Mind the Gap: The Health Advantages that Accompany Parental Marriage Vary by Maternal Nativity

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Abstract

Using data from the British Millennium Cohort Study (MCS), we examine whether and how the health benefits of having two biological parents in a continuous marital relationship vary by maternal nativity, taking into account differences by country origin. Making novel use of Classification and Regression Tree (CART) methods, we demonstrate that marriage is not a uniform marker of economic advantage and better health-related behaviors across four maternal nativity and ethnic groups. The findings, which indicate that the health-related advantages associated with marriage are not uniform across nativity and ethnic groups, have implications for future research on family gaps in well-being and the socioeconomic determinants of health.

″...demographers´main failing is probably that they ... equate...statistical categories, defined in the first place in order to make measurement possible, with the underlying social reality...″

(Caldwell 1996: 312)

Introduction

Previous research has documented marked differences in average levels of child well-being by the parents' marital status. Children born to and brought up by two biological, married parents are relatively advantaged, and those with other family experiences, even those with two stably cohabiting biological parents, have worse outcomes (Amato and Keith 1991; Amato 2000; McLanahan and Sandefur 1994; Sigle-Rushton and McLanahan 2004; Goodman and Graeves 2010). Although studies examining cognitive, educational and behavioral outcomes are more numerous, there is some evidence of differentials in physical health (Biehl et al. 2014; Bzostek and Beck 2011; Harknett 2009; Schmeer 2011). Researchers have suggested that these marriage gaps are due to greater resources accumulated prior to and/or as a consequence of marriage. On average, married biological parents tend to be better educated and have higher incomes than other parents (Manning and Brown 2006; Kiernan and Mensah 2010; Kiernan et al. 2011; Lundberg, Pollack & Sterns 2016). Despite some evidence of its deinstitutionalization in high income countries (Cherlin 2010), compared to cohabitation, marriage might signal a higher quality parental relationship, and it might provide parents with a higher level of social resources, both of which promote competent parenting (Waldfogel et al. 2010). With reference to physical health outcomes, researchers have suggested that married parents may practice better health behaviours and should be better able to provide a healthy physical environment. They may also practice better health behaviors which benefit their children (Harknett 2009).

The quantitative literature examining socioeconomic inequalities in health, and the subset of studies examining ethnic minority and foreign-born groups, offers some insights that we think are relevant to how demographers and family scholars use parental marital status as a control variable. Some authors have cautioned that socioeconomic indicators such as home ownership, overcrowding, occupational class, and education "will have different implications for social circumstances in different ethnic groups" (Smith 2000: 1696, see also Kimbro et al. 2008). For studies of ethnic gaps in health, such variations are important: any unexplained residual effects of ethnicity or nativity on health may be biased in statistical models that adjust for indicators of socio-economic status assuming the association is uniform across population subgroups. To the extent that marital status (or some related measure of family structure) is viewed as an indicator of social circumstances (Carbone and Cahn 2014; Lunderg et al 2016) similar concerns could apply to its use as a control variable in statistical models where the aim is to explain differentials in well-being across different ethnic or migrant generations (see, for example, van Hook and Balistreri 2007; Hamilton, Cardoso, Hummer & Padilla, 2011; Baker, Rendall & Weden, 2015).

Evidence that the resources and health behaviours associated with marital status vary across population subgroups would also have implications for studies that seek to describe, understand and extrapolate the effects of parental marriage on child well-being (see, for example, Goodman and Graeves 2010; Brown 2004). If the social conditions associated with parental marital status vary across population sub-groups, and if regression models do not account for those differences, the unadjusted and adjusted relationship between marital status and well-being will be strongly influenced by the groups with the largest number of observations in the data. As a consequence,

the processes that appear to link marriage and well-being, on average, may misrepresent the experiences of minority groups.

In this paper, our primary aim is to explore whether marital status reflects qualitatively different bundles of advantages across different population sub-groups. Because we draw on conceptual frameworks from research on health differentials by ethnicity and immigrant generation, and because our findings might have implications for that literature as well (marital status is often introduced as a control variable in such studies), we focus on variations by maternal nativity and ethnicity and the relationship between parental marital status and children's *health related resources* (those resources and parental health behaviours likely to promote good physical health in children). Our data were collected in the UK where distinct migration streams and a diversity of adaptation experiences may have resulted in systematic variations in the resource advantages that accompany marriage. In the next section, we outline broad changes in the meaning of marriage in recent decades, and then explain why we might expect the health advantages associated with parental marriage to vary by mother's country of origin in the UK.

Theoretical background

Changes in the meaning of marriage over time

During the second half of the 20th century, family life in wealthy countries changed substantially. A growing share of marital unions ended in divorce, age at marriage increased, cohabitation replaced marriage as the first union, and the labour market participation of mothers increased, with dual earner families displacing the male breadwinner model. In many of these countries, the majority of first births now take place within cohabitation rather than marriage (Perelli-Harris et

al. 2010). Formal institutional regulation of and support for marriage have been dismantled. The pace, nature, and extent of these changes and patterns of diffusion of alternative family forms have varied cross-nationally, however. Similarly to the US, less socio-economically advantaged groups in the UK have been more likely to adopt alternative family forms, particularly as a setting for childbearing (Carbone and Cahn 2016; McLanahan 2004; Lundberg et al 2016). While there has been much debate, particularly in the US, about whether the advantages associated with parental marriage are accumulated prior to or as a consequence of marriage, there is broad consensus that marriage is a marker of socio-economic advantage (Lundberg et al 2016). In most of Northern and Continental Europe, there is less evidence that the highly educated have remained as disproportionately committed to marriage – rather than cohabitation - as the appropriate setting for childbearing. When births within marriage and cohabitation are compared, educational gradients are flatter in many other European countries and even reversed in the case of Italy (Perelli-Harris et al. 2010, Figure 1). Moreover, compared to most of the rest of Europe, a larger share of unmarried mothers in the UK are solo mothers (Perelli-Harris et al. 2012, Table 1). Such trends and variations imply that, like cohabitation, the meaning and function of formal marriage – and the differential resources and advantages that parental marital status represents – are likely to differ across place and time (Hiekel, Liefbroer & Poortman 2014; Ohlsson-Wijk 2011; Holland 2013).

Variations in the meaning of marriage across different nativity groups

Previous research has suggested that the distinct family cultures that migrants have been exposed to in their country of origin may continue to influence their marital behaviour after they migrate (Andersson et al. 2015). Although this literature has often focused on migrants from countries which have not embarked on the Second Demographic Transition, we think it is likely to be true

of migrants from other wealthy countries as well. If the adaptation to a new family culture is partial, the resources and advantages associated with marriage might be expected to vary, not only according to place and time, but also by country or area of origin for people living in the same context. The theoretical literature on migrant adaptation, which stresses the importance of the *context of reception* at the both the macro-institutional and the community level (Reitz 2002), provides a useful framework for conceptualizing these variations.

