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Easton, S. (2014) Can't get No Satisfaction?: How do social and spatial factors in early childhood affect adult well-being? Working Paper. SSM01 . (Unpublished)

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Can't get No Satisfaction?: How do social and spatial factors in early childhood affect Adult well-being?

Abstract

Background

In recent years, research on inequalities in health from birth has provided increasing evidence to support the lifecourse perspective on health inequalities. Studies from the field of health geography have also highlighted the role of birth*place* in adult health outcomes. In this paper, these two threads are combined by taking an ecological approach to how both social and spatial factors in the first few years of life affect adult well-being. The outcome indicator in this case is satisfaction with life at the age of 30.

Method

The treatment of the ordinal life satisfaction variable (measured on a scale of 0-10) and appropriate methods for its analysis are discussed. A wide range of biological, sociological and psychological variables from the birth and childhood (age 5) waves of the British Cohort Study (BCS70) were analysed using multilevel models to nest data on the individual child within neighbourhood and region. The complex interactions between these variables and across time were explored.

Results

Low birthweight (linked with maternal socioeconomic position and smoking), congenital abnormality, being a poor "antisocial" boy or a poor child from a large family at age 5 were all found to be associated with *dis*satisfaction or *lower* levels of life satisfaction in adulthood. Also the number of *adverse events* the child had experienced by the age of 5. An interaction was found between maternal mental health, child hyperactivity and living in a poorer neighbourhood at the age of 5. However, neither of the spatial variables, region or neighbourhood "type", were independently significant.

Conclusions

Poorer adult well-being is found to be the result of a combination of biological, socioeconomic and psychological disadvantages in early life which begin *prior* to birth and that "place" does not have an independent effect. These findings support the theory that it is the social *composition* of an area in terms of individuals and households which is important as no independent "contextual" effects were apparent. In terms of methodology, multinomial (categorical

un/ordered) models are not only more statistically appropriate but were found to give important insights into associations across the range of scores.

Introduction

The model presented here is part of a wider piece of research on how birth and childhood factors affect adult health and well-being. In this paper the focus is on the level of life satisfaction achieved by the age of 30.

In attempting to operationalise Uri Bronfenbrenner's ecological systems theory by including indicators from nested spheres such as the individual, family and neighbourhood, this research inevitably crosses multiple disciplinary boundaries. For example, variables included in the model range from the *biological* - maternal antenatal smoking, birthweight, congenital abnormality, breast-feeding, number of childhood illnesses; *psychological* – birth "trauma", maternal mental "malaise", child behaviour and cognitive development, number of adverse life events; *sociological* - socioeconomic position at birth, household poverty at age 5 and last but not least, *geographical* – by including regional and neighbourhood variables.

Theoretical Background

The Lifecourse Approach to Health Inequalities

> 'Life chances are structured so that they tend to cluster
> cross-sectionally and accumulate longitudinally.' p.55
> (Blane, 2006)

The core of this approach to health inequalities is the accumulation of what might be termed "health capital" which can be built-up or depleted over time (Wadsworth, 1996). This begins with the health of the mother prior to and during pregnancy (Barker, 1991), and extends across the lifecourse from birth through childhood and teenage years into different stages of adulthood (depending on how long somebody lives). As the above quote indicates, not only does socioeconomic disadvantage tend to "cluster" at single time-points so that people

are rarely disadvantaged in only one sphere of life, it also "clusters" across lifetime.

Hence the description of a person accumulating disadvantages across time reads a little like the old song describing the way bones are connected in a skeleton:

A poor person is more likely to lack nutrients and have a low birthweight baby. A low birthweight baby is more at risk of certain illnesses as an adult. A poor child is more likely to grow up in overcrowded, unhealthy accommodation in a deprived area, and to experience inadequate nutrition, physical accidents (both at home and outdoors) and to under-perform at school. As a teenager that child is more likely to leave school without qualifications. Those without skills and qualifications are more at risk of becoming unemployed or working in a low-paid, insecure work with poor or unsafe working conditions (or turning to crime). Adults on low-income through work or benefits often form low-income families (thus continuing the cycle). Unskilled manual workers in unsafe environments are more susceptible to injury and incapacity due to ill-health (or if crime is involved, to end up in prison). As older adults they are far less likely to have obtained a decent pension through occupational schemes or private provision and are therefore more at risk of poverty in old age. (Davey Smith, 2003)

And, like the proverbial skeleton these links *are structural.* For as Blane points out (Blane, 2006), the accumulation of health advantage and disadvantage is *selective* and based on the social organisation of our society. A person who is exposed to hazardous working conditions (chemicals, noise, pollutants) - and unskilled or semi-skilled manual worker, is far more likely to live in unhealthy or inadequate housing due to low-income. Consequently he suggests that, 'A person's past social experiences become written into the physiology and pathology of their body.' p.54. A further example of this can be found in the correlation between slow child growth and a lower level of job control in adulthood, and the fact that those with the slowest childhood growth, who spent the longest time in low-control jobs, had higher blood pressure p.34 (Blane et al., 2007).

