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Author(s): Sidebotham, Peter; Heron, Jon

Article Title: Child maltreatment in the "children of the nineties": a cohort study of risk factors.

Year of publication: 2006

Link to published version:

<http://dx.doi.org/10.1016/j.chiabu.2005.11.005>

Publisher statement: None

CHILD MALTREATMENT IN THE “CHILDREN OF THE NINETIES”: A COHORT STUDY OF RISK FACTORS.

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Word count: 5,923 (excluding references)

Key Words:

Child abuse, child maltreatment, risk factors, aetiology, ecology

Acknowledgements:

We are extremely grateful to all the mothers who took part and to the midwives for their cooperation and help in recruitment. The whole ALSPAC study team comprises interviewers, computer technicians, laboratory technicians, clerical workers, research scientists, volunteers and managers who continue to make the study possible. This study could not have been undertaken without the financial support of the Medical Research Council, the Department of Health, the Department of the Environment, the Wellcome Trust and other funders including the NHS executive, South West, Research and Development Directorate. The ALSPAC study is part of the WHO initiated European Longitudinal Study of Pregnancy and Childhood.

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Practice Implications

Because child maltreatment is a complex phenomenon, influenced by a range of factors in the child's world, those working with maltreated children and their families should take a broad view of children and the environments within which they are growing. This research provides empirical material to inform such an approach. Health and social care professionals in a variety of settings, particularly primary care and social work, but also in paediatrics, child and adolescent mental health and adult mental health, can draw on this information to enhance training, policies and practice. The recognition of vulnerable contexts within which children are growing could lead to preventive work before such contexts result in actual maltreatment. At a secondary level, an understanding of the wider family and environmental context can assist in programmes to support families in which abuse has taken place.

Abstract

Aim: To analyse the multiple factors affecting the risk of maltreatment in young children within a comprehensive theoretical framework.

Methods: The research is based on a large UK cohort study, the Avon Longitudinal Study of Parents and Children. Out of 14,256 children participating in the study, 293 were investigated by social services for suspected maltreatment and 115 were placed on local child protection registers prior to their 6th birthday. Data on the children have been obtained from obstetric data and from a series of parental questionnaires administered during pregnancy and the first 3 years of life. Risk factors have been analysed using an hierarchical approach to logistic regression analysis.

Results: In the stepwise hierarchical analysis, young parents, those with low educational achievement, and those with a past psychiatric history or a history of childhood abuse were all more likely to be investigated for maltreatment, or to have a child placed on the child protection register, with odds ratios between 1.86 and 4.96 for registration. Examining strength of effect, the highest risks were found with indicators of deprivation (3.24 for investigation and 11.02 for registration, after adjusting for parental background factors). Poor social networks increased the risk of both investigation (adjusted OR 1.93) and registration (adjusted OR 1.90). Maternal employment seemed to reduce the risk of both outcomes but adjusted odds ratios were no longer significant for registration. After adjusting for higher order confounders, single parents and re-ordered families were both at higher risk of registration. Reported domestic violence increased the risk of investigation and registration but this was no longer significant after adjusting for higher order variables. Low birthweight children were at higher risk of registration as were those whose parents reported few positive attributes.

Conclusions: This study supports previous research in the field demonstrating that a wide range of factors in the parental background, socio-economic and family environments affect the risk of child maltreatment. By combining factors within a comprehensive ecological framework, we have demonstrated that the strongest risks are from socio-economic deprivation and from factors in the parents' own background and that parental background factors are largely, but not entirely mediated through their impact on socio-economic factors.

CHILD MALTREATMENT IN THE “CHILDREN OF THE NINETIES”: A COHORT STUDY OF RISK FACTORS.

Background

As well as being of direct individual and public concern, child maltreatment places considerable burdens on both health and social services. In the early 1990s in the UK, 27 per 10,000 children were placed on child protection registers each year (Department of Health, 1995). This figure represents those children identified as having been abused or neglected and in whom ongoing risk warrants professional involvement, but underestimates the true prevalence of child maltreatment. At least 100 child deaths per year in the UK are due to child abuse (Fitzgerald, 1998); a far larger number of children suffer adverse emotional and physical consequences of less severe abuse requiring considerable input from health, education and social services.

Previous research has identified a large number of factors associated with an increased risk of abuse or neglect. These have included factors in the parents' personalities, lifestyles and backgrounds, the social environment of the family and community, family structures and function, and factors in the children themselves. While much of the early work on risk factors was based on the divergent strands of psychodynamic and sociological models, Belsky and others have argued for an ecological framework that is able to encompass the complex and multifaceted nature of child maltreatment (Belsky, 1980, 1993; Garbarino, 1985; Kotch et al., 1995, 1997). Drawing on the work of Bronfenbrenner (1979) they argue that child maltreatment is multiply determined by forces at work in the individual, in the family, and in the community and culture, and that these determinants are nested within one another. For the purposes of this research, we have examined factors in each of four domains of Belsky's model: the parental (ontogenic) background, the exosystem (socio-economic environment), microsystem (family structure) and in the children themselves.

Parental Background

Reviewing the published literature on risk factors in the parents' background, four features consistently emerge as having strong associations with subsequent

maltreatment: young parental age (Brown, Cohen, Johnson, & Salzinger, 1998; Connely & Straus, 1992; Egeland & Brunquell, 1979; Kinard & Klerman, 1980; Leventhal, Egerter, & Murphy, 1984, Lynch & Roberts, 1977; Smith & Adler, 1991); low educational achievements (Brown, Cohen, Johnson, & Salzinger, 1998; Egeland & Brunquell, 1979; Kotch et al., 1995; Kotch, Browne, Dufort, Winsor, & Catellier, 1999); adverse childhood experiences, particularly parental exposure to abuse or neglect in their own childhood (Buchanan, 1996; Egeland, 1993; Egeland & Susman-Stillman, 1996; Ertem, Leventhal, & Dobbs, 2000; Kaufman & Zigler, 1993; Langeland & Dijkstra, 1995; Pears & Capaldi, 2001), and parental psychiatric history, including a history of alcohol or drug abuse (Brayden, Altemeier, Tucker, Dietrich, & Vietze, 1992; Chaffin, Kelleher, & Hollenberg, 1996; Fergusson, Lynskey, & Horwood, 1996; Hawton, Roberts, & Goodwin, 1985; Kotch et al., 1997; Lynch & Roberts, 1977; Oliver, 1985; Taylor et al., 1991). All four of these aspects are included in our model.

Socio-economic environment

The association between poverty and child maltreatment is one of the most consistent observations in the published research, both in relation to individual poverty and to neighbourhood characteristics (e.g., Baldwin & Spencer, 1993; Brown, Cohen, Johnson, & Salzinger, 1998; Garbarino & Kostleny, 1992; Kotch et al., 1995, 1997; Kotch, Browne, Dufort, Winsor, & Catellier, 1999). However, interpretation of this association is not without its problems (Crittenden, 1999; Pelton, 1981). In particular, there is a substantial risk of reporting and ascertainment bias in relation to poverty. High rates of paternal unemployment have previously been linked to child maltreatment both at an individual and a neighbourhood level (e.g., Creighton, 1992; Gil, 1971; Gillham, Tanner, Cheyne, Freeman, Rooney, & Lambie, 1998). Findings in relation to working mothers have been less clear cut (Creighton, 1992; Gillham et al., 1998; Searly & Lauderdale, 1983). There is a substantial body of research examining the impact of social networks on child maltreatment, mostly showing a higher risk in those families with poor social networks (Coohey, 1996; Newberger, Hampton, Marx, & White, 1986; Polansky, Chalmers, Bittenwieser, & Williams, 1979). Social support may be particularly important in moderating the impact of stressful life events on families at risk (Kotch et al., 1995, 1997).