Thinking first about the *macro-institutional context of reception*, it may be that the economic advantages enjoyed by the married UK-born, White population, such as the marriage premium in earnings (Bardasi and Taylor 2002), might be more accessible to migrant groups from other wealthy countries and less accessible to those from the Global South. In the UK, opportunities in higher education and employment attract ambitious, well-paid, and highly skilled professionals. Migrants from other wealthy countries such as the United States, Canada, Australia and New Zealand and the members of European Union (EU) or the European Free Trade Association (EFTA), often fit this profile. They face lower (and for the 15 countries that were EU members at the time the children in our data were born, no) entry requirements for study or work and are better able than migrants from other parts of the world to obtain employment commensurate with their educational and professional qualifications. Immigrants from these high-income countries, the vast majority of whom are also White (96.4% in our data), should experience less social and institutional discrimination which would impede their economic integration.

As a legacy of the post-World War II international recruitment policies which targeted low-skilled workers living in British colonies, many migrants from the Global South enter the UK for purposes

of family reunification and marriage. These migrants often have lower levels of education or qualifications that are not directly transferrable to the UK labor market (Hills et al. 2011). In the 1990s, migration streams from some of the former colonies changed. The number and share of asylum seekers from some important sending countries in Africa (e.g. Nigeria, Somalia, Zimbabwe) grew. While their claims are being assessed, asylum seekers cannot work legally and are reliant on the UK government for housing and income. For migrants with lower levels of transferrable human capital, the economic, social, and psychological advantages that are observed in the UK-born White population (more material resources, better quality housing, lower levels of stress) may be largely unattainable before or after marriage. Formal marriage may, of course, be associated with access to other qualitatively different resources for members of more economically excluded groups, but if that is the case, the underlying processes explaining selection into marriage or linking marriage to subsequent well-being may be different (and possibly not observed or well-measured in our datasets).

The *context of reception at the community level* may also influence the extent and the nature of the benefits associated with marriage. Foreign born mothers are likely to retain and be influenced by the norms and attitudes that prevail in their countries of origin, but these norms and attitudes may adapt through interaction with the people they encounter post-migration. Exposure to similar social and behavioral trends that have accompanied the Second Demographic Transition in higher income countries suggests that the understandings and expectations of marriage of migrants from wealthier countries may be fairly similar to the (often) more advantaged UK-born people they live and work alongside at the community-level. However, many of these migrants come to the UK from countries where non-marital childbearing is less strongly associated with socio-economic

disadvantage: educational gradients are less strong and childbearing outside of a union is less common than in the UK. Although the link between socio-economic advantage and marital childbearing is strong in the UK, attitudes towards non-marital childbearing are nonetheless tolerant (Park et al. 2013). More advantaged, White migrants from wealthy countries should, therefore, feel limited pressure to conform to White, middle-class marriage patterns in the UK. If that is the case, social gradients in marital childbearing may be flatter than for UK-born Whites, as non-marital childbearing (primarily within cohabitation) may be more common in socio-economically advantaged groups from some of the largest sending countries like Germany and France.

Amongst some of the more economically disadvantaged, ethnicity minority foreign-born groups, a high prevalence of non-marriage or marital dissolution could indicate the adoption of family patterns or poorer health behaviors associated with the more disadvantaged socioeconomic contexts where they settle (or in the case of asylum seekers are settled) in the UK. This might be more typical of women who came to the UK from the African continent than from South Asia. Migrants from South Asia tend to reside in more homogenous, ethnically segregated communities (Iceland and Mateos 2011), where links to the countries of origin remain strong. For those groups that do not settle in ethnic enclaves, non-marriage might indicate greater distance from but also less social support from those communities where marriage rates are high. For low-income families, it could indicate decreasing social distance with other disadvantaged socio-economic groups where non-marriage is commonplace. Alternatively, non-marriage might be a more feasible economic and normative possibility for those South Asian women who have been able to enter the UK without the support of established migration networks and those (perhaps through higher

education) who have had more exposure to the family models of the White middle class. In contrast, Black Africans have tended to settle in areas that are economically deprived (Goisis and Sigle 2014) and more ethnically diverse (Iceland and Mateos 2011). Compared to South Asian migrants, they might have more interaction with other disadvantaged White and minority ethnic groups. Where Black Africans have been subject to denigration by other Black and minority ethnic groups and denied the same level of resources and support (Owusu-Kwarteng 2017), pressures to integrate (and so not draw attention to their African origin) may have been amplified. At the same time, better resourced Black Africans, or those with ambitions of upward mobility, may have sought to distinguish themselves from pejorative Black Caribbean stereotypes, emphasizing their cultural distinctiveness by maintaining family norms which involve high rates of marriage. If that is the case, high rates of marriage might also be associated with resistance to other aspects of the local destination culture, including those related to parenting and health behaviours.

Documenting variations in the meaning of marriage

In the analysis that follows, we explore whether marriage is a similar marker of health-related resources for each of three foreign-born groups (White mothers from a high-income country, ethnic minority mothers born in South Asia, ethnic minority mothers born in Africa) as it is for the larger White, UK-born population. Previous research in both the US and the UK has shown that foreign-born mothers from less economically developed countries often have better birth outcomes than expected given their socioeconomic position. Explanations have tended to focus on their healthier behaviors. Migrants often have healthier diets, are more likely to breastfeed their children, and are less likely to smoke (Harley and Eskenazi 2006; Kimbro et al. 2008; Jackson et al. 2012; Monasta et al. 2010). Some authors have also pointed to the high rates of marriage within

some immigrant and ethnic minority communities as a protective factor (Landale et al 2011). But is marital status likely to be a uniform marker health-related resources across different nativity groups? This is our primary research question. To answer this question, it is not necessary to distinguish whether any resource differentials are the cause or consequence of marriage, although the findings will be relevant to researchers who are interested in this issue.

Findings that suggest that marriage is not a uniform marker of health-related resources would have a number of important implications for how indicators of parental marital status are (i) used as control variables or (ii) studied empirically as the focus of research. First, variations in the resources and social conditions associated with marriage may compromise efforts to describe and explain ethnic or nativity differences in children's health when parental marital status (or some related measure of family structure) is introduced as a control variable. In regression models that assume the relationship with child well-being is unvaried, the parameter estimate for parental marital status will be heavily influenced by the largest group in the data: e.g. UK-born, White mothers. Suppose, for example, that members of a particular ethnic and nativity group are very likely to be unmarried and their children have poorer health outcomes than the majority population. Suppose also that gaps by parental marital status are narrower. In models which do not account for the distinctiveness of that minority group, parameter estimates which indicate that non-marriage is detrimental (reflecting the large differentials in the majority population) would likely be offset by an adjustment in the parameter estimate for the dummy variable that identifies that minority group towards zero. Predicted values from such models may underestimate the health risks experienced by children born to (the relatively small number of) married parents in that group. We might erroneously conclude, on the basis of a comparison of models with and without a uniform

control for marital status, that high rates of non-marriage "explain" the health disadvantages experienced by children in that group.

