Extract from an application to NICHD in the States for funding on the social science side of the ALSPAC over the next 5 years (submitted on Oct 1 2004)

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SPECIFIC AIMS

The study proposed is an extension through early and mid-adolescence of data collection on a cohort of children who have been followed from birth (the ALSPAC cohort) with a great range of inter-disciplinary collaboration and funding. This previous investment has created the opportunity for a unique study of the multiple processes underlying the developing life chances across a range of important outcomes of a generation of children, taking account of a great wealth of child, family, peer, school and neighborhood information with a data structure that facilitates the examination of processes using variation derived where possible from natural experiments, within a longitudinal, multi-level, multi-disciplinary structure.

Partial core funding for the ALSPAC study has been provided from other sources, primarily the Wellcome Trust and the UK Medical Research Council. Although these other sources of funding create invaluable infrastructural capability for this current project, they will not continue to lead to the rich array of measures for social and developmental scientists that the infrastructure makes possible. We propose to extend the medical components of the study into the arena of social and developmental science and will work with a consortium of funding agencies to collect the wide-ranging data. Specifically, we propose to:

1. Collect social and developmental science data from the sample children, their parents and teachers through ages 13-17. These children were initially sampled ante-natally and have been studied until now when they have reached ages between 11 and 13. The key focus of this study will be the emergence in adolescence of a diverse range of behaviours and states of being across multiple domains of life activity each of which has important and long-term implications for the developing person and the wider society. The three broad domains of outcome considered will be (i) health and well-being, (ii) social attitudes and behaviour, and, (iii) education and employment. Outcomes in these domains are of interest to policy-makers as well as to scientific and social scientific researchers. The data will also enable a consideration of the interactions and coupling between the outcomes in the different domains and of the dynamic processes of engagement and identity that underlay many of the specific outcomes as well as respond to them.

Key research questions include: How is school engagement generated? How do the cognitions (i.e. beliefs, attitudes, knowledge, expectations and self-concepts) of pupils and their families, teachers and peers influence motivation and attainment? How do social class, ethnicity and gender impact on these processes of motivation and attainment? What are the interactions between and within academic, psychological, behavioural and personal development domains of growth? How do teacher beliefs, personality and managerial style impact on children's attainments, engagement and broader development?

2. Link the data to previous measures and make it available to researchers world-wide, under appropriate ethical constraints. A sub-set of data has been part-funded by the UK Government's Department for Education and Skills (DfES) and Home Office (HO). This is available to researchers funded by the DfES and/or HO subject to approval by the relevant ALSPAC committees. These data include measures relevant to the proposed project and will be linked to the data collected in the current proposal so that, subject to the appropriate ethical procedures all researchers will have access to the full developmental history of the sample children.

A. BACKGROUND AND SIGNIFICANCE

The Avon Longitudinal Study of Parents and Children was designed with the overarching aim of identifying factors that influenced health and personal and social development, whether these were biological, physical, genetic, psychological or pedagogical. The study was based on the supposition that early influences can have very long-term effects on health and well-being and that more accurate information can be collected contemporaneously rather than retrospectively. Detailed data have been collected on the medical, social, psychological, occupational and educational background of each parent using well-validated self-completion questionnaires. The survey has continued to survey parents and children annually using structured, postal questionnaires and clinic-based data.

A.1 The unique qualities of the data

The data collection techniques summarized above led to a dataset with unique and important qualities that have particular advantages for social science research and for collaboration between social, biological, medical and psychological scientists. These particular strengths are:

The richness of the data collected. Wide-ranging bio-medical, psychological, demographic and educational information is collected from parents, teachers and pupils and this has been the case throughout the lives of the sample children. DNA is available on over 10,000 of the study subjects and their mothers. Investigation of gene-environment interactions in regard to phenotypes is eminently feasible.

The quality of data. The clinic time enables particularly accurate assessment, reduces missing values and facilitates the development of quantitative information on important but potentially sensitive topics such as bullying and drug-use.

Annual assessment. The fact that children are surveyed and tested every year means that very precise information is gathered on trajectories of change and development. If the period between assessments is large then it can be extremely hard to identify for any developmental period what it is that leads to observed changes. Annual assessment in ALSPAC means that quite short-run effects can be estimated as can the effects of particular teachers, schools or other experiences. The effects of measurement error are substantially less in other studies.

Clustering and the multi-level structure. The geographical concentration of the children means that in most Avon school classes most of the children are ALSPAC children. This is a particularly valuable feature of the data meaning that peer groups and school intakes can be assessed in uniquely rich and new ways enabling studies of the many ways that children influence each other. Such studies can take into account all of the prior developmental information on each of the children involved in the interaction.

Tracking between schools. The geographical concentration also means that as children move schools within Avon they continue to be educated within schools for which all the necessary information is already gathered. This makes it cost-effective to continue to study school movers and to track the effects of mobility. Children who leave Avon continue to be tracked within ALSPAC. Although the clustering advantages are lost for the subsequent data on such children, such movements can be the source of useful random or quasi-random variation that is useful for subsequent analysis.

Building on substantial prior investments, the great potential for value for money. The fact that ALSPAC has been funded from other sources for 12 years and will continue to draw substantial sums of money from elsewhere means that social science and psychological research funds allocated now have the benefit of building on all the earlier data, expertise

and complex administrative systems that have already been developed. These sunk costs have been met by others.

The 3 cohort panel structure. This enables particularly robust and informative study of school and teacher effects because a given teacher will teach different groups of children. Moreover, if policy interventions are experienced only by later waves they can be evaluated in terms of effects on the outcomes of the younger children relative to older children, conditional on school and class composition, area and family background. It is also an advantage that children are tested both at fixed dates and on a rolling-cycle.

The low sample attrition. The geographical concentration of children also adds to the engagement of sample members in the study as well as leading to important cost savings.

There are other large-sample, longitudinal datasets in the UK, US and elsewhere. They all have their own unique attributes and offer value in different ways. However, while many have one or two of the features outlined above or indeed other important strengths, none can match the full set of features of ALSPAC described above, particularly for a study of the development of children in adolescence.

So far over 174 papers have been published in peer reviewed papers based on analysis of the ALSPAC dataset, with several more in press (see Appendix 2.) It has also been the basis of 33 post-graduate dissertations as well as of books, chapters and reports.

A.2 Research questions

Adolescence is a critical period for the development and consolidation of behaviours, values, aspirations, and attitudes (127, 131). Despite recent upsurges in research, there is still much we do not understand. We know, for example, that academic and mental health problems for many adolescents either begin or accelerate with the transition to junior high school (56, 146) and that these changes relate in predictable ways to school characteristics. We know less about other types of psychological and social changes. We lack adequate descriptive data on changes in such developmental characteristics as: self perceptions, interests, and values; attachment to prosocial institutions and goals; short and long range social, educational, and vocational goals; involvement in either positive or risky activities; and relations with their families and peers. There are good theoretical reasons to expect that experiences in the home, at school, on the street, and with one's peers influence the course of adolescent development in complex ways. There have been repeated calls for comprehensive studies of adolescence that: (1) take seriously person-process-context and transactional perspectives on human development; (2) apply risk, protective, and promotive perspectives; (3) consider multiple influences simultaneously; (4) look at the relation of development to variations in the social environment in terms of change, transition, and adaptation;, and (5) look at the changing roles and goals of adolescents as they move through and manage a changing social world (99, 100, 103, 112, 138, 146, 151, 109**,** 110, 111, 135, 136, 81, 141, 159, 130, 87). Few studies have gathered longitudinal information on both personal development and the changing characteristics of the multiple social contexts that adolescents inhabit as they pass through this period. [Salient exceptions include Magnusson's Individual Development and Adjustment Study (112, 149); Conger et al.'s Iowa Youth and Family Study (40); Eccles' Michigan Study of Adolescent Life Transitions (56); and the Denver Youth Study (61)]. However, none of these studies have the large and multi-level sample of ALSPAC combined with the extent of lifespan developmental information. Most existing studies have relied on a limited set of indicators of both adolescent development and social context. In addition, even contextual studies have typically focused on only one or two social contexts. Consequently, we know very little about the interplay of various social contexts as they relate to adolescent development broadly defined.

