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CLS Cohort Studies
Working paper 2012/1

FEBRUARY 2012



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February 2012

First published in 2012 by the
Centre for Longitudinal Studies
Institute of Education, University of London
20 Bedford Way
London WC1H 0AL
www.cls.ioe.ac.uk

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ISBN 978-1-906929-37-4

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Abstract

This paper quantifies the prevalence of multiple risks for families with very young children in the UK, and their prevalence by ethnic groups. It also examines the associations of multiple risks to deficits in developmental outcomes at three and five years of age for children born in 2000 to 2001. The paper uses an ecological model of child development as a framework to map out risk factors, which are obtained from data from the Millennium Cohort Study. We find that out of the 10 risks, 28 per cent of families with young children across the UK in 2001 were facing two or more of these risks. This constitutes an estimated 192,000 young children (under one year old). For the first time, we also find the extent to which children in minority ethnic families faced multiple risks. Finally, in terms of the impact of risk factors on developmental outcomes, we found, from a bivariate analysis, the gap in conduct problems narrowed and the gap in peer problems widened between children living in families with multiple risks and those living in families with low risk from age three to age 5. We also find similar associations for children living in low income households.

Keywords: Multiple risks, child development, Millennium Cohort Study, UK

1. Introduction

It has long been recognised that there can be undesirable outcomes in later life for children who are exposed to adversity as they are growing up. Some of these risk factors are well charted although, as single specific risks factors, their effects on later outcomes have often been found to be modest (Fergusson et al, 2003). More recent work has investigated the effects of children's exposure to multiple risks (Lunthar, 2003). This literature is more advanced in the USA. It necessarily uses longitudinal data to carry out analyses and much research has been carried out by development psychologists working in the context of ecological models of child development (Lunthar, 2003). There has also been growing policy concern about the circumstances in which children grow up in the UK and in the EU (DWP, Opportunities for All, 2001; EU Lisbon Summit, 2000).

In the UK, the consequences of exposure to multiple risks have been investigated for children born in 1958 and in 1970 using the British birth cohort studies. For instance, early exposure to multiple risks in childhood has cumulative effects throughout the life course, influencing both behavioural adjustment during childhood and psychosocial functioning during adulthood (Schoon et al, 2003; Schoon, 2006), as well as occupational attainment in adulthood (Bynner et al, 2000). Sacker, et al (2002) further point out that exposure to multiple risks is related to social inequalities more than to class inequalities and that the former is more predictive of educational achievement in early adulthood. Berthoud (2003) examined the separate risk factors associated with one employment outcome: living in a family or household without any employment. He then went on to examine the combined effect of having more than one risk factor, adding consideration of successively more and more disadvantaging characteristics to a person's portfolio.

Following these earlier lines of research, this paper documents UK children's exposure to multiple risk factors within a theoretical framework from the ecological models of child development (Brofenbrenner, 1979, 1986). It also investigates the short-term impact of this exposure on developmental outcomes. We accept that it is important to have not only inputs and outputs, but to understand more of the processes by which children grow up and become functional or dysfunctional adults. However, in this paper our intention is more modest. We aim to provide new information from the Millennium Cohort Study on the extent, and combinations, of multiple risk factors UK young children are being exposed to. We also aim to investigate the links between this exposure and children's developmental outcomes as they grow up.

In the rest of this paper we consider, first, the literature on ecological models of development which serves as a theoretical basis for mapping out multiple risk factors (Section 2). In Section 3 we identify the risk factors we intend to focus on in this paper related to a child's home environment in the earliest year of life. We then describe our data sources, the risk factors and selective developmental outcomes for analysis (Section 4). Our findings on the prevalence of these individual and multiple risk factors as well as on the impact of these on children's developmental outcomes are presented in Section 5. Finally, we present our conclusions in Section 6.

2. Child development, ecological models and multiple risk factors

The general framework we use to structure and conceptualise multiple risk factors in child development draws on theories of human development in Cairns and Hood (1983), Gottlieb (1983), Lerner (1986, 1998), Magnusson and Stattin (1998) and Sameroff (1983). These theories view behaviour and development as processes that are inextricably linked to the multiple, interrelated contexts or systems within which children grow up. Children do not grow up in isolation, nor emerge as adults from childhood development vacuums. Rather, human character and competence are shaped by the continuity and change in families, schools, peer groups and neighbourhood communities. Brofenbrenner's (1979, 1986) ecological model of human development is one of the most prominent developmental theories to express the importance of understanding this complex, reciprocal and dynamic set of interactions between individuals, their families and their environments. These theories see the individuals interacting with those closest to them, in the case of children, with their main carers. These interactions either support and sustain, or hinder successful development. These relationships and processes are called *proximal* factors in the ecological model; that is, they are the primary processes for influencing development referring to the day-to-day life of a child. Examples of proximal process variables in the context of the family include aspects of parent-child relationships such as warmth, affection, use of discipline, control and punishment as well as the educational content and structure of language used in the home. These processes change and adapt as children develop and mature. They are constrained and influenced by the characteristics of the immediate context, for example, the family or school, as well as by the more distant social, economic and demographic environment. These more distant influences are called *distal* factors, which are part of the wider environment. The child is therefore at the centre of a set of proximal and then ever extending concentric circles of distal interacting relationships.

The distinction between proximal and distal is a generic one; these factors can be applied to any development stage, and their meanings depend on the context in which they are being applied. Family characteristics would tend to be more directly related to day-to-day experiences of the young child, and as such be proximal factors. Socio-economic and demographic factors, such as mother's age, are more often considered to be distal factors. A parent's occupation is a distal factor in explaining a child's behaviour in school if one hypothesises that there are other important factors that mediate this relationship or are closer to the child's lived experience. It is also important to note that the factors that influence child development are not all in one causal direction. The child interacts with the proximal and distal factors and can change the way, for example, parents treat or respond to their child. Similarly, the family is not independent of these other distal contexts and there are vital interactions between contexts and parents and one contextual factor and another. Although further away from the child's everyday experience, distal factors are still important and are substantial sources of impact. Brofenbrenner argues that in ecological models of development, the main effects are likely to be interactions between process, person, context and time.