Second, if marital status means access to different levels or kinds of resources across different nativity groups, the association between parental marital status and child outcomes might differ as well. To the extent that stable marriage produces better child outcomes by improving access to a range of health-related resources, differentials by parental marital status may be narrower for those groups, such as South Asians and Africans, who cannot easily access the benefits that marriage confers more generally. To the extent that children raised by married parents fare because better resourced parents select into marriage, systematic differences in those selection mechanisms may lead to differences in what the relationship between parental marital status and child well-being represents. For example, Brown and Manning (2006) find more evidence of the financial benefits of marriage for white children than for Black and Latino children in the US. However, many studies which examine the benefits of parental marital status for children do not include interactions of marriage and ethnic/nativity group (Brown, 2004; Goodman and Graeves 2010). Evidence that the resources associated with marriage are different for small groups would emphasise the need to exercise care, and where possible, to test for interactions before extrapolating evidence of selection in marriage or of direct effects of marriage to smaller groups.

Data and Methods

The Millennium Cohort Study

Our study analyses data from the UK Millennium Cohort Study (MCS) which has followed over 18,000 households with children born between September 2000 and January 2002. Our study

relies primarily on data collected during the third sweep, when the cohort members were around five years old. We focus on this age since the parents still exert a good deal of control over their children's dietary patterns, physical activity, and social interactions. The analyses use design weights that account for the survey design (Plewis et al. 2007; Hansen 2006) as well as non-response and attrition between the first and third sweep of data collection.

We compare children born to four groups of mothers distinguished by their nativity, country of birth and, to reduce heterogeneity in our country-of-origin groups, ethnicity: (1) White women born in the UK; (2) White women born in a wealthy country (the United States, Canada, Australia and New Zealand, or members states of the EU or EFTA: more than three quarters were born in one of the EU-15 countries, and mothers born in Germany form the largest group, comprising around 27% of the observations in this sub-sample; (3) ethnic minority women who were born in a South Asian country (mothers born in Pakistan and Bangladesh account for 46% and 22% of this sample, respectively); and (4) ethnic minority mothers who were born in an African country (mothers born in Somalia and Nigeria account for 26% and 14% of the sample, respectively). Our aim is to determine whether the health-related resources associated with parental marital status differ across these three groups. In almost all cases (98%), the mother is the main respondent. We retained the small number of cases (n=265) where the mother was not the main respondent at wave 3. The share of South Asian mothers who are not the main respondent at wave 3 is disproportionately high (n=113, around 14% of the South Asian subsample), and we were concerned that dropping those cases might introduce some selection bias.

Methods

Comparing children of UK-born White mothers with those of foreign-born mothers, our study examines whether continuous parental marriage is (1) as strongly associated with and (2) is a similar marker of the same sets of advantaged circumstances. We first compare continuously married two parent families to all other family settings. Next, we compare continuously married (biological) parents to other co-resident biological parents (those who are cohabiting at wave 3 and those who transitioned to marriage some time after birth). The first set of findings will be of interest both to scholars who might want to use marital status as a control variable in their models, as well as to family scholars who are broadly interested in the link between changing family dynamics and well-being. The second set of findings will be of interest to scholars who are particularly interested in understanding the marginal benefits of marriage: the distinction between childbearing within marriage and cohabitation (e.g. Goodman and Graeves 2010).

Because we are interested in sets of characteristics that are associated with parental marital status, recursive partitioning methods are better suited for meeting this aim than standard regression analysis. With regression-based methods, we might identify a set of covariates that yield particularly high or low predicted outcomes, but that profile may be rare, or might not even exist, in the data. Recursive partitioning methods use the covariates to stratify the analytic sample into mutually exclusive subgroups, identifying actual sets of characteristics that exist in the data. The findings are presented as a decision tree: a Classification Tree when the outcome variable is categorical and a Regression Tree when the outcome variable is continuous. Although recursive partitioning is often used to predict subsequent outcomes (e.g. disease or death), our analyses of

marital status are similar to previous studies that have used the method to construct distinct profiles of people who have made particular choices or who behave in a particular way. Researchers have used recursive partitioning to identify distinct groups of people more and less likely to report eating four servings of fruit or vegetables a day (Friel et al. 2005), to be willing to pay a premium for organic milk (Liu et al. 2013), or to combine cigarette smoking with the use of alternative tobacco products (Lei et al. 2015). In our application, we identify profiles (subgroups which share a set of characteristics) with higher and lower shares of continuously married mothers. By examining how married and unmarried mothers are distributed across these profiles, we are able determine which profiles are more and less *typical (*contain the largest share of) of married and unmarried mothers in each nativity group. In other words, if we randomly drew a married or unmarried mother from a particular nativity group, what set of characteristics would she be likely to have? This information allows us to assess whether marriage is a marker of the same set of health-related resources across the different nativity groups.

First developed by Brieman and colleagues (1984), classification and regression trees (CART) are now a familiar sight in epidemiological research and journals (Zhang and Singer, 1999; Lemon et al. 2003; Venkatasubramaniam et al. 2017). Because CARTs have not, thus far, been widely presented in demographic or economic research (Sigle-Rushton 2014, for an exception, see Liu et al. 2013), we introduce some relevant terminology here. The *root node*, which contains the entire analytic sample, is split into two mutually exclusive subsamples that lead to the formation of *child nodes* or *terminal nodes*. Child nodes (often depicted graphically using circles) are further stratified in two sub-groups. Terminal nodes (often depicted as squares), are nodes that cannot be split for one of three reasons: (1) they are homogeneous with respect to the

outcome; (2) the number of observations in a node has fallen below a pre-set threshold (we do not set this sort of threshold in our application), or (3) because some other *stopping rule* has been triggered. A measure of purity (most commonly the Gini index) is used to determine the best way to partition each node - according to the values of the covariates - into the two most homogeneous subgroups. Some packages allow the user to take control of the splitting process, forcing the program to partition a node in a certain way: selecting a specific covariate and/or a particular split. In the results we present below, we exerted no control over the splitting process.

The *rpart* package (R version 3.2.5, R Foundation for Statistical Computing Vienna Austria) that we used does not require us to drop observations with missing values on some of the covariates. When the package identifies the best split, *surrogate splits* (alternative splits which most resemble the best split in terms of the number of cases they assign to each subgroup) are also identified and ranked. Observations with a missing value for the covariate that offers the best split are assigned to one of the subgroups by using the best surrogate split. If that information is also missing, the second best surrogate split is used, and so on.