The central issue for the proposed project is the determination of the outcomes of adolescence (defined in Section D). The project will lead to the construction of a dataset in which researchers can consider the personal, familial and social influences on each outcome, identifying antecedents, causal influences, mediating mechanisms and moderating factors. The project will adopt a multi-level framework for data collection leading to a resource for estimating these relationships recognising the clustering of individuals in classes, schools and neighbourhoods during this developmental phase as well as the important and complex interactions between the pathways of the many different individuals studied as well as within-person coupling relationships between domains of development. The project team will work with the Local Education Authorities and other policy and practitioner organisations to nest natural experiments within the data subject to appropriate ethical guidelines in order to enable robust evaluation of policy interventions for adolescents and to create random and exogenous variation in key variables of interest.

B. PRELIMINARY ANALYSES/PROGRESS

B.1 Qualifications of Investigators

Jacque Eccles and Leon Feinstein will provide scientific oversight for the completion of the specific aims of this study. Leon Feinstein will have particular responsibility for liaising between funders, other researchers (see Appendix 3) and the data collection team. Jean Golding will oversee the day-to-day operational conduct of the study through the ALSPAC research team.

Leon Feinstein is Director of the Centre for Research on the Wider Benefits of Learning, a Centre funded by the UK Government's Department of Education and Skills to explore the relationships between education broadly defined and wide-ranging aspects of adult life and well-being, encompassing health, social cohesion and family life. The Centre undertakes both quantitative and qualitative research, using quantitative techniques to estimate relationships of interest in as robust a way as possible, looking for natural experiments in order to estimate causal relationships and making use of the rich longitudinal data that exist in the UK. The Centre has been running for 5 years and the next three year phase will involve considerable analysis of the ALSPAC data. Feinstein is also Reader in the Economics of Education at the Institute of Education in London and undertakes inter-disciplinary research, leading to publications in leading journals in Economics, Psychology and Education.

Feinstein is also chair of the Education sub-Committee of the ALSPAC study and a member of the ALSPAC Criminality Group and Cognitive, Educational and Social Development Advisory Committee (see Appendix 3). He is an associate of the Centre for Longitudinal Studies at the Institute of Education in London, acting as collaborator on the UK national birth cohorts, the National Child Development Study and the British Cohort Study. He is also an associate of the NSF funded Centre for the Analysis of Pathways from Childhood to Adulthood at Michigan University and of the Centre for Economic Performance at the London School of Economics.

Jacque Eccles is Senior Research Scientist and Co-Director of the Child Development Supplement, Survey Research Center, Institute for Social Research, and Wilbert J. McKeachie Collegiate Professor of Psychology, Women's Studies and Education. Dr. Eccles is one of the leading experts on child and adolescent development, having written dozens of journal articles and books on the subject. She is currently president of the Society for Research on Adolescence, the primary interdisciplinary professional association for researchers in this field, and Chair of the MacArthur Research Network on Successful Pathways through Middle Childhood. She is a member of the National Academy of Education and a fellow in both APA and APS. Her seminal work on

adolescent achievement motivation has been of critical importance in designing the present study. Eccles has substantial prior experience with large-scale longitudinal data collections of this sort, as she has previously served as Principal Investigator for three longitudinal studies all funded, in part, by NICHD: (a) the Michigan Study of Adolescent/Adult Life Transitions (MSALT), a study focused on school and family influences on adolescent development and the transition into adulthood, which collected nine waves of data from approximately 2000 youth from grade 6 until age 29; (b) the Childhood and Beyond study (CAB), a study focused on school and family influences on development during middle childhood and adolescence, which collected 10 waves of data on approximately 800 children and their families from the time the children were in kindergarten until they were 20 years old; and (c) the Maryland Adolescent Development in Context study (MADIC), which focused on race, school, family, peer group, and neighborhood influences on development during the second and third decades of life, which collected six waves of data on approximately 600 African-American and 300 European-American adolescents and their families from the time the youth were in 7th grade until they were 20 years old. Her experience and professional credentials will be invaluable to the success of developing a dynamic, active network of developmental researchers using the CDS.

Jean Golding is Scientific and Executive Director of ALSPAC and Professor of Paediatric and Perinatal Epidemiology at the University of Bristol, in the Division of Child Health within the Department of Clinical Medicine. Initially trained as a mathematician, she spent 3 years as a research fellow in the Department of Human Genetics and Biometry at UCL where she carried out epidemiological research into the aetiology of birth defects. Thereafter she worked on a number of large population cohort studies firstly in the Unit of Clinical Epidemiology within the Department of the Regius Professor of Medicine at Oxford and since 1980 in the University of Bristol. As initiator and designer of the Avon Longitudinal Study of Parents and Children (ALSPAC) she is particularly concerned with the interplay of genetic, environmental exposures in affecting health and development. She is currently Scientific and Executive Director of the ALSPAC study and also the editor in chief of the international journal Paediatric and Perinatal Epidemiology.

B.2 The data collected to date

B.2.1 An overview

The study collected information during the pregnancies of all expectant mothers resident in the county of Avon, UK, with an expected date of delivery between April 1 1991 and 31 December 1992. From the time the child was born the mother has completed questionnaires on the development, behaviour and health of the child. For a 10% sub-group detailed assessments of development were made by trained observers at the ALSPAC “Children in Focus” clinic at 6 monthly intervals until 5 years of age. From age 7 onwards all children in the cohort (n ~ 14000) have been invited to these annual clinic assessments, each lasting half a day. These are aimed at determining abilities and disabilities, including attention and impulsivity, IQ and executive function, speech and language, reading ability and phoneme awareness, motor coordination, vision and hearing. Psychological interviews assess whether the child has been bullied or is a bully, assesses their level of depression, self-esteem impulsivity and locus of control and gather information on self-concepts of ability such as in maths and reading at school as well as their valuations of these and other subjects and perceptions of teachers’ attitudes and values. This process of annual testing is expected to continue until ages 16-18.

In parallel with this information has been collected from parents and carers in regard to the family environment including, for example, measures on family education, income, wealth, housing and assets, social networks and support, sibling interactions, stress in the home,

parental cognitions such as expectations for future education and perceptions of the child's talents, attitudes to baby behaviour and gender role play, feeding, sleeping and disciplinary strategies, HOME score, attachment to the child, partner participation in the birth and delivery of the sample member and subsequent parenting and household management, physical and emotional cruelty to the child and parents' relationships with their own parents and experiences of abuse and cruelty.

Further information has been gathered on quality and type of day care, using information from both parents and carers. Primary schools have been approached, at ages 7/8 and 10/11 – with data collected from the teachers on each child's behaviour and abilities, as well as details of the school and class ethos and physical condition as reported by the head teacher and class teacher respectively.

In order to understand the other features that may impact on intellectual and educational development, DNA is available on over 10,000 children to determine genetic susceptibility factors that may react with school or home environments. Blood samples have been collected at various time points: on a 10% sub-sample at 31, 43 and 61 months, and on the whole cohort at 7, 9 and 11 years. Motor ability, lung function, pulse rate and blood pressure have been repeatedly assessed along with many other physical and anthropometric measures.

Appendix 1 provides a more detailed summary of the different instruments used and the areas of development and environment assessed.

B.2.2 Response rates.

The estimated eligible ALSPAC sample is 13,397 children. Of these 11,300 are still registered with the study. Tables A1.3 and A1.4 in Appendix 1 describe the response rates in the data that have been keyed and coded to date, for each instrument type. For example, in the age 7 data there are 8,256 responses (73%) for the mother's questionnaires, 4021, (36%) for the partner's questionnaires, 8276 (73%) for the child-based questionnaires, 7,096 (63%) for the child-completed questionnaires and 7,407-8,235 (66%-73%) for the clinic-based data.

When data from diverse instruments are combined as in multivariate statistical analysis then the number of available observations will decline. For example, whereas 8,256 mothers responded to the age 7 questionnaire, the number responding to the age 7 and all previous mothers questionnaires was 7,636 (68%). When questionnaire types are combined, sample numbers decline further but, still compare favorably with most other similar studies.

