appears to also have independent long-term effects on cognition (Ernst, Moolchan, & Robinson, 2001; Najman et al., 2004; Olds, 1997) and behaviour (Rodriguez & Bohlin, 2005; Wakschlag, Pickett, Cook, Benowitz, & Leventhal, 2002).

The same pattern is recognized in relation to breastfeeding. In the short-term, breastfeeding is beneficial for the physical health of the infant (less diarrhoea, respiratory infections, otitis media and fewer clinic, emergency and hospital visits) (American Academy of Pediatrics Work Group on Breastfeeding, 1997; Heinig & Dewey, 1996). These short-term effects have a long-term impact on child health and development, while breastfeeding also has independent, beneficial, long-term effects on health (lower rates of diabetes, Crohn's disease, lymphoma, atopic disease and obesity), and intellectual development (Horwood & Fergusson, 1998).

It is well known that maternal depression increases the risk of emotional and behavioural problems among offspring (Brennan, Hammen, Anderson, & Bor, 2000; Cummings & Davies, 1994; Downey & Coyne, 1990; Kim-Cohen, Moffitt, Taylor, Pawlby, & Caspi, 2005). These problems can persist far beyond childhood and there is increasing evidence for inter-generational transmission of psychopathology and its risk factors (Serbin & Karp, 2003; Warner, Weissman, Mufson, & Wickramaratne, 1999). Maternal depression has also been shown to have adverse effects on cognitive and language development among offspring (Cox, Puckering, Pound, & Mills, 1987; Hay et al., 2001; Whiffen & Gotlib, 1989).

These three facets of maternal health and health-related behaviour are interrelated. Depression and cigarette smoking are highly correlated and depressed women are less likely to quit smoking (Borrelli, Bock, King, Pinto, & Marcus, 1996; Pritchard, 1994); there is a substantial, albeit inconclusive, research literature that attempts to determine whether smoking causes depression, or vice versa (Goodman & Capitman, 2000; Hanna, Faden, & Dufour, 1994; Kendler et al., 1993). Women who smoke are less likely to breastfeed than non-smokers and, if they do initiate breastfeeding, they do not breastfeed for as long (Hill & Aldag, 1996; Minchin, 1991). While breastfeeding seems neither to increase or decrease the risk of maternal depression (Cox, Connor, & Kendall, 1982), depressed mothers report more difficulties with breastfeeding, are less responsive to infant feeding cues, and more likely to view breastfeeding difficulties in psychological terms—as a rejection of them and their milk (Nordstrom et al., 1988; Tamminen & Salmelin, 1991). It therefore makes sense to seek common risk factors and/or risk markers for

maternal smoking in pregnancy, breastfeeding and maternal depression.

Single motherhood per se has long been recognized as a socio-demographic risk factor associated with smoking during pregnancy (Ebrahim, Floyd, Merritt, Decoufle, & Holtzman, 2000; LeClere & Wilson, 1997), breastfeeding (Wright, et al., 1988), and maternal depression (Brown & Moran, 1997), although some evidence suggests that this association may not be consistent for breastfeeding (Scott & Binns, 1999). However, it is impossible within the current literature to discern whether or not it is marriage itself, cohabitation, lack of an intimate partner, or a broader lack of social support that makes the most difference to, or acts as the best marker of, maternal health and health-related behaviours. Most studies have been unable to distinguish cohabiting mothers from married mothers, as, for example, in two studies of smoking during pregnancy from Sweden, where married and cohabiting mothers are grouped together (Cnattingius, 1989; Thue, Schei, & Jacobsen, 1995). Moreover, few studies have been able to distinguish between solo mothers who are in a relationship with the father even though they do not live together and those who are without a partner relationship. Nevertheless, there is evidence that lack of paternal support, independently of marital status, affects whether or not pregnant women quit smoking (Dejin-Karlsson et al., 1996), as does the quality of marital relationship (Wakschlag et al., 2003). It has also been shown that fathers' preferences are a major factor in mothers' decisions about breastfeeding (Arora, McJunkin, Wehrer, & Kuhn, 2000) and that the amount of support that a woman receives from significant people in her life affects her risk of postpartum depression (O'Hara, 1986). Beyond the bare facts of marital status, cohabitation and partner support there may be underlying issues, such as socio-economic status and mothers' own experiences of early childhood and adolescence that may link marital status and family structure to maternal health and health-related behaviours.