Each terminal node describes a sub-group that shares a set of characteristics related to the outcome of interest. The predicted outcome for each observation in the data is the average outcome for the terminal node to which that observation belongs. Because CART is not a probabilistic model, confidence intervals cannot be calculated for the estimates. Out-of-sample performance (assessed through *cross-validation*, i.e. fitting the tree to an independent data set and examining whether the tree describes the relationship with the outcome variable similarly well) is the only means of determining the reliability of the model. Out-of-sample predictions

are made by assigning to each out-of-sample observation the predicted value of the terminal node which matches its covariates.

A common stopping rule is based on the *complexity parameter*. Splitting stops when the reduction in classification error from the best additional split falls below its value. When the complexity parameter is set to zero, the decision tree can be very large and unnecessarily complex. At higher levels of the complexity parameter, stopping occurs sooner and the decision tree is smaller. The package that we use grows a series of trees, each with different levels of the complexity parameter. It then calculates the cross-validation error associated with each value. This information allows us to select the complexity parameter which minimizes the cross-validation error. The process of selecting a less complex sub-tree is known as *pruning.*

We first grew a classification tree using the sub-sample of White UK-born mothers and a set of variables that the previous literature finds to be associated with marital status and which might also be relevant to understanding marital status gaps in child health. The terminal nodes of this tree identified a set of mutually exclusive profiles of UK-born mothers with different probabilities of marriage. This group contains the vast majority of mothers in the MCS, and so the relationships we observe for this group would largely determine the relationships we see in the whole of sample (indeed, when we estimate the tree on the whole of the sample, the same profiles are returned with the exception that, for some profiles with low shares of married mothers, South Asian mothers branch off, indicating they have a higher probability of marriage than other mothers with the same profile). We then fit the classification tree to three different nativity/ethnicity samples. Comparing the share married in each terminal node and the distribution of observations across the terminal

nodes in each of these samples allows us to explore whether the resources and behaviors associated with marital status that were observed in the large population of White, UK-born mothers similarly distinguishes the marital status of mothers in the other three nativity groups. Substantial differences would suggest that it may be misleading to estimate regression models which assume the effect of marriage is uniform: *the distinctiveness of smaller groups will likely be obscured*.

Information on the proportion of observations allocated to each terminal node allows us to assess, amongst those who are married or unmarried, which profiles are more and less typical in each sub-sample. For example, a particular profile (terminal node) may have an extremely high share of married observations, but if that profile is rare, the typical married person in the data may look very different from the atypical individual who is, nonetheless, very likely to be married. This kind of information is useful when we want to consider the extent to which marriage is a similar marker of advantage, whether marriage implies a similarly advantaged position across the different groups.

Because the UK-born White group comprises not just the vast majority of observations in our data but also other representative data sources, we expect those profiles to resemble what previous research in the UK has shown: that marital status is a marker of socio-economic advantage and healthier parenting behaviors. *Our aim is to determine whether those well-known profiles differentiate continuously married mothers in the foreign-born samples similarly well*.

Next, we repeat the analysis, restricting the sub-samples to mothers who were co-residing with the biological father of their child at Sweep 3. This supplementary analysis allows us to assess what

characteristics distinguish continuous marriage from less traditional, but stable, partnerships in the largest group of mothers in the UK, and whether those characteristics similarly differentiate continuously married mothers in the smaller maternal nativity groups.

Variables and Sample

In this section, we describe the variables used in the analysis. Table 1 presents their mean values for the four groups of mothers distinguished by their nativity and ethnicity, and for the whole of the analytic sample.

Parental Marital Status

Our outcome variable identifies mothers who were married to the biological father of cohort member at birth and at wave 3. Results in Table 1 suggest that, on average, a substantial minority of cohort members spend the first five years of their lives with mothers who were not continuously married to their biological fathers. However, there are considerable differences across the four sub-groups of mothers. Around 52% of the White UK-born mothers were continuously married. A higher proportion of foreign-born White mothers (61.4%) and mothers born in South Asia (85.7%) were continuously married. Fewer than half of the mothers born in Africa were continuously married (45.7%). Of those who were not continuously married, around half of the White and South-Asian mothers were co-resident with the father at the third sweep, compared to around a third of African mothers. This subset of co-resident biological parents is compared to the continuously married mothers in the second stage of our analysis in order to examine whether the

results of the first stage of the analysis are due to differences in marital status or family structure (the absence of the biological father).

Material health-related resources

Previous research suggests that continuously married mothers will be over-represented amongst those with the highest incomes and under-represented amongst those who are more socio-economically disadvantaged. Our analyses include an indicator for top-quintile, equivalized family income at wave 3 (using the Modified OECD scale). Because cost of living can vary considerably across the UK and because poorer families often receive valuable benefits in kind (such as public housing) which are not reflected in their income, we also consider more qualitative measures of economic disadvantage which might also be related to the health of children. We include indicators of the quality of the neighbourhood and home environment that parents can provide for their children. We constructed a categorical variable that combines two assessments of neighbourhood quality: whether the main respondent described the neighbourhood as fairly or very bad for raising kids, as fairly or very unsafe, or both. In addition to reflecting socioeconomic disadvantage, negative neighbourhood assessment might suggest limited opportunities for outdoor play. We also include an ordered categorical variable that contains information on the existence and severity of damp problems (none, moderate, or severe) in the family home. The figures in Table 1 show that mothers born in South Asia are the least likely to have a top-quintile family income. In contrast, more than one-third of the foreign-born White sample of mothers live in families with a top-quintile income. Problems with housing quality (damp) and the neighbourhood environment are more common in the South-Asian and African sub-samples. That mothers born in South Asia have

the highest rates of marriage but little evidence of socio-economic advantage could indicate that, compared to White (UK- and foreign-born) mothers, marriage is associated with fewer (or qualitatively different) resources that might mean better health for their children.

Because the MCS survey does not measure foreign qualifications well and because (for reasons discussed in the background section) we were concerned about the validity of educational attainment as a measure of earnings potential across different nativity groups, we decided not to include parental education as an additional indicator of socio-economic resources.

Health behaviours

We consider a set of measures of adult and child behaviours that previous studies have identified as directly or indirectly promoting physical health in children and adolescents (Molnar et al 2004; Stensson et al, 2008; Richter et al 2009; Violato, Petrou & Gray 2009; Kelly et al 2016). Each was collected from self-report by the main respondent.

We include two parental health measures which the literature has identified as related to children's health: breastfeeding and exposure to cigarette smoke. The first measure identifies those that were breastfed for less than four months (the recommended period of exclusive breastfeeding when the MCS cohort member was born). The second health measure is a composite measure of exposure to cigarette smoke which identifies those children whose mothers smoked during pregnancy, those exposed to cigarette smoke at sweep 3, and those with both forms of exposure. Evidence suggests that self-reports of breastfeeding practices are reliable and valid (Li et al. 2005). Although smoking (during pregnancy and after) is often underreported (Walsh et al. 1996; Henderson 2008), we are

not aware of any evidence of systematic over- or under-report of health behaviors by maternal nativity or generation groups.