Family environment

Amongst the more proximate factors affecting risk of maltreatment, the structure and dynamics of the family are of prime importance. Children of single mothers have been shown to be at higher risk (Brown, Cohen, Johnson, & Salzinger, 1998; Browne & Saqi, 1988; Egeland & Brunquell, 1979). The presence of a step-parent has also been shown to increase the risk (Browne & Saqi, 1988; Fergusson, Lynskey, & Horwood, 1996; Radhakrishna, Bou-Saada, Hunter, Catellier, & Kotch, 2001), particularly in relation to sexual abuse. Family size may also be important, with higher risks in larger families (Altemeier, O'Connor, Vietze, Sandler, & Sherrod, 1984; Brayden, Altemeier, Tucker, Dietrich, & Vietze, 1992; Brown, Cohen, Johnson, & Salzinger, 1998; Hunter, Kilstrom, Kraybill, & Loda, 1978). Domestic violence is recognised as a risk factor (McGuigan & Pratt, 2001; Rumm, Cummings, Krauss, Bell, & Rivara, 2000), both through an increased risk of violence towards the children, and through the emotional impact of growing up in a household in which violent behaviour is accepted.

Child characteristics

A number of child characteristics have been previously been shown to be associated with risk of maltreatment. Prematurity or low birthweight is frequently reported, although empirical evidence to support this is limited (e.g., Browne & Saqi, 1988; Creighton, 1985; Friedrich & Boriskin, 1976), and other researchers have not found any link (e.g., Brown, Cohen, Johnson, & Salzinger, 1998; Leventhal, Egerter, & Murphy, 1984). Other reported factors in the child include health, behaviour or developmental problems, and disability (Friedrich & Boriskin, 1976; Frodi 1981; Goldson, 1998; Sullivan & Knutson, 2000), although findings are again mixed (e.g., Pears & Capaldi, 2001; Smith & Adler, 1991). These factors may represent real differences between abused children and their non-abused peers, or may be a reflection of differing parental perceptions of their child, as suggested by research showing that children born from unwanted pregnancies may be at greater risk (Altemeier, O'Connor, Vietze, Sandler, & Sherrod, 1984; Zuravin, 1991).

However, in spite of a seemingly large number of studies, research into child abuse is fraught with methodological and ethical issues (Leventhal, 1982), so although widely quoted, these risk factors have largely been identified through retrospective data.

There are few studies based on theoretical models that can “organize risk factors and distinguish distal from proximal, causal from marker, mediator from moderator from direct effect, and strong from weak” (Heyman & Slep, 2001). There remains, therefore, a pressing need for systematic, empirical research based on robust multivariate designs (Korbin, 1991; Neugebauer, 2000; Plotkin, Azar, Twentyman, & Perri, 1981)

By utilising the resource of the Avon Longitudinal Study of Parents and Children (Golding & ALSPAC Study Team, 2001; Golding J., Pembrey M., Jones R., ALSPAC Study Team, 2001), this research is able to address many of those aspects. The study aims to analyse the multiple factors affecting risk of abuse in young children within a comprehensive theoretical framework. Data on the environment and health of a large cohort of children have been collected at regular intervals from early antenatal booking and throughout childhood. Previous papers from this study have identified risk factors for child abuse within each of the levels of the ecological model used. The current paper expands on this work, combining all identified risk factors within a single analytical framework that distinguishes distal from proximal factors and emphasizes the strength of effects.

Methods

Setting

The Avon Longitudinal Study of Parents and Children (ALSPAC) is a large study following a cohort of children born to mothers resident in Avon, UK with expected dates of delivery between 1.4.91 and 31.12.92. The ALSPAC study area has a population of approximately one million and includes the city of Bristol (population 500,000), a mixture of inner city deprivation (7% of Avon children live in poor urban areas), rural areas (15%), suburbs and moderate sized towns. Children living in Avon have similar proportions to the rest of Britain of single parents (4.0% Avon, 5.0% Britain), and non-Caucasian parents (5.1% v 6.4%). They are less likely to have a father in a manual occupation (51.6% v 65.1%).

Study population

All pregnant mothers resident in the Avon area during the enrollment period were invited to participate. In total, 14,893 mothers enrolled, representing an estimated 85-90% of the eligible population. Allowing for fetal or early infancy loss and attrition, a total of 14,256 children were followed up beyond infancy. To prevent any bias being introduced by repeated data, second and subsequent children in a multiple pregnancy were excluded from the analysis.

Participation in the study was entirely voluntary. Enrollment was primarily through midwives, backed up by considerable local publicity, and direct contact of non-enrolled mothers. The issue of confidentiality and the voluntary nature of the study were stressed to mothers at enrollment, and their participation taken as signifying consent. Strict measures were taken to ensure confidentiality.

Children resident in the Avon area who had been investigated or registered for maltreatment were identified through social services. Those in the study were matched with the cohort data, and details entered into the database in such a way that this information could not be traced back to individual children. Since the mothers had not been asked for consent to search the social services records, these records were not examined for details of the abuse (nature, severity, alleged perpetrator etc.), but only that information which was already available to health professionals was obtained. Ethical approval for the study was obtained from the ALSPAC ethics committee and through them from each of the local hospital ethics committees. Approval to use the child protection register data was obtained from the custodians of the registers and the Area Child Protection Committees.

Data collection: criterion variables

In the UK, following referrals of suspected maltreatment a social services investigation leads to a multi-agency case conference at which, if there is evidence of significant harm or risk of harm to the child, the child is placed on a child protection register under one of four categories: physical abuse, sexual abuse, emotional abuse, or neglect (Department of Health, 1999). For the purposes of this study, investigation for suspected maltreatment and registration on the child protection register were taken as the outcome variables.

The local Social Services child protection registers were screened for any children with birth dates in the cohort range who had been investigated for possible child abuse or neglect, or had been placed on the child protection register during the period 1.1.91 - 31.12.98. Full data were therefore obtained on all children to the age of 6.

Data collection: predictor variables

Data collected during pregnancy and the child's first three years have been used to explore the early childhood environment. Factors within the parental background, the socio-economic environment, the family structure and the children themselves have been used in this analysis (Appendix 1).

Parental background

A series of antenatal questionnaires covered features in the parents' past medical, social and environmental history, including parental age at the birth of the study child, highest educational qualification, history of childhood abuse and any psychiatric illness prior to pregnancy.

Socio-economic environment

Four variables were used as indicators of material deprivation: paternal unemployment, overcrowding, car ownership, and housing tenure. These have previously been used to construct a deprivation score for use at a ward level (Townsend, 1987) and at an individual level can indicate different aspects of deprivation: housing tenure as a marker of long-term wealth; overcrowding to reflect living standards; car ownership as a marker of disposable income; and paternal employment reflecting financial security. In addition, mothers were asked about their employment over the child's first three years; and the quality of their social network.

Family environment

Family size, birth order and marital status were determined during pregnancy. Data on domestic violence and the presence of a step-parent or step-siblings in the home were obtained from antenatal and postnatal questionnaires.

Child characteristics

Direct obstetric data were obtained providing gender and birthweight for each child. Qualities of temperament at 4 weeks were assessed using a series of questions relating to specific behaviour traits devised for the study (Golding & ALSPAC Study Team, 2001). In addition, in the first antenatal questionnaire, mothers were asked whether the pregnancy was intended.

Analysis

A staged approach to analysis was taken. First descriptive data were produced on the patterns of child abuse, including the ages at which it occurs and the separate categories. These data have been previously reported (Sidebotham & ALSPAC study team, 2000). Second, logistic regression equations were used to identify risk factors within each of the levels of the ecological model, using registration on the child protection register as a single outcome. Results from these separate analyses have been previously reported (Sidebotham, Golding & ALSPAC study team, 2001; Sidebotham, Heron, Golding, & ALSPAC study team, 2002; Sidebotham, Heron & ALSPAC study team, 2003). In the current paper, the separate analyses have been combined in an overall logistic regression model with outcomes of investigation for suspected abuse or neglect and registration for abuse or neglect. Logistic regression is a statistical tool that enables calculation of the relative contributions (odds ratios) of a number of antecedent (predictor) variables to the overall risk of a specified outcome (criterion variable).