Child Development in Context

In developing the model of how early experiences might affect adult outcomes, an attempt has been made to implement an ecological approach. This was based on the work of Uri Bronfenbrenner, (Bronfenbrenner, 1979) whose "ecological systems theory" focused on the development of the child *in the context* of its environment. These contexts may be conceived of as a series of nested layers or spheres ranging from the microsystem, which includes the child's biology and immediate family through to the macrosystem, which comprises aspects of wider society such as the national political economy or culture (see Figure 2 below).

Figure 1. Simplified Schematic of "Nested" Ecological Spheres
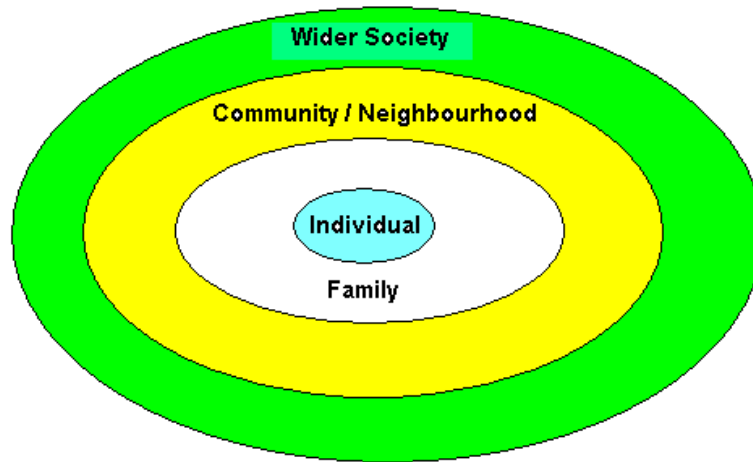
Bronfenbrenner emphasised the relationships and two-way *interactions* between these spheres. One example of this might be the effect of the maternal antenatal behaviour on the developing foetus; another might be how a national economic downturn causes financial pressures that ripple throughout the whole family mediated by factors such as parental stress.

According to this theory, proximal layers of the environment such as close family relationships within the home are more important for the child's development than more distal factors such as societal norms (Schoon, 2006). This is because, "outside" influences are *mediated* by (or filtered through) the more immediate environment, as in the above example.

Not all of the environments conceived by Bronfenbrenner were hierarchical or "nested" in nature. The *mesosystem* describes the links and interactions between the child's various immediate environments, such as home, school, peers and so on. However, in the model under discussion, only the nested spheres are examined.

Life Satisfaction in the BCS70

A burgeoning literature on indicators of life satisfaction and other measures of *positive* subjective well-being has amassed in recent decades as interest in assessing quality of life has grown (Diener, 1984). The single item scales such as the one used in this paper have been found to be both valid (Diener, 1984) and sufficiently reliable to support research into the comparison of group means (Diener, 1984; Kruegera and Schkadeb, 2008). This measure entails an *overall* assessment of a person's life across numerous domains (health, relationships, work, financial situation etc) which is necessarily based upon that person's subjective understanding of what a "good life" entails (Diener, 1984).

Figure 2. below shows the distribution of life satisfaction at the age of 30 is highly skewed towards greater life satisfaction. A similar pattern has also been found in

other longitudinal datasets such as the BHPS (Oswald, 2007 ; Taylor et al., 2009).