In this study, to begin to examine whether the closeness of the tie between parents, as assessed by their partnership status, is related to smoking during pregnancy, breastfeeding and maternal depression, we use data from the Millennium Cohort Study, a British birth cohort established in 2001. We distinguish four sets of parents, married and cohabiting parents and two groups of solo

parents. For solo mothers, as a gauge of the strength of the relationship between the mother and father at the time of the birth we use the mother's self-report of whether or not she was in a close relationship with the father of the baby. Thus the four sets of parents can be viewed as representing a hierarchy of bonding, with the married having the strongest bonds and the solo mothers where the mother does not report a close relationship having the loosest ones. We hypothesized that there would be significant differences in maternal health and health-related behaviours between these groups, with trends towards a decreased likelihood of smoking during pregnancy and maternal depression, and an increased likelihood of breastfeeding, associated with increasingly strong partnership bonds.

Data and methods

The sample

The data for this study came from the Millennium Cohort Study (MCS), which is a large-scale survey of babies born in the four constituent countries of the UK. The first sweep was carried out during 2001–2002 and contains information on 18,819 babies in 18,533 families, collected from the parents when the babies were 9–11 months old. The sample design allowed for over-representation of families living in areas with high rates of child poverty and in areas with high proportions of ethnic minorities in England, and the three smaller countries of the UK. Children with the eligible birth sample dates and living in the selected electoral wards were selected from the Child Benefit register and their parents were interviewed (in all but 30 cases this was the mother), as close as possible to 9.5 months. Child Benefit is a universal benefit, payable (in most instances to the mother) from the date of the child's birth. Child Benefit payments cover virtually all of the child population except those ineligible due to recent or temporary immigrant status. The overall achieved response rate for the baseline survey was 72 per cent (Dex & Joshi, 2005). There was some information on non-respondents derived from information on the Child Registers. For example, the mobile, those living in ethnic minority wards in England and those living in advantaged wards in Northern Ireland were less likely to have responded. Detailed information on the sampling strategy and response rates for the survey can be found in Plewis,

Calderwood, Hawkes, Hughes, and Joshi (2004). At the 9-month old contact detailed information on the pregnancy and birth were collected, as well as social and economic information on the children's families. Follow-up interviews have been carried out at age 3 (data available early 2006), and others are planned for ages 5 and 7 years. Full details on the survey, its origins, objectives, sampling and content are contained in the documentation attached to the data deposited with the UK Data Archive at Essex University (UK Data Archive, 2004).

Measures

Marital status at birth

When the mothers were interviewed around the time their baby was 9 months old, 60 per cent reported that they had been married and living with the father of their child at the time of the birth, 25 per cent reported that they had been cohabiting and living together, and the remaining 15 per cent were not co-residing. This 15 per cent of solo mothers comprised 7 per cent where the mother reported that she was closely involved (i.e. intimate) with the father at the time of birth and 8 per cent who were not involved with the father at that time.

Maternal smoking, breastfeeding and maternal depression

Information was collected on whether the mother smoked at the time of the interview and retrospective information was collected on whether she smoked prior to pregnancy and whether she gave up or continued to smoke during the pregnancy. In this sample, 66 per cent of the mothers did not smoke during the pregnancy, 13 per cent quit during pregnancy and 21 per cent continued to smoke during the pregnancy. We have no direct information on smoking status directly after the birth which would have allowed us to examine, for example, partnership status and reversion to smoking. Mothers were asked whether they ever breastfed their babies and for how long. The mothers were divided into three groups: those who reported that they had never breastfed their baby (29 per cent); those who breastfed their baby for 6 months or more (24 per cent) which is the age to which (exclusive) breastfeeding is recommended by the UK Department of Health (Department of Health, 1999) and the remaining 47 per cent of mothers who

breastfed for less than 6 months. Only a proxy measure for post-natal maternal depression was available for this analysis, which was derived from whether the mother responded positively or negatively to the questions "Since (the baby) was born, has there ever been a time lasting 2 weeks or more when you felt low or sad?" One third of the mothers responded in the affirmative to this question. For simplicity we will refer to this as the depressed group, whilst recognizing that we are not using this in the clinical sense.