This level of sample size makes power analysis unnecessary as for most effect sizes of interest the risk is of finding very trivial effects statistically significant rather than lack of power. However, any degree of missing-ness, although inevitable, must be a cause of concern, particularly where it is non-random. Statistical techniques for dealing with missing-ness such as full information maximum likelihood assume that missing-ness is random conditional on all the information in the model. It is vital therefore that representative-ness be maintained. ALSPAC makes strenuous efforts to maintain the engagement and co-operation of the study children, parents and teachers using vehicles such as magazines, the ALSPAC "kids' club," interactive web-sites, sports days, competitions and linked stories in local TV and newspapers such as the well-advertised participation of 40 ALSPAC staff and parents in the Bristol Half-Marathon.

B.2.3 The structure of the data

ALSPAC children were born in two different years 1991 and 1992 and are spread over three school years. These provide, respectively, two age cohorts and three school cohorts.

There are considerable advantages to these sampling structures but they also introduce complexity. Table 1 summarizes the structure. Note that sampling in ALSPAC was by expected date of birth. Note, too, that in the UK children enter school in the academic year in which they will turn 5, starting in what is called the reception year and moving in the following year to year 1. In most systems children will stay in this primary school setting through to year 6. Secondary school runs from year 7 (age 11/12) to year 11 (age 15/16) after which point children are permitted to leave school.

Table 1: ALSPAC sampling structure

Expected date of birth	*School Year in 2004/05*	*Proportion of births*	*Date of completion of secondary school*
School Cohort 1: 1/4/91 – 31/8/91	9	5/21 = 24%	Summer 2007
School Cohort 2: 1/9/91 – 31/8/92	8	12/21 = 57%	Summer 2008
School Cohort 3: 1/9/92 – 31/12/92	7	4/21 = 19%	Summer 2009

The oldest child had an expected date of birth of the beginning of April, 1991, the youngest end December 1992. Nearly 25% of the sample is in the highest school year, currently year 9, 57% in the middle cohort and nearly 20% in the youngest cohort.

B.2.4 ALSPAC data collection instruments

Postal questionnaires to pupils and parents. ALSPAC children and parents are surveyed annually using postal questionnaires. These surveys are an essential source of information on the lives of sample children and their families, covering a great range of issues either annually or in special, occasional supplements. This instrumentation is sent out on a rolling cycle based on the ages of children. Therefore, it is being sent out and returned continuously, not at a fixed point in the year.

This is a relatively inexpensive form of data collection and offers reliability for many important constructs. The administration of postal questionnaires requires a team of post-room staff. There are also staff costs for coding and creating a data archive that can be deposited and used by researchers. Non-staff costs include printing, postage, bought-in data processing, travel, office costs and costs for support staff. There are economies of scale for questionnaires to parents in that these are part-funded from other sources.

Clinic time. The Children in Focus clinic has provided very high quality data as it is gathered through one-to-one interactions between trained psychologists/interviewers and sample children. Children are invited to the clinic and the information collected on the same on-going, rolling cycle as the parent and pupil questionnaires, although with a substantial lag between the two. This source of data is necessarily time-intensive with high staff costs. Moreover, because of the way the clinic is organized it is not possible to use the clinic to gather information for sub-groups of children.

Postal questionnaires to teachers. Two types of data collection have been achieved through teacher survey: (i) teacher-level data on teachers and classes, and, (ii) pupil-level data. By the latter method can teachers have been used as sources of data on specific sample children and their behaviour, attitudes and attainments. The former has also a very useful source of data on the teachers of the sample children and their peers. This instrumentation is sent to teachers at a fixed date, unlike the parent/pupil questionnaires. The date is determined by the data collection team in discussion with teachers and

schools taking into account the particular circumstances of each school year so as to maximize response and minimize disruption to teachers, school s and pupils.

Information is more expensive to collect from teachers than from parents or pupil. It requires two extra elements the absence of either of which would result in excessive attrition; the staff costs of a school liaison officer responsible for the maintenance of links with local schools and the cost of a payment to teachers for their time. Payments to teachers are £10 per form for each type of questionnaire. Thus the payment to ALSPAC pupils' teachers who responds to the 24 page class-level survey is £10 per teacher. For each teacher who responds to the pupil-level survey the payment is approximately £300.

An additional cost results from the anonymity restriction that teachers must not be able to identify ALSPAC children. This means that data must be collected on all children eligible for the ALSPAC study, an increase from 14,000 children to 21,000. Teacher-level data on teachers and classes is substantially cheaper to collect than pupil-level data from teachers. The former only needs one form to be completed per teacher, instead of one per pupil. However, only by the latter method can teachers be used as sources of data on children and their behaviour, attitudes and attainments.

Teacher led testing. Important and reliable data on pupils' attainments has been gathered through testing in classes, facilitated and moderated by teachers. This has been undertaken at a fixed point in time, although with moderate variation in the precise date at which schools and classes can set the test. Payments to schools are required. ALSPAC pays £50 per teacher who uses class time in this way. (Note that other incentives are also developed for teachers and schools.) Another addition to costs follows from the fact that it is not ethically advisable to exclude children who are not eligible for the ALSPAC study but who are in classes with ALSPAC children. There are, therefore, 12,000 children who must be tested for each of the three waves.

Head-teacher postal questionnaire. Head-teachers have been a vital and relatively inexpensive source of information on school-level structures and administrative features of the school such as adult-teacher ratios, expenditure per pupil, use of classroom assistants and other policy variables. This instrumentation was sent to head-teachers at a fixed date. The main cost item is the £200 payment per head-teacher.

Administrative data. In addition to these sources, data on the ALSPAC children is also available through matching with the Department for Education and Skills' National Pupil Database (NPD). This contains records on the Key stage (KS) scores on National Curriculum tests of all children in England. These tests are set at ages 7 (KS1), 11(KS2), 14 (KS3) and 16 (final, national qualifications). The National Curriculum defines expected levels for each of these Key stages. It is possible to obtain a range of levels in each Key stage. The levels have been designed so that most pupils will progress approximately one level every two years. The expected level at each key stage describes the level achieved by the typical pupil. The expected levels are a level 2C at Key stage 1, a level 4 at Key stage 2 and levels 5 or 6 at Key stage 3.

Appendix 1 provides detailed descriptions of the types of instruments used in prior data collection in ALSPAC.

B.2.5 The timing of data collection

One source of complexity for data collection is that whereas surveys of teachers or tests in schools are undertaken at fixed points in time with the children spread across the three cohorts, parent and pupil questionnaires and clinic tests are undertaken on a rolling cycle based on the age of the child. So, for example, the age 13 postal survey instrument will be posted out as children reach a fixed age (to within a month.) At the same time, and on the

same days, the age 12 postal instrument will be posted out to the children one year younger. In this sense there are two age cohorts. Therefore, a postal questionnaire or clinic test takes 21 months to be completed.

In Table 2 we consider the school cohort and age structure for a fixed date instrument such as a test or teacher questionnaire. These are administered in schools on a fixed date, with June 1 here taken as an example.

Table 2: The 3 school cohorts and the timing of a fixed-date test.

Date of birth	*1 June 2005*	*1 June 2006*	*1 June 2007*	*1 June 2008*	*1 June 2009*
School cohort 1:	Year 9	Year 10	Year 11		
4/91 - 5/91	Age 14	Age 15	Age 16		
6/91 – 8/91	Age 13	Age 14	Age 15		
School cohort 2	Year 8	Year 9	Year 10	Year 11	
9/91 - 5/92	Age 13	Age 14	Age 15	Age 16	
6/92 - 8/92	Age 12	Age 13	Age 14	Age 15	
School cohort 3	Year 7	Year 8	Year 9	Year 10	Year 11
9/92 – 12/92	Age 12	Age 13	Age 14	Age 15	Age 16

As Table 2 shows the study would continue until the end of the school year ending summer 2009.