A theoretical model of parent-child interaction was developed (Figure 1). The analysis proceeded in a stepwise fashion, starting with the parent's background, then working inwards from the exosystem, or socio-economic factors, to the more proximal factors in the child and his/her immediate family and home environment (microsystem). The outer layer of the model, the macrosystem, represents cultural factors in our society that contribute to an environment within which children may be abused. This level of the model lent itself more readily to qualitative methodology rather than the statistical techniques used in the rest of the study and has been reported separately (Sidebotham & ALSPAC Study Team, 2001).

The analysis used has followed an hierarchical approach as described by Victora, Huttly, Fuchs, and Olinto (1997). In this approach, the factors used are based on a conceptual framework as described above, and not simply the statistical effects of a single large model. Table 1 and Figure 2 describe the steps taken. Step one assessed the overall impact of background parental variables, including age, education, psychiatric history and childhood abuse. Step two assessed the effect of socio-economic variables after controlling for parental background factors. Step three added the effects of the family structure and function and the final step analysed the impact of child factors after controlling for all the more distal factors.

Given the large overall dataset and the fact that a number of parents, particularly among the registered group did not respond to all the questionnaires, listwise deletion of all cases with some missing data was not thought practical in this model. The method employed here was to include missing cases as a separate category in each explanatory variable – known as the missing indicator method (Little & Rubin, 1987). For our regression model we used odds ratios for both the categories of interest and the missing category but we only consider there to be a significant effect if there is evidence of differences between the non-missing groups. The sample size is restricted to cases for which we have at least one of the explanatory variables.

In any extensive epidemiological study of this nature, there is a need to balance the large quantity of data available with the increasing complexity of statistical models. If too many variables are included, there is a danger of the data becoming less robust, and of potential errors being introduced (Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996). For this reason, we limited the predictor variables to a small number for each level of the ecological model used and to those variables for which we had robust data with a minimal number of missing cases.

Results

Out of the total 14,256 children in the ALSPAC study, 293 (2.1%) were investigated by social services for suspicion of abuse before their sixth birthday. Of these, 115 were placed on the child protection register (44% of those investigated; 0.8% of the total cohort). The age at registration is given in Table 2. The pattern of registration has been previously reported with 31.7% of registrations being for physical injury,

10.9% for sexual abuse, 25.1% for emotional abuse, 29.0% for neglect and 3.3% for other reasons (Sidebotham & ALSPAC study team, 2000).

The overall study characteristics of children in the cohort and in each of the outcome groups (registered; investigated but not registered; neither investigated nor registered) are given in Table 3. For each of the variables studied, there were significant differences between the groups on univariate analysis (Chi square).

Results of the hierarchical regression are shown in Tables 4-5 and Figure 3 and are outlined below. In each of these tables, the figures in bold indicate the most appropriate odds ratios to consider for those variables according to the stepwise model.

Step 1: parental background

Young parents, those with low educational achievement, and those with a past psychiatric history are all more likely to have children on the child protection register, with risks varying from over 2 to nearly 5 times that of the baseline population. Young parents account for just over 30% of the investigated and registered groups, compared to just 8% of the overall cohort (Table 3). This represents an adjusted odds ratio of 3.41 (Table 4) or a 3-fold increase in risk of maltreatment. However, the absolute risk remains low, with only 3.6% of young parents having a child on the child protection register. A similar finding is found with respect to parental education, with a low educational achievement presenting close to a five-fold increase in risk. A previous history of psychiatric disorder increases the risk of maltreatment with an odds ratio of 2.82. Parents with a history of abuse in their childhood have nearly twice the risk of having a registered child, although again the absolute risk is low with only 1.2% of abused parents going on to maltreat their children. All the variables entered in step one show some modification of the odds ratios once other factors in that level are taken into account, but all remain significant factors in their own right.

Step 2: socio-economic environment

The highest risks are found with the indicators of deprivation, with an adjusted odds ratio of 11.02 for those families with at least one indicator of deprivation. There is a

substantial drop in the odds ratio for these deprivation factors once entered into step 2, suggesting that a large part of the impact of poverty is consequent upon the effects of parental background. Maternal employment seems to reduce the risk, but this loses its significance once other social and parental factors are taken into account. A poor social network increases the risk of registration nearly 2-fold. There is a drop in the odds ratios for parental background factors in step 2, suggesting that these are in part mediated through their impact on the socio-economic environment. Most notably, the impact of a parental history of childhood abuse loses its significance in step 2.

Step 3: family environment

Family size shows just a marginal effect: while children from large families appear to be more at risk (unadjusted odds ratio 3.10), this loses its significance once other factors are controlled for. Single parent status and reordered families both increase the risk of registration more than twice (odds ratios 2.64 and 2.58 respectively). With both of these factors, but particularly single parent status, there is a substantial drop when the variables are entered into step 3, compared with the unadjusted odds ratios. This implies that, while important, the effects of family structure are modified by the confounding roles of parental background and socio-economic environment. Once again the absolute risk is low, with just 3.5% of all single mothers having children registered for child abuse or neglect. Reported domestic violence was associated with a higher risk of registration (unadjusted odds ratio 3.11); however, this again did not remain significant after adjusting for higher order variables.

There is very little change in the odds ratios for parental background and socio-economic factors between steps 2 and 3, and all the previously significant variables remain significant. This implies that these more distal factors are not primarily mediated through effects on the family structure.

Step 4: child characteristics

Whether the pregnancy was intended or not does not have an impact on risk of registration once other factors are controlled for. Children who were low birth weight are at higher risk, even after controlling for other background factors, with an adjusted odds ratio of 2.23. Parents who reported few positive attributes of their child were

more likely to have their child placed on the register. These child variables have very little impact on the higher order variables entered in previous steps.

Investigation and Registration

Comparing those children registered with those who were investigated but not registered, the odds ratios for investigation alone (Table 5, Figure 3) are mostly either similar to or lower than those for registration. However, for all variables the confidence intervals overlap suggesting that these differences are not significant. Again the strongest risk factors are those in the parental background and socio-economic levels. Young parents have a slightly higher odds ratio for investigation (3.98) than for registration (3.41), as do those parents with a childhood history of abuse (odds ratio 2.61 for investigation, 1.86 for registration). A childhood history of abuse remains significant in the later steps of the model for investigation. The indicators of deprivation, while proving very strong risk factors for registration (odds ratio 11.02) are much lower for investigation (odds ratio 3.24). Employed mothers are less likely to be investigated, a finding which remains significant after controlling for background factors. A poor social network carries very similar odds for both investigation and registration.

The pattern of odds ratios for the family and child variables is very similar comparing investigated to registered children, with the one exception that reordered families are no more likely to be investigated, once other background factors are accounted for (odds ratio 1.10). In contrast to registration, reporting few positive attributes of the child is not a risk factor for investigation (odds ratio 1.01), nor is being of low birthweight (odds ratio 1.53, not significant); however, children of unintended pregnancies are more likely to be investigated (odds ratio 1.52).

Discussion

Through a multivariate analysis of data in the parents' backgrounds, socio-demographic environment, and characteristics of the child and family, we have been able to explore risk factors for child maltreatment within a comprehensive ecological framework. The use of different outcome variables has enabled an exploration of factors affecting reporting of child maltreatment (leading to investigation) or registration (approximating to officially recognised or substantiated maltreatment).

Parental Background

Four key factors come out as significant in relation to the parents: age, education, a psychiatric history, and adverse features of the parent's own childhood. The children of young parents and those with poor academic achievements are at greater risk of maltreatment with 3- and 5-fold increases in risk respectively. These findings are in keeping with much other research in the field (Brown, Cohen, Johnson, & Salzinger, 1998; Buchholz & Korn-Bursztyn, 1993; Connelly & Straus, 1992; Egeland & Brunnuquell, 1979; Kinard & Klerman, 1980; Kotch et al., 1995; Kotch, Browne, Dufort, Winsor, & Catellier, 1999; Leventhal, Egerter, & Murphy, 1984, Lynch & Roberts, 1977; Smith & Adler, 1991). There is a drop in the odds ratios in step 2, suggesting that to some extent, these factors are mediated through the socio-economic environment of these families, however, this does not account for the entire picture and there must be other factors through which young and poorly educated parents are a higher risk. In studies of this kind, there is a risk of referral bias influencing the results, for example through lower thresholds of referral for young or poorly educated parents. For young parents in our study, odds ratios for investigation and registration were similar, indicating that these parents are genuinely perceived to be at higher risk. In relation to education, odds ratios were higher for registration, suggesting that educational level is more of a factor in the decision to register rather than the decision to refer in the first place.

