UNIVERSITY OF Southampton
Southampton Statistical Sciences Research Institute

Working Paper A10/03

Applications and Policy

Life Course Determinants Of Poor Psychosocial Health In Adulthood: Young Motherhood As A Mediating Pathway

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Abstract

This paper takes a life course approach, viewing an individual's health status as an outcome of their parental background, experiences in childhood and adolescence and adult circumstances. By using a graphical chain model, the paper investigates whether young motherhood plays an independent role as a mediating pathway through which socio-economic disadvantage in childhood is associated with poor psychosocial health in adulthood. Prospectively collected data from a national birth cohort study of women born in Britain in 1970 allow us to demonstrate the direct and indirect ways in which young motherhood is associated with later health status. Two measures of health status at age 30 are used: malaise, and the 12 question version of the General Health Questionnaire (GHQ12). Young motherhood is found to be a key mediating factor in the development of socio-economic differentials in adult health, particularly the incidence of malaise. Psycho-social morbidity as measured by GHQ12 is more related to current circumstances and only indirectly related to past life course experiences.

Life course determinants of poor psychosocial health in adulthood: young motherhood as a mediating pathway

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Summary

This paper takes a life course approach, viewing an individual's health status as an outcome of their parental background, experiences in childhood and adolescence and adult circumstances. By using a graphical chain model, the paper investigates whether young motherhood plays an independent role as a mediating pathway through which socio-economic disadvantage in childhood is associated with poor psychosocial health in adulthood. Prospectively collected data from a national birth cohort study of women born in Britain in 1970 allow us to demonstrate the direct and indirect ways in which young motherhood is associated with later health status. Two measures of health status at age 30 are used: malaise, and the 12 question version of the General Health Questionnaire (GHQ12). Young motherhood is found to be a key mediating factor in the development of socio-economic differentials in adult health, particularly the incidence of malaise. Psycho-social morbidity as measured by GHQ12 is more related to current circumstances and only indirectly related to past life course experiences.

KEY WORDS: *life course, adulthood, young motherhood, psychosocial health, graphical chain modelling, birth cohort study*

Introduction

Aim of the research

This paper brings together socio-demographic research concerning the longer term outcomes of young motherhood (Maughan and Lindlelow, 1997; Kiernan and Hobcraft, 1999, for example) with epidemiological research on the development of social inequalities in health across the life course (see, for example, Cheung et al. 2002; Power et al. 2002; Sacker et al. 2002). Our aim is not to quantify precisely the impact that young motherhood has on a woman; this is difficult using observational data since there are likely to be unmeasured characteristics differentiating women who have a teen birth, from those who do not (including those who become pregnant but have a termination). Research based on sibling-comparisons, for example, Geronimus and Korenman, 1992), and comparisons of teenage miscarriages versus teenage births (for example Hotz et al. 1997), suggest that the impact of becoming a teen parent may be over-estimated in standard research using observational data. However, as Jaffee (2002) notes, studies that attempt to control for unmeasured differences cannot, by definition, tell us about the pathways that lead women into young motherhood and similar or additional pathways through which young motherhood may lead to negative outcomes. Instead, our aim is to elucidate the *mechanisms* whereby young motherhood acts as a mediator through which socio-economic disadvantage in childhood is associated with later poor health. Using a graphical chain modelling approach and prospectively collected data from a recent cohort of women born in Britain in 1970 we are able to demonstrate more explicitly the complex way in which life course experiences are associated with health status in early adulthood. We use two measures of self reported health at age 30: the malaise index, and the General Health Questionnaire - 12 question version (GHQ12). The malaise index incorporates

both somatic and psychological symptoms of anxiety and depression, whilst GHQ12 focuses on the respondent's feelings, asking about psychosocial symptoms of depression and anxiety during the last few weeks, and whether they are more or less prevalent than usual. Hence GHQ12 may reflect more immediate short term psychosocial ill health.

Young motherhood as a mediating variable

Previous research has identified a number of early life course circumstances and characteristics which are associated with later psycho-social morbidity. Power et al. (2002) using data from the 1958 British birth cohort note the importance of child-adult continuities in psychological status and show how poor childhood material circumstances and childhood characteristics, particularly anti-social behaviour and low educational ability, are predictors of psychological distress in adulthood (as measured by the malaise index). Rutter and colleagues (1990) highlight the relationship between experience of institutional care and problems in adult social functioning, whilst previous research among Canadian adolescents showed a strong association between external locus of control and higher GHQ score (D'Arcy and Siddique, 1984).

All of these predictors of poor psychosocial health are also important predictors of teenage motherhood in the UK (Maughan and Lindelow, 1997; Hobcraft and Kiernan, 1999; Cheesbrough, 2003). It is therefore not surprising that previous research has found early childbearing to be associated with greater risks of poor adult psychological health (Maughan and Lindelow, 1997; Power et al. 2002). The first aim of this paper is to examine the pathways into young motherhood and hence to identify

whether the observed association between teenage childbearing and later poor health is due to these common antecedents.

There are a number of reasons why we might expect early childbearing to have a direct negative impact on adult health, with possibilities including financial implications of a truncated educational career, social difficulties arising from responsibilities of caring for a young child, or difficulties in forming supportive partnerships (Quinton et al. 1993; Maughan and Lindelow, 1997). The second aim of the paper is to explore the pathways through which any remaining association between young parenthood and later ill health operate. This approach views young motherhood as an additional risk factor for poor adult health. Adult social inequalities in health can then be seen to result from the accumulation of risk factors over the life course (Power et al. 2002; Sacker et al., 2002).

We use graphical chain models to explore the life course pathways through which young women are selected into young motherhood and the mechanisms through which young motherhood is associated with later poor health as a result of the adult circumstances of young mothers. Instead of comparing teenage mothers with everyone else we use a categorical variable to identify other younger mothers who began childbearing in their early twenties, those who began childbearing in their late twenties, and those who had not had a child by age 30. The focus on pathways and mechanisms is important in trying to identify policy levers for the reduction in the levels of young parenthood and in the improvement of young mothers' life chances following the birth. Such an approach is invited by Woodward and Furgusson, (1999, pp. 127-8) who argue that "an understanding of the life processes that lead to early

pregnancy and motherhood will be important in identifying strategies for breaking intergenerational cycles of poor mental health and social functioning".

Conceptual Framework

Figure 1 presents the conceptual framework which views an individual's health as an outcome of their own attributes (for example reading ability), in the context of their family background (for example social class of origin) and experience of societal constraints and opportunities (for example availability of social support). Parental background and birth characteristics (block 1) and childhood circumstances (block 2) predict age at entry into parenthood (block 3). These three all act as predictors of the likelihood of experiencing partnership dissolution (block 4) and other socio-demographic circumstances in adulthood (block 5). If a significant relationship between young motherhood and later poor health (block 6) remains once antecedent factors (blocks 1 and 2) are controlled, this would suggest that experience of young motherhood may result in additional adversities. Parental background and childhood circumstances may be directly associated with poor adult health, or associated with poor adult health via their relationship to age at motherhood. The inclusion of blocks 4 and 5 will provide evidence for the mediating pathways through which past life course experiences including young motherhood are associated with adult psychosocial health.