A test on a given date may split the school cohorts into two age groups. For the Year 9 test, for example, those in the cohort born before June 1 will be age 14, those after that will be 13. At the same time there will be 13 year olds in the second school cohort receiving the Year 8 test. There will also be 12 year olds receiving the Year 8 test if they are in school cohort 2 and the Year 7 test if they are in school cohort 3. Thus testing is spread over three school cohorts. Note that in subsequent analysis it is of course possible to use actual age as a source of standardization and control.

Therefore, a fixed date instrument takes just over two years to be completed and the time-scale for a full secondary school study is 7 years. Ideally a full, annual study following these children through secondary school would have started in the school year beginning Autumn 2002 when the eldest cohort entered Year 7. Since that didn't happen what is proposed here is 5 years of data collection.

The picture for a rolling-cycle instrument such as a clinic interview or pupil or parent questionnaire is different, see Table 3.

Table 3: The 2 age cohorts and the timing of a rolling-cycle assessment

Date of birth	*5/05 – 4/06*	*5/06 – 4/07*	*5/07 – 4/08*	*5/08 – 4/09*
Age cohort 1:				
4/91 - 3/92	Age 14	Age 15	Age 16	
Age cohort 2:				
4/92 - 12/92	Age 13	Age 14	Age 15	Age 16

Note: Table assumes that assessment follows birthday by 1 month.

For these instruments, children will all be assessed at the same age and in a given school year but at different calendar times. This structure means that it is possible to develop time-series data on pupils' perceptions. This could be useful for factors such as school engagement or valuation of the importance of school. A second key point here is that for the fixed date tests children are different ages whereas for the rolling cycle data (including clinic data) children are the same age. With both sources of data available, sophisticated age standardizations are possible. The differences between children in test results are commonly expressed in terms of age differences, e.g. each unit increase in scores is equivalent to an age increase of *x* days. This metric can be developed if children are tested at different ages. However, it is rare to have sufficient numbers of children tested to develop reliable age metrics. Also, where children of different ages but in a given school year are tested on the same date age differences are compressed because the children have been taught together.

Children in ALSPAC are tested in schools on fixed dates but also in the clinic when they reach a given age. This enables us to identify differences in scores that are due to the child's place in the school year (i.e. age relative to peers), season, summer break or time of day. In this way, the study will enable a very robust assessment of age metrics holding these factors constant.

The survey using these assessments would run from May 2005 – April 2009 assuming that survey followed birthdays by one month.

This structure has important implications for costing as well as methodological advantages. The total cost of a single postal questionnaire or use of clinic time is spread over 21 months. If no further testing is to be done after the completion of a one-off sweep then it is straight-forward to calculate the annual cost as 12/21 times the total cost in the first year and a further proportion of 9/21 in the second year. (This assumes for simplicity that the data collection year matches the tax year and ignores pre- and post-interview period costs.)

If the sweep is repeated annually, then there will be two instruments in the field at any one time and the annual cost is the original total cost of the one-off survey. Children costed into the 13 year survey but not reaching 13 during the year of the costing will not cause expense on the 13 year survey but, assuming that all sweeps have the same cost and holding inflation and incremental rises out of the equation for the moment, they will cause an equivalent expense on the 12 year survey that is still on-going. So long as data collection is on-going it is possible to provide an annual costing for data collection that ignores the issue of the 2 year or 3 year age and school cohort cycles.

C. RESEARCH DESIGN AND METHODS.

In this section we lay out the proposed data collection. To do so we first describe the adolescent outcomes of interest (sub-section D1) and the theoretical framework that has guided our choices about the constructs that must be measured (sub-section D2). These constructs are set out in the third sub-section. In the fourth sub-section we describe the capacity of the different data collection methods to collect data on the required constructs. In sub-section 4 we describe the proposed data collection for which we are seeking funding in this proposal. Finally, in sub-section 5 we describe the specific proposal and set out the processes by which survey instruments will be selected.

C.1 Outcomes

The project will focus on four sets of outcomes, all of which can be well measured in the data. The outcomes can usefully be listed separately because the models underlying the explanation of each are different as are the policy interests linked to each. They are nonetheless strongly linked, having related and mutual influences as well as having strong causal inter-dependence. Indeed, a full understanding of development during this period requires a multidimensional view. Too often, researchers focus their attention on 1-2 dimensions of adolescent development (e.g., mental health, school achievement, or delinquency). There is growing evidence that outcomes across a wide array of domains are related to each other (62, 63, 105, 109, 110, 122, 153, 156) and that there are many successful pathways through adolescence (112).

C.1.1 Health and well-being

There are three main foci in this domain, namely (i) mental health and well-being, i.e. depression and psychiatric health and efficacy, self-esteem, self-regulation, coping skills and flourishing (ii) health behaviours, i.e. diet, smoking and exercise, and, (iii) physical health. The third of these is not central to this study as it is well dealt with in other ALSPAC projects developed by medical researchers. However obesity will be considered under this heading as will issues in relation to physical fitness. Such outcomes interact with other behaviours and outcomes and so are valuable as control variables as well as being of interest in themselves.

C.1.2 Social outcomes

There are 8 key outcomes in this domain; (i) anti-social and pro-social behaviour, (ii) civic participation including usages of out of school time and participation in volunteering and diverse non-school contexts and activities, (iii) social attitudes such as racial tolerance, attitudes to the environment or the police or to social institutions and the political process, (iv) criminality (recognising the important distinction between persistent and adolescence-limited offending) , (v) use of alcohol and illegal drugs, (vi) sexual behaviours, and (vii) relationship formation, in terms of bonds with family, peers and partners.

C.1.3 Education and employment

For the developing adolescents in the study there are 4 key issues in this domain, namely (i) general academic and technical success, in terms of the level of attainment reached and the nature of the choices made about subjects studied and continuing participation in general or technical learning, (ii) cognitive development, related to but distinct from exam success is the nature of the underlying cognitive shifts and learning taking place over this period, (iii) transition into the labour market.

C.1.4 Engagement and identity

A fourth domain of outcomes will be engagement in school and family and community life, an important element of social inclusion. Engagement is an important focus for research on adolescence because there is much discontinuity in development in this phase. It is during this phase that disengagement and broad developmental differences between children become most strongly established, in terms of academic and cognitive development but also more generally in developing identities and in terms of behavior and social inclusion. It is likely that many of the causes and first signs of these differences are apparent during primary school but it is in secondary school that they often become heavily reified and start to impact most strongly on wider outcomes. These differences have very serious long-term consequences because consciously or otherwise, children are making choices during this phase of their education that will influence their future educational and economic careers with important repercussions on other areas of their lives.

Identity formation has long been considered a critical component of adolescent development. Our conceptualization of identity formation is similar to the ego identity perspective of Erikson (64) and Marcia (113), the self-schema and future selves perspective of Markus (114, 115), and the self-concept perspectives of Eccles (51) and Harter (96). We conceptualize identity formation as a life-long process that involves both discovering who one is and is not, and making (at least temporary) commitments to particular aspects of one's identity. Consistent with other research (115, 129), we believe this process of discovery and commitment is motivationally significant - influencing both attitudes and behavioral choices.

Our specific interests in studying identity development are fourfold: (1) documenting the content of people's self schemas, particularly those associated with academic achievements, activity involvement (both promotive and risky activities), and future educational and occupational aspirations; (2) understanding the factors that motivate adolescents' psychological and behavioral commitments to particular identities; (3) determining the extent to which the salient components of one's identity predict subsequent behavioral choices; and (4) understanding how both the content and the process of identity formation are affected by one's gender, race/ethnicity, and social class.