Out of the research charting these sets of interacting relationships which support children's development has come the identification of a number of key risk factors which strongly hinder successful development. Well recognised risk factors for children include poverty, mental illness of a parent, instability in the relationship of parents, war, maltreatment and being a premature baby. Each of these individual risks has been noted in longitudinal studies to be

associated, on its own, with undesirable effects in later life. More recently, there is the further recognition that multiple risks matter. Measurement of multiple risks for such analyses is most often done by counting up the number of risk factors present (Garmezy and Masten, 1994; Rolf et al 1990; Rutter, 1979; Sameroff and Siefer, 1983) although other methods are also used, for example factor analysis on a set of disadvantages. Sameroff et al (1998) and Gutman et al, (2002) have all found that while there were significant effects of single risk factors, most children with only one risk factor would not end up with a major development problem. It is the accumulated number of risks that has been found to be most damaging and is predictive of higher probabilities of negative outcomes. In general, the higher the number of risk factors, the more subsequent problems observed (Masten et al, 1993; Masten and Sesma, 1999). Also, more explanation was offered in models attempting to explain indicators of child development when the number of (multiple) risks was used as an explanatory variable. Fergusson et al (2003), summarising their own and other research on multiple risks, argued that high risk children are those with a life history characterised by multiple disadvantages. Such disadvantages include social and economic elements such as impaired parenting, neglectful and abusive home environments, marital conflict, family instability, family violence, and high exposure to adverse family life events (Fergusson et al, 1994; Masten et al, 1990; Shaw et al, 1994). Among 1,265 New Zealand children followed up from birth in 1977 for 21 years, 50 per cent of the cohort experienced none or one childhood adversity and, at the other extreme, nine per cent of these children experienced six or more adversities. Among adolescents exposed to more than six childhood adversities, increases in the number of childhood adversities were associated with significant increases in rates of problem outcomes by age 21¹ (Fergusson and Horwood, 2003). Those exposed to 6 or more childhood adversities had rates of externalising problems that were 3.1 times higher than those with low exposure to childhood adversities; those exposed to six or more childhood adversities had rates of internalising problems that were 2.3 times higher than those not exposed to childhood adversity.

While there are discussions in the literature about how best to measure some individual risk factors, there are fewer considerations of how to measure multiple risks. The most common method has been to count them up paying no attention to which combinations are present in two, three, four or the higher risk combinations. Masten and Sesma (1999) comment on the limitation of counting up risks. Although this aggregate measure has been found to result in better overall prediction when modelling development outcomes, they think it obscures what may be important distinctions in the nature of the resources or the threats children face. Neither is a simple numerical aggregate measure conducive to understanding the processes that affect children's development. The analysis in this paper also derives multiple risks by counting up individual risks. However, it also attempts to improve on previous analyses by providing more information about the various combinations of individual risks to show which combinations children are exposed to.

The measurement of the risk factor of living in poverty has probably been given the most extensive examination in the literature. Poverty, most commonly relative poverty, can be measured by an income definition, or by other measures of whether families have or want, but do not have, various common consumption goods. The term 'material deprivation' is commonly used to describe the absence of one or more consumption good that the majority of people in a society can have if they wanted them. Since there are a list of such potential items, studies have also investigated ways of creating measures, often called multiple deprivation measures, (or multi-dimensional disadvantage or, more recently, deep exclusion²) that give an indication of the multiple dimensions of material deprivation. Such papers then go on to examine the

correlations between their multiple deprivation measure and other concurrent factors and characteristics which we would recognise as risk factors. There would appear to be an overlap between such studies and this paper's focus on multiple risk factors, but in fact, the overlaps are fairly minimal. Poverty or low income is one of the potential risk factors for children's development we consider, but we are not intending to investigate all of its manifestations. Our main interest in this paper is in the accumulation of multiple risks to child development across different life domains, income being only one such domain, albeit a very important one. We are also interested in the consequences of these multiple risks on the future outcomes in the life chances of children. This is an interest Berthoud (2003) claimed was largely absent from the multiple deprivation/social exclusion literature partly because multiple disadvantage was itself treated as the outcome measure in that literature.

3. Identifying risk factors

Across the range of literature examining risk factors, a number of domains have been identified. These domains vary considerably from one study to another. The Audit Commission (2005) drew up 33 life indicators under seven domain headings³. The poverty and social exclusion study (Gordon et al, 2000) drew up eight indicators with which to calculate a multiple deprivation index for all households⁴. Burchardt et al (2000) calculated multiple deprivation using 4 domains⁵, Taylor (2005) using 10 indicators, and Barnes (2005) using 7 dimensions. Levitas et al's (2007) recent review on multiple risks points to the plethora of domains used and is critical of this free-for-all. Levitas et al go on to offer another new set of 10 domains which, although it clearly has overlaps with earlier sets, is more comprehensive⁶. However, researchers are always constrained by the data that are available. None of the earlier studies focused on very young children and none cover ethnic minority families adequately, although some studies have listed 'ethnicity' as a risk factor (Levitas et al, 2007). The 1999 government *Opportunities for All* framework suggested 60 indicators to measure social protection, but these are divided up into age groups, 'children under 16' is one of the categories. However, this is still a very broad heading under which to consider children's development. The Every Child Matters Agenda (DfES, 2006) mentions five domains important for children:

- being healthy
- safety and security
- enjoying and achieving
- social and civic participation
- economic well being.

What is missing from all of these discussions are the principles needed to identify the appropriate domains.

We consider that the most important question in making a choice of risk factors is: Who are the subjects? The risk factors need to be suited to the age and population groups being considered. Appropriate risk factors are likely to vary across different age, lifecourse or populations groups. Risk factors and risk domains also need to be chosen in the light of existing research on outcomes and this means that the set of risk factors may change over time as new research on unfavourable outcomes from a particular experience comes to light.

In this paper we focus on risks attached to the home and family relationships of young children since our data are rich in such measures. Indicators of risk were selected based on a number of criteria:

- the existence of existing literature demonstrating a relationship to unfavourable outcomes for children
- suitability to the age of the children and the lifecourse stage of the parents
- risks that can be directly targeted by government policies
- prevalence and reliability.

Risk factors of extremely low prevalence were excluded from the counting of the number of risk factors⁷. Risk factors with such low prevalence rates are very unreliable as measures even when derived from a large-scale and representative survey, albeit one that is not focused on the particular low prevalence risk factors in question. Levitas et al's (2007) review points out that virtually all of the information about children in social surveys is collected from adults. The data and domains in this study are no different. However, we would argue that this is entirely appropriate given we are considering multiple risks factors only for children under one year old.

Our data allow us to identify known risk factors, which we map into the three most important dimensions of the ecological model of child development for very young children, i.e. proximal family processes, distal family factors and characteristics of the home environment (Lunthar, 2003; Feinstein et al, 2008)⁸. ‘Proximal family processes’ refers to measures of parent-child interactions. ‘Distal family variables’ relates to parental attributes that can only exert their influence on the child via family-child interactions. Finally the characteristics of the home context are the physical features of the place in which the child grows up.

Table 1 shows that there are multiple potential indicators of risk for each dimension. Each indicator is in itself an important signal of a possible problem within each dimension, and one that may have direct and indirect impacts on a child’s life.