Parents with a psychiatric history are at greater risk of both investigation and registration. Again, this is in keeping with much of the literature (Brayden, Altemeier, Tucker, Dietrich, & Vietze, 1992; Chaffin, Kelleher, & Hollenberg, 1996; Fergusson, Lynskey, & Horwood, 1996; Hawton, Roberts, & Goodwin, 1985; Kotch et al., 1997; Lynch & Roberts, 1977; Oliver, 1985; Taylor et al., 1991). There is a slight drop in the odds ratio in step 2, but little change in the subsequent steps, suggesting that the impact is largely mediated through other pathways. For the purposes of this study, only a psychiatric history prior to pregnancy was considered, and it is likely that contemporary psychiatric problems are likely to have an even greater effect. Nevertheless, the effect size is substantial with a more than 2 fold increase in risk. Thus the presence of psychiatric problems preceding pregnancy may

set in place patterns of behaviour that influence subsequent parenting, or may be a marker of other deeper issues that influence both parenting and overall mental health.

The findings are similar for those parents with a history of childhood abuse, with increased risks of both investigation and registration, although interestingly the odds ratios are higher for investigation. This cannot be due to ascertainment or referral bias, since any professional knowledge of the background history is only likely to come out in later assessment, suggesting that the increased risk is genuine. It does support previous findings in relation to a cycle of maltreatment (Buchanan, 1996; Egeland, 1993; Kaufman & Zigler, 1989; Langeland & Dijkstra, 1995; Oliver, 1993) but the overall effect is modest (odds ratio 1.86) in comparison to other factors in this model. There is a drop in the odds ratio in step 1 and further reductions in steps 2 and 3 to the extent that this no longer remains a significant variable in these later steps. This implies that, to a large extent, the impact of a childhood history of abuse is mediated through its effects on age at parenting, educational achievement, a psychiatric history, and the influences of poverty.

A recent study by Pears and Capaldi (2001) used a similar hierarchical approach to explore the pathways between a childhood history of abuse and abusive parenting. They hypothesized that intergenerational transmission of abuse would be mediated through effects on early childbearing, parental psychopathology and inconsistent discipline, but that the whole would be moderated by the contextual factors of parental socio-economic status. In contrast to our findings, Pears and Capaldi found that socio-economic status (based on income, parental education and employment) significantly predicted abusive parenting, but that this lost its significance once the other factors were entered into the model and the strength of effect for SES was much lower than that of a childhood history of abuse. They also found that the transmission of abuse was not mediated through early childbearing, parental psychopathology or consistency of discipline. Some important methodological differences may explain some of the discrepancy in outcomes. First, the Pears and Capaldi study used adolescent report of their parents' abusive behaviour as the outcome, compared to our use of officially recognised maltreatment during the first 6 years of life, thus their study was less subject to potential reporting and ascertainment bias. Second, their measure of abuse focused almost entirely on physical abuse, whereas ours

incorporated neglect, emotional abuse and sexual abuse. Thirdly, their model conceived SES as a confounding rather than a mediating factor. Clearly the interaction between parental background factors and socio-economic status is a complex one and difficult to capture in any meaningful statistical analysis. The pathways by which maltreatment is transmitted from one generation to another are similarly complex, and while they may, as in our study, be partly mediated through effects on early childbearing, parental psychopathology and socio-economic status, this does not explain the entire picture. In another well-designed study, Egeland and Susman-Stillman (1996) showed differences between parents who continued a cycle of abuse and those who broke the cycle in the dissociative symptoms experienced (idealization, inconsistency and escapism) and in factors such as their use of alcohol and drugs and suicide attempts. It is conceivable that such dissociative symptoms could influence structural factors such as age at parenting, employment and social networks, thus the findings in our study, while focusing on more structural factors would be consistent with the concept of dissociation as a mediator in the cycle of maltreatment.

Socio-economic environment

The relationship between poverty and child abuse has been pointed out previously (Pelton, 1981). In our study, the indicators of poverty come out as the strongest risk factor both for investigation and registration. Again there is a risk of referral bias, but the much higher odds ratio in relation to registration (11.02 compared to 3.24 for children investigated but not registered) would suggest that this is more a factor in the decision to register a child. While the risks associated with poverty remain very high, controlling for parental background factors reduces the odds ratio considerably. Furthermore, as detailed above, adding socio-economic factors into the model does moderate the strength of effect of parental background factors. Thus one can postulate a cycle of deprivation whereby young and poorly educated parents, typically from backgrounds of poverty, are more likely to be living in poverty. Children growing up in these situations are more vulnerable to maltreatment. There is a modest drop in the odds ratio (to 8.15) when family factors are entered into the model, indicating that part of the effect of social factors is mediated through their impact on family structures and function. However, there are clearly other pathways through which socio-economic status is associated with maltreatment risk.

Maternal employment exerts a slight protective effect in relation to investigation (odds ratio 0.52), though this trend is not significant for registration. A number of factors could be associated with this effect, including the economic benefit of employment, the impact on maternal stress and self esteem, increased social networks gained through work and direct effects on the mother-child relationship. This is an area in which more research is required (Erllich, 1996).

One possible mediating factor on risk of maltreatment is the social support available to parents (Coohey, 1996). Mothers with a poor social network have approximately double the risk of maltreatment compared to other mothers. Again, the odds ratio controlling for parental background factors is much lower than the unadjusted risk, and overall is only a modest risk suggesting that it is the parents with high-risk backgrounds who have poorer social networks, and that this may be one mechanism through which the risk is mediated.

Family environment

This study, like many previously, has emphasised the importance of family stability in relation to maltreatment (e.g., Brown, Cohen, Johnson, & Salzinger, 1998; Coohey, 1995; Egeland & Brunquell, 1979; Finkelhor, Hotaling, Lewis, & Smith, 1990; Hunter, Kilstrom, Kraybill, & Loda 1978; Smith, Hanson, & Noble, 1974). Although in our study the majority of mothers in both groups had a partner at enrollment, those who were single were more likely to have a registered child. In the unadjusted, bivariate analyses, single parent status was, in fact, the largest risk factor after the deprivation indices (odds ratio 7.69). Seagull (1987), in a helpful review of social support and maltreatment, has explored some of the reasons why children of single parents are at greater risk of maltreatment. First there are the financial stresses of being a single parent, and a recognised socio-economic gradient in single parenthood. Second, there are stresses due to isolation and a lack of social support. Finally, in some, the single parent status might be an indicator of other underlying problems with inadequate personal functioning. In our study, once adjustment was made for the confounding effects of parental background and socio-economic status, the risk associated with being a single parent was less marked (odds ratio 2.64). It would seem likely, therefore, that all the pathways outlined above play a part.

Divorce and separation have previously been shown to affect the risk of maltreatment (Fergusson, Lynskey, & Horwood, 1996; Hunter, Kilstrom, Kraybill, & Loda 1978). In our study, children living in reordered families were more at risk of maltreatment (odds ratio 2.58) although there was no association with those children investigated but not registered. Again this risk may operate through a number of different pathways. The presence of other family members, either temporarily or long term brings new dynamics into the family with new relationships between the various family members, both existing and new. Risks of maltreatment may be related to underlying disruptions in the family relationships, or to the presence of a step-father in the family (Radhadkrishna, Bou-Saada, Hunter, Catellier, & Kotch, 2001).

In contrast to other studies (Altemeier, O'Connor, Vietze, Sandler, & Sherrod, 1984; Brayden, Altemeier, Tucker, Dietrich, & Vietze, 1992; Brown, Cohen, Johnson, & Salzinger, 1998; Kotch, Browne, Dufort, Winsor, & Catellier, 1999; Zuravin, 1991) which have shown increased risks in larger families, in our study, family size at the birth of the index child was not a significant factor in relation to investigation or registration once accounting for the confounding effects of parental background and socio-economic environment.