Figure 2. Distribution of Life Satisfaction at Age 30 (BCS70)
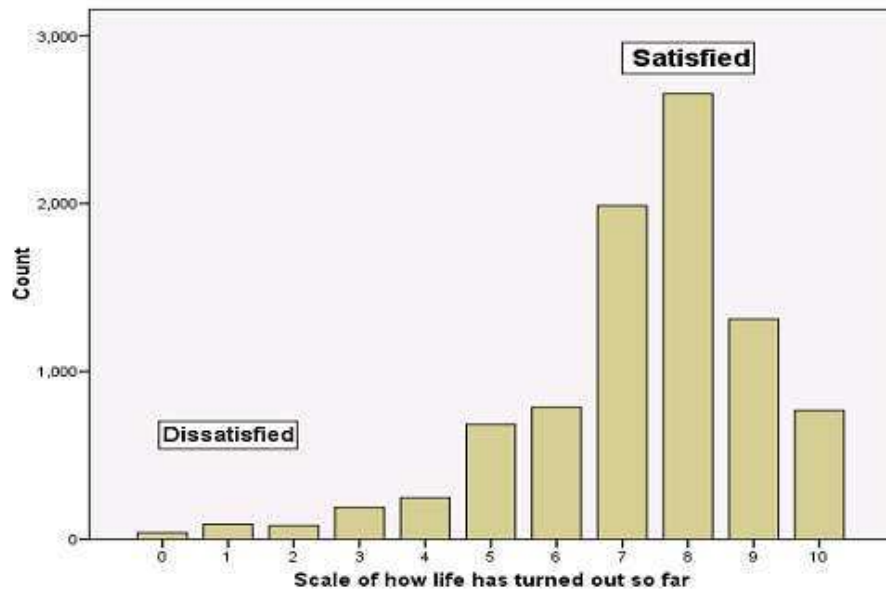
The Data

The *British Cohort Study* (BCS70) has followed the progress of all babies born in Britain during the week of 5th – 11th April 1970. Among the original sample of 17,196 babies, the 16,771 *surviving* children were followed up (where possible) every few years since birth through surveys with parents (mostly mothers) and from the age of 18, with cohort members themselves. As with most longitudinal surveys there has been a fairly high level of attrition from the original sample. Approximately 11,000 cohort members are still participating in the study which currently comprises four yearly interviews. Previous surveys were undertaken at the ages of 5, 10, 16, *(26[1])*, 30 and 34 (the last being in the year 2004). As the original sample attempted to include *all* births during a particular week, it should initially have been representative of the British population as a whole. However, child survival rates and sample attrition have been found to be biased towards certain sections of the population[2] (own research). The loss of the original sample population is a problem for all longitudinal surveys, and is known to lead to sample bias (Hawkes and Plewis, 2004). In this case by the time sample attrition, wave non-response and item non-response were taken into account, the working sample comprised approximately *half* the original birth cohort sample from 1970 (depending upon which variables were in the model).

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[1] This was only a postal survey planned at short notice due to the late and limited funding.
[2] All non-respondents were traced in a sub-sample survey in 1977 to assess the effects of attrition on the sample.

The initial drive for the BCS70 came very much from an interest in birth and neonatal care (Institute of Child Health, 1989), therefore the first survey was very healthcare oriented and contained only a limited number of variables pertaining to the social and economic situation of the parents. For example, neither income nor housing tenure were included in the 1970 survey. Unfortunately this means that the same variables cannot be compared across time from birth as the same questions were not asked in every survey. In later waves surveys became more comprehensive and has included questions on family life, household, education, employment/unemployment, health, finances, housing, and attitudes related to some of these spheres of life, as well as a range of medical measurements on physical and cognitive development.

Geography

No sub-regional geography is available until the age of 10 which precluded modelling by small areas from birth. However, data on region of residence of the mother at birth and early childhood are available in the 1970 and 1975 surveys. A typology of neighbourhoods was included in the 1975 survey. In the absence of small area geographical data, this variable has been utilised in the models described below (see *Methodology* for further information).

Variables at Each Contextual Level

A range of variables are available from the BCS70 at each layer of Bronfenbrenner's (simplified) model in Figure 1 above. For the *individual child*: behaviour, cognitive ability, health, disability. Characteristics of the *family*: closeness (bond eg breast-feeding), stability, behaviours (smoking), health, family size, economic activity (role models), household poverty and socioeconomic position (these indexes were created). Unfortunately only an indication of the level of affluence or poverty was available at the *neighbourhood* level. This typology was validated through correlations with several other variables (poverty, household size).