< Figure 1 about here >

Methods

The Sample

The data come from the 1970 Birth Cohort Study which has followed up all children born in Britain between the dates 5-11 April 1970. This paper uses data collected at birth, age 10 and age 30, from parents, schools and in later sweeps the subjects themselves. Our sample consists of 7389 females born in Britain who took part in the birth survey. Out of these, 6249 took part at age10 and 4766 were present in all three relevant sweeps. In order to maximize sample size, in each block analyses are carried out on all available cases. Attrition weights are used to compensate for the disproportionate loss-to follow up of more disadvantaged subjects (Little and Rubin, 2002). We construct the weights using classification and regression trees (Breiman et al. 1984). For further details of their estimation see Borgoni et al., 2004). Any remaining item non-response is dealt with by imputation. We first look to see whether the missing information is available in another sweep of the survey. If not, we use a hot deck procedure where donors are identified through the terminal nodes of a classification tree (see Borgoni and Berrington, 2004 for a description of the multivariate imputation procedure).

Why Use A Graphical Model?

Odds ratios produced from a logistic regression of health status at age 30 with the variables in blocks 1 to 5 as covariates supply information about the ways in which categories of the covariates are related to health at age 30, but only provide estimates of the direct or net effects. In contrast, the graphical model depicts the structure of relationships between all of the variables, and shows both the direct and indirect pathways through which parental background and childhood factors are associated

with entry into young motherhood which is then associated with health in adulthood. Furthermore, unlike the usual multivariate regression approach, the graphical chain model explicitly models inter-dependencies between covariates, for example housing tenure and unemployment. This provides the potential opportunity to simulate, in a more appropriate way, the possible impact of a policy intervention to reduce health inequalities, assuming causality. The graphical model is not a data mining exercise; variables are chosen on the basis of clear theoretical pathways through which early life course experience may influence adult health. We have not excluded any potential edges from the model on the basis of theory, but it is possible to constrain some parameters to be zero and hence assume *a priori* no relationship between two variables. For some applications of graphical chain models to survey data, see Mohamed et al. (1998), Magadi et al. (2004) and Evans and Anderson (2006).

The graphical model analyses follow the approach of Mohamed et al. (1998). The graphical model (Whittaker, 1990) is a stochastic model specified via a mathematical graph that is a set of nodes and edges. Nodes represent variables and undirected edges (lines) represent significant associations between pairs of variables. Asymmetric relationships between variables, i.e. one anticipating the other, are represented through directed edges (arrows). Directed graphs allow us to specify directions of causality. Variables are entered into the model in a series of blocks (Figure 1). These reflect the temporal ordering of the variables and the assumed causal ordering of relationships. Hence, directed edges can only flow from variables in a preceding block to variables in subsequent block(s). Fundamental to graphical modelling is the concept of conditional independence represented by the lack of an edge. That is to say once relationships with other variables are included in the model, two variables are no

longer associated. For example, once father's social class is controlled there is no longer a relationship between geographical region and birth order. Tests for conditional independence are used to eliminate non-significant pathways.

Model Selection

The modular structure of the graphical model enables computation of a complex overall model via a series of simpler regressions. Log-linear models can deal with polytomous response variables common in this sort of social data and allow us to model simultaneously more than one categorical response variable as found for example in blocks 1, 2 and 5. First we fit a log-linear model to the variables in block 1. The second model identifies the variables in block 2 as responses and the variables in block 1 as predictors. Variables in block 2 are simultaneously modelled which means that the log linear model allows for potential interactions between pairs of block 2 variables. For block 3 we only have a single categorical variable and hence the regression can be a multinomial logistic regression with all of the variables in blocks 1 and 2 as predictors. Results are shown in Table 1. Block 4 contains partnership dissolution, a single binary variable estimated using logistic regression. Block 5 has a number of categorical variables and can be modelled using a log linear model. However, in practice inclusion of these additional variables means that frequencies for particular combinations of characteristics become small or zero. It is well known that log linear models have problems with sparse data and hence we approximate the log linear model using a series of six logistic regressions. For the final analyses of health outcome a logistic regression is used with all the other variables entered as covariates, and the resulting model shown in Table 2. For each block a step-wise search procedure is implemented to find significant edges. (See

Agresti (2002) for use of log linear models in modelling asymmetric relationships and Borgoni et al., (2004) for further details of our implementation).

Outcome Measures

GHQ12: The twelve questions ask about general level of happiness, experience of depressive and anxiety symptoms, and sleep disturbance over the last few weeks. Respondents are asked to indicate their present state relative to their usual state. GHQ12 is strongly correlated with clinical diagnosis and has satisfactory internal consistency (Goldberg and Williams, 1988). In line with common practice we interpret answers using a bimodal method (symptom present: 'not at all' = 0, 'same as usual' = 0, 'more than usual' = 1 and 'much more than usual' = 1). Subjects who score 4 or more are identified as being at potential risk of poor psychosocial health (Goldberg and Williams, 1988). In BCS70, 20.7% of women had a score of 4 or more compared with 21 % of women aged 25-34 in the 1995 English Health Survey (Sturgis et al., 2001). Among the BCS70 sample Cronbach's alpha was 0.86.

Malaise Inventory: The Malaise Inventory, developed by Rutter et al. (1970), comprises a series of 24 self completion questions relating to the presence of symptoms of anxiety and depression (such as feeling tired, worried miserable, scared) and somatic symptoms of emotional distress (such as suffering from indigestion, headaches, upset stomach). Each answer is coded as a binary variable (yes=1, no =0) and summed to provide a total score out of 24. Previous research has shown the malaise inventory to have satisfactory internal consistency and validity (Rodgers et al., 1999). In our sample Cronbach's alpha was 0.91. As in previous research (Power

and Manor, 1992; Sacker et al., 2002) we identify individuals with a score of 7+ (20.3% of our sample) as having a greater risk of psychological disorder.

The two health outcomes measures are correlated (Pearson Correlation between GHQ12 and malaise in their continuous form 0.51). Half the respondents with a malaise score of 7+ also have a GHQ12 score of 4+ and *vice versa*. Ten per cent of the sample is thus identified on both measures as having poor health.

Explanatory variables

Block 1: Parental background

Parental characteristics: Subjects are identified according to whether they were a first or higher order birth. Their mother's age at her first birth is classified as under 20, 20-24, 25 and above years. Father's occupational social class is categorized as: professional and intermediate, junior non-manual, skilled manual, semi and unskilled. The small number of fathers whose occupation was classified as "other including armed forces" are included within the skilled manual group. Cohort members who were not living with a father in the birth survey are treated as a separate group labelled "no father figure". Information about the age at which their parents left school is used to characterize parental education. Those whose only parent (in the case of lone parents), or both parents (in two parent families) left school at or before age 16 are identified separately.