In keeping with other studies (McGuigan & Pratt, 2001; Tajima, 2000), reported domestic violence shows a clear association with child maltreatment as shown in the unadjusted odds ratio (3.11). The relationship did not persist, however, once entered into the logistic regression model. This may suggest that domestic violence and child maltreatment both bear a similar relationship to family structures and other background factors, and domestic violence should be seen as much as an adverse outcome as a risk in itself. While not denying the importance of the association between domestic violence and child maltreatment, this may be a reflection of common underlying risk factors for both, rather than a direct causal relationship. Such a finding is in keeping with those of Tajima (2000) who found that while wife abuse was a consistently significant risk factor for violence against children, other parent, child and family characteristics were more important predictors.

Child characteristics

In looking at the children themselves, these analyses suggest that children who are subsequently maltreated differ from other children in respect of their birthweight and in the way they are perceived by their mothers. These risks remain even after controlling for other more distal factors with effect sizes around a two-fold increase. Other studies have shown an association between prematurity or low birth weight and maltreatment (e.g., Browne & Saqi, 1988; Creighton, 1985), although this is not universal (Brown, Cohen, Johnson, & Salzinger, 1998; Leventhal, Egerter, & Murphy, 1984). A number of factors may underlie this association, including effects on child behaviour, parent-child bonding, and potential increased stresses. Once again though, the association may reflect other underlying factors affecting both birthweight and the risk of maltreatment. Parents in the maltreatment group in our study tended to report fewer positive attributes of their baby at 4 weeks. At this stage, most mothers speak very warmly of their babies, so a tendency not to do so may reflect difficulties in bonding with the baby that lead to subsequent maltreatment. However, even amongst the registered group, two thirds of mothers reported over 4 (out of a total of 7) positive attributes of their child. Thus, while parental perceptions of their child are important and may be a marker of underlying concerns, these are by no means deterministic of subsequent maltreatment.

Strengths and limitations

This study is one of just a very few prospective studies that have used multivariate techniques to study the complexity of risk factors for child maltreatment across several domains. The large cohort size and the range of data collected have enabled us to overcome many of the difficulties faced by smaller samples. Nevertheless, ascertaining and defining cases remains a problem, and even with these data, we will certainly not have captured all cases of maltreatment in the population. In spite of the large sample size, we have not been able to differentiate risks for different types of maltreatment. This is an important limitation as there may well be different risks associated with different types of maltreatment (Brown, Cohen, Johnson, & Salzinger, 1998; Finkelhor, 1994; Fleming, Mullen, & Bammer, 1997; Leventhal, 1998). Nevertheless, there are valid reasons for studying combined categories of maltreatment as an outcome. As Dong et al. (2004) have shown, there are overlaps between the different types of maltreatment, which often co-occur. Moreover, all forms of maltreatment are known to have adverse effects on children, and from the

perspectives of both recognition and prevention, it may be unrealistic and counterproductive to divide out separate risks for different forms of maltreatment.

A further limitation is that we have focused on static outcome variables of investigation or registration up to age 6. We have not been able to explore the dynamic changes that may be associated with differing ages or developmental stages of the children, recognizing that parent-child interaction is a dynamic rather than a static process. Within this study we have incorporated findings from mother's partners, another well recognized gap in maltreatment research (Haskett, Marziano, & Dover, 1996). However questionnaire responses from partners were considerably lower than those for the mothers, and for both mothers and their partners, responses from the registered group were lower than for the cohort as a whole.

In spite of the wide range of data collected, the constraints of multivariable analysis have meant that we have not been able to include all factors that may be of relevance (Katz, 1999; Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996). We recognize that others may choose different conceptual approaches to modeling. Nevertheless, this study represents an initial attempt at such modeling that has yielded valuable empirical data on the strengths associated with different risks.

The results from this study are in keeping with the few other studies that have used robust longitudinal designs to explore risk factors (Brown, Cohen, Johnson, & Salzinger, 1998; Chaffin et al., 1996; Egeland & Brunquell, 1979; Kotch et al., 1995, 1997). All of these studies have concluded that a range of factors in different domains of the ecological model are important; however, it is also clear that not all factors carry the same weight. The strongest risks are from socio-economic deprivation, and from factors in the parents' own background rather than the more proximal factors within the child and the family structures. In interpreting these results, it is important to recognize that our study has explored relative risks, and that the absolute risks associated with each of the identified factors remains very low; and that we have not attempted to show causation, but rather correlations between risks and the outcome of maltreatment.

Conclusions

In the assessment and management of child abuse, practitioners in all agencies are being encouraged to take a broad view of the child and the environment within which they are growing (Department of Health, 2000; Department for Education and Skills, 2004). This research provides empirical material to inform such an approach. By combining factors within a comprehensive ecological framework we have demonstrated that the strongest risks are from socio-economic deprivation and from factors in the parents' own background and that parental background factors are largely, but not entirely, mediated through their impact on socio-economic factors. Health and social care professionals in a variety of settings can draw on this information to enhance training, policies and practice. At a policy level, community wide preventive strategies need to acknowledge the importance of material disadvantage and the interplay between socio-demographic factors and social interactions at the family and community level. Recognising the wider environmental and family contexts within which children are growing could lead to more effective preventive work to protect vulnerable children, and the delivery of appropriately targeted services for children in need.

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**Table 1 Summary of the steps in the hierarchical analysis of the data
(based on Victora, Huttly, Fuchs & Olinto, 1997)**

Step	Equation (variables entered)	Interpretation
1	Parental background (Ontogenic development)	Overall effect of parents background, not adjusted for mediating variables.
2	Parental background + Exosystem (sociodemographic variables)	Effect of sociodemographic variables adjusted for confounding role of parental background. Effect of parental background represents that not mediated through sociodemographic variables
3	Parental background + Exosystem + Microsystem (family variables)	Effect of family structure and function adjusted for confounding roles of parental background and sociodemographic variables. Effect of sociodemographic variables represents that not mediated through family structures. Effect of parental background represents that not mediated through sociodemographic or family variables
4	Parental background + Exosystem + Microsystem + Child factors	Effect of child factors adjusted for confounding roles of parental background, sociodemographic and family variables Effect of family structure represents that not mediated through child factors Effect of sociodemographic variables represents that not mediated through family structures or child factors Effect of parental background represents that not mediated through sociodemographic, family or child variables.

Table 2 **Numbers of registrations according to age group**

Age at First Registration	Number of Children registered	Rate per 10,000
Prenatal	8	5.6
0 - <12 months	27	18.9
12 - <24 months	20	14.0
24 - <36 months	13	9.1
36 - <48 months	13	9.1
48 - < 60 months	17	11.9
60 - < 72 months	17	11.9
Total	115	97.5

Table 3 **Characteristics of the cohort**

Characteristic	Registered n = 115¹	Investigated, not registered N = 178	Neither investigated nor registered n = 13,963²	Significance (p value)
Parental Ontogenic Background				
Young parent (<20)	34.8%	32.0%	7.3%	< 0.001
Low educational achievement	78.8%	58.7%	35.6%	< 0.001
Psychiatric history	43.8%	40.3%	16.4%	< 0.001
History of childhood abuse (any)	32.5%	39.1%	16.6%	< 0.001
Exosystem (socio-demographic) variables				
Any indicator of poverty	91.2%	82.0%	39.8%	< 0.001
Mother employed	32.7%	36%	52.6%	< 0.001
Poor social network	50.8%	47.0%	20.2%	< 0.001
Microsystem (family) variables				
High parity	16.9%	11.7%	6.1%	< 0.001
Single mother	16.9%	11.9%	2.5%	< 0.001
Reported domestic violence	27.4%	23.6%	10.7%	< 0.001
Reordered family	32.4%	16.2%	8.8%	< 0.001
Child variables				
Unintended pregnancy	61.0%	56.2%	30.2%	< 0.001
Low birthweight	14.0%	9.6%	5.0%	< 0.001
Few positive attributes reported	33.3%	17.9%	15.5%	< 0.001

¹ Responses ranged from 47.8% to 70.0%, with complete data on parental age and birthweight

² Responses to specific questions ranged from 82.6% to 99.7% for the overall cohort, with complete data on parental age. The denominator for each question therefore varies. Percentages are calculated on the basis of completed questions.