Methodology

The Treatment of Ordinal Variables

Life satisfaction is an *ordinal* variable (having a scale of 0 to 10). One traditional approach to analysing ordinal variables with 10 or more categories is to treat them as if they were *continuous* and to analyse them using statistical tests designed for *cardinal* data. If the data is skewed a transformation is simply applied prior to analysis as it would be for a continuous variable. However, this approach is problematic because the points on an ordinal scale (0,1,2,3 etc) represent *arbitrary* divisions for an underlying (or "latent") variable which is assumed to be continuous, and whose distribution is unknown. Although these discrete cut-off points are arbitrary, they provide our only observed data about the "true" values of the latent variable (life satisfaction, opinion etc) based on the proportion of people in each category. Therefore, given that the *true* distribution

of the latent variable is unknown, the effect transformation might have on the relationship between the *observed values* and *latent values* they attempt to measure, is also *unknown*. In lay terms, *it is possible that transformation might redistribute the proportions of people in each category or interfere with the relationship between the observed and unknown ("latent") values.*
For reasons such as these it has been argued that the violation of theoretical assumptions underlying analytical techniques developed for ratio or interval data by using them inappropriately results in a "critical mismatch" which, '…undermines confidence in the validity of the conclusions that are drawn from empirical data with respect to a theoretical model of interest.' p.466 (Flora and Curran, 2004).

However, given the above caveats, in order to provide a *reference point* which the subsequent multinomial model can be compared to, (as suggested by Rasbash *et al* (Rasbash et al., 2009b)), a standard linear model was fitted to the *life satisfaction* scores. The best approximation to the normal (Gaussian) distribution was achieved using the method outlined by Darlington (Darlington, 1997), which was applied using a command in MLwiN software[3] version 2.11 (Rasbash et al., 2009a).

Life Satisfaction Groupings for Multinomial Model

Due to the computationally intensive nature of running multilevel multinomial models, and the *low numbers* in the tail-end of the distribution of life satisfaction scores, it was necessary to recode this variable into a smaller number of categories in order to use ordered and unordered category response models. Mean differences for different life satisfaction scores were tested for using ANOVA and post-hoc Scheffe tests on a range of ordinal variables from the 2000 wave. The use of variables from the birth and age 5 surveys was avoided as these were explanatory ("x") variables in the model, therefore it was important that they should not be used to re-group the dependent ("y") variable as this may have affected the results. To this end an explanatory variable representing "breadline poverty" 2000 was created in order to examine the split of life satisfaction scores using only variables from the adult survey[4].

Through observing significant differences between means, the breakdown in life satisfaction scores was identified: **0-4, 5, 6, 7, 8-9 & 10.**

For each of the above methods variables were entered into the models in stages: birth variables first, then age 5 variables. Interaction terms between/among the variables were explored at each stage and across waves (across *time*).

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[3] A specialist package for multilevel modelling: http://www.cmm.bristol.ac.uk/MLwiN/index.shtml.
[4] Although there is likely to be a relationship between childhood SEP and poverty, the relationship is by no means deterministic.

Multilevel Modelling

> 'A fundamental assumption of this regression model is that the residuals (the distance of the data points from the …regression line) are independent. However, data often have a multilevel structure which violates this assumption.'
>
> ("MLwiN - What is Multilevel Modelling? ," 1999)

Nested or hierarchically structured (that is, "multilevel") data are the norm in geography and the social sciences (Rasbash et al., 2005). Common examples include individuals grouped within families, households, classes, GP practices, schools, hospitals, workplaces and different-sized geographical areas. This "grouping" needs to be taken into account in order to select the appropriate statistical model for the data (above quote, (Tranmer and Steel, 2001).

Figure 3. Schematic of a Multilevel Model
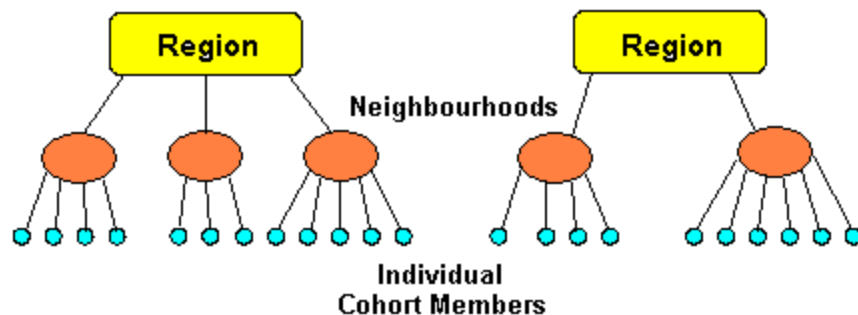
Results

The possibility of bias caused by the high proportion of missing cases due to attrition, wave and item non-response should be highlighted as the extent of missing data from the original birth cohort was found to be over 55% (N = 7048, 42% of original sample). The effect this may have had on the distribution of *life satisfaction* scores is unknown. Bearing in mind this caveat, the results from the final models are presented below.