Since the risk of becoming a teenage mother was found in preliminary analyses to be significantly lower in London, the South East and East Anglia subjects living at birth in this region are identified separately. Ethnicity is coded using the respondent's self-

report at age 30, augmented by the respondent's mother's report from the age 10 survey. Due to the small number of respondents within individual minority ethnic groups, two broad categories of "non-white" and "white" are used. Those who at age 30 responded that they were "British" but for whom at age 10 their mother reported them as belonging to a minority ethnic group were classified according to the mother's view. Hence we identify those who either during their childhood or adulthood were considered to belong to a minority ethnic group. This grouping does not acknowledge important cultural and structural factors which could differentially affect the outcomes for women from Indian, Pakistani, Bangladeshi, Caribbean or African origin.

Block 2: Childhood characteristics

Material circumstances: Subjects whose families at age 10 received one or more means-tested benefits were identified separately. Housing tenure at age 10 is categorised into social housing versus other types of tenure.

Family structure: Children living with both biological parents at age 10 are identified separately from those living with two parent figures where at least one of these is not the biological parent. A third group who are living with only one parent figure (who may be either a biological parent, or a non-biological parent-figure for example a foster parent or step-parent) are also coded. The 29 children who were not living with any parent figure are included within the largest category of "two biological parents".

Parental educational aspirations for their child: At age 10 the subject's mother was asked when she thought her child would leave school. Subjects are categorised according to whether or not their mother thought they would stay on after age 16.

Individual child characteristics: Educational ability at age 10 was measured using the Shortened Edinburgh Reading Test. Those with a score in the lowest quartile are identified as having low reading ability. Locus of control, based on the original concept of Rotter (1966) was measured at age 10 using the child's response to 13 statements about the extent to which they perceived they had control over events in their lives. For each statement with which they agree they receive a score of one. Those who disagreed or said they did not know score zero for that statement. The summary measure is the sum of the scores for the 13 statements. Cronbach's alpha was 0.55. Children whose total score is in the top 10% are coded as having an "external locus of control".

Conduct disorder at age 10 is assessed using an adapted Rutter Parent Behaviour Scale, a screening tool that has been shown to be reasonably good at discriminating between children attending child guidance clinics and other children (Rutter et al., 1970). Mothers were asked to indicate the extent to which their child "often destroys own or others belongings"; "frequently fights with other children"; "sometimes takes things belonging to others"; "is often disobedient"; "often tells lies". Possible answers to each statement range from "does not apply" (score 0) to "certainly applies" (score 100). Reliability was high (Cronbach's alpha 0.80). The total score is the sum of the score on each of the items, and those falling in the top 10% are identified as exhibiting behavioural problems.

Block 3: Age at motherhood

Age at entry into motherhood is derived from the fertility histories collected from cohort members at age 30. We compare the experiences of women who gave birth prior to age 20, those who became mothers in their early twenties, those who became mothers between age 24 and 30 and those who have not yet become a parent.

Block 4: Partnership dissolution

Partnership dissolution has obvious implications for household composition and wealth, and has previously been found to be associated with a deterioration in psychosocial health (Hope et al., 1999). We therefore identify those who have experienced dissolution of a co-residential partnership since age 16.

Block 5: Adult circumstances

Socio-economic circumstances: At age 30 respondents are asked about their own and their partner's employment status. We distinguish women who live in a family where neither themselves nor any partner are employed in paid work as being in a "non-working family". Current housing tenure identifies women living in social housing separately from the others.

Living arrangement: Those who are living with another adult - partner, other relative, or unrelated person - are coded separately from those living with no other adults. This variable is distinct from whether they had ever experienced a dissolution. Due to repartnering, only one third of those who had experienced partnership dissolution were later living as a lone adult.

Satisfaction with neighbourhood: Respondents were asked “How satisfied or dissatisfied are you with the area you live in?” Subjects who responded that they were “very” or “fairly satisfied” are identified separately from those who said that they were “neither satisfied nor dissatisfied”, “fairly dissatisfied” or “very dissatisfied”.

Emotional support : The cohort member was asked to describe their relationship with their mother. Those who said they were “very close” or “close” are compared to those who responded that they were “not very close”, “had no contact” or their mother was dead. We identify those who felt they had only limited emotional support available from a family member or friend separately from those who said that they could discuss anything within this supportive friendship.

Results

Pathways into young motherhood

Figure 2 contains the chain graph depicting the pathways through which parental and childhood characteristics are related to age at motherhood. In order to make the chain graph easier to read by reducing the number of edges displayed, some variables within a block have been rearranged into sub-blocks. Variables in the same sub-block are dependent, although not all variables that are dependent are in the same sub-block. The decision to group variables within a sub-block is based on whether these variables are also related to other variable(s) in the same way. Arrows from a sub-block to another variable or block denote that all of the variables within the sub-block are directly associated with this other variable or other block. For example, father’s social class, maternal age at first birth and ethnicity are all dependent upon each other and are all directly associated with receipt of benefits, family structure and reading ability.

Instead of drawing individual lines between each individual variable we summarize the associations by drawing an arrow from the first sub-block in block 1 to a second sub-block in block 2. When not all of the variables in a sub-block are directly related to another variable (or sub-block), a single edge is drawn between the variable in the first block and the second variable (or sub-block). For example, father's social class and ethnicity are related to experience of statutory care, but mother's age at first birth is not. Therefore, we draw two arrows, one linking father's social class and experience of statutory care, and one linking ethnicity and experience of statutory care.

The chain graph can be read in conjunction with Table 1 which gives the relative risk ratios from a separate multinomial logistic regression model of age at motherhood with variables in blocks 1 and 2 as covariates. The multinomial logistic models the probability of experiencing a teenage birth, a birth at age 20-23 or at age 24+, relative to the probability of the baseline outcome of not becoming a parent by age 30. Relative risk ratios (for example in the first column) describe the ratio of the odds of experiencing a particular outcome (i.e. teenage parenthood) associated with a particular category of an independent variable, to the odds (i.e. of teenage parenthood) associated with the reference category of the independent variable. For ease of interpretation only main effects are displayed in Table 1.

< Figure 2 and Table 1 around here >

With the exception of birth order and region, all variables measured at birth are inter-related with one another, indicated in Figure 2 by either an undirected edge or by

inclusion within the same sub-block. Social housing, receipt of benefits, family structure and reading ability at age 10 are all mutually dependent. Conduct disorder is related to all the other age 10 variables, being more prevalent among children in less socio-economically advantaged positions and those with experience of statutory care, and is associated with exhibiting an external locus of control, lower reading ability and with lower parental expectations for the child's education. The age at which the subject's mother thinks her child will leave school is directly associated with social housing tenure, receipt of benefits, antisocial behaviour, locus of control and reading ability, but is conditionally independent of experience of statutory care and family structure. Experience of statutory care is related to reading ability, anti-social behaviour and family structure, but is conditionally independent of other childhood variables.