Table 1: Indicators of risk in Millennium Cohort Study Sweep 1 – summary statistics

Type of risk	Variable from the MCS	Proximal, Distal or Characteristics	N	% of MCS families
Depression	Either the mother or partner often feels depressed	Proximal	17,902	19.4%
Physical Disability	Either the mother or partner has a longstanding illness that limits daily activities	Proximal	18,549	15.0%
Substance Misuse	Mother smoked during pregnancy	Proximal	18,538	11.7%
Alcohol	At least one of the parents is at risk of alcoholism (risk of alcoholism is defined as consumption of over 14 units (women) or 21 units (men) of alcohol per week	Distal	18,541	12.3%
Domestic Violence	Either mother or partner often gets in violent rage	Proximal	12,731	4.0%
Financial Stress	The family finds it quite difficult or very difficult to manage financially	Distal	18,494	7.7%
Worklessness	Neither mother or father in paid work or on leave from paid job	Distal	15,348	5.5%
Teenage Parenthood	The mother is (was) a teenage mother (under 20 years old) for their first born child	Distal	17,865	11.1%
Basic Skills	Either the mother or partner lacks basic skills which limits their daily activities	Proximal	18,547	3.6%
Overcrowding	Ratio of persons to number of rooms in the house (excluding toilets, halls, kitchen, living room, and garages) >2	Characteristics	18,503	9.4%

Depression, physical disability, and lack of basic skills among parents are mapped into proximal family processes because they directly impact on the interactions between parents and the child. Parental smoking during pregnancy is mapped into proximal family processes since smoking impacts on development in uterus and has long-term consequences for child development (e.g. birthweight, development of asthma and other respiratory problems). Whether a mother or father often gets into a violent rage is mapped into proximal family processes, as this is an indicator of a poor relationship between family members experienced by the child (and it may also affect the relationship between parents and the child, but this precise information is not available in our data).

In contrast, parental alcohol misuse is mapped into distal factors since we are unsure whether parents are interacting with children under the influence of alcohol (in which case this would be mapped into proximal family processes). Similarly, whether the household experienced financial hardship, worklessness, and teenage parenthood are all mapped into distal family factors. These can only impact on child development through the characteristics of the home (e.g. lack of income can limit the resources that families can provide to their children) and/or the proximal family processes (e.g. the relationship between parents and children could be affected by stress induced by lack of employment opportunities or financial hardship). Finally, we use overcrowding as an indicator of the quality of the home environment, which is mapped into characteristics of the home context.

Of course, within a dataset there may be other indicators of proximal family processes, distal factors and characteristics of the home context. For example, the Millennium Cohort Study contains measures of mother-infant attachment, parental beliefs about childrearing and breastfeeding practices that can be used as indicators of proximal family processes. It also contains information regarding parents' highest educational qualifications, family composition and parental income, which are indicators of distal family factors. Finally, it also contains information about housing facilities and the availability of a developmentally enhancing environment, which are measures of the characteristics of the home context. However, as mentioned above we focused on indicators of risk factors that can be targeted by government interventions and for this reason other indicators were left out of the analysis.

4. Data set

The Millennium Cohort Study (MCS) was available for this investigation. MCS is a large-scale longitudinal survey of, at the outset, 18,818 of the new century's babies, in 18,552 families who were bringing them up, in the four countries of the UK. Its first sweep was carried out during 2001 to 2002 by interviewing parents when the babies were around aged nine months. The sample design allowed for disproportionate representation of families living in areas of child poverty in all of the four UK countries. There was also oversampling in the three smaller UK countries of Northern Ireland, Scotland and Wales and in areas with high minority ethnic populations in England (Dex and Joshi, 2004). These nationally representative large-scale data provide a set of important risk indicators appropriate for a young child. The data also allow us to calculate multiple risks for the population of UK children as a whole, for children from minority ethnic families and for children in the four countries of the UK.

Furthermore, the longitudinal aspect of the data enables us to investigate some developmental consequences for children who live in families facing multiple risks. We also drew on two MCS follow-up surveys carried out when the children were three and five years of age. From these surveys we obtained measurements for children's cognitive and behavioural development. Children's cognitive development at ages three and five was measured by the score in naming vocabulary of the British Ability Scale, BAS (Elliott et al, 1978). The average score in the naming vocabulary of the BAS at age three was 49 points and at age five was 53 points. At both ages, the range of the scale was between 20 to 80 points, higher scores indicating more

advanced vocabulary development. The scores were standardised by subtracting the mean and dividing by the standard deviation.

Behavioural development was obtained from the Goodman's Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) completed by parents when the child was three and five years of age. The scale identifies five dimensions of behavioural development: emotional symptoms, conduct problems, hyperactivity, peer problems and prosocial behaviours, each of which are measured by five items, 25 items in total. Each item has the following possible response from parents: not true, somewhat true and certainly true. These responses are valued 0, 1 and 2 respectively. A separate score for each of the five dimensions is obtained by adding up parental responses from each of its five items. Each of the five dimensions has a score, therefore, ranging from 0 to 10.

5. Prevalence of risk factors among MCS babies

The risk factors that were available in MCS1, when the child was around nine months old are displayed in Table 1 alongside the number of carers of these children who responded to each question and their frequencies⁹. From this list, the most common experience, of one in five families, was having a parent who had experienced depression. The least common were having a parent lacking basic skills (3.6 per cent) or experiencing rage (4 per cent). An indication of the relationships between these risk indicators is given in Table 2. The entries in the body of the table represent the odds ratios of having a named risk, given the child is growing up in a family with one of the other risks. Odds ratios greater than one indicate a higher likelihood of having both risks, whereas odds ratios lower than one indicate that those with one risk have a lower likelihood of having the other risk. For example, in the case of depression, children with a parent with a longstanding illness had 2.7 times the odds of having a parent reporting depression than those whose parents do not have longstanding illnesses. The highest odds ratio linked to parents' depression was domestic violence, where parents who often get into a violent rage had a ratio of 4.3 times the odds of reporting depression.

Table 2: Bivariate relationships between risks factors (MCS) – Odds ratios

	Depress	Illness	Smoked in pregnancy	Alcohol	Viol	Financial Stress	Workless family	Teenage parent	No Basic Skills
Depression									
Illness	2.73*								
Smoked in pregnancy	1.32*	1.28*							
Alcohol	1.22*	0.74	1.23						
Violence	4.32*	2.78*	1.51*	1.18*					
Financial stress	1.81*	2.35*	1.63*	0.78	2.73*				
Workless family	3.55*	4.44*	1.80*	0.95	2.51*	2.78*			
Teenage parent	1.06	2.04*	2.79*	0.70*	2.69*	1.85*	3.20*		
No basic skills	3.01*	2.78*	1.30*	1.16	2.37*	1.88*	3.99*	1.17*	
Overcrowding	1.40*	2.52*	1.01	0.57*	2.20*	1.98*	4.02*	2.46*	1.40*

Source: All main respondents MCS1 families. Notes: * indicates significant at 1% level of confidence.
Estimates weighted and adjusted for the cluster sample design of MCS data.

We find that the vast majority of odds ratios linking the various risk indicators between MCS families are higher than one. This suggests that being at risk in one respect does correlate with being at risk in other respects also. In five cases related to the risk of parental alcoholism correlations were not statistically significant at the one per cent level. Similarly, correlations were not significant between being a teenage parent and parental depression, and between living in overcrowded housing and parental smoking during pregnancy. Those at risk of alcoholism were significantly less likely to be at risk of either being a teenage parent or living in overcrowded housing conditions. In these two cases, the risks were not accumulating. These results confirm that, on the whole, risk factors do not exist in isolation and that children living in families with one of these risk factors are likely to be exposed to other risk factors as well. However, in most cases, the sizes of the relationships are relatively modest. The types of correlations found between these risk factors in the MCS data are not dissimilar from some of those found in other studies, albeit with a different focus.¹⁰

Prevalence of multiple risk factors

We first estimated the prevalence of multiple risks on the basis of all of the 10 risks listed in Table 1. The prevalence was calculated twice (Table 3). First it was calculated using children whose parents provided information on at least one risk factor and counting missing values as zero (Average 1 in Table 3) and then using children with full information on risks factors (Average 2 in Table 3). Since the first method assumes that any information that is missing for a particular risk is equivalent to the absence of risk, the prevalence of multiple risks will be smaller than in the second method, which is therefore a more conservative estimate.