Socio-demographic characteristics

Measures of maternal age at birth, parity, mother's educational attainment divided into 6 groups on the National Vocational Qualification scale, ranging from having no qualifications to having degree-level qualifications, and the mother's self-reported ethnic group (White, mixed, Asian, which includes two groups of mothers Indian and those of Pakistani and Bangladeshi origins, Black or other) were included in the multivariate analyses. Level of educational attainment was used as a proxy for socio-economic status as we have no information on income or on the employment status of parents prior to the pregnancy or at the time of birth. These measures are all statistically significantly associated with the partnership context in which the mothers gave birth. As can be seen in Table 1 younger mothers, first-time mothers and less-educated mothers are more likely to be unmarried or solo at the time of the birth; White mothers are more likely to be cohabiting, Asian mothers are more likely to be married and Black mothers are more likely to be solo. These attributes are also correlated with our measures of maternal health-related behaviours. As seen in Table 2, younger mothers are more likely to smoke, less likely to breastfeed and more likely to report that they have been depressed. Mothers having their first child are more likely than those having a second or later born child to be smokers but if they are smokers they are more likely to stop during the pregnancy. First time mothers are also less likely to breastfeed, but are less likely to be depressed. The more educated mothers are less likely to smoke, are more likely to breastfeed and are less likely to report that they have been depressed. Non-White mothers compared with White mothers are less likely to smoke and are more likely to breastfeed, but there are no strong differences across ethnic groups with respect to depression.

Table 1
 Characteristics of mothers according to the partnership status of the parents at the time of the birth

	Married	Cohabiting	Solo—Closely involved with the father	Solo—Not in a relationship with the father
Numbers in the sample	10 801	4418	1739	1783
<i>Characteristic</i>	%	%	%	%
Mother's age at birth				
Under 20	1.0	11.2	27.2	24.8
20–24 years	8.8	25.6	28.4	30.9
25–29 years	28.8	28.7	19.3	20.1
30 and older	61.5	34.5	25.1	24.2
Parity of child				
% First born	37.4	50.7	51.7	51.5
Mother's educational qualifications				
None	8.1	12.8	25.1	32.8
NVQ Level 1	5.6	10.7	15.5	15.6
NVQ Level 2	27.4	36.3	34.9	29.9
NVQ Level 3	14.4	16.0	13.4	11.9
NVQ Level 4	39.2	22.1	10.2	8.9
NVQ Level 5	5.3	2.1	0.8	0.8
Mother's ethnic origin				
White	86.8	96.9	85.7	86.2
Mixed	0.7	0.7	2.7	2.0
Indian	2.8	0.1	0.1	0.1
Pakistani/Bangladeshi	5.9	0.1	0.8	2.4
Black	1.8	1.6	7.5	8.0
Other	0.2	0.1	0.2	0.1

Differences were statistically significant at $p < 0.0001$.

Statistical analysis

All analyses were carried out using survey weights to correct for the complex sampling design of the study. Multinomial logistic regression analyses were used to estimate the relative risk among mothers who gave birth in different partnership settings of not smoking (the reference group), quitting or continuing to smoke during pregnancy. A similar analysis was used to estimate the relative risk of breastfeeding and whether or not breastfeeding was of long or short duration. Logistic regression analysis was used to assess whether or not women in different partnership contexts were more or less likely to report that they had been post-natally depressed. As we view the four types of partnership settings as representing a hierarchy of bonding, with the married having the strongest bonds and the solo mothers where the mother does not report a close relationship having the loosest ones, we also conducted trend tests of partner bonding in relation to each maternal health outcome.

Results

Table 3 shows the relative risk ratios for unmarried mothers in different partnership settings relative to married mothers for whether they gave up or continued to smoke compared with those who were non-smokers. Model One is the simple model with no controls, while Model Two includes as covariates maternal age, parity, educational attainment and ethnicity. Among those mothers who continued to smoke there is a gradient according to degree of partner bonding in the extent to which this occurred: from married mothers down through cohabiting (relative risk of 4.7 compared with married mothers); to solo mothers who were involved with the father at the time of the birth (relative risk of 7.6); and on to those who were not in a close relationship—who had the highest risk (relative risk of 9.2) of continuing to smoke. This pattern persisted after adjusting for socio-demographic factors, although the risk ratios were attenuated. An adjusted Wald test for Model Two showed that the differences in the estimates between

Table 2
Maternal health characteristics according to socio-economic status of the mother