Arrows between the first block and the second block depict significant, potentially causal, associations between parental and birth circumstances and characteristics at age 10. The most significant predictors of poor socio-economic circumstances at age 10 are father's social class, parental education, and mother's age at first birth. Low reading ability, anti-social behaviour and having an external locus of control are also significantly more common among those whose fathers were in manual occupations, and those who did not have a father figure at birth. Even when reading ability is controlled, expectations that they will leave school at 16 are more common for children from manual or unsupported class backgrounds, those whose parents had themselves left school at 16 or before, those whose mothers became young parents, and those who were a second or higher order birth. Coming from a non-White background was related to increased likelihood of receiving benefits, low reading

ability, external locus of control, and not living with two biological parents at age 10. After controlling for socio-economic circumstances, non-white children remain significantly more likely to experience statutory care. (Further investigation of the relationship between ethnicity and ever being in care among 1970 cohort members suggests that the increased risk of being taken into care is confined to the Black ethnic group). Figure 2 includes arrows linking region with various childhood characteristics. However, all of the latter relationships, although statistically significant, are substantively very small and are not considered further.

In Figure 2, arrows between the first two blocks and the third, depict significant, potentially causal, relationships between parental and childhood characteristics and age at motherhood. Becoming a mother in their teens or early twenties was more common among girls who at age 10 were living in poorer socio-economic circumstances and those not living with two biological parents. The graphical model depicts a direct relationship between family structure and age at motherhood despite the fact that the relative risk ratios in Table 1 for the main effect of family structure are not significant. This is because there are significant two-way interactions not shown in Table 1 (which presents main effects only) suggesting that the impact of social housing and benefits at age 10 on age at motherhood were different from those from step-families. Table 1, shows that controlling for other variables, the odds of becoming a teenage parent, relative to the baseline of not having a child by age 30 were twice as high for those living in social housing, and 40% higher for those receiving benefits. Individual child characteristics are also found to be significant predictors of age at motherhood. The odds of young motherhood were twice as high among those with a conduct disorder and 60% higher among those in the lowest

quartile of reading ability at age 10. Parental educational aspirations exert an additional impact on age at motherhood over and above the child's socio-economic circumstances and individual characteristics. Age at motherhood is independent of experience of statutory care and locus of control given the other variables in the first and second blocks, since there are no edges from these variables to age at motherhood. Locus of control and experience of statutory care are, however, indirectly associated with teenage motherhood through their association with other age 10 variables such as anti-social behaviour and low reading ability.

Four of the block 1 variables have an arrow linking them directly to age at motherhood. The graph tells us that mother's age at first birth, father's social class, parental education and region of residence are related to age at motherhood, directly and indirectly through the impact of social class background on the child's circumstances and characteristics at age 10. Ethnicity and birth order are only indirectly associated with age at entry into parenthood by association with the other block one variables, and the age 10 circumstances. The size of the direct effects of father's social class, maternal age at first birth and parental education on the likelihood of becoming a teen mother can be seen from the relative risk ratios in Table 1. When other factors are held constant, the odds of becoming a teenage mother, relative to the baseline category were twice as high for women from unskilled and semi-skilled class backgrounds and for women who were born into a lone mother family. Even after controlling for the socio-economic characteristics of parents, girls whose own mother was a teenage parent were five times more likely to become a teenage mother than girls whose mother had her first birth aged 25+. We might

speculate that this reflects the inter-generational transmission of attitudes and norms about sexual behaviour, abortion and childbearing.

Young motherhood and psychosocial health in adulthood

The chain graphs in Figures 3 and 4 show, for the two health outcomes, the pathways through which age at motherhood and other variables in blocks 1, 2 are associated with partnership dissolution, circumstances in adulthood, and ultimately, reported health status at age 30. In order to simplify the presentation, only edges *leading* to variables in blocks 4, 5 and 6 are depicted. The pathways leading to young motherhood shown in Figure 2 are identical for both health outcomes and are not repeated. Table 2 contains odds ratios from two logistic regression models predicting health status, with variables in blocks 1 to 5 as covariates. Significant predictors are reflected by the presence of a directed edge between these variables and health status in the chain graph. For both health outcomes, age at motherhood is associated directly and indirectly with reported health status in adulthood as discussed below.

<Figure 3 and Table 2 around here>

Malaise

Father's social class is the only parental background variable to remain directly associated with malaise at age 30 in the final chain graph (Figure 3). However, the chain graph makes it clear that the parental and birth circumstances are associated indirectly with malaise in adulthood through their impact on childhood circumstances. Four childhood characteristics have a direct relationship with malaise: receipt of

benefits, reading ability, locus of control and conduct disorder. Age at motherhood is related to malaise in adulthood in part due to these common childhood antecedents.

The importance of reading ability and conduct disorder on later risk of malaise was also found by Power et al. (2002). They speculate on the pathways through which educational ability could be associated with later ill health, suggesting two possibilities. The first, that it is through the relationship between educational ability and later financial circumstances, is supported by the graphical chain model – poor reading ability is directly associated with living in a workless family at age 30. Our model suggests, however, that poor reading ability in childhood is also related to malaise through its association with young motherhood. The remaining direct association may be explained by their second hypothesis that "….ability affects an individual's sense of mastery and possibly their self-esteem, and in turn, influences the development of emotional well-being" (Power et al. 2002, p. 2001).

Commenting on the link between conduct disorder and adult depression Quinton et al. (1993) suggest it is the relative inability of women with psychosocial maladjustment to form stable, supportive partnerships that causes greater risks of adult depression. Locus of control also has a direct association with malaise, a relationship which may reflect lack of empowerment among these women. Unlike Rutter et al. (1990) we do not find statutory care to be directly associated with malaise. This may be a result of the small size of our sample that experienced care, or due to the inclusion of more control variables. We do find, however, that experience of care is indirectly associated with adult health through its relationship to socio-economic circumstances at age 10

The graphical model tells us that age at motherhood continues to be associated with malaise in adulthood even after controlling for these childhood antecedents. In part this association is mediated through the relationship between age at motherhood and the risk of experiencing partnership dissolution. Teenage parents were twice as likely to have experienced partnership dissolution by age 30 (Table not shown) and the odds of having a high malaise score at age 30 were found to be 1.3 times higher for such women (Table 2). Young motherhood is also associated indirectly with malaise through its relationship with poorer living conditions in adulthood as indicated by being in a workless family. The odds ratios in Table 2 suggest the risk of psychosocial distress is twice as high for women living in a workless family.

Among the BCS70 cohort the risk of malaise was also related to social factors. The odds of poor psychosocial health were around 70% higher for women who report being less emotionally close to their mother, those who do not have a fully confiding relationship, and those not satisfied with their neighbourhood. Being a lone parent as opposed to a couple at age 30 was not associated with malaise once these variables are included in the analyses. The graphical model suggests that in part the association between age at motherhood and malaise is mediated through younger mothers being significantly less likely to be emotionally close to their mothers. This is an important finding and is not related to the frequency of physical contact between mother and daughter (analyses not shown). To test whether the inclusion of women whose mother's had died in the category of "not close to mother" was creating a spurious relationship due to inherited health characteristics we re-estimated the model with these women as a separate group, but no difference in the effect of closeness to mother was found in any of the three models. We refitted the two health models

excluding satisfaction with neighbourhood and the two measures of social support: having someone to confide in, and closeness to mother. No impact was seen on the remaining variables suggesting that these, more subjective, indicators do represent independent effects. There remains the possibility that women who report more negatively on other aspects of their lives may also report their health more negatively (Macleod and Davey Smith, 2003).