Table 1 shows the results from a linear regression analysis in MLwiN on the *transformed* life satisfaction scores were. These results are presented *for the purposes of comparison only* with the following multinomial model (see *Methodology*).

TABLE 1. Linear Regression Model of *Transformed* Satisfaction Scores

	Coefficient & its	χ^2

	(standard error)	
Higher Level Spatial Grouping Variables		
Neighbourhood & Region	___	*Not Significant*
Individual Level Variables		
Interaction term: *SEP * Smoking during pregnancy * Birthweight*	-0.004* (0.002)	6.5
Congenital Abnormality No *(Ref)* Yes	1 - 0.21*** (0.059)	13.2
Interaction term: *Household Poverty Age 5 * Gender * Child Antisocial Behaviour*	- 0.003*** (0.000)	52.6
Interaction term: *Household Poverty Age 5 * Number of Previous Children * Child Antisocial Behaviour*	- 0.001*** (0.000)	19.1
Interaction term: *Household Poverty Age 5 * Neighbourhood Type*	-0.008* (0.004)	*(borderline)*
Number of Adverse Events by Age 5	-0.018** (0.007)	6.3
Interaction term: *Maternal Malaise * Child Hyperactive Behaviour * Neighbourhood Type*	- 0.000*** (0.000)	6.85

* = significant at 0.05 level; ** = significant at 0.01 level; *** significant at 0.001 level.

Neither of the higher level spatial variables, region (N=10) or "social rating of neighbourhood" (N = 4), were found to explain a significant proportion of the variance in adult life satisfaction[5].

The variation in the "error term" for individual level variables was highly significant (χ^2 = 3418), indicating that *all* of the variation was explained by *individual level factors*. However, as the coefficient for Level 2: Neighbourhood in Table 1 above shows, *none* of the variation was attributed to the neighbourhood

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[5] Due to the small number of higher level units a Bayesian method - MCMC (Monte Carlo Markov Chain) - was used to estimate the models.

level (although some interactions between individual/household level variables and neighbourhood were found).

The above *individual* factors all have an inverse relationship with life satisfaction by the age of 30 (hence the minus sign). In other words, they are all associated with *lower* levels of life satisfaction, or *dis*satisfaction. The resulting coefficients were fairly similar when estimated using alternative non-linear methods[6] which supports the robustness of the model.

However, what these results do **not** reveal is any *detailed differences* across the distribution of satisfaction scores. For example, there is likely to be a significant difference between a satisfaction score of 6 or 7 compared to the higher satisfaction ratings of 8, 9 or 10 and actually being a bit *dis*satisfied, (5) compared to the extreme tail-end of the distribution (represented by scores of 0-4). This is where multinomial analysis is useful.

Ordered and Unordered Category Response Models

In the results below, the subcategories for those who rated their satisfaction with life as 0-4, 5, 6, 7 or 10 are compared to the modal reference category who selected scores of 8-9 (see *Methodology*).

The aim of using an *"ordered"* categorical response model is ultimately to develop a *single* equation (model) which applies across all categories (which in this case are scores or score-groups). However, significant variation in values across score-groups was evident as soon as the first core variables were entered into the model. Only one variable was found to have similar enough coefficients across all categories to estimate the variable across the full range of scores. Therefore *separate* models were calculated for each category (score-group) for most variables. Rasbash *et al* stated that the model is "formally equivalent" to an *unordered* category response model p.175 (Rasbash et al., 2009b).

Geographical Variables

Early test models showed that, although there were some interactions with spatial grouping variables, neither region or neighbourhood explained a significant proportion of the variance in life satisfaction score once all of the individual variables were entered into the model. Therefore these higher level variables were dropped from the final model. (A further reason for doing this is that MCMC estimation would not run without a "positive definite" value for the spatial grouping variable, and checking the coefficients following different types of estimation was essential to check model robustness).

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[6] Such as Restricted Iterative Generalised Least Squares (RIGLS) with partial quasi-likelihood (PQL) or MCMC (Monte Carlo Markov Chain) see Rasbash J, Steele F, Browne W, Goldstein H, 2009b *A User's Guide to MLwiN Version 2.10* (Centre for Multilevel Modelling, University of Bristol, Bristol) and Browne W, 2009, "MCMC Estimation in MLwiN, v2.1", (Centre for Multilevel Modelling, University of Bristol., Bristol) for further information.

