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WHAT PREDICTS A SUCCESSFUL LIFE? A LIFE-COURSE MODEL OF WELL-BEING*

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Abstract

Policy-makers who care about well-being need a recursive model of how adult life-satisfaction is predicted by childhood influences, acting both directly and (indirectly) through adult circumstances. We estimate such a model using the British Cohort Study (1970). We show that the most powerful childhood predictor of adult life-satisfaction is the child's emotional health, followed by the child's conduct. The least powerful predictor is the child's intellectual development. This may have implications for educational policy. Among adult circumstances, family income accounts for only 0.5% of the variance of life-satisfaction. Mental and physical health are much more important.

'The ultimate purpose of economics, of course, is to understand and promote the enhancement of well-being'.[1] This sentiment, expressed in 2012 by the Chairman of the US Federal Reserve, is of course directly in line with that of Adam Smith and the other founding fathers of economics. However, what has been lacking is evidence regarding the

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[1]Speech by Ben S. Bernanke to 32nd General Conference of the International Association for Research in Income and Wealth, Cambridge, Massachusetts, 6th August 2012.

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determinants of well-being. With the rise in interest in subjective well-being across the social sciences, that situation is now changing. Cross-sectional data have been analysed for some decades, and reveal the strong relation between current characteristics and well-being. But we also need to know how those characteristics themselves arose, if we want to decide at what point in the life-cycle interventions would be most effective.

A prerequisite for any policy which aims to maximise well-being is then a model of the life-course that captures in a quantitative way the relative impact of all the main influences upon subsequent well-being. Separate studies of the effect of one variable at a time are of little use in thinking about resource allocation, as the size of the different effects have to be compared.

The need here is not unlike the need of macroeconomic policy for a working model of the economy. So it is not surprising that the OECD, having developed an international standard for the measurement of well-being,[2] are calling for much more research to model what determines it.

1. Why a Life-Course Model?

To be useful, a model must combine the two main strands in previous well-being research. The first of these, pioneered by among others Campbell, Converse and Rodgers, Diener, Kahneman, Oswald, Frey and Helliwell, has focussed on how well-being is affected proximally by other adult outcomes. These include those that can be called ‘economic’ (income, employment, educational qualifications), those that are ‘social’ (family status, criminality) and those that are ‘personal’ (physical and emotional health).[3]

The second strand of work has used cohort data to explore the distal influence of childhood and adolescence upon adult well-being. This strand follows the earlier work of economists such as Heckman and Smith[4] on the lifetime determinants of earnings, but with adult well-being now being the outcome of interest. Recent leaders in this field of work include Frijters, Johnston and Shields.[5] But their work focusses exclusively on the well-being outcome, and ignores the determination of other adult outcomes such as income, employment, family status, criminality and health, which then feed into well-being. Such an approach could lead to an excessive focus on childhood and adolescence as determinants of well-being, with little role left for policies relating to adult life.

We believe that a combination of the two approaches is required, of the kind depicted in Figure 1. In this first attempt at such a combined “path model”, we take adult life-satisfaction as the measure of a successful life. This life-satisfaction is determined partly by “adult outcomes”, and partly by family background and childhood development. But these

[2]OECD (2013).
[3]See for example, Campbell *et al.* (1976); Clark and Oswald (1994); Kahneman *et al.* (1999); Frey and Stutzer (2002); and Helliwell (2003). Layard *et al.* (2012) summarise much of this research.
[4]See for example Cunha and Heckman (2008); Cunha *et al.* (2010); Goodman *et al.* (2011).
[5]Frijters *et al.* (2011), see also Richards and Huppert (2011) and Boyce *et al.* (2013). There is a considerable earlier literature on the determinants of adult malaise e.g. Furstenberg and Kiernan (2001); Knapp *et al.* (2011a) also examine effects on earnings and employment.

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"adult outcomes" also have to be explained themselves – and family background and childhood development play an important role in this.

The key question here is the relative importance of the different links in the chain that predicts life-satisfaction. A good model will focus on the following questions

- **i.** How important are the different adult outcomes (economic, social and personal) for well-being?
- **ii.** What is the role of the different dimensions of child development (intellectual performance, conduct and emotional health) and of family background? How do they affect adult life-satisfaction, both directly and through their effect on adult outcomes?
- **iii.** How far can we predict adult life-satisfaction at different earlier points in a person's life? In other words, does the child "reveal" the adult? Or can we all be remade in adulthood?

By answering these questions we can have a powerful, new integrated way of thinking about how a satisfying life is constructed and, in that process, what matters more than what. With such models we should be able to help policy-makers with the huge issues they have to decide: how much to spend (or cut) on schools, children's services, youth services, physical health, mental health and so on. Rational answers should depend on the size of the different influences on well-being, and the cost of affecting these influences.