Table 4 Hierarchical Regression¹: Children registered for maltreatment

Variable		Unadjusted Odds ratio [95% CI]	Step 1	Step 2	Step 3	Step 4
Parental Ontogenic Background						
Young parent (<20)		6.44 [4.36, 9.49]	3.41 [2.28, 5.09]	2.46 [1.65, 3.68]	2.46 [1.62, 3.74]	2.36 [1.54, 3.61]
Low parental educational achievement	Yes	6.65 [3.68, 12.01]	4.96 [2.72, 9.03]	2.98 [1.62, 5.47]	2.87 [1.56, 5.27]	2.92 [1.59, 5.39]
	Missing	13.92 [7.67, 25.26]	8.54 [3.77, 19.36]	3.53 [1.54, 8.10]		
Parental Psychiatric history	Yes	3.89 [2.37, 6.39]	2.82 [1.69, 4.72]	2.20 [1.31, 3.70]	2.02 [1.19, 3.43]	2.11 [1.24, 3.58]
	Missing	7.26 [4.72, 11.15]	3.45 [1.98, 6.00]	1.13 [0.41, 3.11]	1.11 [0.40, 3.13]	1.06 [0.37, 2.99]
Parental history of childhood abuse	Yes	2.38 [1.47, 3.85]	1.86 [1.13, 3.06]	1.65 [0.99, 2.74]	1.45 [0.86, 2.43]	1.47 [0.88, 2.48]
	Missing	5.03 [3.30, 7.66]	0.68 [0.33, 1.42]	0.47 [0.22, 1.03]	0.53 [0.22, 1.26]	0.55 [0.23, 1.32]
Exosystem (socio-demographic) variables						
Poverty: any indicators of deprivation	Any indicator	28.24 [8.84, 90.22]		11.02 [3.36, 36.11]		
	Missing	67.47 [21.08, 215.89]		19.51 [5.53, 68.87]	8.25 [2.49, 27.32]	7.66 [2.31, 25.42]
Mother employed	Yes	0.29 [0.16, 0.50]		0.62 [0.35, 1.11]	0.68 [0.38, 1.22]	0.71 [0.40, 1.29]
	Missing	2.90 [1.92, 4.38]		1.41 [0.84, 2.39]	1.76 [1.01, 3.07]	1.73 [0.98, 3.07]
Poor social network	Yes	4.01 [2.40, 6.69]		1.90 [1.12, 3.22]	1.82 [1.07, 3.09]	1.78 [1.04, 3.04]

¹ In interpreting the odds ratios, the figures in bold represent those odds ratios considered most appropriate for the variable in question according to the hierarchical model. These figures take account of the confounding influence of higher order (more distal) variables, but not the lower order (more proximal) variables.

	Missing	7.69 [4.90, 12.07]		2.16 [0.80, 5.80]	2.03 [0.75, 5.50]	2.06 [0.76, 5.62]
Microsystem (family) variables						
Large family	3+ older children	3.10 [1.70, 5.66]			1.59 [0.83, 3.05]	1.48 [0.76, 2.85]
	Missing	4.30 [2.87, 6.45]			1.08 [0.53, 2.18]	0.80 [0.26, 2.49]
Single mother	Yes	7.69 [4.09, 14.44]			2.64 [1.36, 5.12]	2.34 [1.19, 4.61]
	Missing	6.52 [4.40, 9.68]			3.10 [0.91, 10.54]	2.72 [0.80, 9.25]
Reordered family	Yes	4.92 [3.01, 8.04]			2.58 [1.52, 4.37]	2.56 [1.51, 4.34]
	Missing	6.86 [4.52, 10.40]			0.54 [0.15, 1.91]	0.60 [0.17, 2.15]
Domestic violence	Yes	3.11 [1.92, 5.03]			1.60 [0.96, 2.68]	1.60 [0.95, 2.69]
	Missing	5.49 [3.54, 8.49]			0.90 [0.42, 1.92]	0.89 [0.41, 1.94]
Child variables						
Unintended pregnancy	Yes	3.57 [2.25, 5.65]				1.48 [0.91, 2.41]
	Missing	7.49 [4.62, 12.12]				1.85 [0.54, 6.33]
Low birthweight	Yes	3.27 [1.94, 5.51]				2.23 [1.30, 3.84]
Few positive attributes reported	Yes	2.72 [1.63, 4.55]				1.93 [1.13, 3.31]
	Missing	4.97 [3.30, 7.48]				1.15 [0.64, 2.04]

Table 5 Hierarchical Regression: Children investigated for maltreatment but not registered

Variable		Unadjusted Odds ratio [95% CI]	Step 1	Step 2	Step 3	Step 4
Parental Ontogenic Background						
Young parent (<20)		5.95 [4.31, 8.20]	3.98 [2.84, 5.58]	2.83 [2.02, 3.97]	2.74 [1.92, 3.89]	2.57 [1.80, 3.67]
Low parental educational achievement	Yes	2.57 [1.79, 3.70]	1.95 [1.34, 2.83]	1.25 [0.85, 1.84]	1.25 [0.85, 1.85]	1.28 [0.87, 1.89]
	Missing	4.64 [3.16, 6.80]	3.20 [1.66, 6.16]	1.45 [0.75, 2.82]	1.40 [0.72, 2.74]	1.38 [0.70, 2.70]
Parental Psychiatric history	Yes	3.44 [2.40, 4.94]	2.44 [1.67, 3.56]	1.96 [1.33, 2.87]	1.92 [1.30, 2.83]	1.93 [1.31, 2.84]
	Missing	3.81 [2.68, 5.44]	1.81 [1.12, 2.93]	0.82 [0.35, 1.95]	0.82 [0.34, 1.98]	0.79 [0.33, 1.91]
Parental history of childhood abuse	Yes	3.23 [2.28, 4.60]	2.61 [1.81, 3.77]	2.36 [1.62, 3.42]	2.29 [1.57, 3.35]	2.32 [1.59, 3.39]
	Missing	3.91 [2.70, 5.65]	1.06 [0.53, 2.12]	1.04 [0.49, 2.21]	1.20 [0.54, 2.68]	1.19 [0.53, 2.65]
Exosystem (socio-demographic) variables						
Poverty: any indicators of deprivation	Any indicator	6.88 [4.33, 10.92]		3.24 [1.97, 5.32]	2.93 [1.76, 4.85]	2.72 [1.64, 4.53]
	Missing	9.61 [5.85, 15.78]		2.79 [1.42, 5.47]	2.14 [0.98, 4.67]	1.96 [0.89, 4.29]
Mother employed	Yes	0.33 [0.22, 0.49]		0.52 [0.34, 0.79]	0.54 [0.35, 0.83]	0.55 [0.36, 0.84]
	Missing	2.22 [1.59, 3.10]		1.80 [1.18, 2.74]	1.94 [1.26, 2.98]	1.86 [1.19, 2.91]
Poor social network	Yes	3.50 [2.42, 5.04]		1.93 [1.32, 2.83]	1.87 [1.27, 2.75]	1.89 [1.28, 2.77]
	Missing	4.00 [2.80, 5.71]		1.75 [0.78, 3.94]	1.66 [0.73, 3.74]	1.67 [0.74, 3.79]
Microsystem (family) variables						
High parity	3 plus	2.04 [1.21, 3.46]			1.38 [0.79, 2.42]	1.32 [0.75, 2.32]
	Missing	2.49 [1.74, 3.57]			0.80 [0.42, 1.52]	0.63 [0.23, 1.71]
Single mother	Yes	5.34 [3.13, 9.10]			2.21 [1.26, 3.87]	1.94 [1.10, 3.44]