Constant

The constant indicates the likelihood of being in a sub-group compared to being in the modal reference group. This is why all the constants are negative, because those scoring 8-9 comprise 46% of the sample (see Table…below).

TABLE 2. Percentage of sample by Life Satisfaction score-group

Satisfaction Rating					*Ref Group* **8-9**	*10*
	0-4	*5*	*6*	*7*		
% of Total Sample	7%	8%	9%	22%	**46%**	9%

Results & Discussion

*SEP * Smoking during pregnancy * Birthweight*

A significant interaction was found between smoking during pregnancy and birthweight. Furthermore, although SEP was not found to be *independently* significant in the above model, a significant association was discovered with the level of maternal smoking during pregnancy. Therefore a three-way interaction term was created to represent the relationship between SEP, smoking during pregnancy and birthweight (with heavy smoking, low SEP mothers, who had low birthweight babies at one extreme and non-smoking, high SEP mothers who have heavy babies at the other).

All subgroups, including those who scored 7 and 10, were affected by the interaction between socioeconomic position (SEP), smoking and birthweight, compared to the modal reference group (8-9). However, there seem to be a particularly strong association with those who scored 5 (dissatisfied). This indicates that cohort members in the modal group less likely to be lower weight babies as a result of lower SEP mothers smoking heavily throughout their pregnancy.

The fairly strong result for this interaction term for those who scored 10, also seems to indicate a difference between those who stated that they were completely satisfied, and those who scored 8-9. Those who are at *either extreme* of the distribution do not appear to be the same as those in the modal reference group. This finding goes some way towards explaining why an *ordered* category model was not found to be appropriate for this data.

> 'There was a direct dose-response association
> between the number of cigarettes smoked and the
> risk of growth retardation.' p.140 (Horta et al., 1997)

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Birthweight has a long association with poorer health outcomes (UNICEF& WHO, 2004) and the relationship between smoking, retarded growth and low birthweight has long been an established fact (above quote). Therefore it is unsurprising that the interaction between lower SEP mothers who are more likely to smoke heavily (Marsh and Mackay, 1994), having lower birthweight babies was found to be significant.

The interaction between SEP, smoking and birthweight described above also highlights very early (ie prenatal) points in the lifecourse trajectory, indicating smoking as one possible path for the *transmission* of poor outcomes (eg through increased risk of health problems in adult) across generations for children from lower social strata.

Congenital Abnormality

The presence of a congenital abnormality was significantly associated with dissatisfaction (0-4) or a *low level* of satisfaction (a score of 6) at p=0.05. It proved difficult to compare this finding to those of other researchers as a literature search of journal articles[7] turned up only references dealing with *specific* congenital anomalies eg (Aho et al., 1997; Moons et al., 2006).

Assuming that policies and practice in relation to people with a range of disabilities including those from birth have advanced since 1970, this finding highlights the important role of longitudinal cohort studies in comparing the well-being of sub-groups within different generations[8] of British children. However, such a comparison would be complicated by the fact that medical technology has also advanced. For example, the increased survival rate of extremely low weight (preterm) babies is associated with a rise in congenital disabilities such as cerebral palsy (Bhushan et al., 1993).

Index of Adverse Events in Childhood

The number of adversity events child had experienced by the age of five was significantly associated with dissatisfaction (scoring 0-4), or lower levels of dissatisfaction compared to the reference group (8-9). This variable was not significant for those who scored 5 or 10.

The literature on childhood *"resilience"* shows that adverse events vary and affect people in different ways (Garmezy and Masten, 1994; Luthar, 2003; Masten et al., 1990; Schoon, 2006). Some may be affected in the long term in terms of their mental health (which could lead to extreme dissatisfaction in later life)(Garmezy, 1974), while others, though not as badly affected, may be inhibited in some way from achieving full satisfaction in adulthood. Due in part to poorer health outcomes of lower SEP groups (Black et al., 1982), children from poorer households are more likely to experience traumatic experiences such as family

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[7] Using the terms "congenital abnormalit*/anomal*/malformation" + "life satisfaction" (+ adult*).
[8] As well as the loss engendered by the lack of British cohort studies between 1970 and 2000.

illness or loss, which may lead to a loss of employment and income and working class mothers were more likely to experience life stressors (Brown and Harris, 1978) – see *Maternal Malaise* below.