Finally, even after adult circumstances are controlled, there remains a direct association between age at motherhood and higher risk of malaise. The odds ratios in Table 2 suggest, however, that risk of malaise is equally raised (odds ratio around 1.5) for teenage mothers and those who gave birth in their early twenties, and is lowest for women who became parents in their later twenties. Interestingly, once all the variables in blocks 1-5 were controlled, the risk of malaise was also higher among those who had not yet become a mother.

In contrast to the graph for malaise, ethnicity is the only parental or childhood variable that remains associated with a high GHQ12 score once all the subsequent blocks are included (Figure 4). The odds of a GHQ12 score of 4 or more were 1.4 times higher for non-white women (Table 2). All remaining parental and childhood characteristics are only indirectly associated with a high GHQ12 score through their relationship with ethnicity, age at motherhood, partnership dissolution, or adult socio-economic circumstances. Recall that GHQ12 asks respondents to compare their current disposition with their “usual” situation. The GHQ12 may thus reflect more short-term, current conditions which are less related to past childhood conditions, and

may under-represent chronic conditions more affected by social inequalities experienced over the life course up to age 30.

<Figure 4 around here>

Indeed, it is the adult circumstances which appear to be the strongest predictors GHQ12 score. The odds of poor health among women living in a workless family were found to be 1.8 times higher than for women living in a family with an adult in paid employment. Social circumstances were also important. As was found for malaise, women who reported a partnership dissolution, those who were not emotionally close to their mother, those who said they had no one in whom they could fully confide, and those who were dissatisfied with their neighbourhood were all more likely to have a higher GHQ12 score (odds ratios of around 1.5). GHQ12 score was conditionally independent of whether the woman lives with another adult, suggesting again it is the level of social support rather than living with another adult *per se* that is important.

Given that young motherhood is a key determinant of adult circumstances, the chain graph tells us that age at motherhood is one of the mediating variables between childhood social circumstances and GHQ12 score at age 30. The extent to which there remains any association between age at motherhood and psychosocial health, once adult circumstances are taken into account, is less clear. The odds ratios in Table 2 suggest that those who began childbearing in their late twenties have the lowest risk of poor psycho-social health, but the odds for teenage mothers are not significantly

higher. In fact, once all variables are controlled, the odds of a high GHQ12 score are highest among women without children.

Discussion

The graphical chain models have visually demonstrated how differentials in adult health among the 1970 cohort reflect the cumulative impact of social disadvantage experienced from birth. They demonstrate that individual attributes such as reading ability can combine with parental characteristics and aspirations, and wider constraints and opportunities such as availability of social support, to influence social inequalities in health.

An advantage of graphical chain graphs over structural equation path models is that they can handle individual observed categorical variables, indicating their relationships with other variables measured contemporaneously, and identifying potentially causal relationships with subsequent life course variables. A single multivariate model of health in adulthood, such as those in Table 2, can lead to the conclusion that most parental and birth characteristics have no significant association with adult health. However, our analyses show that socio-economic circumstances at birth are indirectly associated with adult health through their impact on later circumstances. The policy implications from these findings clearly relate to the need to consider a life course approach to tackling health inequalities.

Data from BCS70 are not ideal for examining ethnic differences in adult health, partly because of the small number of non-white cohort members. Nevertheless it is striking

that ethnicity remains directly associated with GHQ score and overall heath. Further work, using more appropriate data, is required to investigate differences within the non-white group, potential causal mechanisms, and the possibility of ethnic differences in the reporting of health.

The dependencies found at age 10 between material deprivation, family structure, low parental expectations for the child's education, poor reading ability and poor adjustment (as reflected in either conduct disorder or an external locus of control) are striking. This suggests it is not just material conditions but also family environment and parental aspirations which impact on educational ability and individual attributes. The observed direct relationships between reading ability and conduct disorder and malaise in adulthood are consistent with the findings of Sacker et al. (2002) who consider both educational qualifications and psychosocial adjustment as two developmental resources that act as markers for health potential. The graphical chain model is able to go further and show how these markers operate. They are related to poor adult health, partly through their association with the experience of young motherhood and partly through their association with poorer socio-economic circumstances in adulthood.

Our findings concerning the antecedents of young motherhood are consistent with studies based on the earlier 1958 and 1946 cohorts (Kiernan, 1980; Maughan and Lindlelow, 1997; Hobcraft and Kiernan, 1999), suggesting remarkable continuity over time in the pathways leading to young motherhood. The graphical chain models confirm that young motherhood is associated with poor adult health partly though common antecedents, particularly poor material circumstances, conduct disorder, poor

educational ability, experience of institutional care and low parental aspirations for their child's education. The graphs also show how adult circumstances mediate the relationship between young motherhood and later poor health. Greater risk of partnership dissolution and poorer socio-economic circumstances are important pathways through which young motherhood is associated with both measures of health status. Finally, data from BCS70 have highlighted the importance of social support as a mediator of adult mental wellbeing. Younger mothers are significantly less likely to report a confiding relationship and less likely to report being emotionally close to their mother. The protective effect of being emotionally close to one's mother is very striking for both malaise and GHQ12 and requires further investigation. These findings emphasise the importance of policy measures to support both young mothers and young fathers where appropriate.

For malaise, but not for GHQ12, teenage mothers remain at higher risk of poor adult health even when their adult circumstances are controlled. This may represent a causal relationship. Alternatively, it is possible that we have not included one or more variables in our model which are related to both age at motherhood and adult health. What is clear is that when all the variables in blocks 1 to 5 are included, the relationship between age at motherhood and adult psychosocial health is not linear. For both health measures, women who had not had any children by age 30 were also found to be at higher risk of poor psychosocial health. Further work is required to investigate the extent to which this is the result of reverse causation. As in the US (Furstenberg, 2003) and New Zealand (Jaffee, 2002) women who delay childbearing to their early twenties do not seem to fare much better than teenage mothers in terms of their health status. It is thus questionable as to whether a broader concept of young

motherhood needs to be considered by policy makers rather than a focus on a specific age cut-off (as is currently (April 2010) done by the UK Government).

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Acknowledgements:

Data from the 1970 British Cohort Study were made available by the Centre for Longitudinal Studies, Institute of Education, University of London via the UK Data Archive. We acknowledge the financial support of the England Department of Health under grant number 0370020. The views expressed here are those of the authors and not necessarily the Department of Health. The authors thank Ray Chambers and Chris Skinner for their advice on imputation and attrition weights.