Ideally what policy-makers need is a fully causal model. Here candidate areas for policy development could first be identified. Specific policies would then be evaluated by controlled experiment, hopefully followed up over many years. But such long follow-up is expensive and involves delay. So a second use of a causal model is to simulate the long-run effects of interventions where we only know their short-run effects.

The development of a fully causal model will take years more of data-collection and research. In particular it will be crucial to include genetic controls, since omitting variables of this kind can exaggerate the extent to which earlier life determines later life.[6] At the same time, measurement error tends to underestimate the continuities, and better measures need to be developed.

But in the meantime policy-making will continue. At present most of the policy debate is conducted without reference to any quantitative evidence about what matters most for well-being. It would be much better if it were informed by broad orders of magnitude from a quantitative model, even if the model is more properly called predictive than causal. We have to start somewhere and, as we shall see, even from a simple model, some important conclusions emerge.

[6]See for example, De Neve *et al.* (2012).

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2. Our Model, Data and Methods

The model we appeal to here is a recursive path model in which life-satisfaction at each age can in principle depend on everything that happened before that.[7] As shown in Figure 1, the antecedent conditions include seven adult state variables (X_i) that evolve throughout a person's adult life (income, educational level, employment, conduct, family status, physical and emotional health) – or eight if we include life-satisfaction (X_8). During childhood we only have data on three of these characteristics: intellectual performance (corresponding to 'qualifications' in later life); conduct (continuing in later life); and emotional health (continuing in later life).[8] Thus for three of the X_i variables we have data for early life, while for the others the data start in adulthood. We also have data on the family background of the individual, characterised by the family's economic status (F^E) and its psychosocial state (F^P).

We explain the evolution of all the X_i variables by a recursive or path model, in which the value of each variable may in principle depend on everything that has gone before.[9] We thus have

$$X_{it}=f_{it}\left(F^E, F^P, lags \quad of \quad X_1, \ldots, \quad lags \quad of \quad X_8\right) \quad (i=1, \ldots, 8; all \quad available \quad t) \quad (1)$$

2.1. Variables

Our empirical analysis uses data from the British Cohort Study, which covers people born in the second week of March, 1970.[10] Well-being is measured by life-satisfaction at age 34. We explain life-satisfaction by the adult outcome variables, three sets of childhood characteristics, and family characteristics.

The definition of our **adult outcomes** appears in Figure 2 (and in more detail in Appendix A). Note that we appeal to emotional health and self-perceived health as measured at age 26 rather than at 34 so as to avoid any charge that these are synonyms of life-satisfaction rather than predictors of it.

Emotional health and life-satisfaction turn out in fact to be very different, which is why life-satisfaction is predicted by so many other variables as well. The life-satisfaction question is, "How dissatisfied or satisfied are you about the way your life has turned out so far?"[11] Clearly cognitive processing must play a role in the way this question is answered.[12] By contrast, for adult emotional health we have 24 Yes/No questions relating to tiredness,

[7]For this type of structural equation modelling, see for example Goodman *et al.* (2011) and Schoon *et al.* (2012).
[8]Unfortunately the BCS includes no measure of physical health in childhood, but childhood physical health probably accounts for a relatively small part of the variance of adult outcomes.
[9]We thus make a causal statement whereby past variables predict current outcomes. It could instead be the case that early behaviour is adjusted to fit the individual's expectations of later outcomes. We simply do not know if the conduct, for example, of teenagers, is controlled in anticipation of certain economic and social outcomes in their 30s. One way of making progress here would be to include information on children's expectations of their adult life. The BCS unfortunately does not include such variables.
[10]http://www.cls.ioe.ac.uk/page.aspx?&sitesectionid=795&sitesectiontitle=Welcome+to+the+1970+British+Cohort+Study+(BCS70)
[11]Life satisfaction as a broad measure of subjective well-being has been subject to a number of validity tests, via its relations to physiological and neurological measures, and its predictive power regarding future observed behaviours. Some of this validation work is described in Clark *et al.* (2008). The BCS life-satisfaction question is a little different from that found in some other general-purpose surveys, although we believe that this question will likely behave similarly to the more standard question.

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depression, worry, irrational fear, rage, irritation, tension and psychosomatic symptoms (see the questionnaires section of the online Appendix). These are very different in nature from the life-satisfaction question.

The **childhood variables** are shown in Figure 3. They include variables relating to the child and to the parents ("family background"). For a child there are three main dimensions of development – intellectual performance, social behaviour and emotional health. Economists have traditionally focussed heavily on intellectual development, but some like Heckman have widened the perspective to include also non-cognitive skills.[13] But by this they usually mean social behaviour or sometimes self-discipline (or grit). They do not usually mean how the children feel – are they anxious or depressed? But feelings are a very important dimension of a person, and psychologists who study child development make a strong distinction between social (externalising) development and emotional (internalising) development. [14] This is reflected in our paper by the distinction between social behaviour and emotional health.