	Smoking			Breastfeeding			Depression	
	Non-smoker at pregnancy	Gave up during pregnancy	Continued to smoke during pregnancy	Never fed	Breast fed less than 6 months	Breastfed 6 months or more	Not Depressed	Depressed
Numbers and % in the sample	12 047	2407	4264	6217	8622	3926	12 325	6430
	66.0%	13.4%	20.6%	28.8%	47.5%	23.7%	67.4%	32.6%
<i>Characteristics</i>								
Mother's age at birth								
Under 20	32.3	26.3	41.4	52.7	42.2	5.1	58.9	41.1
20–24 years	49.9	17.4	32.8	40.6	48.2	11.2	61.3	38.7
25–29 years	65.7	14.0	20.3	29.1	49.6	21.3	66.8	33.2
30 and older	76.3	9.8	13.9	21.3	46.8	31.9	70.8	29.2
Parity of child								
First born	63.6	18.1	18.3	23.8	54.4	21.8	68.7	31.3
Later born	67.8	9.9	22.4	32.6	42.2	25.1	66.2	33.8
Mother's educational qualifications								
None	46.7	11.3	42.0	52.1	37.2	10.7	60.8	39.2
NVQ Level 1	48.1	15.4	36.6	46.7	44.5	8.8	63.1	36.9
NVQ Level 2	59.3	16.4	24.3	35.9	48.6	15.5	64.8	35.2
NVQ Level 3	67.2	15.0	17.8	25.7	51.4	22.9	67.3	32.7
NVQ Level 4	81.4	11.1	7.6	12.0	50.7	37.3	72.6	27.4
NVQ Level 5	88.6	7.7	3.7	7.0	39.2	53.8	77.7	22.3
Mother's ethnic origin								
White	63.5	14.2	22.3	30.7	46.9	22.3	67.5	32.5
Mixed	55.5	20.0	24.4	11.4	53.0	35.6	64.3	35.7
Indian	92.9	5.0	2.1	14.7	51.0	34.3	65.7	34.3
Pakistani/ Bangladeshi	96.1	1.1	2.8	20.0	55.7	24.3	68.3	31.7
Black	80.1	9.9	9.9	5.9	50.9	43.2	62.1	37.9
Other	84.1	10.0	5.9	6.2	44.3	49.5	70.5	29.5

Differences were statistically significant at $p > 0.0001$ with two exceptions: parity and depression $p > = 0.001$ and ethnicity and depression which was not significant $p = 0.164$.

the cohabiting group and the two solo mother groups were significantly different (cohabiting vs. closely involved, F -test 14.55, p -value < 0.01 ; cohabiting vs. not in a relationship, F -test 29.3, p -value < 0.01); the difference in the estimates between the two groups of solo mothers was smaller (F -test 3.09, p -value = 0.08). The test for trend of increasing risk of continuing to smoke with decreasing parental bonding was significant (p -value < 0.01). The association between giving up smoking during pregnancy and partnership status was less clear-cut (Table 3). Compared with the married mothers, the unmarried groups of cohabiting and solo mothers were less likely to give up smoking i.e. they had higher risks of not quitting smoking, but

within the unmarried set the differences in quitting were only weakly associated with the level of bonding between the parents. The difference between cohabiting mothers and those who were not living with the father but were closely involved had similar risks of quitting (Model Two, adjusted Wald test, F -test = 0.01, p -value = 0.92). However, the difference between the cohabitants and the solo mothers who were not in a relationship was statistically significant (Model Two, adjusted Wald test, F -test = 0.59, $p = 0.015$), as was the test for trend relating quitting smoking to the hierarchy of bonding (p -value < 0.01).

Turning to breastfeeding, Table 4 shows the relative risks for the groups of unmarried mothers

Table 3

Smoking behaviour according to partnership status at birth: relative risk ratios and confidence intervals from multi-nomial regression analysis

	Non-smoker vs. continued	Non-smoker vs. not quit	Continued smoking vs. quit
<i>Model 1</i>			
Partnership status at birth			
Married	1.00	1.00	1.00
Cohabiting	4.71*** (4.2–5.3)	3.51*** (3.1–4.0)	1.34*** (1.2–1.6)
Solo—closely involved with the father	7.60*** (6.4–9.0)	3.92*** (3.2–4.8)	1.94*** (1.6–2.4)
Solo—not involved with the father	9.19*** (7.9–10.7)	4.77*** (4.0–5.7)	1.93*** (1.6–2.3)
<i>Model 2</i>			
Partnership status at birth			
Married	1.00	1.00	1.00
Cohabiting	2.89*** (2.5–3.3)	2.35*** (2.0–2.7)	1.22** (1.1–1.4)
Solo—closely involved with the father	3.90*** (3.3–4.6)	2.38*** (1.9–3.0)	1.64*** (1.3–2.1)
Solo—not involved with the father	4.57*** (3.8–5.4)	2.99*** (2.4–3.6)	1.52*** (1.3–1.9)