The child-level health measures are constructed using information provided by the main respondent about the cohort member's diet and physical activities. We consider whether the child regularly eats breakfast, watches television more than 3 hours on a weekday, has an irregular bedtime, or is regularly given sugary drinks.

The figures in Table 1 are similar to what has been reported in previous studies (Jackson et al. 2012): Children born to both groups of ethnic minority mothers are far less likely to be exposed to cigarette smoke than White mothers (6-7% of mothers from South Asia or Africa, compared to more than 30% of the UK-born White mothers, and 27% of the White foreign-born mothers). However, there is little evidence that the behaviours of children of mothers from South Asia or Africa are distinctly healthier.

Analytic sample

Among the 15,246 families that provided some information at Sweep 3 (79.2% of the families potentially eligible for inclusion), we selected cohort members with White mothers born in the UK or another wealthy country and those with ethnic minority mothers born in either South Asia or Africa (n=12,583). In families where there was more than one cohort member (twin or triplet births), we selected one child. We dropped five observations that were missing information on all of the candidate variables. The final analytic sample included 12,578 unweighted observations.

Results

Figure 1 presents the final classification tree grown to identify profiles of UK-born White mothers more and less likely to be continuously married. Splits using indicators for housing quality (damp problems). irregular bedtimes, hours of television, and sweet drinks were observed in the largest tree (with the complexity parameter set to zero) but not the final, pruned tree (after selecting the complexity parameter that minimizes cross-validation error: see the methods section above for details).

The root node (the top of the tree in Figure 1) contains the entire sample of UK-born White mothers, 52% of whom are married. The first two splits, which are based on the measure of smoke exposure (any versus none) and top quintile income, resulted in three terminal nodes in the pruned tree. The profiles associated with these three nodes contain just over half of the sample. The other half of sample (those with no smoke exposure and family income in the bottom four quintiles) is distributed across four terminal nodes differentiated by child feeding (breastfeeding duration and (ir)regular breakfast) and neighbourhood assessment.

The proportion married in each of the seven terminal nodes (identified by squares at the bottom of the Figure) ranges from 0.25 to 0.80, compared to 52 percent of mothers in the whole of the UK-born White subsample. Continuously married mothers are over-represented in sub-groups with top-quintile income, especially when they also report no exposure to cigarette smoke. Amongst mothers with no smoke exposure and a lower family income, married mothers are under-

represented in sub-groups with less healthy behaviours (smoking and child feeding) and a less salubrious home environment (smoke exposure and poor neighbourhood assessment). Given previous literature linking parental marriage and children's health, these patterns are consistent with our expectations.

Table 2 presents the results when the classification tree grown using the White, UK-born sample is fitted to three other subsamples: (1) foreign-born White mothers from more wealthy countries, (2) ethnic minority mothers born in South Asia, and (3) ethnic minority mothers born in Africa. For each sample, the first column contains the proportion of mothers married in each of the 7 terminal nodes. This figure is used to assess whether the profiles identified using the large, UK-born White sample, similarly differentiates continuously married mothers who were born outside of the UK. The percentage of observations which are assigned to each node (the relative size) is presented for the whole of each sub-sample (column labelled *total*) and broken down by marital status (columns labelled *married* and *not married*). This information shows how prevalent each of the profiles are. Even if a profile is associated with a very high proportion of mothers who are (not) continuously married, if that profile is relatively rare, the typical mother who is (not) continuously married in that sub-sample may have very different characteristics.

The figures in Table 2 reveal several differences between the UK-born sample and other sub-samples. The terminal nodes do not differentiate the marital status of foreign-born mothers to the same extent. When we consider only those nodes with at least 20 observations, the range of the share continuously married is narrower in all three of the foreign-born subsamples than it is for the UK-born White sample. UK-born white mothers in node 1 (income quintiles 1-4 and any exposure

to cigarette smoke) are far less likely to be continuously married than their sample average. Mothers from South Asia are very likely to be married regardless of their characteristics, and those assigned to node 1 are actually slightly more likely to be married than the sample average. In the foreign-born White and African samples, continuous marriage is not as sharply under-represented in node 1 and it is not as sharply over-represented in node 7 (top quintile income and no smoke exposure) as it is in the UK-born White sample. Similarly, the over-representation of continuously married UK-born White mothers in terminal node 6 (a profile that includes mothers in the bottom four income quintiles reporting no smoke exposure, and 4 or more months of breastfeeding) is not replicated in the South Asian sub-samples and is less marked in the white foreign-born and African sample. UK-born White mothers in node 6 are disproportionately likely to be married: the share married is 17 percentage points higher than the sample average. In contrast, for African-born mothers in node 6, the increase in the share married is only 6 percentage points. For White foreign-born mothers the increase is even smaller (around 3 percentage points). Like the UK-born White sample, node 3 (no smoke exposure, bottom 4 income quintiles, short breastfeeding, and poor neighbourhood assessment) contains the smallest share of married mothers in the South Asian sample, although the share married is still high at 77%. Taken together, the results suggest that the profiles do not differentiate married and unmarried foreign-born mothers in the same way or to the same extent.

While the over- or under-representation of married cases within each of the nodes provides information about which sets of characteristics are most strongly associated with marital status, an examination of the relative size of the nodes, allows us to identify which profiles describe large shares of the married and unmarried cases in each of the samples: *what health-related resources*

is parental marital status a marker of? The figures in Table 2 suggest that marriage is a more definitive marker of health-related resources (as we have measured them) in the UK-born, White sample than in the other three sub-samples. Around 48% of the UK-born continuously married mothers are assigned to node 6 or node 7 (no smoke exposure and either a top quintile income or at least 4 months of breastfeeding), compared to only 17% of those who are not continuously married. Conversely, around 46% of the not continuously married mothers in this sample are assigned to node 1or 2 which indicates their child has some exposure to cigarette smoke. Amongst the White, foreign-born mothers, marriage is less of a marker of health-related resources, mostly because of the way the not married mothers are distributed across the seven terminal nodes. Around 22% of the not married mothers in the foreign-born White sample enjoy a top quintile income compared to around 10% of the UK-born White mothers (nodes 2 and 7). For the South Asian and African mothers, marriage is less of a marker of advantage because fewer married mothers in these samples enjoy the same economic advantages as the married mothers in the UK-born sample. Although top quintile income is associated with a relatively high share of married cases, few continuously married mothers in these samples, the South Asian sample especially, have a top quintile family income (nodes 2 and 7 contain 8% and 18% of the married observations in the South Asian and African samples, respectively versus 33% of the married mothers in the UK-born White sample). In addition, far fewer not married mothers in the South Asian and African samples report any smoke exposure. The relatively large share of all three groups of foreign-born, not married mothers assigned to node 6 (which identifies those with income in the bottom 4 quintiles, no smoke exposure, *and* at least 4 months of breastfeeding) suggests that marriage is less a marker of good parental health behaviours than it is for the UK-born White mothers.