Figure 1: Conceptual Framework

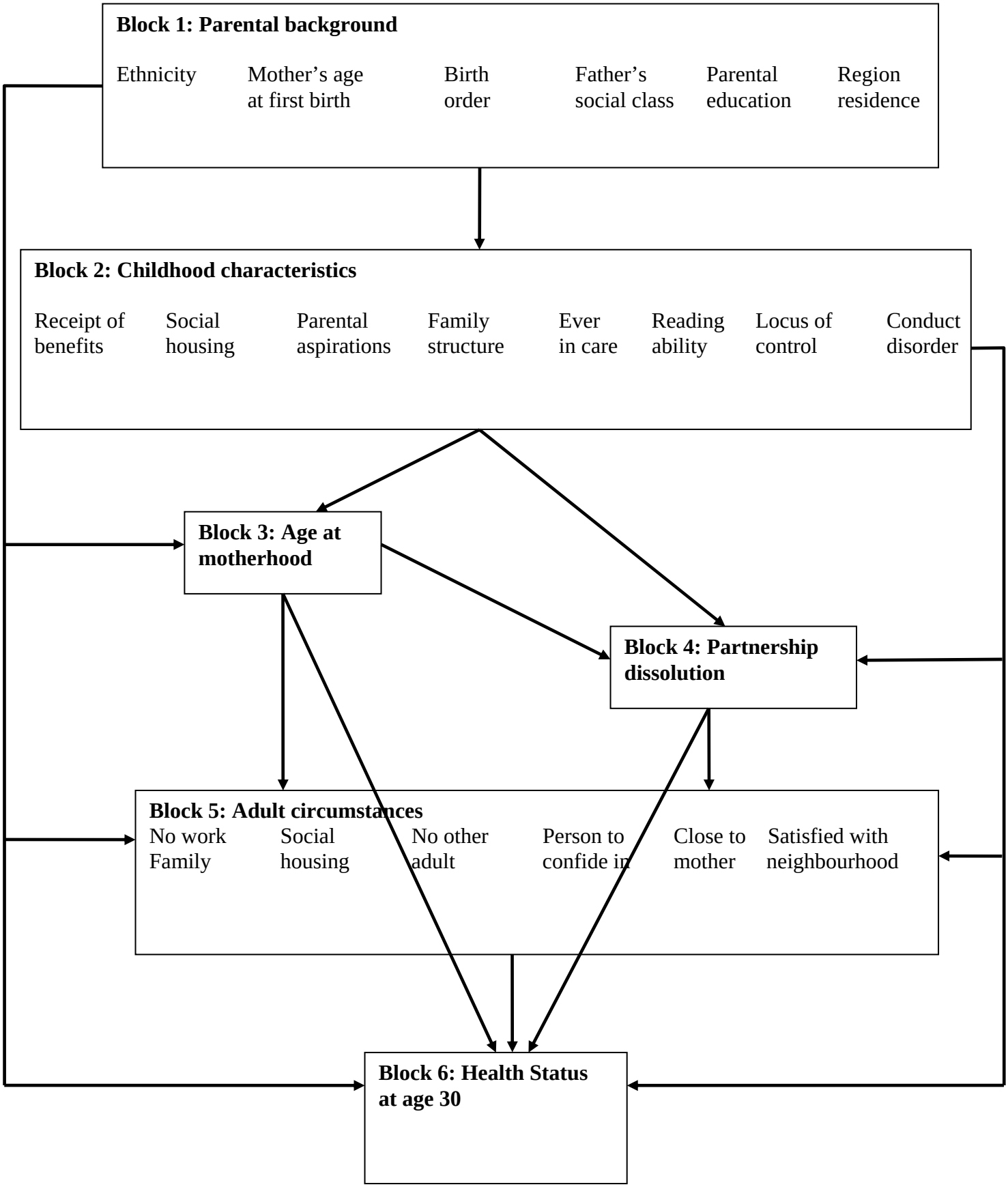

Figure 2: Antecedents of Age at Motherhood

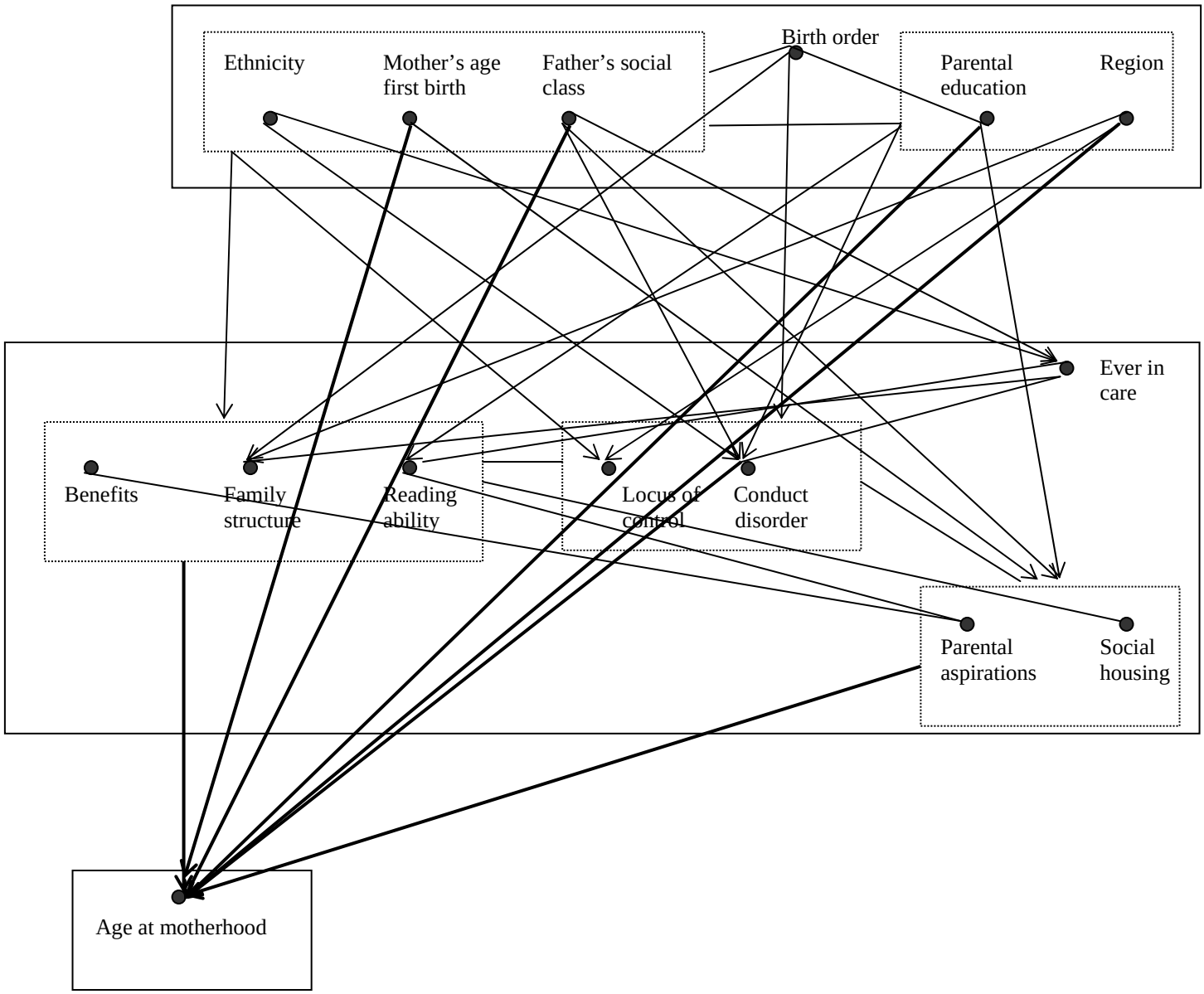

Figure 3: Antecedents of High Malaise Score

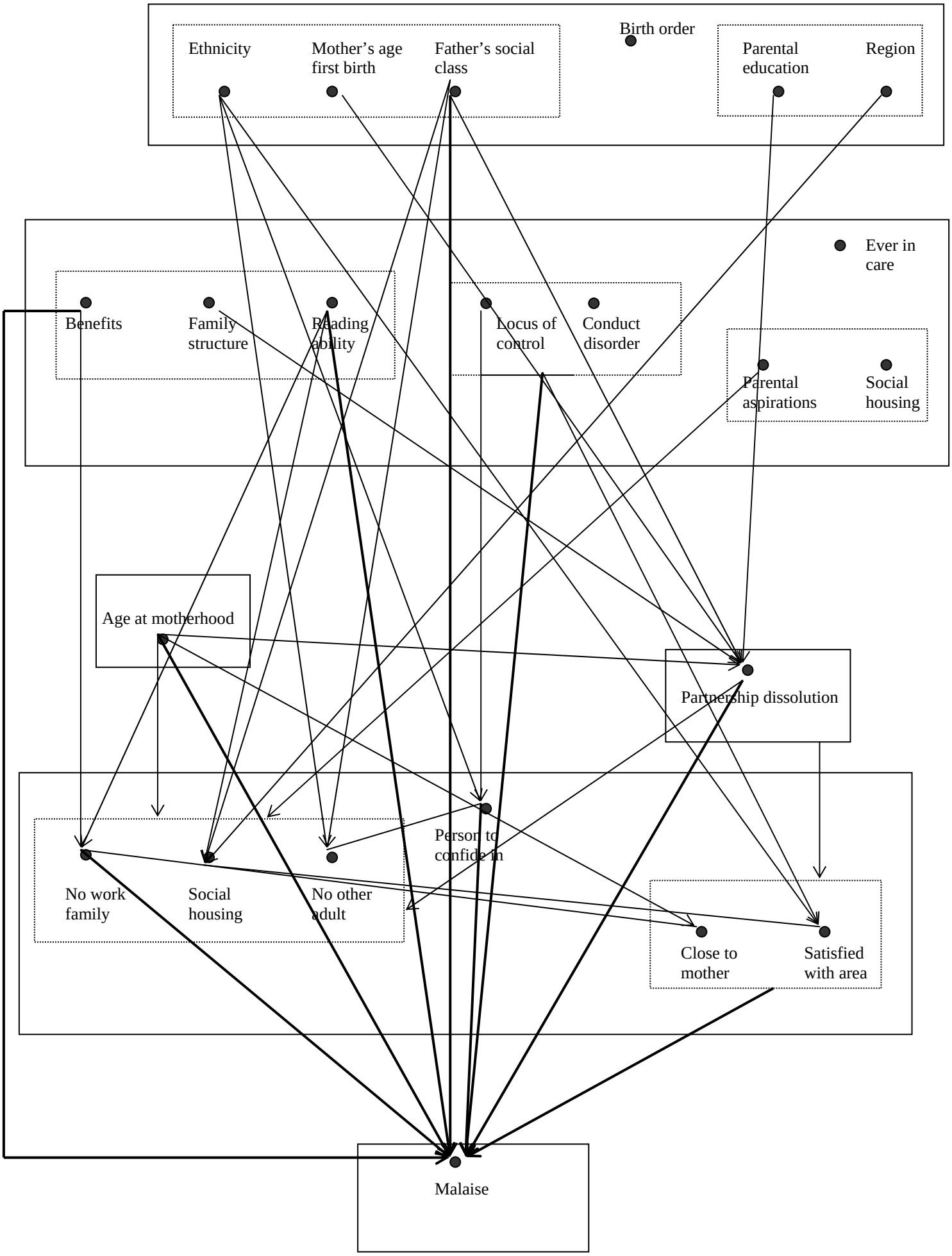