In general, a relatively low proportion, between 41 and 43 per cent, of the sample were not exposed to any of these risks. In 30 to 31 per cent of families, the child was exposed to one risk factor only (Table 3), a level of risk that previous studies have found to be mostly unproblematic for child development. Of the sample as a whole, between 27 and 28 per cent of these very

young children were subject to multiple risk factors. As we might expect, the prevalence of exposure to multiple risks declined as their number increased; between 15 and 16 per cent of cohort families faced two risk factors, and three risk factors were faced by between 6.9 and 7.5 per cent of families. But in less than two per cent of families were the children exposed to five or more risk factors. The maximum number of risk factors experienced by any family was nine.

Table 3: Percentages of children in UK living in families with multiple risks

Number of risks, N	Avg. 1 ^(a)	Cumulative		Cumulative At least N
		At least N	Avg. 2 ^(b)	
None	0.407		0.431	
1	0.311	0.593	0.297	0.569
2	0.160	0.282	0.146	0.272
3	0.075	0.122	0.069	0.126
4	0.031	0.049	0.035	0.057
5	0.012	0.018	0.014	0.022
6	0.004	0.006	0.006	0.008
7 or more	0.002	0.002	0.002	0.002
Total %	100.00		100.00	
N	18,552		12,583	

Source: MCS1. Notes: (a) Calculations are based on all children with parental information on at least one of the risk factors. It assumes zero when there is missing information. Number of observations is 18,552.

(b) Calculations are based on children whose parents responded on all questions relating to the 10 risk factors. Number of observations is 12,583.

All estimates weighted and corrected by the clustered sampling design of the MCS data.

Compared with other studies, counting up multiple indicators of disadvantage, these figures are in the middle range, although the other studies are not of families with very young children¹¹.

The average proportion for children living with one or more risks and with two or more risks was the lowest in Northern Ireland and it is significantly different than for England at one per cent level of confidence (Table 4). For the rest of the proportions, we do not find significant differences between children in Wales, Scotland and Northern Ireland.

Population of children affected

Similar to the analysis above, we estimated the prevalence of multiple risks by nations within the UK. In addition, we used figures for the total population of children aged under one year old in 2000 from the Office of National Statistics (Quarterly Population Trends). Using these figures, we calculated the total number of children who were likely to be growing up facing multiple risk factors in the UK and in each nation within the UK (Table 4) around the turn of the century. Again, these are based on conservative estimates of the prevalence of multiple risks. For the UK, 403 thousand children born in 2000 were likely to be living in families that had at least one of these 10 main risk factors; approximately 192 thousand children were facing two or more risk factors; 83 thousand were facing 3 or more risk factors; down to one thousand families facing 7 or more risk factors. Clearly, given we have not counted all possible risks in this list, these population calculations should be regarded as an underestimate and probably the lower bound of a range.

**Table 4: UK families with a child under one in 2000 who are likely to be facing multiple risk factors
(proportion and estimated total number)**

Number of risks	Mean % of families at risk				Total population of children at risk				Total population of children at risk UK
	England	Wales	Scotland	NI	England	Wales	Scotland	NI	
At least 1 risk	0.595	0.620	0.583	0.535*	341,321	19,852	30,901	11,779	403,893
At least 2	0.283	0.303	0.275	0.241*	162,648	9,699	14,556	5,308	192,302
At least 3	0.123	0.127	0.119	0.103	70,418	4,079	6,293	2,272	83,115
At least 4	0.049	0.053	0.049	0.038	28,281	1,695	2,606	830	33,443
At least 5	0.017	0.021	0.023	0.013	9,743	666	1,222	280	11,995
At least 6	0.006	0.008	0.009	0.004	3,194	257	461	91	4,047
At least 7	0.001	0.002	0.002	0.001	795	69	127	31	1,039
Population estimate of children <1 ⁺					574,000	32,000	53,000	22,000	681,000

Source: MCS1. Notes: Asterisk (*) indicates significant difference at a 1% level between averages in Wales, Scotland and Northern Ireland (NI) versus England. ⁺ Population estimates of children<1 in 2000 from ONS *Quarterly Population Trends*.

Estimates weighted and adjusted for the clustered sample design of MCS data.

Relationships between risk factors and ethnicity

The MCS data allow us to calculate the prevalence of multiple risks by ethnicity. It is rare to have sufficient data to be able to do this although even with these rich data there are limitations to the analyses as we note below. The figures in Table 5 display the prevalence rates for the same set of 10 possible risks and using the conservative estimate, (assuming that missing values indicate the absence of risk). Indian families were the most likely to be free of these risk factors; 47.6 per cent of such families had none of these risks, followed by 41.3 per cent of white families. Bangladeshi families were the least likely to be free of any risk factors. Only one fifth of Bangladeshi families were facing none of these 10 risk factors, as were 29.5 per cent of Black African families and 32.5 per cent of Pakistani families. Black African and Bangladeshi families are those who were the most recent minority ethnic groups to have migrated to the UK, of those examined here.

Table 5: MCS families with a child under one in 2000 by mother's ethnic origin likely to be facing multiple risk factors (proportion)

Number of risks	White	Indian	Pakistani	Bangla-deshi	Black Caribbean	Black African	Other (incl. mixed)
None	0.413	0.476	0.326	0.201	0.382	0.295	0.381
At least 1 risk	0.586	0.523	0.673	0.798	0.617	0.705	0.619
At least 2	0.278	0.204	0.344	0.480	0.292	0.314	0.329
At least 3	0.118	0.104	0.171	0.277	0.128	0.109	0.148
At least 4	0.048	0.025	0.077	0.102	0.045	0.035	0.058
At least 5	0.017	0.010	0.025	0.032	--	0.015	0.027
At least 6	0.006	--	0.004	0.004	--	0.012	0.010
At least 7	0.002	--	0.001	0.002	--	--	0.001
Unweighted UK sample size	15,398	479	933	370	262	378	560
Population estimate of children <1	602,685	13,211	21,367	7,150	7,638	10,427	17,433
Population children 2 or more risks	167,546	2,695	7,350	3,432	2,230	3,274	5,735

Source: MCS 1: Notes: Estimates weighted and adjusted for the clustered sample design of MCS data.

Considering the prevalence rates of facing two or more risk factors, the level at which studies have suggested risks become more serious for children's later outcomes, we find that Bangladeshi families also display by far the highest prevalence rates at this level of risk; 48 per cent of Bangladeshi families faced two or more risks, followed in order of prevalence by Pakistani families (34.4 per cent), other mixed (32.9 per cent), black African (31.4 per cent), black Caribbean (29.2 per cent), white (27.8 per cent) and Indian (20.4 per cent) families.