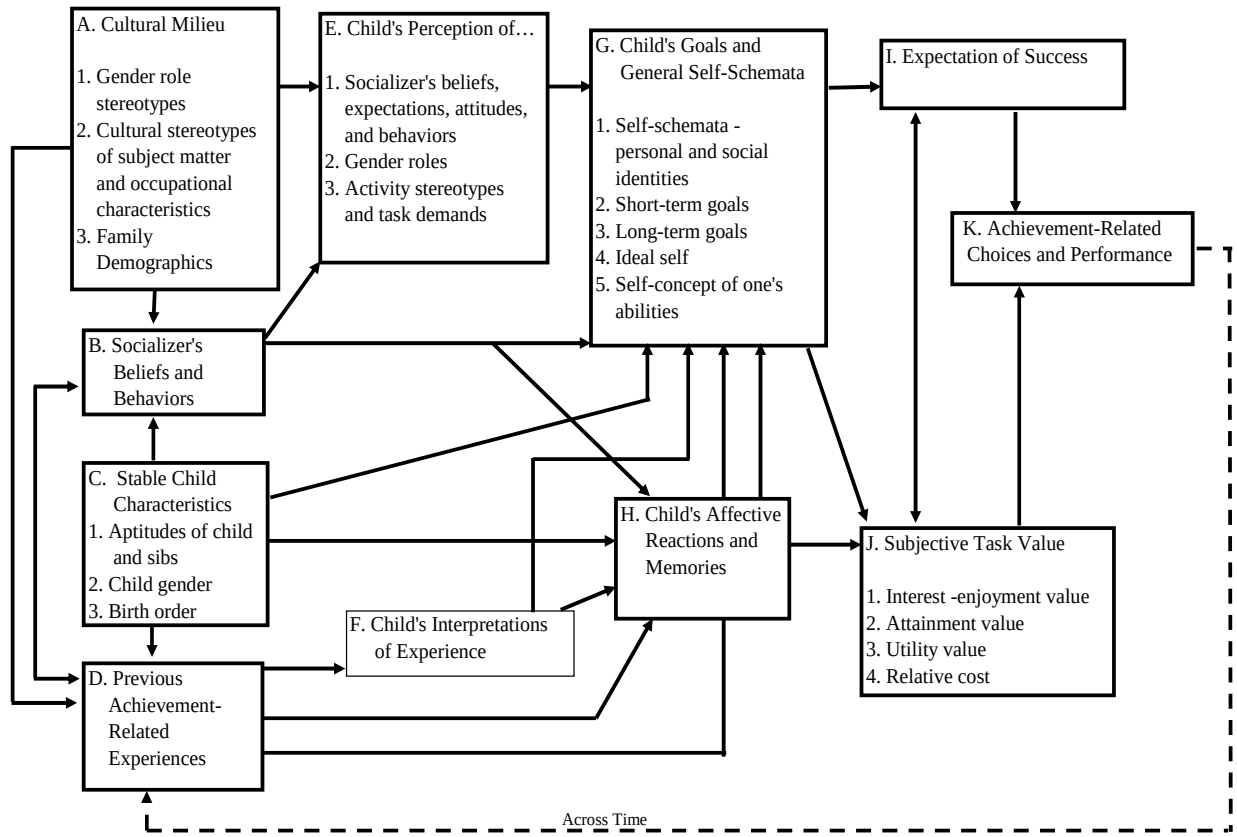
C.2 Theoretical framework for data collection

Scholars in the several fields of the developmental and social sciences are focusing on the conjoint influences of individual biological factors, personal agency and social structure in shaping individual's developmental trajectories. Developmental scientists with a particular interest in adolescence stress the possibility that adolescence is particularly marked by an increased role for personal agency constrained by both biological changes and the multiple interacting and changing social contexts that make up adolescents' social worlds. Adolescent development can be conceptualized both in terms of choices leading to individual variations in promotive and risky behavioral involvement, and in terms of the discovery and commitment to multiple personal identities. Social scientific researchers such as economists and sociologists are also concerned to conceptualise the rational basis of decision-making, focussing, for example, on decisions to participate in post-16 education (29, 21, 17, 91), fertility and marriage decisions (80, 79), crime (133, 152, 42) or occupational choice and labour market supply (14, 126). These perspectives can usefully be further integrated.

C.2.1 Expectancy-Value and Efficacy Models of Behavioral Choice.

Adolescence is a time when individuals consider and try many activities. Eccles et al's (41) expectancy/value model of behavioral choices and performance provides a useful theoretical framework for understanding the influences on adolescents' decisions regarding which activities to try and which activities to specialize in, particularly as they reassess the value and success probabilities of the variety of activities available to them. This model is outlined in Figure 1.

Figure 1. General Expectancy Value Model of Achievement Choices



Drawing upon the theoretical and empirical work associated with decision-making, achievement, efficacy, and attribution theory, the model links behavioral choices to expectancies for success and subjective task values, and specifies the relation of these two psychological constructs to cultural norms, experiences in various contexts, aptitudes, and a set of personal beliefs and attitudes. We believe this model is particularly useful for analyzing individual differences in a variety of activity choices that impact adolescent development both directly (through their influence on day-to-day experiences) and indirectly (by their influence on the range of options that remain available to adolescents as they move toward adulthood). Examples of important activity choices include high school course selection, investment of time on academic achievement versus activities that detract from school achievement, selection of peer networks and romantic partners, decisions regarding employment, involvement in both positive and risky activities, and educational and occupational aspirations, expectations, and planning (50).

Inherent in this model is the idea that participation in any specific activity is influenced not only by the values and expectations associated with that activity, but also by the expectations and values associated with other activities. Therefore, the model is strongly linked to rational action theory approaches developed in economics and elsewhere but with a greater level of specification of the intra-individual elements allowing for a greater level of sophistication and heterogeneity between persons and clearer specification of the measures required for empirical analysis. To the extent that a specific Activity A has higher value than another Activity B, Activity A will be preferred even if Activity B has positive value to the individual. To the extent, for example, that some activities take on higher value than academic achievement, we can expect these activities to divert adolescents' energies away from their academic studies - leading to declining academic achievement and increases in the negative sequelae associated with poor school performance. To test this hypothesis, we need to gather information on the values and expectations adolescents

attach to a wide range of common activities, and then use the relative value of, and expectations for, each activity to predict engagement and performance in the activity.

C.2.2 Agency

The model is strongly oriented towards the agency of the child such that, for example, parenting practices are not seen as exogenous but part of a dynamic interaction between parent and child. The interaction between the child's own internal resources and external influences is a key source of individual heterogeneity of outcome but the project will also be concerned to identify points at which external pressures on the child's maturing self-concepts and capabilities become excessive, e.g. situations of multiple risk or where the impacts of social processes are repeated over time eventually overcoming the child's resilience.

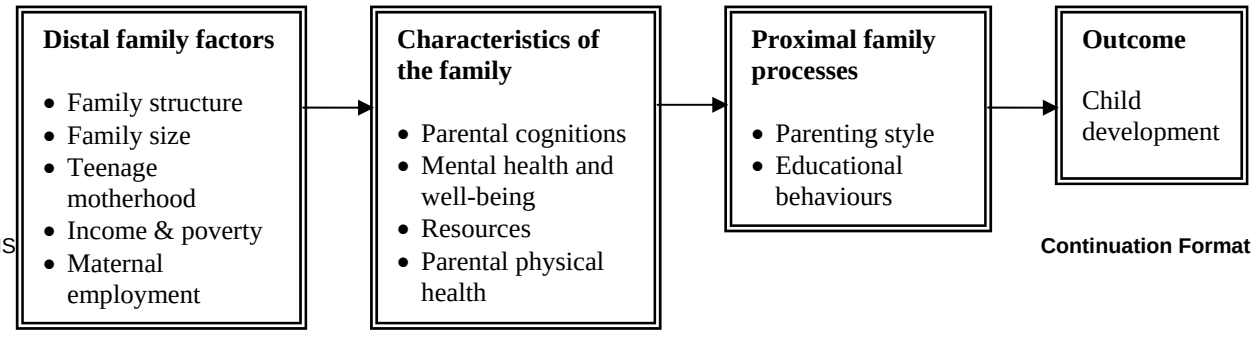
Personal resources. This sense of agency can thus be related to the personal "resources" of the child in terms of developmental factors such as self-esteem or self-efficacy, themselves also important "outcomes" in the study. Thus, agency plays a number of roles in this theoretical framework, acting as both outcome whose antecedents and determinants we are interested in examining, and as dynamic influence on outcomes. These resources can be theorised as capitals internalised or invested in the individual, i.e. human capital (7, 143) and/or identity capital (44), or alternatively as capabilities as in Amartya Sen's formulation (144) of the potential to achieve desired levels of functioning in the different domains of life. Beyond these individual level "resources" are the family, social, cultural, community and national resources and structures (18, 132, 2, 32, 85, 25) that link with the individual in complex ways, partly discussed below.