	Missing	3.33 [2.35, 4.73]			1.89 [0.54, 6.66]	1.72 [0.49, 6.00]
Reordered family	Yes	2.00 [1.26, 3.17]			1.10 [0.67, 1.80]	1.10 [0.67, 1.80]
	Missing	3.15 [2.20, 4.50]			0.84 [0.23, 3.07]	0.88 [0.24, 3.19]
Domestic violence	Yes	2.58 [1.75, 3.81]			1.33 [0.88, 2.01]	1.31 [0.86, 1.98]
	Missing	3.41 [2.31, 5.04]			0.96 [0.48, 1.92]	0.91 [0.44, 1.85]
Child variables						
Unintended pregnancy	Yes	2.96 [2.11, 4.16]				1.52 [1.06, 2.19]
	Missing	4.12 [2.76, 6.16]				1.82 [0.62, 5.36]
Low birthweight	Yes	2.02 [1.22, 3.35]				1.53 [0.91, 2.57]
Few positive attributes reported	Yes	1.19 [0.74, 1.92]				1.01 [0.62, 1.65]
	Missing	2.89 [2.09, 3.99]				1.06 [0.67, 1.68]

Figure 1 An ecological model of child abuse

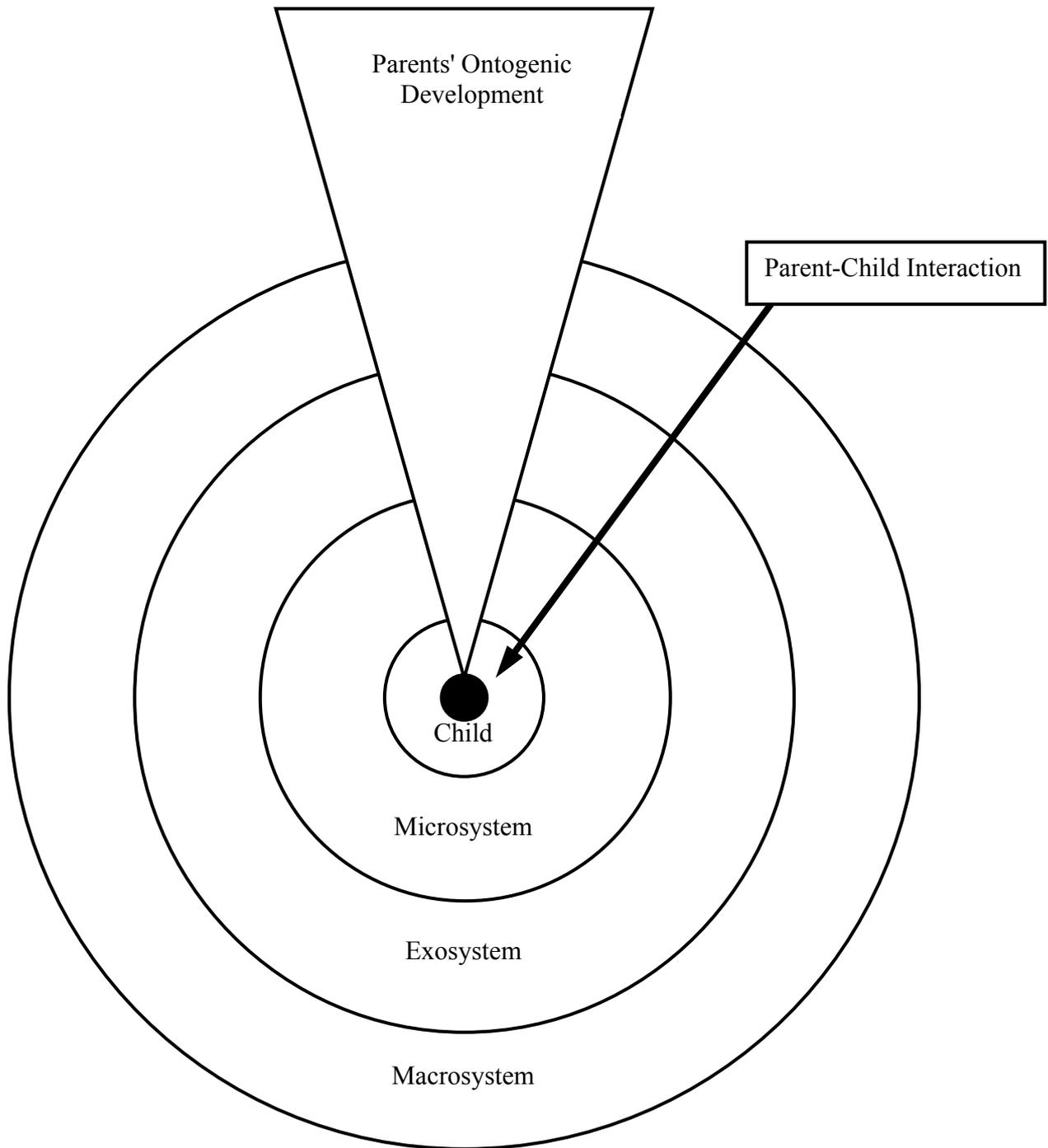


Figure 2 Causal Pathways for Child Abuse

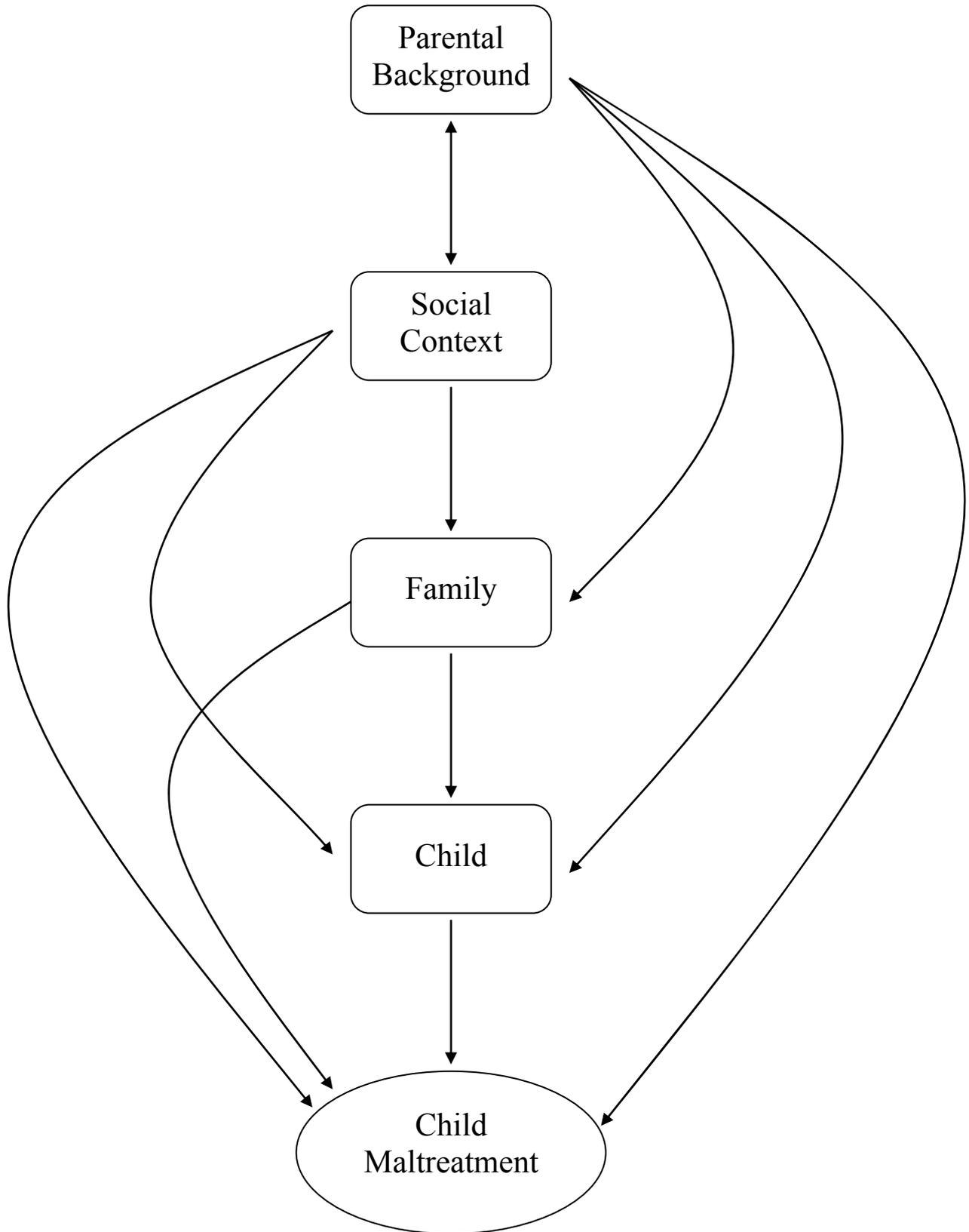
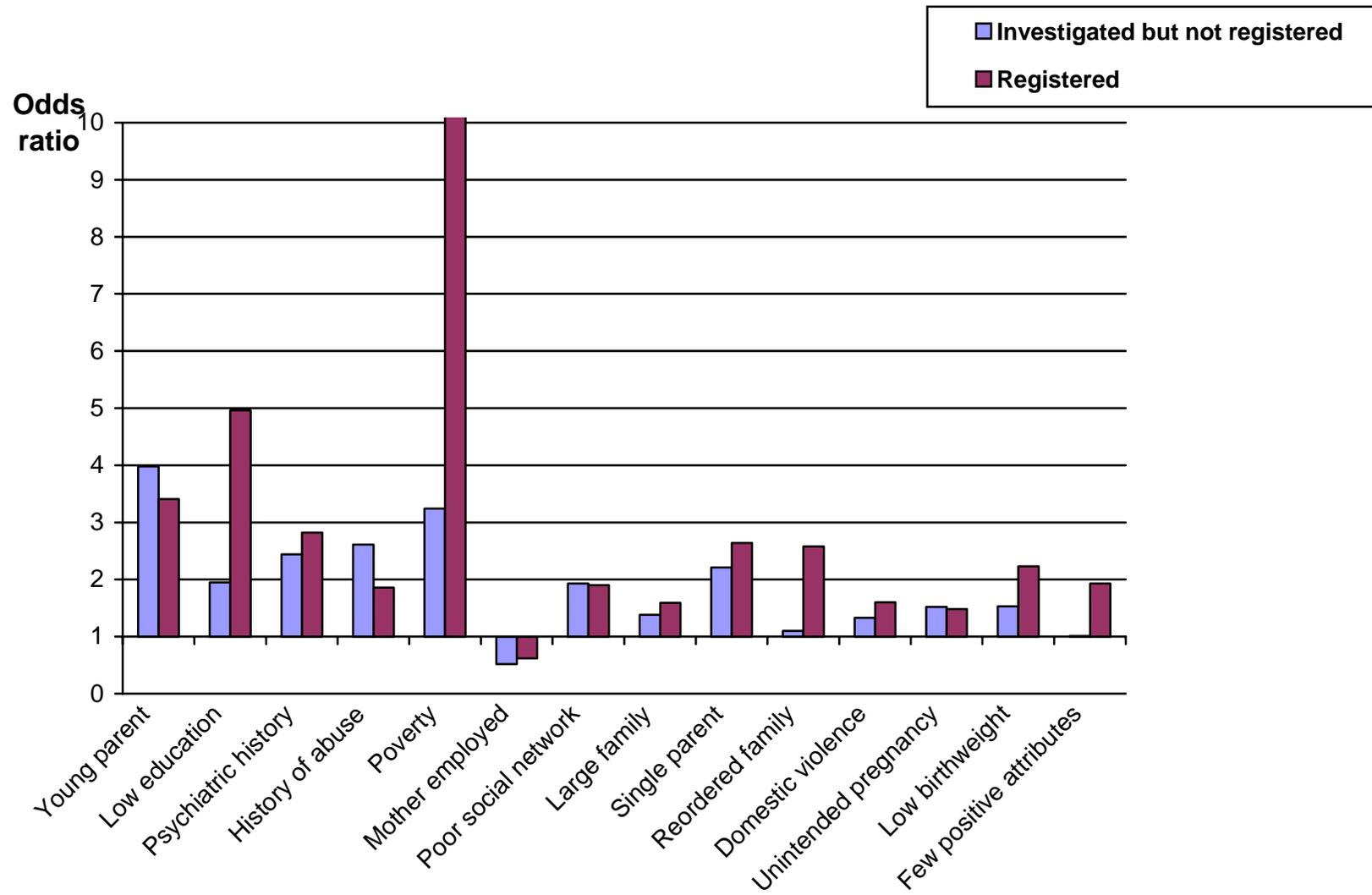


Figure 3 Adjusted odds ratios for investigated and registered children



Appendix 1 Variables studied: categories and sources of data

Variable	Categories	Notes
Parental age at delivery	≥ 20 years (Reference ¹) < 20 years	Obtained from the mothers at enrollment and confirmed by hospital records from delivery
Highest educational qualification	GCE O-level ² or higher (Reference) CSE/Vocational training	Parental questionnaires in pregnancy
Parental history of childhood abuse	No history of abuse (Reference) Any reported history of abuse	Antenatal questionnaires included a life events inventory specifically devised for the study using previous such inventories as a basis for selection of items (Golding & ALSPAC Study Team, 2001). This inventory incorporated a history of having been sexually abused, or experiencing physical or emotional cruelty from a parent.
Parental psychiatric history	No psychiatric history (Reference) Any psychiatric history	Antenatal questionnaires asking about any psychiatric history prior to the pregnancy, including depression, alcohol/substance abuse, and other psychiatric illness
Deprivation indices	No indicators of poverty (Reference) Poverty (1-2 indicators) Extreme poverty (3-4 indicators)	Based on questions in the initial antenatal questionnaire and at 8, 21, and 33 months. Indicators were: Housing tenure (council or rented accommodation)

¹ The reference category provides the baseline category against which risks are calculated