However, there may be inaccuracies in some of these figures. The MCS sample sizes for some minority ethnic groups, for example Black Caribbean families, may still be too small to provide robust estimates of the risk prevalence for risks with the smallest prevalence rates. As the figures in Table 5 illustrate, in the case of black Caribbean families, there were no occurrences

of families facing five or more risks, and for Indian families none were facing six or more and for black African families none were facing seven or more risks. This may be due to small samples sizes and it would mean that the prevalence of *all levels* of multiple risks may be underestimated for these groups. The figures in Table 4 should be regarded, therefore, as the minimum rates of multiple risks for the separate minority ethnic groups examined.

The estimates of the UK population of each ethnic group facing two or more risks is displayed on the bottom row of Table 5 and ranges from an estimate, at the highest end, of 7,350 children under one year old from Pakistani families to 2,230 families from black Caribbean families. Again these are likely to be lower bound estimates for reasons outlined above.

Types of multiple risks

Earlier studies have not tended to examine the types of risk factors that more commonly co-occur. To do this, we kept children who faced three risks and estimated the proportions facing each possible combination of these three risks (e.g. the proportion of children whose parents have risk of depression, financial difficulties and low basic skills). We then sorted the data according to the combinations of these risks with the highest prevalence. Similar analysis is undertaken for children facing four risks and upwards. It is a complicated presentation issue to show the full range of possible combinations of risks across these 10 risk factors. Some combinations were extremely small with hardly any cases. We are only able to present the most common types of co-occurring risks within each level of combinations of three risks and upwards in Table 6.

In the case of families facing three risk factors, the most common combination was that of smoking, financial stress and teenage motherhood. This corresponds to six per cent of all children living in families with three risk factors. The next most common three-risk patterns, each with 4.2 per cent of all families with three risks, were smoking plus teenage motherhood plus overcrowding, and smoking plus teenage motherhood plus low basic skills. For families facing four risks, the most common combination, accounting for three per cent of those with four risk factors was parental depression plus worklessness plus teenage motherhood plus low basic skills. Parental depression occurred in all of the most common four-risk combinations, and also in all of the most common combinations of six-risk and seven-risk combinations as well as in three out of five of the most common five-risk combinations. This is not so surprising given that parental depression was the risk with the highest prevalence rate (Table 1).

It is also worth noting that parents with alcohol problems, violence within the home and parental longstanding illness rarely appeared among the most common combinations, until the seven-risk combinations were reached. However, basic skills, worklessness, teenage motherhood and parental depression appeared pervasively among the most common combinations from four-risks upwards. It is perhaps noteworthy that worklessness and basic skills are relatively low in prevalence but associated with many of the more common combinations.

Information from these tables confirms the hypothesis that there is not a single dominant pattern of risk factors that accounts for most of the information. As we can see the patterns are diverse, as no single combination of risk applies to more than 9 per cent of cases. However, at the same time, some combinations were more frequently occurring than others, and provide a base on which higher order multiple risk combinations frequently build.

Table 6. Most common combinations of risks for children living in families with multiple risk factors

# N Risks	Percent	Cum.% facing N risks	Depression	Illness	Smoking	Alcohol	Violence	Financial Stress	Workless	Teenage mother	Basic Skill	Over Crowding
3	6.0	6.0	.	.	X	.	.	X	.	X	.	.
3	4.2	10.2	.	.	X	.	.	.	.	X	.	X
3	4.2	14.4	.	.	X	.	.	.	.	X	X	.
3	3.0	17.4	.	.	X	.	.	.	X	X	.	.
3	2.8	20.2*	.	.	.	.	.	.	X	.	X	X
4	3.0	3.0	X	.	.	.	.	.	X	X	X	.
4	2.9	5.9	X	.	.	.	.	.	X	.	X	X
4	2.2	8.1	X	.	.	.	.	X	X	.	X	.
4	2.2	10.3	X	.	.	.	X	X	.	.	X	.
4	2.2	12.6*	X	.	X	.	.	.	.	X	.	X
5	4.5	4.5	X	.	.	.	.	.	X	X	X	X
5	4.1	8.6	.	X	.	.	.	X	X	.	X	X
5	3.7	12.2	X	.	X	.	.	.	X	X	.	X
5	3.3	15.5	.	.	X	.	.	.	X	X	X	X
5	3.3	18.8*	X	.	X	.	.	.	X	X	X	.
6	7.8	7.8	X	.	X	.	.	.	X	X	X	X
6	5.6	13.3	X	X	.	.	.	X	X	X	X	.
6	4.4	17.8	X	.	.	.	.	X	X	X	X	X
6	4.4	22.2	X	.	X	.	.	X	X	X	X	.
6	3.3	25.6*	X	.	.	.	X	X	X	X	X	.
7+	9.1	9.1	X	X	.	.	X	X	X	X	X	X
7+	6.1	15.2	X	.	X	.	X	.	X	X	X	X
7+	6.1	21.2	X	.	X	.	X	X	X	X	X	.
7+	6.1	27.3	X	X	.	.	X	X	X	X	X	.
7+	6.1	33.3*	X	X	.	X	X	X	X	.	X	.

Source: MCS1. * The cumulative totals are calculated for the each number of risks separately. The sample contains 1,479 families with children facing 3 risk factors for which reported patterns are 20.2% of all families facing 3 risk combinations. It contains 629 families with children facing 4 risk factors, for which reported patterns are 12.6% of all families facing 4-risks; 245 families with children facing 5 risk factors, for which reported patterns are 18.8% of all families facing 5-risks; 90 families with children facing 6 risk factors, for which reported patterns constitute 25.6% of families facing 6-risks and finally 33 families with children facing 7 or more risk factors for which reported patterns constitute 33.3% of families facing 7-risks.

Relationships between risk factors and children's development

Having identified children who were born in families facing multiple risks, we carried out a preliminary investigation of some of the potential outcomes for children living in these families. The outcomes we examine were children's average cognitive and behavioural development outcomes for different risk exposures. We are interested in differences in children's developmental outcomes at ages three and five according to their earlier exposure to multiple risks in the home environment and in whether the gaps change over time.