To sum up, the findings indicate that for foreign-born mothers, continuous marriage is not as strongly associated with the profiles that are identified using the UK-born White sample. Moreover, continuous marriage is not a similar marker of the same sets of health related resources for children. Amongst the foreign-born White mothers, a larger share of not married mothers are allocated profiles that suggest higher economic resources and healthier behaviours: 35% are assigned to the nodes that indicate no exposure to cigarette smoke and either top quintile income or 4+ months of breastfeeding, compared to only 17% of the UK-born White mothers. Amongst the mothers born in South Asia of Africa, regardless of their marital status, few mothers have a high income and few mothers report any exposure to cigarette smoke (during pregnancy or at Sweep 3).

Figure 2 and Table 3 present the results of the tree grown on and fitted using only those mothers who were co-resident with the biological fathers at Sweep 3. The continuously married mothers are compared to those mothers who were cohabiting with the biological father at Sweep 3 or who had married him after the birth. As a robustness check, when we defined marriage as married to the biological father at wave 3, the classification tree for this (and the tree estimated for the whole sample, discussed above) was exactly the same. The distinctions we identify across the four terminal nodes are, therefore, primarily due to differences between the continuously cohabiting parents and the continuously married parents. When only co-resident biological parents are compared, continuous marriage remains strongly associated with health-related resources in the UK-born White sample. However, the final tree is smaller (fewer covariates differentiate the married and not married groups) and the range of the shares continuously married in each of the

terminal nodes is narrower (31 percentage points across the four nodes, compared to 53 percentage points across the seven nodes in Figure 1). This suggests that some of the differences observed in the first stage of the analysis might be associated not with formal marital status but with the absence of biological father. For the UK-born white sample, continuously married women are over-represented amongst those who report no smoke exposure. The share of continuously married mothers who fit this profile (terminal node 4 in Table 3) is 8 percentage points higher than the sample average. Only 44 percent of UK-born White mothers assigned to node 1 (smoke exposure, short breastfeeding and a family income in the bottom 4 quintiles), compared to 69 percent of mothers in the whole of the sub-sample. When smoke exposure is combined with a lower income but 4+ months of breastfeeding, the share continuously married increases to 62 percent. When smoke exposure is combined with a high income, the share married increases to 70 percent, about same as the sample average.

When the classification tree in Figure 2 is fitted to the three other sub-samples, the results are similar to what we found in the first stage of the analysis. The tree grown using UK-born White mothers does not distinguish continuously married foreign-born mothers in the same way or to the same extent. Very few South Asian and African mothers report any smoke exposure and node 4 contains the majority of observations in each of the subsamples. Consequently, the share of continuously married South Asian and African mothers assigned to node 4 is the same as the sample average. For the African-born sub-group, fewer than 20 observations are assigned to nodes 1-3, and even for the larger South Asian sub-group, fewer than 20 observations are assigned to nodes 2 and 3. White foreign-born mothers who are assigned to node 4 (no smoke exposure) are only 4 percent more likely than their sample average to be continuously married. Continuously

married foreign-born White mothers are under-represented in node 1 (smoke exposure, bottom four quintiles of family income, and short/no breastfeeding) but, again, not to the same extent as the UK-born mothers. South Asian mothers in node 1 are slightly *more* likely than the sample average to be continuously married, but this figure is based on fewer than 50 observations. While our ability to interpret the evidence in Table 3 is severely constrained by the small number of observations in the three sub-samples, the findings reaffirm our conclusions in the first stage of the analysis. The health-related resources that are linked to continuous marriage (compared to cohabitation with biological father) in the UK-born White sample are not observed to the same extent, or at all, in the three, foreign-born samples.

Discussion and Conclusion

Drawing on previous literature which suggests that the meaning and function of marriage is likely to be context-specific, and integrating theoretical insights from the migration and health literature, we asked whether parental marital status is a similar marker of health-related advantages across four different maternal nativity and ethnic groups in the UK. Constructing profiles of White, UK-born mothers who are more and less likely to be married, and examining the distribution of different maternal nativity groups across these profiles, we found that marital status is not a uniform marker of health-related resources for children. This result, which suggests that the relationship between marital status and child health might well be heterogenous, has implications for future research and for policy. Whether family indicators are used as a focal variable or control, their conceptualization and the possibility of heterogeneity requires careful consideration. Parameter estimates for marital status or family structure will be difficult to interpret meaningfully in statistical models that do not take heterogeneity in the meaning of marriage into account.

Similarly, any unexplained residual effects of ethnicity and (maternal) nativity on health may be biased in statistical models that adjust for marital status assuming its effect is uniform across population subgroups. For researchers interested in explaining ethnic variations in health, it might be better to attempt to control directly for the resources that marital status is posited to represent. Of course those data sources which have the largest numbers of minority groups (e.g, register data) are less likely to include rich measures that would make this strategy possible. Moreover, to the extent that our understanding of the processes linking marital status to child well-being represents the experiences of the majority groups, more and complementary research should focus on what marital status means in different communities so that differential patterns can be interpreted and valid indicators can be developed to represent the selection processes and direct effects of family structure that are not currently well measured in secondary survey data.

Even in large studies which oversample minority groups, small samples and low statistical power often impede efforts to identify and test for heterogeneity (a key limitation in our study). However, it is important to keep potential heterogeneity in mind when using (representative) survey data to estimate and interpret statistical models, particularly when attempting to extrapolate the results to small and potentially distinct social groups. From a policy perspective, we need to be particularly cautious about assuming that all individuals select into marriage or benefit from it in the same way (Huston and Melz 2004; Sigle-Rushton and McLanahan 2002). Differences between continuously married and co-resident biological parents were narrower than the distinctions between continuously married and all other parents, suggesting that some of the apparent resource

advantages might be more accurately attributed to family structure (the presence of the biological father) than the marital status of the biological parents. Differences in the propensity to cohabit may be another factor to consider when extrapolating results to minority groups.

While our findings suggest the need for a cautious approach to how we use and interpret indicators, they also suggest some potentially productive directions for future research. A better understanding of variations in family gaps in child health across different population sub-groups could contribute to new theoretical developments in family studies and to better targeted policies which improve the circumstances and life chances of children.