Gender, Household Poverty & Antisocial Behaviour Score at Age 5

> ' Robins (1966) showed that antisocial boys had a
> much increased risk of experiencing reputed divorce,
> multiple changes of jobs, prolonged periods of
> unemployment, and a lack of personal friendships.'
> p.67 (Rutter et al., 1995)

This variable was created in order to highlight the outcome of boys who displayed evidence of antisocial behaviour in childhood. This group have been shown to be at increased risk in terms of poorer life outcomes (Rutter et al., 1995).

As with the risk of adverse events above, the interaction between household poverty, being male and displaying evidence of antisocial behaviour at age 5 is significantly associated with dissatisfaction (0-4), and lower life satisfaction scores (6, 7) compared to the modal reference group who scored 8-9. In this case, the coefficient for **10** is *negative,* indicating that poor, antisocial boys are significantly less likely to achieve a high degree of satisfaction in later life, and are significantly *more likely* to be dissatisfied with life by the age of 30.

Number of Prior Siblings, Household Poverty & Antisocial Behaviour Score at

Age 5

The interaction of household poverty at age 5, number of prior siblings and evidence of antisocial behaviour is particularly strong for those scoring 0-6 (p= 0.001) compared to the modal reference group, but the coefficients are also significant for those scoring 7 and 10. A low but *positive* correlation was found between poverty at age 5 and the number of children a woman had in 1970 (ρ = 0.155, p = 0.01)[9] and household size at age 5 (ρ = 0.2, p = 0.01).

This provides a second piece of evidence that cohort members at the extremes of the distribution (the dissatisfied tail end, and the completely satisfied) are *different* from the largest sub-group. This interpretation is supported by the fact that the coefficient for those scoring 7 is less significant (p=0.05) compared to coefficients for other scores.

Given that no variable on income was available, the number of children may be acting here as a proxy for the greater poverty of large families. This interaction is

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[9] Spearman's rho (ρ) is used as the correlation statistic due to the ordinal rather than cardinal nature of the poverty index.

likely to be picking up increased behavioural problems of some of the *poorest* children (as income must be stretched further) with the lowest adult to children ratio.

Household Poverty & Neighbourhood Rating at Age 5

The combination of childhood poverty at the age of five and living in a poor neighbourhood was highly significant for the most dissatisfied group at the tail end of the distribution, as well as for those who scored only 5 when compared to the reference group. *This is the strongest evidence from this model yet that childhood poverty has a long-term impact on adult well-being.* As, unlike previous variables, this interaction was *not significant* for *any* of the satisfied score-groups, we can conclude that growing up in a poor family in a poor community leads to a particularly high risk of dissatisfaction in later life.

Maternal Malaise during Early Childhood

Exploratory analysis of maternal malaise showed that this variable interacted with SEP at the time of the cohort birth five years earlier, childhood hyperactive behaviour, concurrent poverty in 1975 and living in a poorer neighbourhood (see below).

Interaction: *Neighbourhood & Maternal Malaise*

ANOVA and Scheffe tests showed that there were significant differences in the mean "maternal malaise" scores by neighbourhood rating (see TABLE 3 below) and that the difference between poor, average and wealthy/rural neighbourhoods was highly significant (p=0.000).

TABLE 3. Maternal Malaise Score BY type of Neighbourhood

Social Rating of Neighbourhood	N	Average Maternal Malaise Score *(higher = greater)*
Wealthy	2153	3.4
Rural	1741	3.7
Average	4103	4.7
Poor	553	5.8

Scheffe Results: All mean differences significant at p=0.000 except rural/wealthy which = p=0.05.

Interaction: *Maternal Malaise, Child hyperactivity & Neighbourhood Type*

There was only one variable for which coefficients were both significant and had comparable values across all five subgroups[10]. This was the interaction term for

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[10] Although greater variation may have been evident in coefficients with 4 or 5 decimal places, as the values of the coefficients were clearly very small.

maternal malaise, hyperactive behaviour and living in a poor neighbourhood. This variable represents a combination between poor maternal mental health, often depression, which may be exacerbated by the stresses of living in a poor neighbourhood, leading to evidence of hyperactivity in the cohort child at age 5. This provides further evidence that those who rated their life satisfaction as 10 are *different* and possibly *poorer* in childhood than those who scored 8-9.