This difference between social behaviour and emotional health is conceptually important, and the two variables are not highly correlated. Questions on social behaviour relate to destroying things, fighting, stealing, disobedience, lying, bullying, being disliked and unsettled and impulsive behaviour. Questions on children's emotional health are more internal, and relate to worry, unhappiness, sleeplessness, eating disorder, bedwetting, fearfulness, school avoidance, tiredness, and psychosomatic pains. These are very different dimensions of personality, and we may well expect their effects not to be the same.[15]

The BCS data provide us with measurements on the three child variables at 5, 10 and 16. We also have measurements on the family at different ages but for simplicity we consolidate these into the two sets of family variables as shown in the figure (where age refers to the age of the child).[16] The exact definitions of all variables appear in Appendix A.

2.2. Method of analysis

Our analysis of the BCS data begins in Table 1 by predicting life-satisfaction from other adult outcomes and childhood variables. Then in Table 2 we examine how the other adult outcomes are themselves determined by childhood variables. In Table 3 we examine the issue of mediation: by what route each childhood variable affects the life-satisfaction of the adult. In Table 4 we focus on the family as the sole predictor, and in Table 5 we examine

[12]One intriguing possibility is that cognitive skill changes how individuals calculate life-satisfaction. We know, for example, that cognitive ability is correlated with impatience and risk aversion (Dohmen *et al.*, 2012). It is rather difficult to know how to test for this explicitly. It is worth nothing that some psychologists question the extent to which life-satisfaction is cognitive.

[13]For papers by economists on non-cognitive skills see, for example Cunha and Heckman (2008); Almlund *et al.* (2011) and Goodman *et al.* (2011). Recently Heckman's group has extended their perspective to the 5 main (OCEAN) dimensions of personality (Almlund *et al.* (2011)). These main personality traits have long been analysed in psychology (see Digman, 1990).

[14]On the measurement of children's emotional health and behaviour, see Rutter *et al.* (2008).

[15]To measure these two variables we take simple aggregates of answers to the individual questions. Clinical psychologists usually do the same. Developmental psychologists often do also, but at other times they carry out factor analysis to extract one or more factors from the multiple answers. The problem with factor analysis is that it relies on the internal coherence of the answers, not on their predictive power with respect to some outcome variable. For prediction one could of course enter each answer separately, but the problem then would be different relative weights in every separate regression. For an approach using factor analysis see Richards and Hatch (2011).

[16]We have sacrificed the purism of a totally recursive model, with the family variables changing from period to period, for a clearer but simpler broad-brush approach where we construct aggregated measures of what the family was like when the child was young.

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how far adult life-satisfaction can in fact be predicted by information available at each age. More detailed analyses are available in an online appendix, whose contents are listed in Appendix C.

Analysis is by OLS and variables (except gender) are standardised throughout. Thus all coefficients are standardised regression coefficients (i.e. partial correlation coefficients or β-coefficients). The squared value of each coefficient shows how much the right-hand variable contributes on its own to the variance of the left-hand variable (ignoring its covariance with the other right-hand variables). This is a meaningful measure of the importance of the variable.

However, to see the wood for the trees, some simplification using composite variables is helpful. We illustrate below. Suppose we are looking at the predictors of an adult variable called *Y*, and focus on the effect of child conduct at ages 5, 10 and 16 (call these variables C_5, C_{10}, C_{16}). Then we have a regression:

$$\begin{aligned} Y = & \quad c_5 C_5 + c_{10} C_{10} + c_{16} C_{16} + etc. \\ = & \quad (c_5 + c_{10} + c_{16}) \, . SD\,(C) \, . \left(\frac{C}{(SD(C))} \right) + etc. \end{aligned} \quad (2)$$

where *C* is a composite variable defined by

$$C = \left(\frac{c_5}{c_5 + c_{10} + c_{16}} C_5 + \frac{c_{10}}{c_5 + c_{10} + c_{16}} C_{10} + \frac{c_{16}}{c_5 + c_{10} + c_{16}} C_{16} \right)$$

Thus, if we form the composite variable *C*, its coefficient is the sum of the separate coefficients times the standard deviation of the composite variable.[17] This is the procedure we use throughout to calculate the effect of composite variables. (The detailed first-stage regressions appear in Appendix C online.)

Unfortunately there are many missing values for the variables that we want to use. Each regression is performed on all survey members for whom we have a non-missing value of the left-hand variable. When there are no data on a right-hand variable, we include a variable-specific dummy to register this fact (the so-called Missing Indicator method). We have also used as an alternative the Multiple Imputation method, producing very similar main results – see Appendix D online. Our discussion of results is consistent with the results from both methods.