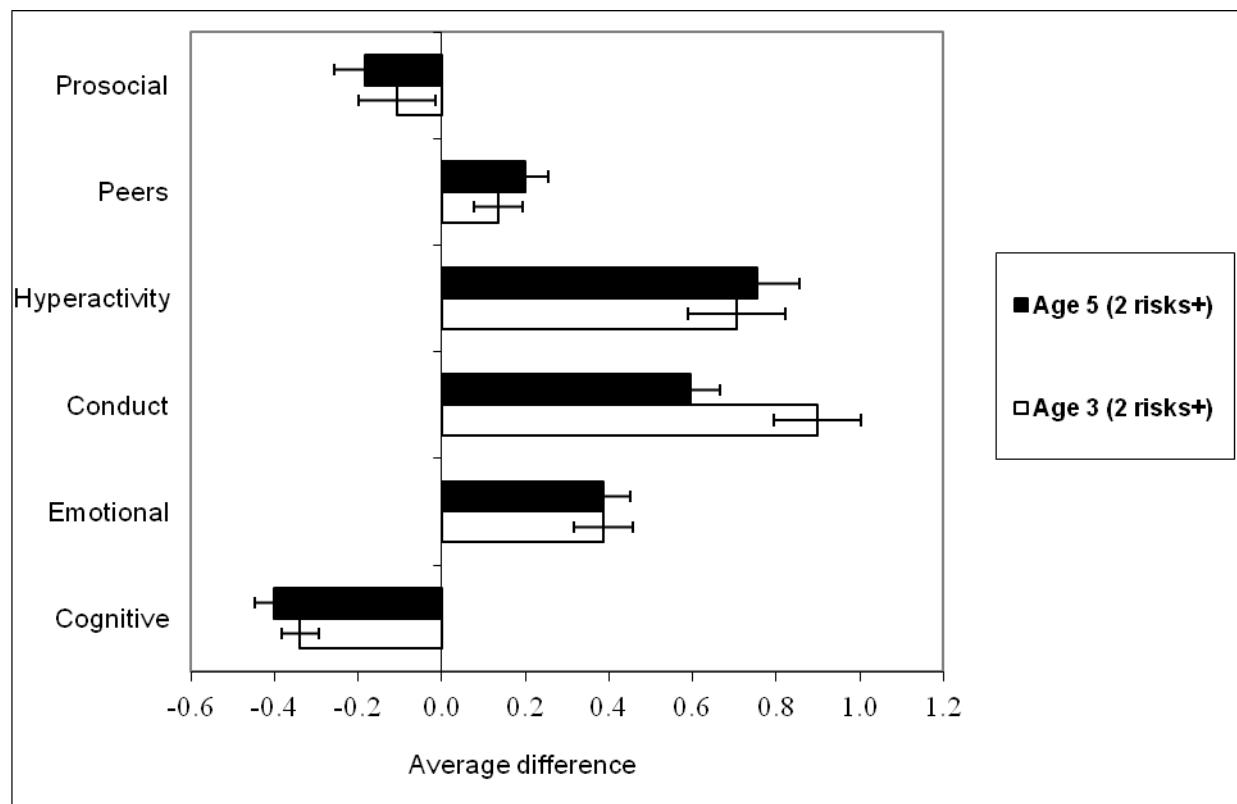
Figure 1 summarises our main findings for all children who completed the assessments. Each of the bars represents the difference in developmental outcomes between children living in families with two or more risks compared with children living in families with exposure to none or one risk factor. For cognitive naming vocabulary development the difference is measured in standard deviation scores. For behavioural development, the difference is measured in the 10-point scale, which is the range of each of the five separate dimensions of the SDQ.

Those living in families with exposure to two or more risks have lower scores in naming vocabulary than children living in households with no or one risk only. For example, the average vocabulary score at age three for children living in households with low risk was 0.20 (that is, 0.20 standard deviations above the mean of zero). The average vocabulary score at age three for children living in families with two or more risks was -0.14. The difference between these scores (-0.34) is plotted in Figure 1, white bar for cognitive development (age three). Similar calculations were obtained for vocabulary scores at age five and the larger difference for the high risk group (i.e. of -0.40) is plotted with a black bar.

On five indicators of SDQ behavioural development, children exposed to two or more risks were likely to have higher average negative outcomes on all dimensions at age three and five than children exposed to fewer risks. The gap between being exposed to two or more risks compared with one or no risks was between one tenth and one point at both age three and age five.

We can also examine whether the gaps widened or narrowed between the ages of three and five. We can see a widening gap in cognitive development, hyperactivity, peer problems and prosocial behaviours for children with exposure to two or more risks compared to one or no risks between ages three and five. The gap did not change for emotional symptoms and the gap narrowed for conduct problems. However, we found that only the narrowing of the gap in conduct problems and the widening of the gap in peer problems was statistically significant at the five per cent level.

Figure 1: Average difference in cognitive and behavioural developments between children at ages 3 or age 5 living in families with 2 or more risks compared with those 'no risk or 1 risk'



Notes: Cognitive assessments are based on the naming vocabulary scores of the BAS; behavioural development is based on the Goodman's SDQ. Average scores at age 5 contain all children with information about family risk at birth and BAS (14,412) and family risk and SDQ (14,199). Average scores at age 3 contain all children with information about family risk at birth and BAS (12,473) and family risk and SDQ (12,631). All calculations have been weighted.

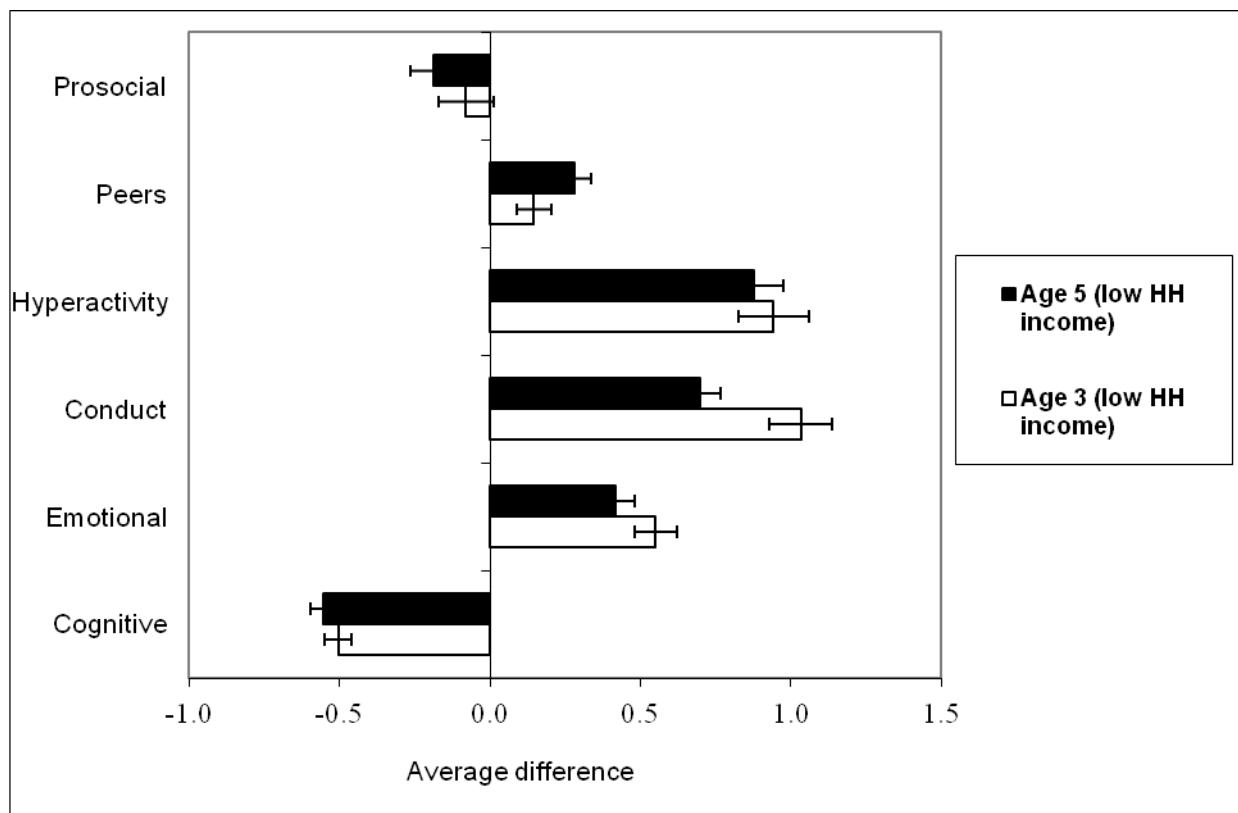
Risk factors, low household income and children's development