** $p < 0.01$.*** $p < 0.001$.

Table 4

Breast-feeding behaviour according to partnership status at birth: Relative risk ratios and 95% confidence intervals from multi-nomial regression analysis

Model 1	Never vs. breast fed for 6 months or more	Breast fed for 6 months or less vs. breast fed for 6 months or more	Never breast fed vs. breast fed for less than 6 months
<i>Model 1</i>			
Partnership status at birth			
Married	1.00	1.00	1.00
Cohabiting	3.10*** (2.7–3.5)	1.84*** (1.6–2.1)	1.68*** (1.5–1.9)
Solo—closely involved with the father	5.36*** (4.2–6.9)	2.08*** (1.7–2.6)	2.56*** (2.2–3.0)
Solo—not involved with the father	6.74*** (5.3–8.6)	2.13*** (1.7–2.6)	3.17*** (2.7–3.7)
<i>Model 2</i>			
Partnership status at birth			
Married	1.00	1.00	1.00
Cohabiting	1.59*** (1.4–1.8)	1.27*** (1.1–1.5)	1.24*** (1.1–1.4)
Solo—closely involved with the father	2.36*** (1.8–3.0)	1.37*** (1.1–1.7)	1.72*** (1.4–2.1)
Solo—not involved with the father	2.73*** (2.1–3.6)	1.30* (1.0–1.7)	2.10*** (1.7–2.5)

* $p < 0.05$.*** $p < 0.001$.

in different partnership settings relative to married mothers for whether they never breastfed, or breastfed for less than 6 months, compared with those who breastfed for 6 months or longer. Relative to married mothers, there is a gradient between the degree of bonding between parents and the extent to which babies are ever breastfed. In the unadjusted model, the relative risk of a cohabiting mother not breastfeeding are 3.1 times greater than that of a married mother, and the risks for solo mothers are 5.4 times and 6.7 times, respectively for

those who were in, and not in, a relationship with the father. An adjusted Wald test showed that the differences in the estimates between the cohabiting group and the two groups of solo mothers were significantly different (cohabiting vs. closely involved, F -test = 18.67, p -value < 0.01; cohabiting vs. not in a relationship, F -test = 39.25, $p < 0.01$) and the difference between two groups of solo mothers was smaller and not statistically significantly different (F -test = 2.66, p -value = 0.10). After adjustment for maternal socio-demographic

factors, the risks are reduced, suggesting that these factors account for some of the observed differences between the groups of women, although differences in ever breastfeeding between some groups of women continue to be statistically significant and the test for trend by hierarchy of bonding was also significant (p -value <0.01). The analogous adjusted Wald tests are: cohabiting vs. closely involved, F -test = 10.9, p -value <0.01 ; cohabiting vs. not in a relationship, F -test = 13.93, p -value <0.001 ; and there was no difference between the two groups of solo mothers, F -test 0.82, $p = 0.36$. In Model One with no adjustments, and in Model Two with adjustments for maternal socio-demographic factors, relative to married mothers, all of the unmarried groups have an increased risk of breastfeeding for less than the recommended 6 months compared to breastfeeding for 6 months or longer. None of the pair-wise group comparisons in the adjusted model are statistically significant (adjusted Wald tests: cohabiting vs. closely involved, F -test = 0.35, p -value = 0.55; cohabiting vs. not in a relationship, F -test = 0.03, p -value = 0.85; closely involved vs. not in a relationship, F -test 0.11, $p = 0.74$), although the test for trend of hierarchy of bonding with duration of breastfeeding is significant ($p < 0.01$).

Models estimating the impact of parental bonding on maternal post-natal depression are shown in Table 5 and paint a broadly similar picture to that seen for smoking during pregnancy and breastfeeding. As the degree of connection between the parents weakens, so the risk of a mother reporting having been low or sad increases. After taking into account the socio-demographic characteristics, compared with married mothers; cohabiting mothers were 1.3 times more likely to report that they had felt depressed, the solo mothers who were closely involved with father were 1.5 times more likely to do so, and the solo mothers who were not

in a relationship were 1.7 times more likely to report being depressed. However, while the differences between the two groups of solo mothers and reported depression was not statistically significant, the test for trend of increasing depression with lower bonding was significant (p -value <0.01).