Multi-dimensionality and coupling. The study also recognises important interactions between aspects of agency such that, for example, the developing cognitive capability of the child is protective in the development of capabilities in other domains such as emotional regulation and vice versa. Development during this phase will be taking place in relation to personality, mental health, behaviour and relationship formation, as well as in biological maturation through puberty into adolescence. There will be important differences between children in the relative valuations they place on these different aspects of development. These differences may underlay aspects of changes in engagement. For many children, the non-academic aspects of development will be more important than their academic attainments. This presents an important challenge to schools, which have to work with children to develop a valuation of learning. It also leads to calls to study positive development in a more sophisticated manner (148, 10, 88), necessitating the inclusion of such constructs as mental health, self- and identity-linked beliefs and values, interpersonal relationships and connectedness to pro-social institutions in our models of successful adolescent functioning.

C.2.3 The complexity of the relations between the distal and proximal features of each context

The starting point and key foundation for a consideration of the influences on each particular outcome of adolescence is the developmental model (22, 108, 140) although as

Figure 2: Conceptual model for the related influences on child development



suggested above we will also bolster this theoretical framework with theoretical insights from sociological and economic literatures. For any given developmental outcome, and holding agency to one side, the immediate lived experience of the child is conceptualised as the dynamic process of interaction with each context within which the child experiences life but each such proximal process is in turn influenced by the more distal characteristics of the context. This is described in Figure 2 which, taking the example of the family context, distinguishes between three categories of environmental context measures: distal factors, characteristics within the family and proximal processes within the family (83, 84).

The proximal process of the family and school have been well-theorised and measured in the developmental psychology literature (1,3, 19, 20, 27, 34, 48, 82, 98, 134, 145), as have the distal features of the environment that constrain and/or enrich the proximal processes (8, 24, 4, 37, 38, 39, 58, 59, 89, 90, 119, 120, 150, 158). The importance of the distal factors has also been a major issue in economics, sociology and other social sciences (9, 11, 15, 23, 28, 30, 33, 43, 46, 47, 65, 67, 86, 97, 101, 118, 154).

Household production models. For example, the application of the economic model to children's attainment derives from Becker (5, 6) and a tradition which considers how children's educational attainments can be modelled on the basis of an analogy between the family and the firm (94, 45). In this model, the family can be figured as a production unit, producing the basic goods of family well-being such as health, consumption goods and the successful development of children on the basis of the allocation of the time of the productive members of the family in the relevant production processes. Inputs are allocated in such a way as to produce that set of outputs that maximises the utility of the decision-making family members subject to the constraints of the family which are constraints of time, wealth and of their ability to produce the desired outputs.

In this sense parents can choose to influence children's attainment by spending resources of time and money on those activities that produce attainment. The limit to this investment is the limit of time and money available and the ability of the attainment production process to produce attainment. The strength of the model is that it makes explicit the substitutions involved in parental decision-making. Money spent on school-books for children cannot simultaneously be spent on restaurants for the parents. Time spent in the labour market earning income to buy consumer goods cannot be spent on leisure and so on. The decisions about the relative allocation of time and resources depend on the valuation parents make about the different outputs obtainable to them. These are referred to as preferences and expressed mathematically in economic modelling as utility functions.

Although the theory of the neo-classical economic approach is based on utility maximising, rational agents, it is not unrelated to developmentally grounded models of development. The assumption of rationality implies a level of determinism and self-knowledge in the Beckerian model that is absent in the developmental formulations. The mechanics of this determinism enables a mathematical clarity with respect to the predictions of the model bought at the cost of a strong and simple specification of the context of individuals' consciousness and temperaments. Foster (71) usefully indicates the value of this approach in clarifying the substitution effects that occur within families. On the other hand, the developmental approaches offer insights into the processes of household production of children's attainment and development that are left as a black box in the economic approach. The developmental model provides more insight into these processes and wider constraints on them. However, while it recognises the importance of financial and other constraints at the distal level it has been less explicit in formulating their implications. The two approaches can thus be brought together beneficially.

C.2.4 The interactions between contexts as central to the ecologically lived experience of the child

Ecological models of human development depict development as occurring within a multilevel environment such that the family is not the only context that matters for child development. There are many important contexts in childhood, including the family, neighbourhoods, preschools, schools and peer-groups. These contexts matter not only in that they are channels for the effects of distal factors but also because they are causal factors in their own right. They have characteristics that impact on proximal processes and the subsequent experiences of the child.

Other contexts interact both with the family context and so shape the development of the child as well as directly influencing the experiences of the child. However, these other contexts can be modelled within this same distal/proximal conceptual structure. Cook *et al.* (41) usefully note the distinctions between a context's structural features (distal factors) and its more micro-level processes (proximal processes). Structural features of the neighbourhood include, for example, neighbourhood socio-economic status and racial composition, while process takes account of neighbourhood social cohesion and social control, aspects of the interactions between community members (142).

Characteristics and measures of contexts. The key characteristics of neighbourhoods are in many cases the same characteristics that matter in the home but assessed at the neighbourhood level, i.e. factors such as local resources and neighbourhood beliefs and attitudes. The difference in level makes the nature of the links different, but many if not all the key characteristics are the same. Similarly, the proximal processes include the same issues of discipline and cognitive stimulation as at the family level but at a local level in terms of multi-faceted relations between individuals in complex communities. Other contexts interact both with the family context and so shape the development of the child as well as directly influencing the experiences of the child. Moreover, contexts overlap and a given context can operate as either a risk factor or a protective factor depending on its characteristics.

Unfortunately, rarely are these contexts assessed using similar constructs. One cannot easily or reliably compare the impact of various contexts unless one has comparable measures across the contexts drawn from a comprehensive theory of contextual influences. Eccles & Gootman (52) argued that there are critical components of various contexts that can be measured in analogous ways across contexts. These include: (a) structure and control, (b) support for autonomy, (c) emotional support, (d) support for developing both actual and perceived competence, (e) opportunities to learn and make significant contributions (f) presence of risks, (f) shared beliefs, values, and expectations, and (e) the developmental fit between changes in both individuals and contexts as individuals mature. Similarly, Deci, Ryan, and Connell (139) argued that individuals thrive in contexts that meet certain core needs: the need for automony, connectedness, and competence. Finally, Eccles et al. (55) argued that we can understand adolescents attachment and engagement in various contexts by comparing the extent to which each of the adolescents' major contexts provide for these basic needs as well as for the need to be respected and to make meaningful contributions. More specifically, Eccles et al. argued that adolescents have substantial control over how much time and energy they invest in being an active participant in various contexts (e.g., schools versus time with their peers; time with peers versus time with family) and that adolescents will become most invested in those contexts that best meet their developmental and psychological needs. If these needs are not being met at school, Eccles et al. predicted that the adolescents would detach themselves from the school context and shift their time and energy investments to a better fitting context such as their peer group or a place of employment.

We are proposing to develop a battery of comparable measures of key contextual characteristics drawing on the work that was done as part of the MacArthur Research Network on Successful Pathways through Adolescence and the work being done by Eccles and her colleagues. Many of these measures have already been developed, tested and reported in Cook et al. (41); Furstenberg et al. (77); and Elder & Conger (60). Such measures will allow developmental scientists to compare the relative influence of various contexts on human development. Even more importantly, they will allow developmental scientists to study the dynamic processes associated with individuals picking certain contexts and the contexts then reinforcing, or stimulating the emergence of, particular behavior patterns.

Cross-context and cross-time dynamic processes. We are particularly interested in both the relation among the social contexts of adolescence and the nature of changes in these contexts over time. With regard to these issues, we have focused on the following cross-context and cross-time relations: (1) compatibility versus discrepancy, (2) continuity versus discontinuity, (3) synergistic versus agonistic versus compensatory processes, and (4) management of multiple contexts over time. For example, discontinuous negative changes in family composition or family financial security, and in one's peer group or school environment are likely to impact negatively on adolescents' development: Changes such as these may precipitate a drop in academic motivation, school attachment, and school performance, particularly among those adolescents who are already experiencing difficulties in school (146,54). As another example, negative peer groups and poor school achievement likely interact synergistically to increase the odds of involvement in problem behavior. We have already collected measures designed to assess these cross-context and cross-time dynamic processes. We expect that their interplay will become even more important as the adolescents move through high school.