Figure 4: Antecedents of high GHQ12 score

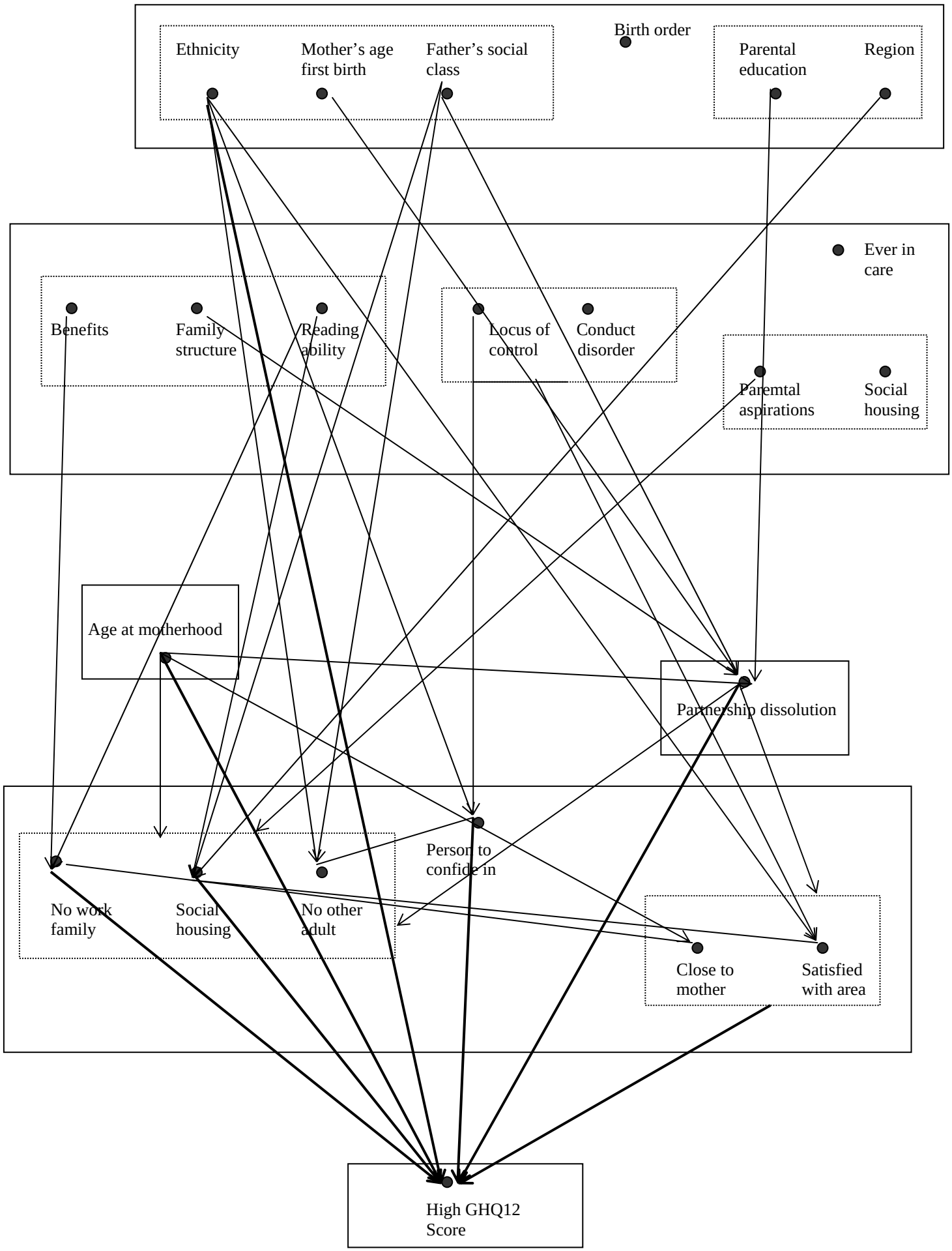

Table 1: Relative Risk Ratios from Multinomial Logistic Regression of Age at Motherhood. Baseline category is "not yet a parent".