In this final part of the analysis, we examine the bivariate relationships between multiple risks, low household income and child development. For low household income, we used the derived variable in the MCS for non-equivalised net household income from single parents and couples which grouped income into six bands (Calderwood and Ward, 2004). We used this variable's lowest band, net household income below £10,400 per year. This corresponds to 21 per cent of the MCS children and is the same as the national estimate of children living in poverty in approximately the same year from the Department for Work and Pensions publication, *Households Below Average Income* (HBA1) (DWP, 2000-01).

Of those children whose family income was higher than £10,400 per annum in 2001, 59 per cent lived in families with at least one of these risks and 27 per cent with two or more risks whereas 80 per cent of the children living in low income households (less than £10,400 p.a.) experienced at least one risk and nearly half lived with two or more risks.

Figure 2 shows the difference in developmental outcomes between children living in families with household income below £10,400 compared with children living in families with household income above this threshold. Children living in low income households fared worse than those living above this income in all cognitive and behavioural developmental measurements. Interestingly, when investigating the widening or closing of the gap over time with age, we found a widening of the gaps for cognitive vocabulary development, peer problems and prosocial behaviours, and a narrowing of the gaps in emotional symptoms, conduct problems, and hyperactivity. But, as shown for the case of children living in families with multiple risks, only the narrowing of the gap in conduct problems and the widening of the gap in peer problems were statistically significant. In addition, the narrowing of the gap in emotional symptoms was also statistically significant.

Figure 2: Average difference in cognitive and behavioural developments between children living in families with family income above £10,400 and those living in families with household income below £10,400



Notes: Cognitive assessments are based on the naming vocabulary scores of the BAS; behavioural development is based on the Goodman's SDQ. Average scores at age 5 contain all children with information about low family income at birth and BAS (13,251) and low family income and SDQ (13,052). Average scores at age 3 contain all children with information about low family income at birth and BAS (11,518) and low family income and SDQ (11,623). All calculations have been weighted.

Previous studies have suggested that different risks may be salient for children's cognitive and behavioural development, with distal factors such as income having stronger associations with cognitive skills and educational achievement than they have with behavioural outcomes (Duncan and Brooks-Gunn, 1997; Brooks-Gunn et al, 1997). Proximal factors, as expected, showed the reverse associations (Maughan, 2001). In order to shed light into this issue, we reclassified children according to whether they lived in a low income household but without

multiple risk (i.e. without two or more risks), in a household with multiple risks and no low income, or in a household with both low income and multiple risks. We then estimated the change in cognitive and behavioural outcomes between ages three and five for these children, compared with children living in households without multiple risks or low family income, conditioning on gender, ethnicity and region (see Table 7).

Table 7. Parameter estimates (with standard errors) of the impact of low family income and multiple deprivation on cognitive and behavioural outcomes at age 5

	Cognitive	Emotional	Conduct	Hyperactivity	Peers	Prosocial
	-0.25 (0.03)***	0.14 (0.05)**	0.25 (0.05)***	0.34 (0.08)*** 0.33 (0.06)***	0.27 (0.04)***	-0.20 (0.06)***
Low income only	-0.20 (0.02)***	0.18 (0.04)***	0.21 (0.04)***		0.17 (0.03)***	-0.18 (0.04)***
Multiple risk only						
Income and multiple risk	-0.34 (0.03)***	0.27 (0.06)***	0.52 (0.05)***	0.47 (0.07)*** 0.56 (0.01)***	0.29 (0.05)***	-0.20 (0.06)***
Cognitive at 3						
	(0.01)*** 0.43	- (0.01)***	- 0.35	- -	- -	- -
Emotional at 3	-					
Conduct at 3	-	-	(0.01)*** -	- 0.56 (0.01)***	- -	- -
Hyperactivity at 3	-	-	-			
Peers at 3	-	-	-	-	(0.01)*** 0.19	- 0.37
Prosocial at 3	-	-	-	-	-	(0.01)***
Gender	Yes	Yes	Yes	Yes	Yes	Yes
Ethnicity	Yes	Yes	Yes	Yes	Yes	Yes
Region	Yes	Yes	Yes	Yes	Yes	Yes
Sample size	11,390	11,481	11,481	11,481	11,481	11,481

Source: Millennium Cohort Study, Waves 1-3. Notes: Asterisks *, **, *** indicate statistical significance at 10, 5 and 1% levels. Estimates weighted and adjusted for the clustered sample design of MCS data.

In general, our results showed that children living in low income households and those living in families with multiple risks fared worse across all developmental outcomes than children living in families with no risk. Except in the case of peer problems, we did not find differential effects of family income and other family risk factors on different developmental outcomes. For peer problems, children living in low income households had greater problems than children living in households with multiple risks (the difference between 0.27 and 0.17 is statistically significant at 5 per cent level).

Children living in families with both multiple risks and low income fared the worst across most developmental outcomes. These children achieved the lowest change in vocabulary test scores between ages three and five. They differed not only with respect to children living in families without risk, but also from children living in households with low income or multiple risks. They also had more conduct disorders than children living in low income households, more emotional problems than the rest of the children, and more peer problems than children living in families with multiple risks. Our results support previous research showing that cumulative disadvantage together with compounding risk is likely to matter more for child development than any one risk in isolation (Masten et al, 1993; Masten and Sesma, 1999; Schoon et al, 2002; Schoon, 2006).

6. Conclusions

In this paper we have examined and quantified the experience of multiple risks among a generation of families with children who were born shortly after the new millennium. We have seen that facing risks that can be disadvantageous to future child development and adult outcomes is not uncommon among children. However, it is less common to be facing two or more risks. This is the number which earlier studies suggest is the level of multiple risk that policy makers should start worrying about if they want to safeguard children. Out of the 10 risks we examined, approximately 27-28 per cent of families with young children across the UK in 2001 were facing two or more of these risks and this constituted an estimated 192,000 young children (under one year old) at the time. Since many of these young children lived in families with older siblings, the total numbers of children at risk from two or more disadvantages were considerably higher at the time.