Where there are missing values, the R^2 of the equation is biased downwards since all missing values have been assigned the same (dummy) value. To make our best estimate of

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i. To compute *SD(C)* we use only the observations where there are no missing values on any of the variables in the composite variable, *C*. Since C_5, C_{10} and C_{16} are all standardised variables *SD(C)*<1 unless all the variables are perfectly correlated.

ii. To obtain the standard error of the estimate of ($c_5 + c_{10} + c_{16}$). *SD(C)* we rerun the equations replacing C_5, C_{10} and C_{16} by *C*. This gives an estimate of the standard error of the estimate of ($c_5 + c_{10} + c_{16}$) and we then multiply this standard error by *SD(C)*.

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the true R^2, we start from the standard property of all standardised regressions. This is that, if

$$Y=\Sigma p_i X_i+e, \quad (3)$$

the R^2 is given by

$$R^2=\Sigma Y^2-\Sigma e^2=\sum_i\sum_j p_i p_j r_{ij}$$

where r_{ij} is the correlation coefficient between the two variables. All of our regression tables compute the R^2 using this formula, taking r_{ij} from the correlation matrix in Appendix C.[18]

We can now turn to the results.

3. Results

3.1. Predictors of life-satisfaction

We begin by looking directly at the determinants of life-satisfaction. The first column of Table 1 focuses on the **proximal predictors of life-satisfaction** – that is, the effect of the individual's other adult characteristics. We can straight away see a result quite different from all previous research – the prime factor is emotional health (measured 8 years earlier). All the other six variables also have significant effects and, as usual, education is the least important predictor of life-satisfaction. Income explains on its own about 0.5% of the variance of life-satisfaction – a fairly common finding.

One might of course question the validity of cross-section results like these. Clearly it would be helpful to carry out a panel data analysis, but the BCS data do not permit this. We adopted two strategies here, using the data for age 34 and age 26. In one analysis we regressed the change in life-satisfaction over time on the change in "having a partner", self-perceived health and emotional health (the only 3 variables for which there are good data on changes). The standardised coefficients for the 3 variables (comparable with those in Column 1) were 0.01, 0.09 and 0.11 – supportive of our earlier conclusions about the importance of emotional health. In the second analysis we introduced lagged life-satisfaction on the right-hand side and measured all 7 other variables at their age 34 level (the idea being that this would remove at least part of the fixed effect). The results are shown in Appendix B and are again supportive of the conclusions from Column (1).

What happens if we now instead look at the **distal predictors of life-satisfaction**, that is the "childhood variables" (family background and child characteristics)? The result is shown in the second column of the table. Again emotional health emerges as the most important variable – in childhood as in adulthood. Next comes behaviour as a child. The intellectual development of the child is the least important of the three dimensions of child development, when we consider life-satisfaction as the outcome of interest.

[18]In doing so, we are attempting to use all available information to proxy the 'true' explanatory power of our equations as it would be in a world without missing observations.

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This ranking is probably the inverse to that of most policy-makers. In popular discussion one encounters two main criticisms of the well-being approach. One is that the concept is meaningless; the other is that, even if we accepted its importance as a policy goal, it would make no difference to policy priorities.[19] As our evidence shows, the second point is not correct.

Two other points emerge from the second column of the table: family background continues to matter, even after taking child characteristics into account; and women are more satisfied with their lives, by about 8% of a standard deviation.

The next obvious question is, how does early life exert its influence on adult life-satisfaction? If the influence were only to be direct, we might wonder why there are in fact so many policies that relate to adulthood – employment policy, income redistribution, health and the like. But, as the third column shows, adult life still has an important impact on life-satisfaction even after we have allowed for the influence of family and childhood. In Column (3), which includes both sets of influence, the coefficients on adult characteristics are very little reduced, while those on child characteristics are mostly reduced by about a half.

This means that roughly half the effect of childhood on adult life-satisfaction is mediated through the effect of childhood on adult outcomes and then the effect of adult outcomes on life-satisfaction.[20] The other half is a direct, unmediated effect. The exception is intellectual performance, where the direct effect is estimated as somewhat negative but there is a substantial mediated effect through adult outcomes.

3.2. Predictors of adult outcomes

The next step is then to examine the effect of childhood on the adult outcomes. This is what we do in a series of regressions in Table 2. The specification here is the same as that used to predict adult life-satisfaction in column 2 of Table 1 (and we include the results of that estimation for reference in the last column of Table 2).When we consider the economic outcomes (income, unemployment and educational achievement), the most powerful influence is the intellectual development of the child and the child's socio-economic background. These are of course standard findings in labour economics. However, the pattern changes sharply when we turn to the social outcomes (criminality and family formation): here the key is how the person behaved as a child. Finally, for the 'personal' outcomes, adult emotional health and self-perceived health, by far the most important influence from childhood is the child's emotional health. This echoes our earlier finding that adult life-satisfaction depends the most heavily on emotional health as a child.