It was reported above in Table 2 that compared with White mothers Asian and Black mothers were more likely to breastfeed and less likely to smoke. Given these differences in behaviour we investigated whether the closeness of the relationship between parents mattered in the same ways for these two sets of ethnic minority mothers. The analyses showed that with respect to breastfeeding that there was little evidence of a trend in the propensity to breastfeed and the closeness of the relationship between the parents amongst Asian and Black mothers, but that there was a trend with respect to giving up smoking. The findings in relation to breastfeeding suggest that cultural differences in breastfeeding habits may be more salient than a mother's family circumstances.

Discussion

Our results suggest that the degree of bonding between parents may have important implications for maternal health and health-related behaviours. Our analyses highlight two important points. First, for smoking in pregnancy, breastfeeding and maternal depression tests for trend, adjusted for socio-demographic factors, showed a statistically increased risk of adverse health and health behaviours by degree of parental connectedness. There are also consistent and statistically significant differences between married mothers vs. non-married mothers; particularly noteworthy is our finding that cohabiting mothers have greater risk of adverse outcomes than married women. Secondly, among the non-married set, there are differences in

Table 5

Mothers report of depression post birth, according to partnership status at birth: odds ratios and 95% confidence intervals from logistic regression analysis

	Mother depressed or not	Mother depressed or not
Partnership status at birth	Model 1	Model 2
Married	1.00	1.00
Cohabiting	1.40*** (1.3–1.5)	1.29*** (1.2–1.4)
Solo—closely involved with the father	1.74*** (1.5–2.0)	1.47*** (1.3–1.7)
Solo—not involved with the father	2.01*** (1.7–2.3)	1.67*** (1.4–1.9)

*** $p < 0.001$.

risk of adverse outcomes. For smoking in pregnancy, the key difference in risk of not quitting in the non-married set was between cohabiting mothers vs. solo mothers, whereas the key difference for continuing to smoke throughout the pregnancy lay between mothers involved with partners and those lacking an intimate relationship. For breastfeeding, stronger parental bonds were associated with initiation of breastfeeding, with a clear difference between cohabiting vs. solo mothers. The likelihood of breastfeeding for more than 6 months was also reduced with looser parental bonding, although pair-wise differences between groups were modest. There was an increased risk of maternal depression with looser parental bonding and among non-married groups this increased risk was most noticeable among cohabiting vs. solo mothers. In summary, we find that mothers who are more loosely bonded with partners are more likely to have health and health-related behaviours that may have adverse consequences for the health and development of their children.

More and more babies are being born outside of a married family setting and it is important to understand how this major demographic trend might have an impact on child health and development. We have shown that maternal health and health-related behaviours are worse among cohabiting mothers, compared to married mothers, which raises the question of what it is about the absence of a legal bond of marriage that increases risk. Similarly, by demonstrating trends of increasing risk across the hierarchy of parental bonding, our findings raise the issue of whether or not it is partnership status itself that matters, or emotional and economic differences between these groups of women. There is evidence that cohabitants tend to be less happy than married people (Ferri & Smith, 1996), that they are more depressed (Lamb, Lee, & DeMaris, 2003), and they report lower levels of father support (Carlson, McLanahan, & England, 2004). Cohabiting couples also tend to have more relationship problems (Amato & Booth, 1997) and to be less committed to each other than are married couples (Brown & Booth, 1996). Such factors are likely to lie behind the significantly higher dissolution rates found amongst cohabiting couples. Cohabiting mothers, on the other hand, report more emotional support from fathers than do mothers who are closely involved with the father and not living with him (Carlson, McLanahan, & England, 2004). Moreover, there is substantial

evidence that women from more disadvantaged backgrounds are more likely to become solo and cohabiting mothers (Kiernan, 2002); that solo mothers are amongst the poorest families in Britain (DSS, 1999); and cohabiting families are more likely to have fathers who are unemployed or in less skilled occupations (Ermisch, 2001). Relative impoverishment and fragility are hallmarks of the lives of these unmarried families.