> 'Women were more likely than men to have a
> [common mental disorder] (19.7% and 12.5%
> respectively), and rates were significantly higher for
> women across all categories of [common mental
> disorder] ….' p.12 (McManus et al., 2009)

Mental distress in the original cohort mothers (measured here by "maternal malaise") led to significant risk of their children developing a limiting long-term illness in adulthood and has been shown to interact with indicators of socioeconomic position, poverty and childhood behaviour. The strongest combination was found to be with child hyperactivity at age 5 and living in a poorer neighbourhood. Therefore a three-way interaction term was created between these variables. (The interaction between maternal malaise and household poverty at age 5 did not appear to be significant, but it is possible that this is as a result of the *method* used to construct a poverty index, see *Methodology*).

The *Adult Psychiatric Morbidity Survey*[11] (McManus et al., 2009) which began in 1993 has consistently found the rate of common mental health disorders (mostly non-psychotic depression and anxiety) to be far higher for women than men (above quote). Furthermore, mothers may be at particular risk due to hormonal changes[12] (Department of Health, 2002).

Rates of mental illness have also been shown to be higher for those disadvantaged by material deprivation, poor education and low socioeconomic status (Fryers et al., 2005). Consequently low SEP women have been shown to have a higher risk of becoming mentally ill (Barry and Yuill, 2002; Brown and Harris, 1978).

> '…greater hyperactive-impulsive symptom severity was
> significantly associated with maternal smoking during
> pregnancy…and social class.' p.1 (Langley et al., 2007)

The increased risk of developmental disorders among the children of parents with psychiatric problems was discovered long ago (Bleuler, 1911, English translation 1978; Schoon, 2006). More recent research has highlighted the increased incidence of depression among mothers of ADHD children (Chronis et

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[11] A *household* survey of the English population.
[12] Which may bring on postnatal depression and other postpartum illnesses.

al., 2007) and the links between social class, smoking, low birthweight and with ADHD "conduct disorders" in childhood (Langley et al., 2007) *above quote*.

Brown and Harris (Brown and Harris, 1978) noted the increased risk of depression in lower status women, who are more likely to live in *poor* areas than those from the middle-classes. They also found that major *adverse events* and serious difficulties played a key role in both the initial onset and worsening of an established depression. Working class women experienced a higher rate of these so-called "provoking agents" (quote below).

> 'Women are at greater risk than men of child sexual abuse, domestic violence, sexual violence and rape. [and] are three times more likely to have been abused than men... …[it is estimated that] 18-30% of women experience domestic violence during their lifetime and 14-40% of women have experienced sexual violence.'
> p.8 (Department of Health, 2002)

It is the author's experience that events of a traumatic or adverse nature such as: domestic violence, physical violence, eviction, drug and alcohol abuse/addiction, accidents due to risky behaviours such as joyriding, are more common in poor areas such as social housing estates[13].

However, the interaction between poor maternal mental health and living in a poor neighbourhood, does not explain the *direction* of influence, which may well be two-way. For example, people who suffer from higher levels of mental distress may be more likely to end up living in a poorer neighbourhood (due to reduced income through loss of work for example), and living in a poorer neighbourhood may exacerbate their stress (a theory which has been termed "deprivation amplification" (Macintyre, 2007)).

Differences between the Models

The above results demonstrate two important reasons for using techniques developed specifically for orders and unordered categorical data rather than a simple linear regression. Aside from the issue of transforming ordinal data (which is discussed in *Methodology*)*,* the unordered category model has provided evidence for comparing the extremes to the modal group in the skewed distribution. Perhaps more importantly, the results show the fact the combination of household poverty and living in a poor area is actually *highly significant* for those who are _dis_satisfied later in life. Furthermore, the difference between those who stated that they were "completely satisfied" and the modal reference group who scored 8-9 highlights the non-linear distribution of the variable and adds weight to the use of methodologies appropriate to the data.

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[13] This is based on 10 years work experience in social housing.

Conclusion

Poorer life satisfaction in adult life is found to be the result of a combination and accumulation of biological, socioeconomic and psychological disadvantages in early life which begin *prior* to birth. "Place" was not found to have an independent effect once longitudinal social factors were taken into account. The complex and multi-dimensional nature of disadvantage associated with *poverty* and low socioeconomic position (smoking, maternal mental health, child behaviour) is of fundamental importance.

In terms of methodology, multinomial un/ordered category response models are not only more statistically appropriate but were found to give important additional insights into the non-linear aspect of distribution of life satisfaction and the detail of strong associations with dissatisfaction and lower scores.

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