[19]See HM Treasury (2008).

[20]To think about mediation it is helpful to note the following relationships between standardised variables. Suppose $Y = aX + bZ$ and $X = cZ$. Then $Y = (ac+b)Z$. Since all coefficients are less than unity and (we assume) positive, finding that $ac+b$ is roughly double b can only arise if a is substantially larger than b.

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3.3. More on mediation

Now that we have charted how childhood affects adult outcomes, it is worth checking the consistency of our earlier findings regarding mediation (when we discussed the results in Table 1). Table 3 presents the estimated indirect effect of each childhood variable, combining the way it affects adult outcomes (in Table 2) with the way these outcomes affect life-satisfaction (in Table 1, Column 3). The results of this calculation appear in the left-hand column of Table 3. We can compare these 'simulated' indirect effects with the indirect effects implied in Table 1 (as given by the difference between columns (2) and (3)). As can be seen, the estimates are close, which confirms that we have a consistent story.

3.4. The effect of the family

As we have noted, the effect of family variables is only small, once childhood variables have been taken into account. But these childhood variables are of course themselves very likely affected by family influences. So what happens if we look at the reduced-form equations, where we include only the effects (direct and indirect) of family characteristics on adult outcomes?

The results appear in Table 4. The family does now emerge as more important, and in particular as a predictor of educational performance and income – the variables hitherto most studied by economists. But (insofar as we can measure the family's characteristics) family variables have a smaller impact on life-satisfaction, criminal behaviour, and family formation.

3.5. Does the child reveal the adult?

This brings us to a final question. At what stage of an individual's development can we predict their adult outcomes? Our answer to this question appears in Table 5. It has recently become quite fashionable to argue that key experiences by age 5 (plus genes) largely determine adult outcomes.[21] This argument has been supported by large odds ratios between the adult outcomes of more- and less-advantaged children. However, the proper test of predictability is the R^2s: these appear in Table 5.

The table shows how well we can predict each adult outcome from information available about a person at different stages of their life – birth (roughly speaking), age 5, age 10, and age 16. As Frijters, Johnston and Shields[22] have pointed out, life-satisfaction is extremely difficult to predict even at age 10 and only slightly easier at age 16. The most predictable outcome is educational achievement. But family income is difficult to predict from information up to age 16, as is life-satisfaction. Almost all outcomes are much easier to predict at age 16 than at age 5.[23]

[21] See for example Field (2010), Allen (2011), and less strongly Marmot *et al.* (2010).
[22] Frijters *et al.* (2011).
[23] Clearly all of the findings in this paper are affected by measurement error.

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4. Use for Policy Analysis

Any future policy-maker aiming at population well-being will require a model of the kind we have been discussing – including genetic controls if possible.[24] A life-course model is the product of the interaction between millions of individuals and the institutions in which they live. It is not a law of nature. But it is the correct starting point for considering whether changing some institution or policy would affect citizens for better or worse. Our existing model already suggests some new areas for policy development, although an ideal model would be more detailed, and refined by replication.

How could such a model be used? Let us assume that the policy-maker wanted to maximise the sum of life-satisfaction of citizens of all ages.[25] This would require a continuous record of life-satisfaction at each age, plus a model of how that path was determined. That model would suggest areas for policy development.

4.1. Effectiveness of intervention

To know whether any particular intervention was cost-effective, we would ideally require an experiment, with a long follow-up. However, such follow-ups are expensive, and often we only know the short-run effects of an intervention. A model can therefore be extremely useful for simulating the long-run effects of an intervention whose short-run effects we know (but nothing more). For example, say that we provide parent training to a badly-behaved 5-year-old and find an effect size of β. We can then go to the estimated model and simulate all the subsequent effects of a β standard deviations change in conduct at 5.

4.2. Costs

Establishing the effects of an intervention is one thing; assessing its cost-effectiveness is another. For the latter we need to know not only the initial cost of the original intervention but also any impact that this has on subsequent public expenditure. Some “positive” impacts will increase subsequent public expenditure – for example, a successful education intervention may lead to more staying on at school. On the contrary, other effects on cost may be negative – for example fewer costs of crime and justice.

If the well-being benefits were positive and the net costs were zero or negative, we could make a decisive argument for the intervention: much of the discussion of early intervention to date has been of this kind.[26] However, public expenditure does not have to have a zero net cost to the taxpayer, and much of it has of course a positive net cost. The analysis of childhood interventions will need to appeal to estimates of benefits as well as net cost in order to get some feel for the level of cost-effectiveness.

[24]This may become possible through greater availability of twin and adoptee studies, or better identification of critical gene sequences in DNA (such DNA data are now routinely collected in many studies).

[25]Many people believe more weight should be given to the avoidance of misery than the achievement of the highest levels of life-satisfaction (Layard (2011), ch.15). This would require a concave social-welfare function, based on ethical judgements. We here ignore that complication.