Mothers who are cohabiting or solo are themselves more likely to have grown up in single parent or loosely bonded families (Kiernan, 2004b). This could have both indirect and direct effects on the likelihood that non-married mothers in our cohort are more likely to smoke during pregnancy and be post-natally depressed and less likely to breastfeed. Indirectly, characteristics of their family of origin may contribute to the economic and emotional instability of non-married mothers as, all other things being equal, they are more likely to have grown up in a poor household and without the positive example of strong parental bonding. Direct effects are also possible: we know from our own results and from numerous other studies that non-married mothers are more likely to smoke during pregnancy, less likely to breastfeed and more likely to be depressed. So the non-married mothers in our cohort are more likely to have experienced negative role modelling for health and health-related behaviours in their family of origin. Whilst we are unable to disentangle these effects in our study, exploring the inter-generational transmission of health-related behaviours in different partnership settings may be a fruitful area for further research.

Aside from their economic and emotional disadvantages, and the adverse effects of having grown up in non-married settings, non-married mothers may be more likely to engage in adverse health behaviours and be depressed due to underlying characteristics of temperament or personality that also predict childbearing outside of a marital setting. Women who smoke during pregnancy “exhibit difficulty modulating their behaviour in many other aspects of their lives”; including having increased problems in inter-personal relationships (Wakschlag et al., 2003). Personality differences have long been shown between women who breastfeed and bottle-feeding mothers. Breastfeeding mothers are more likely to be home-oriented and less likely to have a conflict in accepting the mothering role (Call, 1959). Similarly, there is a major body of research demonstrating

temperamental associations with depression. (See for example: [Hansenne et al., 1999](#)).

Strengths of our study include the ability to distinguish between mothers in different partnership settings and the size and representative-ness of the study sample. Nevertheless, our study has some limitations. First, all of our outcome and explanatory variables are based on maternal self-report. It is not certain that mother's reports of whether or not they were in an intimate partnership with the baby's father at the time of birth is a good way to distinguish between solo mothers with and without intimate partner support. However, we also explored the presence of the father at the baby's birth as an alternative and more concrete measure of being in an intimate partnership for solo mothers and found no material differences in results when using the alternative definition. Nevertheless, marital status can only be a proxy for the quality of the relationship between parents during the transition to parenthood and it would have been preferable to have more direct measures on this topic. The validity of self-reported smoking in pregnancy has been questioned and, indeed, non-disclosure rates are variable in contemporary studies. However, non-disclosure rates are lower in non-clinical research settings and recent work has pointed out the limitations of using biomarkers to measure patterns of smoking in pregnancy and the validity of using maternal self-report in epidemiological studies ([Pickett, Rathouz, Kasza, Wakschlag, & Wright, 2005](#)) The accuracy of breastfeeding data collected by maternal recall has also been questioned, but a recent review suggests that this is a valid and reliable method, especially when the recall period is less than 3 years ([Li, Scanlon, & Serdula, 2005](#)). Measuring depression by self-report is methodologically challenging, as clinical depression is a syndrome rather than a single symptom or sign. Self-report methods cannot distinguish clinical depression from less debilitating malaise nor can they indicate the severity of symptoms. The most depressed subjects may be the least able to respond well to survey questionnaires and, as postnatal depression in particular is still seen by many as a stigma, many mothers may give socially desirable answers to questions around unhappiness and depression ([McDowell & Newell, 1996](#)). We recognize that our measure of mother's report of feeling low or sad for more than 2 weeks since the baby was born is only a proxy for true clinical postnatal depression. Another limitation is that we lack information on

family income and social class prior to the birth of the baby and use mother's education as an indicator of socio-economic position. However, educational achievement is a commonly used indicator of socio-economic status and adequately captures maternal social gradients in health ([Gazmararian, Adams, & Pamuk, 1996](#); [Parker, Schoendorf, & Kiely, 1994](#)). It is possible that the associations we report between parental bonding and maternal health and health-related behaviours are mediated or moderated by family income and social class, and other factors such as levels of social support and cultural norms which may be fruitful areas for further research.

In conclusion, our findings highlight previously unexplored public health consequences of recent demographic shifts in the family context of child-bearing in many developed countries. Whether or not our findings point to a causal relationship based on the degree of intimate support and commitment that mothers experience in different settings is not clear. Notwithstanding, partnership context may be a useful additional marker for clinicians in risk assessments related to education, screening and interventions for smoking in pregnancy, breastfeeding and maternal depression. Without such targeted intervention, given that cohabiting and solo mothers are more socio-economically disadvantaged than married mothers, social inequalities in child health and development are likely to be exacerbated.

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