We were also able to examine, for the first time, the extent to which children in minority ethnic families faced multiple risks. The results showed there were large variations in the prevalence rates. Bangladeshi families were facing by far the highest rates of multiple risks followed by black African and Pakistani families. Indian families were facing the lowest levels, lower in fact than equivalent white families in the MCS data.

Analyses of MCS children's outcomes at ages three and five suggested that being exposed to two or more risks in first years of life is likely to disadvantage children's cognitive and behavioural development as they grow up. Similar associations were found for children living in households with low income. Some studies have suggested that income may be more important for cognitive outcomes than other features of the family. We found that both low income and the experience of other risks in the family are important for child development, but more important are the problems associated with compounding risks. The greater the number of risks experienced by the child, the greater the problems that the child will face during the lifecourse.

Although indicative, our study finds large inequalities in developmental outcomes for children living in multiple risk households compared with the rest of the children. Previous studies based on the 1958 and 1970 British birth cohort members found that poor cognitive development in children was associated with a high probability of leaving schooling at the minimum school leaving age (Feinstein and Duckworth, 2006), having few if any educational qualifications (Sabates et al, 2007), and a low wage in adulthood (Blundell et al, 2005). Behavioural and emotional problems during childhood have been associated with a higher probability of living in a workless household during adulthood (Feinstein and Bynner, 2003), higher likelihood of criminality (Feinstein and Sabates, 2006; Collishaw et al, 2007), a range of measures of family adversity during adulthood (McCulloch et al, 2000; Maughan et al, 2001), and hazardous drinking (Percy and Iwaniec, 2010), among others. Earlier studies suggest, therefore, that children living in families with multiple risks are more likely to have long-term disadvantageous cognitive and behavioural consequences.

Clearly, government policy aimed at safeguarding children from damaging levels of multiple risks has a challenging task ahead. It has to address the predominant co-occurring economic disadvantages some families face such as worklessness and low basic skills among parents as well as the mental health problems of parents, teenage motherhood and associated

overcrowded housing conditions. These calculations do not suggest this will be an easy task. The multiple risks experienced by some families were not found to group together very comfortably. Among the risks considered here, there are not obvious sets of circumstances that hang together which might be described as risk types or clusters. This lack of clustering points to a gloomy conclusion that there are no easy wins for policy and intervention. In fact, the wide range and varying nature of multiple disadvantages found here suggests it will be extremely difficult to tackle simultaneously all of these disadvantages in order to reduce family risks for the benefit of children where they occur two or more at a time. In addition, the findings point to low income and multiple risks both mattering independently and jointly to children's outcomes. This is in contrast to the literature on social exclusion where income poverty tends to be an additional deprivation or exclusionary factor, and to the literature on multiple deprivation where income level is used to qualify and define 'real' deprivation.

Our findings point to the conclusion that there is relatively little to be gained by policy from tackling clusters of disadvantage rather than individual disadvantages. However, there may still be some knock-on effects from tackling some individual risk factors and disadvantages, even if not all, according to the extent to which individual risks increase in the presence of others. However, identifying areas for interventions of this sort requires further research.

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Notes

¹ The problem outcomes considered were conduct/antisocial personality disorder, violent crime, property crime, and alcohol and illicit drug dependence.

² See for example Levitas et al, (2007); Burchardt, (2000); Burchardt et al, (2002); Milliband, (2006).

³ The domains were income deprivation; employment deprivation; health deprivation and disability; education, skills and training deprivation; barriers to housing and services; crime; and living environment deprivation.

⁴ The eight domains consist of: (1) not in paid work; (2) lives in jobless household; (3) excluded from three services because they are unaffordable or unavailable; (4) does not participate in five or more social activities for any reason; (5) has no daily contact with either friend or family; (6) has poor support on four or more indicators; (7) not currently or in the past three years involved in civic or political activities including voting; (8) poor on income or subjective poverty. On these indicators 24 per cent of British households had no experience of any of them, and 10 per cent had experience of five or more.

⁵ These four domains consisted of: (1) consumption or low income; (2) production or socially valued activity; (3) political engagement; (4) social interaction. As applied to the population of Great Britain using BHPS data 61.6 per cent were not excluded on any dimension, 9.8 per cent were excluded on two or more dimensions.

⁶ The Bristol domains are part of a matrix consist of: (1) material/economic resources; (2) access to public and private services; (3) social resources; (4) economic participation; (5) social participation; (6) culture education and skills; (7) political and civic participation; (8) health and well being; (9) living environment; (10) crime, harm and criminalisation.

⁷ Low prevalence among risk factors may exist because (i) prevalence is actually low and/or (ii) the questionnaire was not intended to collect this information and we can only obtain a proxy measure. Among these indicators we find history of criminality, having had a child in care, and experiences of homelessness. For the MCS, the only indicator of history of criminality comes from a question asked to individuals who lived away from their parents. They were asked the place where they mainly lived before the age of 17 and one of the possible answers was "in a Young Offenders Institution". Only 0.18 per cent of the sample reported to have lived in a Young Offenders Institution before the age of 17 as their main residence. This is not a history of criminality, but represents a very small subset.

⁸ Of course, for older children, there are a range of other locations or institutional settings (e.g. pre-school settings, schools, neighbourhoods and peer groups) within which particular set of interactions are experienced by the child. These contexts can be developmentally appropriate (constructive) or inappropriate (destructive) for the child. Inappropriate settings can serve as indicators of risk; for example, neighbourhood deprivation, community violence, and gangs (as proxy indicators of anti-social behaviour). As the main focus of this paper lies with very young children within the home or family context, we do not investigate in full all possible risk factors associated with other contexts.

⁹ The number of children, 18,818, is higher than the number of families, due to the presence of a small number of twins and triplets in the survey. Calculations of numbers of children at risk do not add in second and third children in families with twins and triplets, and are underestimates therefore.

¹⁰ Studies of social exclusion and material deprivation, while having different aims, also have some overlaps with the data we use and offer the potential for limited comparisons therefore. The social exclusion literature has commonly noted high correlations between income, worklessness and living in social housing (e.g. Taylor et al, 2004; Lloyd, 2006). However, on

the whole, researchers have been surprised at the relatively low levels of correlation between indicators. Multiple deprivation, measured in a variety of ways, has been found to be correlated with larger family size, households headed by a woman, no earner households and separate or divorced people (Cappellari and Jenkins, 2007); also with employment status, education and home ownership (Figari, 2010; Whelan et al, 2003). Correlations have been noted between social housing, overcrowding, ownership of durables and income (Taylor et al, 2004) but only weak correlations were found between income and health, housing quality, social isolation, and local area quality. A similar weak correlation between vandalism in the area and persistent poverty was also noted by Whelan et al (2003).

¹¹ See for example Gordon et al's 1996 study of deprivation and poverty found 22 per cent of the whole population were disadvantaged on two or more indicators; eight per cent were disadvantaged on three or more. Calculations on a sample of older adults aged 50 and over found 13 per cent were disadvantaged on two or more, seven per cent on three or more indicators (Barnes, 2005); 9.8 per cent were excluded on two or more dimensions in the Burchardt et al study (2002). These figures are based on data from the English Longitudinal Study of Ageing (ELSA) data.

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