[26]See for example, Knapp *et al.* (2011b).

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4.3. Cost-effectiveness

In that case how would we judge if interventions were cost-effective? It is best to think of the level of public expenditure as being pre-determined, and independent of the potential benefits of current policy options.[27] If so, the correct decision rule for evaluating an intervention is to select a cost-effectiveness ratio (λ) such that all interventions with ratios lower than λ would together just exhaust the available funding for public expenditure.

All of this does require good information on costs. Future models should therefore include much more structure than the model in this paper. They will need to include all publicly-financed activities in which the individual becomes involved (be they education, pre-school, health-related, law and order, employment or welfare benefits). In our future work, on data from ALSPAC,[28] we plan this degree of detail.

4.4. When to intervene?

What can we now say about where and when to intervene? These are separate issues. The first asks which areas of life require more intervention or less – for children is it their emotional, behavioural or intellectual life, and for adults is it income support, employment policy or family support? But the second is when any interventions should take place – earlier or later?[29] If we consider that childhood well-being matters as much as adult well-being,[30] then perhaps the main issue on the benefit side is how long the effects last. With respect to language learning, for example, the answer is clear (it lasts longer if the intervention is earlier). But for emotional learning there is still much to be discovered. On the cost side, adult interventions generally produce immediate flows back to public finance as more people go out to work and earn. Child interventions can produce massive savings to public finances but these are often at a much later date. Clearly we need interventions at all ages and the optimum balance will remain unclear until we have better life-course models and better experimental data.

5. Conclusions

Policy-makers need models which show them the impact of all the main factors affecting adult life-satisfaction, in a consistent framework using the same metric. We estimate such a model using the British Cohort Study (1970), in which adult life-satisfaction is directly affected by both adult circumstances and by childhood characteristics. But, even though childhood characteristics also affect adult circumstances, they have only limited power in predicting adult life-satisfaction.

By far the most important predictor of adult life-satisfaction is emotional health, both in childhood and subsequently. Pro-social behaviour in childhood is the next most important childhood predictor. We find that the intellectual performance of a child is the least important childhood predictor of life-satisfaction as an adult. Intellectual performance is of

[27] See for example O'Donnell *et al.* (2014)
[28] Avon Longitudinal Study of Parents and Children.
[29] Cunha and Heckman (2008) argue strongly in favour of early intervention on the grounds that 'skills beget skills' for which they offer supporting evidence.
[30] As argued for example by Layard and Dunn (2009).

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course a good predictor of adult educational achievement and income. But income only explains 0.5% of the variance of adult life-satisfaction. Such findings are highly suggestive but need to be followed by more detailed models which are therefore more operational.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Appendix A: Adult and Child Variables31

ADULT		
Log income (34)	Household disposable income per OECD adult equivaler (extra adults .7; children .5)	
Educational achievement (34)	PhD or masters = 0.750 Degree = 0.486 A level = 0.237 GCSE = 0.188 CSE = 0.043 No qualifications = 0 (Values taken from a regression of male log full-time earnings on "having a family", childhood emotion and conduct and 5 education dummies.)[32]	
Employed (34)	Not unemployed at time of interview.	
Has a partner (34)	Married/cohabiting with children = 0.685 Married/cohabiting without children = 0.530 Single with children = −0.004 Single without children = 0 (Values taken from a regression of life-satisfaction on 6 "success" variables plus 3 family dummies.)[28]	
Good conduct (16-34)	Minus total times found guilty by a criminal court or formally cautioned at police station.	(subjects' replies)
Self-perceived health (26)	Single Question with answers treated as 1-4	
Emotional health (26)	Sum of replies to 24 questions	(subjects' replies)
Life-satisfaction (34)	"Here is a scale from 0-10. On it "0" means that you are completely dissatisfied and "10" means that you are completely satisfied. Please tick the box with the number above it which shows how dissatisfied or satisfied you are about the way your life has turned out so far."	*Life-satisfaction (34)*
CHILD		
Intellectual performance	Age 5 Copy designs test score Age 10 British Ability Scales (BAS) total score Age 16 Whether any GCSE pass	
Good conduct	Age 5 Sum of replies to 10 questions Age 10 Sum of replies to 10 questions Age 16 Sum of replies to 10 questions	(mothers' replies) (mothers' replies) (mothers' replies)
Emotional health	Age 5 Sum of replies to 28 questions Age 10 Sum of replies to 24 questions Age 16 2/3 × replies to 22 questions + 1/3 × replies to 8 questions	(mothers' replies) (mothers' replies) (subjects' replies) (mothers' replies)

[32]We use this approach in order to derive a single variable which can be used as a left-hand or right-hand variable in a linear model

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Appendix B: Predictors of Life-Satisfaction at 34, including the lagged dependent variable

(Dependent variable: life-satisfaction at 34)

Life-satisfaction at 26	.258	(.013)
Log Income (34)	.034	(.010)
Educational achievement (34)	.019	(.009)
Employed (34)	.065	(.011)
Good conduct (16-34)	.029	(.012)
Has a partner (34)	.090	(.011)
Self-perceived health (34)	.095	(.010)
Emotional health (34)	.323	(.012)

Note: See Note to Table 1.