² General Certificate of Education O-levels were standard state exams taken at 16 years of age. Pupils at this age could opt to take the alternative Certificate of Secondary Education (CSE) exams the standard for which equated to the lower grades of the GCE O levels. School leavers at this age could undertake vocational training instead of the state exams. GCE A-levels are state exams taken at 18 years of age.

		Overcrowding (1 or more person per room) Paternal unemployment (at any stage) No access to a car
Maternal employment	No evidence of working (Ref) Returned to work	3 questions at 8, 21 and 33 months asked whether the mother had started work. Recorded as missing if no data available; recorded as returned to work if any return to work was reported; otherwise recorded as no evidence of working.
Social network score	Adequate social network (top 4 quintiles; Reference) Poor social network (lowest quintile)	A composite score developed for the study (Golding & ALSPAC Study Team, 2001), based on a series of questions asked in late pregnancy. Continuous variable, range 1-29, a higher score indicating a fuller social network. The lowest quintile was taken to indicate a poor social network.
Family size	0-2 older siblings (Reference) Large family (3 or more older siblings)	Antenatal assessment of parity
Partner status	Any partner (Reference) No partner	Antenatal questionnaire
Reordered family	Stable family (Reference) Any family reordering	Data on the presence of a step-parent or step-sibling in the home were collected from several questionnaires over the first three years and combined to give an indicator of reordered families.
Reported domestic violence	Any reported physical or emotional cruelty between parents	Questions embedded in life events inventory during pregnancy and at 8 weeks, 8 months and 21 months to mother and partner

Low birth weight	Birthweight \geq 2500g (Ref) Birthweight $<$ 2500g	Taken from obstetric records
Intended pregnancy	Pregnancy intended (Ref) Pregnancy not intended	Asked at 12 weeks gestation
Mother's report of child's characteristics	Child seen in positive light (5-7 positive characteristics reported) (Ref) Not seen in positive light (0-4 positive characteristics reported)	Number of positive characteristics reported by mother at 4 weeks out of a total possible 7 characteristics: placid, communicative, cuddly, active, sociable, alert, happy.