We are proposing to gather data that will allow developmental and social scientists to continue to study constructs that reflect each of these cross-context/cross-time relations among family, peer, school, and neighborhood contexts and to relate variations in these constructs both to initial differences and to changes over time in the beliefs, psychological adjustment, self perceptions, and behaviors of early adolescents. In addition, we are especially interested in how variations in individuals moderate the effects of all of these contextual influences. Because the ALSPAC study is theoretically rich, longitudinal, and has a large broad-based sample, developmental scientists will be able to study the complex interplay of multiple contexts on adolescent development, as well as the bi-directional processes of change during one of the most dynamic periods of development.

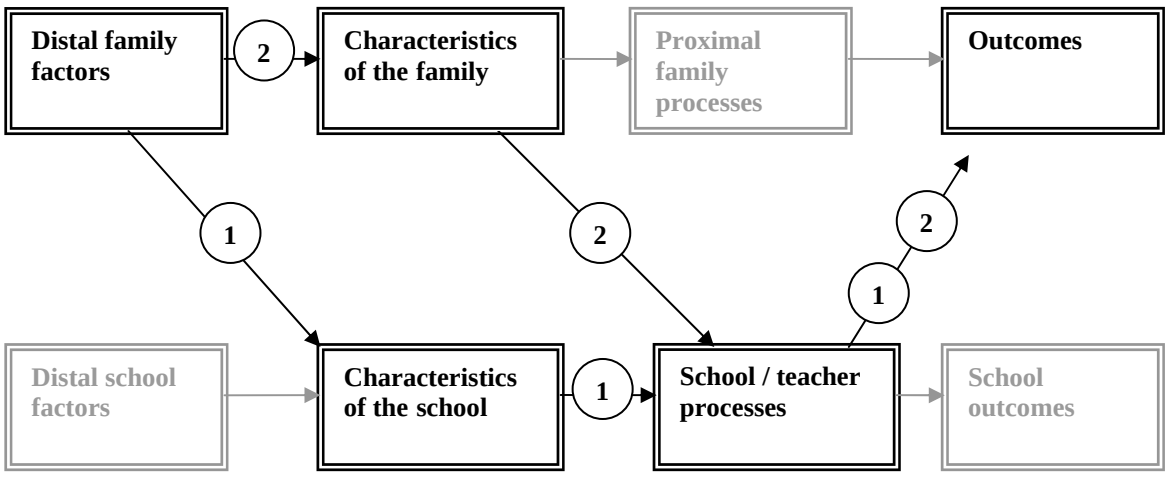
Social networks: methods for dealing with peer interactions. One of the key contexts of adolescence is the peer network. This network is partly self-selecting as friendship and peer choices are made from within the diverse and multiple possibilities created by social and neighbourhood institutions, geography and chance. Peer influence models recognise that individuals’ cognitions are formed in a dynamic process of interaction and negotiation with others (76, 104, 31, 72). Friedkin and others (73, 157, 16, 75, 74) have developed mathematical models and software that enable empirical investigation of the multi-level and dynamic impacts of peers. We will collect data amendable to this type of analysis.

Interactions between families and schools. School continues to be a focal life arena for older adolescents, and variations in school contextual factors related to structure/control, support for autonomous decision-making, emotional support, exposure to risks and opportunities, shared beliefs and expectancies, and developmental appropriateness have been shown to affect adolescent development (35, 53, 56, 102, 106, 137). While less research has focused on high schools than middle schools, current research suggests that as adolescents move into larger, more bureaucratic middle and high school environments (the transition in the UK from primary to secondary school), they experience more teacher

control and less autonomy, more social comparison and differential opportunities based on ability, and perceive less emotional support from school teachers and personnel (36, 57, 68, 121, 116, 78, 95, 107). These types of changes are related to students' decreased feelings of belonging and engagement in school (121), which, in turn, may result in lower achievement and/or the initiation and enactment of decisions leading to withdrawal from school (69, 70).

Figure 3 provides a graphical description of reciprocal influences and relations between the family and school contexts. Distal family factors influence the characteristics of a given school. More affluent families, for example, are able to choose better resourced and more desirable schools and more educated parents may be better equipped to assess quality and so choose the more successful, higher achieving schools. These school characteristics influence outcomes through the mediating channel of school and teacher processes (arrows 1).

Figure 3: Conceptual model for multi-level interactions between family & schools



A second channel for the effect of family distal factors is through an impact on the relationships with teachers and the school (arrows 2). This has been studied mainly in terms of social class or ethnicity differences (128, 49, 66, 155, 12, 13) and in terms of language codes (88). The cognitions and values of parents are important characteristics of the family context. Parents bring these characteristics to the interactions they have with their children's school. They may, for example, be more proficient in interacting with teachers as well as better able to support and reinforce traditional academic goals (98, 147). Similarly, teachers are likely to recognise these characteristics of children and their parents and may respond more positively to them.

However, teachers may also come to make assumptions about parents' cognitions and values from signals provided by distal elements of social class (parental education, income and occupational status) or to features of family structure without these necessarily being mediated by actual family characteristics. These in turn can impact on teacher's views of pupils (124, 125) These child-teacher interactions are thus a channel for the effects indicated by arrow 2 in Figure 3, impacting on attainment and so potentially giving rise to lasting effects on health and well-being in adult life (92, 93, 123).

C.2.5 The non-random selection of contexts by children and families

The selection process by which children come to participate in diverse contexts means that contexts and the features of contexts cannot be considered as exogenous

determinants of outcomes but are themselves an aspect of the process of inter-generational transmission of advantage and disadvantage. This has vital implications for estimation and for the interpretation of results. For example, aspects of the school peer group such as the average SES of parents or the average expected attainment of pupils are often found to correlate with the attainments of individual pupils but even conditioning on standard distal and proximal characteristics of the family the peer group measures may nonetheless proxy for unobserved family characteristics that lead both to school choice and to increased child attainment giving rise to confounding bias. Factors such as unobserved aspirations of expectations by the parents for the child or information about school processes are important examples of such confounding factors which make even conditional estimates prone to selection bias. Social experimental designs may be the best way to deal with these confounding biases but good knowledge of local selection processes in schools can give rise to useful information to (i) identify where processes are random or exogenous in relation to parameters of interest, or, (ii) provide reliable measurement of key aspects of the selection process leading to the capability to control for these aspects and so reduce bias in estimation.

C.2.6 Heterogeneity in the processes that impact on children of different sub-groups of interest

It is important to differentiate between different groups of children for whom the processes influencing outcomes may differ from the mean or for whom outcomes and processes may be of specific interest to policy makers and scientists. ALSPAC will enable assessment of how children from different social groups, ethnicities and gender, of different abilities and mixes of ability choose or are moved into trajectories and behaviours that lead to the achievement or otherwise of levels of general or specialist success that match their potential.

In the UK policy community there is particular concern for the worst off 10% of children who face the greatest obstacles to their well-being and opportunity, with well-known long-run implications for the nature of their participation in adult society. ALSPAC enables a specific focus on this group as they progress through secondary school and into the economic and social contexts of adolescence. The very great social class differences in rates of participation in higher education are based primarily on differences in achievement at 16 and before; given age 16 attainment, social class plays little role in the decision to continue in education. Thus development through the secondary school phase is critical. The large sample size of ALSPAC enables a detailed study of the key factors providing protection and risk for this group.

The heterogeneity between groups is of interest to scientists as well as to policy-makers, providing clues about the importance of specific mechanisms in the development of adult life chances.

C.2.7 The co-existence of continuity and discontinuity in the development and contexts of children

Children mature and develop at different rates and might demonstrate both stability and instability in different aspects of development during different stages of childhood. Key events take place at dates that cannot be well forecast by those responsible for data collection. There are important relations between children's attainments, self-concepts and valuations and these aspects changes over time. Thus, pathways of development during this period are not linear trajectories that can be well measured from two data points.