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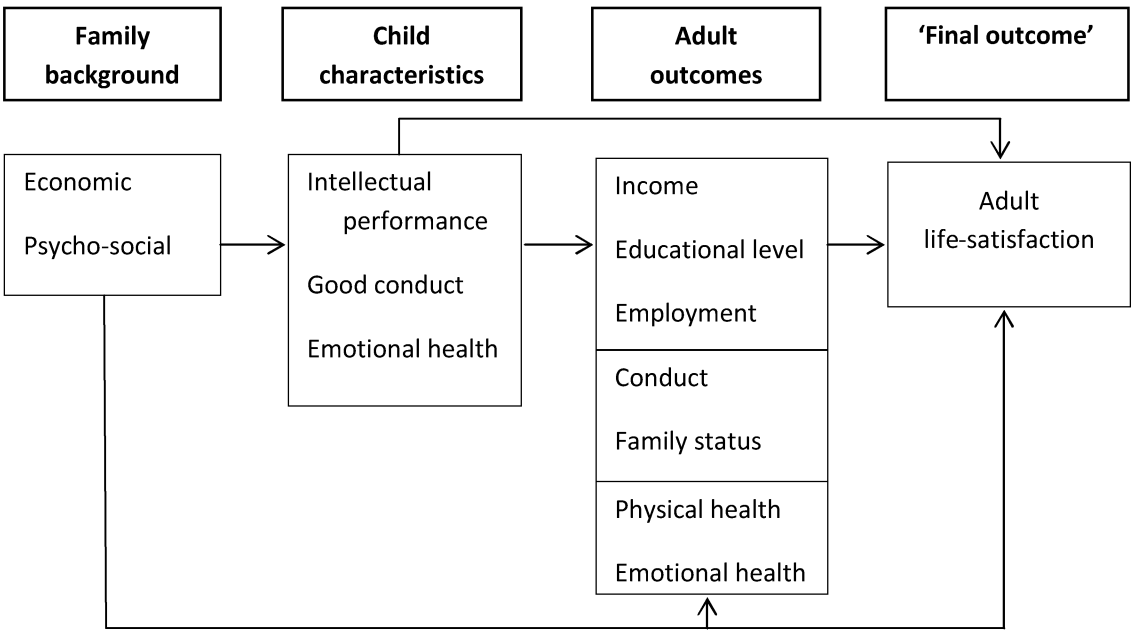

Fig. 1. A Model of Adult Life-Satisfaction

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Economic	Log income (equivalised)	at 34
	Educational achievement	by 34
	Employed (measured as not unemployed)	at 34
Social	Good conduct (= -no. of crimes)	at 16-34
	Has a partner	at 34
Personal	Self-perceived health	at 26
	Emotional health	at 26

Fig. 2. Adult Outcomes

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	Age of child
Child characteristics	
Intellectual performance	5, 10, 16
Good conduct	5, 10, 16
Emotional health	5, 10, 16
Family background	
Economic (F^E)	
Father's socio-economic group	10
Family income	10
Number of siblings	10
Father in work	0, 5, 10 average
Mother's and father's age on leaving full-time education	--
Psycho-social (F^P)	
Mother's emotional health	5, 10 average
Child conceived within marriage	--
Both parents still together	10

Fig. 3. Childhood Variables

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Table 1
Predictors of Life-Satisfaction (Dependent variable: life-satisfaction at 34)

	(1) Using adult variables only	(2) Using childhood variables only	(3) Using both
Log income	0.055		0.052
	(0.012)		(0.012)
Educational achievement	0.035		0.029
	(0.010)		(0.011)
Employed	0.085		0.082
	(0.013)		(0.013)
Good conduct	0.066		0.061
	(0.014)		(0.014)
Has a partner	0.116		0.113
	(0.012)		(0.012)
Self-perceived health (26)	0.068		0.065
	(0.013)		(0.013)
Emotional health (26)	0.204		0.181
	(0.014)		(0.015)
Intellectual performance (5 10 16)		0.045	-0.035
		(0.016)	(0.020)
Good conduct (5 10 16)		0.085	0.052
		(0.019)	(0.019)
Emotional health (5 10 16)		0.174	0.098
		(0.021)	(0.020)
Family Economic		0.055	0.025
		(0.018)	(0.014)
Family Psychosocial		0.030	0.024
		(0.016)	(0.018)
Female	0.068	0.082	0.072
	(0.021)	(0.022)	(0.021)
Observations	8,868	8,868	8,868
Adjusted R^2	0.108	0.071	0.142

Note: For variable definitions see Figs 2 and 3 and Appendix A. All variables are measured at age 34 unless stated otherwise and are standardised (except gender). Adjusted R^2 excludes the effect of gender on the explained variance and the total variance. Estimation is by OLS with robust standard errors in parentheses.