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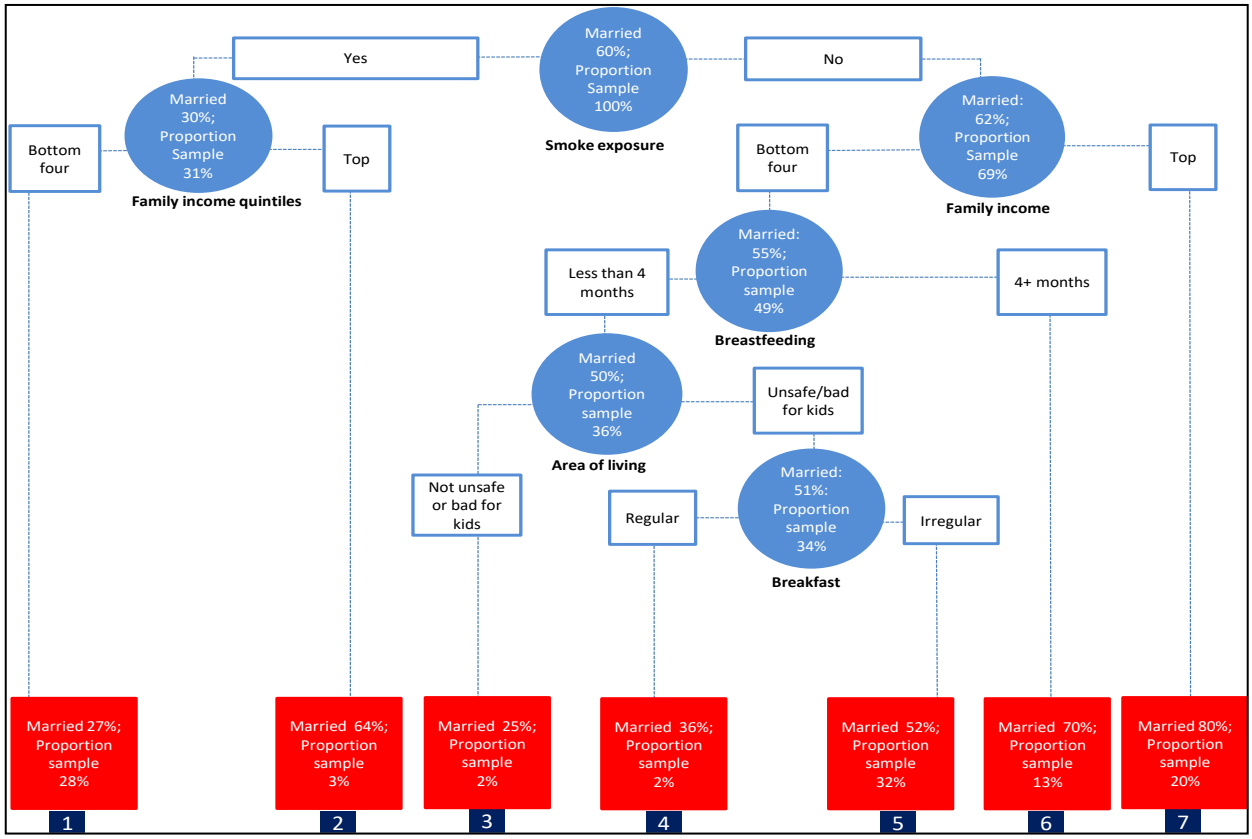
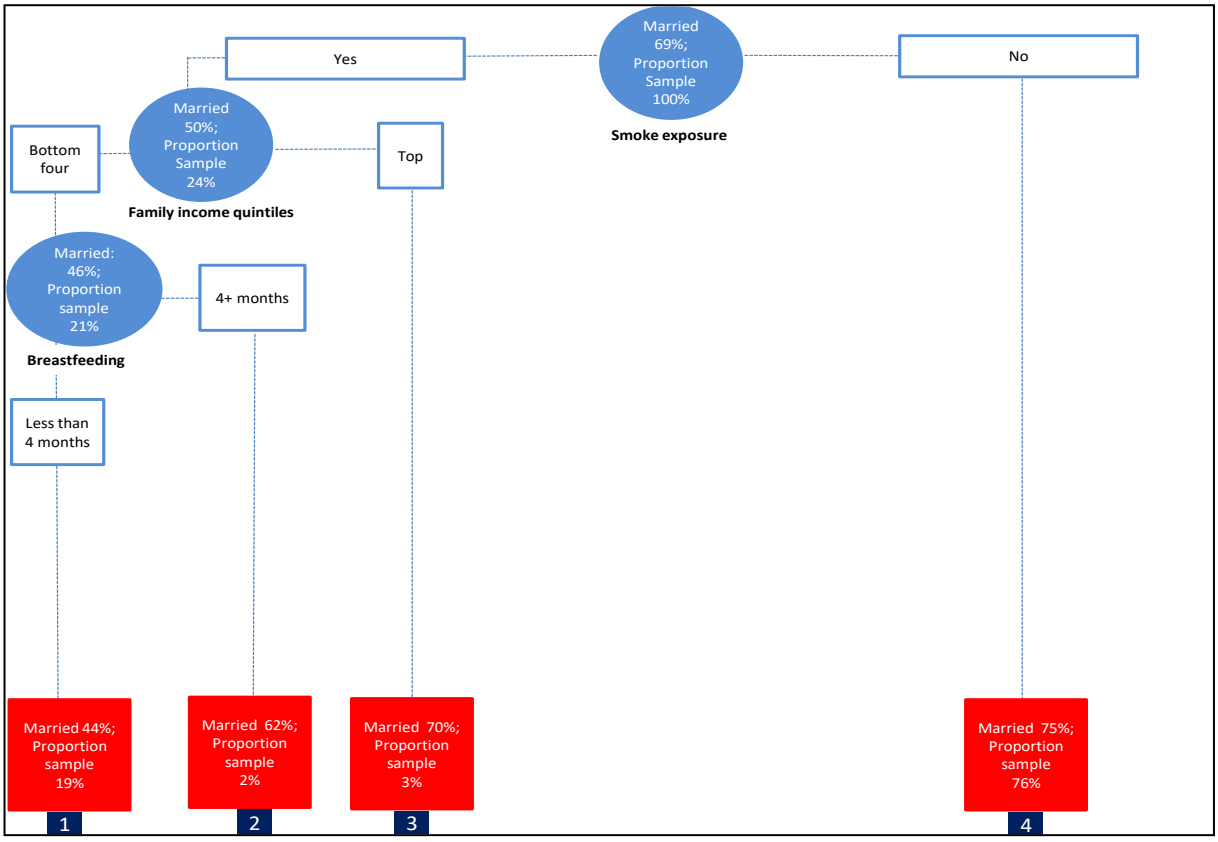
TABLES and FIGURES

Figure 1 Classification Tree for Marriage at Birth and Wave 3, Grown Using UK-Born White Mothers