	Age at motherhood								
	Under 20 yrs			20-23 yrs			24-29 yrs		
	RRR	[95%	Conf.]	RRR	[95%	Conf.]	RRR	[95%	Conf.]
Birth order									
First	1			1			1		
Higher order	1.04	0.82	1.32	0.93	0.77	1.13	0.97	0.84	1.12
Mother's age at first birth									
15-19	5.11	3.44	7.58	3.64	2.71	4.90	1.96	1.57	2.45
20-24	2.67	1.86	3.85	2.11	1.64	2.73	1.58	1.34	1.87
25+	1			1			1		
Father's social class									
I & II	1			1			1		
IIIn	1.45	0.84	2.48	1.59	1.07	2.36	1.00	0.78	1.27
IIIm	1.46	0.93	2.28	1.55	1.11	2.17	0.93	0.76	1.14
IV&V	2.20	1.35	3.60	2.02	1.39	2.94	0.93	0.72	1.21
No father figure	2.70	1.35	5.41	2.64	1.47	4.71	1.30	0.82	2.05
Parental education									
Both left < 16	1.48	1.13	1.95	1.26	1.02	1.55	1.18	1.01	1.38
One or both left >=16	1			1			1		
Ethnicity									
White	1			1			1		
Non-white	0.87	0.49	1.52	0.85	0.52	1.39	0.90	0.61	1.33
Region									
London & SE	0.54	0.42	0.71	0.92	0.76	1.12	0.80	0.69	0.93
Rest	1			1			1		
Social housing									
Yes	1.96	1.53	2.52	1.77	1.44	2.18	0.98	0.82	1.18
No	1			1			1		
Receipt of benefits									
No	1			1			1		
Yes	1.43	1.04	1.97	1.33	1.00	1.77	1.05	0.83	1.34
Ever in care									
No	1			1			1		
Yes	1.52	0.79	2.92	1.09	0.57	2.08	0.96	0.56	1.66
Family structure									
Two biological parents	1			1			1		
Two parents, other	0.96	0.63	1.48	1.03	0.72	1.46	1.03	0.76	1.38
Lone parent	1.08	0.72	1.63	0.71	0.48	1.04	1.04	0.79	1.38
Reading ability									
>25%	1			1			1		
<= 25%	1.67	1.30	2.14	1.60	1.29	1.98	1.13	0.94	1.37
Parental aspirations									
Leave at 16	1.46	1.14	1.85	1.33	1.09	1.62	1.05	0.89	1.23
Leave after 16	1			1			1		
Locus of control									
Internal	1			1			1		
External	1.28	0.87	1.89	1.12	0.79	1.60	0.82	0.59	1.13
Conduct disorder									
No	1			1			1		
Yes	1.94	1.42	2.66	1.23	0.91	1.66	0.94	0.71	1.23
	N=4766, Wald Chi Square = 681.49								

Table 2: Odds ratios from logistic regression models of self reported health status at age 30

Variable	Malaise score 7+			GHQ12 score 4+		
	Odds ratio	[95%	Conf.]	Odds ratio	[95%	Conf.]
Birth order						
First birth	1			1		
Higher order	1.05	0.89	1.24	1.15	0.99	1.34
Mother's age at first birth						
15-19	1.12	0.88	1.43	0.90	0.71	1.13
20-24	1.05	0.86	1.28	1.06	0.88	1.24
25+	1			1		
Father's social class						
I&II	1			1		
IIInm	1.17	0.87	1.59	1.09	0.83	1.44
IIIm	1.26	0.98	1.62	0.91	0.73	1.15
IV-V	1.42	1.06	1.91	1.02	0.78	1.35
Usup/no father	0.95	0.59	1.53	0.85	0.53	1.37
Parental education						
One or both>16	1			1		
Both <=16	0.97	0.81	1.16	0.97	0.82	1.15
Ethnicity						
White	1			1		
Non white	1.35	0.91	2.00	1.52	1.04	2.21
Region						
London and SE	1			1		
Rest	1.04	0.88	1.23	1.05	0.89	1.22
Social housing						
No	1			1		
Yes	1.14	0.95	1.38	1.12	0.93	1.35
Receipt benefits						
No	1					
Yes	1.26	1.00	1.59	1.14	0.89	1.44
Ever in care						
No	1			1		
Yes	1.34	0.83	2.15	1.11	0.68	1.80
Family Structure						
2 biological parents	1			1		
2 parents, other	1.13	0.85	1.51	1.09	0.82	1.46
Single parent	0.77	0.56	1.05	0.86	0.64	1.16
Reading score						
> 25%	1			1		
<= 25%	1.26	1.05	1.51	1.09	0.90	1.32
Parental aspirations						
Leave after 16	1			1		
Leave at 16	1.16	0.97	1.38	1.00	0.84	1.19
Locus of control						
Internal	1			1		
External	1.39	1.04	1.88	1.11	0.82	1.49
Conduct disorder						
No	1			1		
Yes	1.40	1.09	1.79	1.23	0.96	1.59

Contd.

Table 2 (contd.): Odds ratios from logistic regression models of self reported health status at age 30

Age at motherhood						
<20	1.49	1.11	2.00	1.24	0.92	1.68
20-23	1.57	1.22	2.03	1.41	1.10	1.82
24+	1			1		
Non-mother	1.53	1.25	1.87	1.47	1.22	1.78
Ever had partnership diss						
No	1			1		
Yes	1.31	1.10	1.55	1.30	1.10	1.53
Non-working family						
No	1			1		
Yes	2.03	1.58	2.61	1.86	1.44	2.40
Social housing						
No	1			1		
Yes	0.97	0.76	1.24	0.72	0.56	0.94
Living arrangement						
Other adult	1			1		
Lone (parent), alone	0.88	0.71	1.10	1.20	0.98	1.47
Satisfied with area						
Yes	1			1		
No	1.68	1.37	2.06	1.53	1.25	1.87
Someone to talk to						
Yes, fully confide	1					
No, or only somewhat confide	1.76	1.48	2.08	1.45	1.24	1.72
Whether close to mother						
Yes	1			1		
Not close/dead	1.74	1.40	2.16	1.59	1.28	1.97
	N=4716, Wald Chi Square=301.57			N=4717, Wald Chi Square=177.77		