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Table 2

Predictors of Adult Outcomes, Using Information up to Age 16 (Dependent variable: life-satisfaction at 34)

	(1) Log income	(2) Educational achievement	(3) Employed	(4) Good conduct	(5) Has a partner	(6) Self-perceived health (26)	(7) Emotional health (26)	(8) Life-satisfaction
Intellectual performance	0.136	0.437	0.028	0.074	0.095	0.086	0.097	0.045
(5 10 16)	(0.014)	(0.012)	(0.015)	(0.012)	(0.016)	(0.015)	(0.013)	(0.016)
Good conduct	0.031	0.078	0.008	0.169	0.089	0.054	0.078	0.085
(5 10 16)	(0.019)	(0.013)	(0.028)	(0.018)	(0.020)	(0.022)	(0.018)	(0.019)
Emotional health	0.069	0.036	0.017	−0.056	−0.023	0.158	0.328	0.174
(5 10 16)	(0.018)	(0.036)	(0.055)	(0.014)	(0.020)	(0.020)	(0.021)	(0.021)
Family Economic	0.081	0.188	0.020	0.087	0.038	0.056	0.075	0.055
	(0.015)	(0.015)	(0.031)	(0.088)	(0.063)	(0.019)	(0.029)	(0.018)
Family Psychosocial	−0.009	0.023	−0.027	0.038	0.030	0.043	0.066	0.030
	(0.064)	(0.013)	(0.015)	(0.015)	(0.028)	(0.016)	(0.018)	(0.016)
Female	0.175	−0.014	0.041	0.409	−0.061	−0.090	−0.306	0.082
	(0.022)	(0.018)	(0.020)	(0.018)	(0.025)	(0.023)	(0.021)	(0.022)
Observations	8,888	10,575	8,928	10,918	6,896	8,260	8,254	8,868
Adjusted R^2	0.05	0.376	0.01	0.07	0.029	0.067	0.207	0.071

Note: See Note to Table 1.

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Table 3

Indirect Effect of Childhood Variables upon Life-Satisfaction at 34

	(1) Simulated	(2) From Table 1 [Col (2) minus Col (3)]
Intellectual performance (5 10 16)	0.068	0.080
Good conduct (5 10 16)	0.049	0.033
Emotional health (5 10 16)	0.079	0.076
Family Economic	0.046	0.030
Family Psychosocial	0.022	0.006

For explanation see section 3.3.

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Table 4

Predictors of Adult Outcomes, Using Information on Family Only (Dependent variable: life-satisfaction at 34)

	(1) Log income	(2) Educational achievement	(3) Employed	(4) Good conduct	(5) Has a partner	(6) Self-perceived health (26)	(7) Emotional health (26)	(8) Life-satisfaction
Family Economic	0.124	0.323	0.079	0.134	0.069	0.069	0.114	0.067
	(0.018)	(0.019)	(0.030)	(0.051)	(0.020)	(0.020)	(0.027)	(0.017)
Family Psychosocial	0.032	0.079	0.009	0.068	0.035	0.066	0.115	0.065
	(0.014)	(0.079)	(0.026)	(0.013)	(0.013)	(0.012)	(0.014)	(0.013)
Female	0.183	0.054	0.072	0.477	−0.028	−0.092	−0.326	0.086
	(0.021)	(0.018)	(0.021)	(0.019)	(0.024)	(0.022)	(0.021)	(0.021)
Observations	8,888	10,575	8,928	10,918	6,896	8,260	8,254	8,868
Adjusted R^2	0.021	0.0176	0.007	0.028	0.009	0.022	0.051	0.018

Note: See Note to Table 1.

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Table 5

Adjusted R^2 for Equations Predicting Adult Outcomes, Using Different Amounts of Information. (Dependent variable: life-satisfaction at 34)

	(1) Log income	(2) Educational achievement	(3) Employed	(4) Good conduct	(5) Has a partner	(6) Self-perceived health (26)	(7) Emotional health (26)	(8) Life-satisfaction
Information on:								
Family only	0.021	0.176	0.007	0.028	0.009	0.022	0.051	0.018
Up to age 5	0.029	0.176	0.008	0.043	0.016	0.027	0.061	0.022
Up to age 10	0.035	0.247	0.009	0.051	0.019	0.029	0.071	0.027
Up to age 16	0.050	0.376	0.010	0.070	0.029	0.067	0.207	0.071

Note: See Note to Table 1.