Candidate covariates: family income, smoke exposure (during pregnancy, at wave 3 or both), mother's duration of breastfeeding, CM eats breakfast regularly, CM watches TV, CM given sweet drinks, CM irregular bedtime, neighbourhood assessment, damp problems in housing

Figure 2 Classification Tree for Marriage at Birth and Wave 3, Grown Using Sub-Sample of UK-Born White Mothers Co-Resident with the Biological Father at Wave 3



Candidate covariates: family income, smoke exposure (during pregnancy, at wave 3 or both), mother's duration of breastfeeding, CM eats breakfast regularly, CM watches TV, CM given sweet drinks, CM irregular bedtime, neighbourhood assessment, damp problems in housing

Table 1 Distribution of maternal and child characteristics at age 5, by maternal nativity and ethnicity

	U.K born	Foreign born			
	white	White, wealthy countries	South-Asia	Africa	Total
Parental marital status					
Married when CM born and at wave 3	52.2%	61.4%	85.7%	45.7%	53.8%
Not continuously married to biological father					
Transitioned to marriage	16.8%	16.4%	39.9%	22.0%	17.2%
Cohabiting with father	33.4%	44.2%	13.3%	9.9%	32.9%
Solo parent wave 3	38.2%	33.6%	43.7%	67.9%	38.8%
(Re-)partnered at wave 3	11.6%	5.8%	3.1%	0.3%	11.1%
Material Resources					
Family income: top quintile	22.4%	35.3%	7.5%	12.3%	22.0%
Housing quality: damp problems					
Moderate problem	10.6%	12.3%	15.9%	15.6%	10.9%
Great problem	1.8%	2.5%	3.3%	5.6%	1.9%
Assessment of neighbourhood					
Fairly/very unsafe only	2.9%	2.5%	6.6%	8.7%	3.2%
Fairly/very bad for kids only	1.9%	0.5%	3.0%	6.3%	2.0%
Both unsafe and bad for kids	2.9%	2.0%	3.9%	6.7%	3.0%
Parental health inputs					
CM breastfed for <4 months	73.6%	59.0%	63.1%	46.3%	72.3%
Expsoure to cigarette smoke					
Mother smoked during pregnancy	16.2%	15.9%	1.2%	3.4%	15.4%
CM exposed to smoke at wave 3	7.1%	2.5%	5.5%	2.4%	6.8%
Both types of smoke exposure	8.3%	8.6%	0.3%	0.2%	7.9%
Child health behaviours					
CM irregular breakfast	7.1%	4.4%	12.6%	15.4%	7.4%
CM watches TV 3+hr per day	14.7%	10.4%	18.7%	13.0%	14.7%
CM irregular bedtime	4.3%	1.9%	6.5%	8.5%	4.4%
CM is given sweet drinks	19.9%	12.6%	22.9%	14.4%	19.7%
%	91.0	2.9	4.3	1.8	100%
N	11,130	354	811	283	12,578

note: CM=cohort member

Table 2 CART Results for all UK-Born White Mothers Fitted to Independent Samples of Foreign Born Mothers

		UK-born White mothers				Foreign born mothers											
						White Foreign -Born				*South Asian*				*African*			
		share married	distribution across nodes			share married	distribution across nodes			share married	distribution across nodes			share married	distribution across nodes		
Terminal node			cont. married	not married	total		cont. married	not married	total		cont. married	not married	total		cont. married	not married	total
1	smoke exposure: pregnancy AND/OR wave 3, bottom 4 income quintiles	0.27	14%	44%	28%	0.36	13%	37%	22%	0.90	7%	5%	7%	0.33	6%	10%	8%
2	smoke exposure: pregnancy AND/OR wave 3, top income quintile	0.64	3%	2%	3%	-	4%	2%	3%	-	0%	no obs	0%	-	1%	no obs	1%
3	no smoke exposure, bottom 4 income quintiles, short breastfeeding, neighbourhood is unsafe AND/OR bad for kids	0.25	1%	3%	2%	-	0%	2%	1%	0.77	7%	12%	7%	0.20	4%	14%	10%
4	no smoke exposure, bottom 4 income quintiles, short breastfeeding, neighbourhood is NEITHER unsafe NOR bad for kids, irregular breakfast	0.36	1%	3%	2%	-	1%	2%	1%	0.89	7%	6%	7%	-	5%	2%	3%
5	no smoke exposure, bottom 4 income quintiles, short breastfeeding, neighbourhood is NEITHER unsafe NOR bad for kids, regular breakfast	0.52	32%	32%	32%	0.64	25%	22%	24%	0.85	42%	45%	42%	0.36	23%	34%	29%
6	no smoke exposure, bottom 4 income quintiles, 4+ months breastfeeding	0.70	18%	9%	13%	0.64	17%	15%	16%	0.85	29%	30%	29%	0.52	43%	33%	38%
7	no smoke exposure, top quintile income	0.80	30%	8%	20%	0.76	39%	20%	32%	0.96	8%	2%	7%	0.68	17%	7%	12%
unweighted N			11,130				354				811				283		
overall proportion married			0.52				0.61				0.86				0.46		

Note: share married is not reported when there are fewer than 20 observations in a node. Proportions which are unlined are based on 21-50 observations.

Table 3 CART Results for Subsample of UK-Born White Mothers Co-Resident with Father at Wave 3: Fitted to Independent Samples of Foreign Born Mothers

		UK-born White mothers				Foreign born mothers											
						White Foreign -Born				*South Asian*				*African*			
			distribution across nodes				distribution across nodes				distribution across nodes				distribution across nodes		
Terminal node		share married	cont. married	not married	total	share married	cont. married	not married	total	share married	cont. married	not married	total	share married	cont. married	not married	total
1	any smoke exposure, bottom 4 income quintiles, short breastfeeding	0.44	12.2%	33.2%	18.8%	0.54	9.1%	20.5%	12.2%	0.98	5.4%	1.0%	5%	-	1.1%	1.1%	1%
2	any smoke exposure, bottom 4 income quintiles, 4+ months breastfeeding	0.62	2.2%	2.9%	2.4%	-	4.2%	4.1%	4.2%	-	1.3%	4.3%	2%	-	1.0%	6.4%	2%
3	any smoke exposure, top quartile income	0.70	3.4%	3.1%	3.3%	-	4.0%	4.1%	4.1%	-	0.2%	no obs.	0%	-	0.9%	no obs.	1%
4	no smoke exposure	0.75	82.3%	60.8%	75.5%	0.75	82.7%	71.4%	79.6%	0.92	93.1%	94.7%	93%	0.73	97.1%	92.5%	96%
unweighted N			8,500				298				759				182		
overall proportion continuously married			0.69				0.72				0.92				0.73		

Note: share married is not reported when there are fewer than 20 observations in a node. Proportions which are unlined are based on 21-50 observations.