Tracking these trends is important because the influence of important interactions with others, such as teachers, will depend on the timing of the interaction, i.e. whether it is within a period of continuity or discontinuity in key dimensions of development. These

important aspects of development mean that a considerable amount of repeat data collection and measurement must take place if processes are to be tracked and analysed.

Experiments using different lag structures can address this question, testing how prior changes influence current outcomes. However, appropriate modeling will clearly require rich data with year on year assessments of key variables. This is important because the larger the gaps between assessment the larger the level of error in the analysis. This is true for the analysis of the trajectories but also for, say, the assessment of school or teacher effects. If we wish to assess effects of teachers on children's trajectories but only assess class ethos every two years then we must attempt to attribute two years' of change to the class experience of only one year. This again introduces error as the one measurement only measures half the experience, leaving the other half unmeasured. In the analysis it will reappear as bias, reducing our ability to identify accurate estimates of effects.

C.2.8 The biological substrate of all features of development.

Biological development and change will be a focus of other strands of research and data collection in ALSPAC. Medical researchers will be working on issues in relation to genetics, physical health, sleeping patterns, brain development, diet and hormonal balances, for example, all studied in and for themselves but also of interest to this project. These aspects of biological performance and well-being interact with social processes in ways that are still little understood and it is one of the great strengths of ALSPAC that it provides a sufficient breadth of information to enable study of how such biological and social processes relate. To give one example, it will be interesting, for example, to test whether children who study maths at times of the day at which cognitive receptiveness tends to peak outperform others.

More generally, the collection of these social data alongside the medical data with possibilities of linkage between the two will offer great potential for future inter-disciplinary collaboration.

C.3 Required constructs

Based on this discussion, the following constructs should be assessed in addition to what is already being gathered:

On pupils

1. Pupils' self-concepts, valuations, beliefs and expectations and perceptions of school, peers and family;
2. Pupil attainment;
3. Broader development of pupils;

On parents and families

4. Parental concepts, valuations, beliefs and expectations;
5. Demographics of the family (social class, income, etc.);
6. Family processes (including parenting style, expectations and beliefs) and family management;

On teachers and schools

7. Teacher quality (standard distal measures such as experience and qualifications and participation in training);

8. School policy variables such as adult-pupil ratios;
9. Proximal teacher characteristics and class ethos (teacher beliefs, personality and managerial style);
10. School ethos;

On peers and other contexts

11. Specific friendship and group membership choices;
12. Peer groups in classes;
13. Non-school activities and neighbourhood contexts.

C.4 The capacity of the different data collection methods to collect data on the required constructs

We now describe the extent to which the 13 research constructs can be assessed by the available methods of data collection. This information is summarized in Table 4 and discussed in more detail in the following sub-sections.

Table 4: The relative capabilities of the available data collection methods

Construct	Collection method						
	Pupil Questionnaire	Parent Questi-onnaire	Teacher Questionnaire on class	Teacher Questionnaire on pupil	Classroom test	Head-teacher	Clinic
On pupils							
Pupils' cognitions	3	2	..	2	..	..	3
Pupil attainment	1	1	..	2	3	..	3
Broader development	3	2	..	3	..	..	3
On parents and families							
Parental cognitions	3	3	..	2	..	..	..
Family demographics	1	3	..	..	..	..	..
Family processes	3	3	..	2	..	..	3
On teachers and schools							
Teacher quality	..	1	3	..	..	3	..
School policy	..	1	2	..	..	3	..
Teacher characteristics/ Class ethos	3	2	3	..	..	2	3
School ethos	3	2	3	..	..	2	3
On peers and other contexts							
Friendships	3	2	..	2	..	..	3
Peer groups in classes	3	1	3	3	..	1	3
Non-school contexts	3	2	..	2	..	..	3

Key:
1 = A source of very limited and unreliable information only
2 = A useable, valuable source but mainly for subjective data and/or triangulation
3 = An important source for most of the relevant research questions, though possibly needing triangulation in some instances

Postal pupil questionnaire. Pupils can provide essential information on their own beliefs, attitudes, expectations and identity goals (construct 1), as well as information on their family environments (4 and 6), schools and teachers (9 and 10) and peer groups and friendships and out of school contexts (11-13.) Their perceptions of some of these constructs such as class ethos (including teacher cognitions) and parent cognitions will be what drives their own behaviour and cognitions, so these subjective records are essential pieces of information.

Instruments exist for assessing student self-concepts and valuations, the key focus of the study. These have been used in "Childhood and Beyond," a large-sample US study at the University of Michigan and in the Panel Study of Income Dynamics - Child Development Supplement and found to have good levels of reliability and validity.

Moreover, by asking pupils about a number of randomly selected peers in their class, it is also possible to use the pupil questionnaire as a source of data on individual-level peer relations, communications skills, teamwork, anti-social behaviour, physical attractiveness and other issues that will be particularly valuable for the research questions concerned with wider skills and attributes.

Postal parent questionnaire. Parents can provide reliable information on the family (constructs 4-6). They are the best source of information on the demographic and socio-economic background (construct 5) and provide interesting perspectives on the child's development (constructs 1 and 3), the school (constructs 7-10) and other contexts (constructs 11-13).

Teacher questionnaire on classes. Teacher information is required for many of the relevant distal measures of school quality such as experience and training (construct 7). Teachers are also essential sources for information on classroom contexts. It is to be preferred that more than one teacher be surveyed as contexts will vary considerably through the school week and this within-school variation can only be assessed if more than one teacher is approached.

Pupil-level teacher questionnaire. Teacher information on individual pupils is one method for obtaining reliable data on children's attainment and broader development (constructs 2 & 3). None of the methods discussed so far can achieve this. Teacher assessments are particularly useful for rating subject specific progress and perseverance, classroom-based externalizing behavior, attentiveness, communications skills, teamwork and peer relations.

This is also a way to provide triangulation of pupil and parent attitudes (constructs 1 & 4). Indeed, differences between parent, pupil and teacher perceptions of pupil attitudes and engagement may be very informative for understanding of teacher effects.

Class-based tests. Classroom testing of individual pupils is the best method for obtaining reliable data on core competences such as literacy and numeracy or for assessing pupils' underlying cognitive strengths (construct 2). Class time might also be used for assessment of IT skills.

Head-teachers- postal questionnaire. Head-teachers are a necessary source for information on school policy variables and can also provide valuable assessment of school-level factors such as the general level of teacher quality or ethos (constructs 7-10).

The Focus clinic. The most expensive method of collecting information is use of clinic time. The information is extremely high quality as it is gathered from face-to-face interviewing. The clinics also enables assessment of some features of development that cannot be assessed in other ways, for example, where other potential sources of information may be

biased either because of their close relationship with the child or because they observe the child in particular situations, such as classrooms. The interview also enables the skilled ALSPAC psychologist researchers to gather information on quite intimate aspects of children's lives that may not be picked up on in a postal questionnaire to children, such as school bullying, relationships with teachers and other adults, drug use or anti-social behaviour.

The clinic is also a potential context for the most robust available assessments of technical skills, communication skills, cognitive function and teamwork.

C.5 Proposed data collection

The full long-term project

The current proposal must be seen as part of a wider project, funded from many other sources. The full ALSPAC study itself receives partial core funding from the MRC and Wellcome Trust and is also seeking funding from other branches of NIH, particularly for research in neuroscience. The Avon Adolescent Development Project is a supplement to the core study that will enable a far greater range of social scientific and psychological data to be collected. In the long-term, further funding will be sough to enable linkages between these mainly medical or biological datasets and the social science data. The full Avon Adolescent Development project will enable data collection in the domain of social science and psychology as described above. In the last two years this project has already received over £500,000 (~$900,00) of funding from the UK Government's Department for Education and Skills and is also receiving £37,500 p.a. (~$70,000) from the Home Office for data collection in the domain of anti-social behavior. A further application for funding is in train with the UK Economic and Social Research Council, which has more substantial funds available for research than have Government Departments.

Year 1 of the full project is May 2005-April 2006, at which point the sample children are age 13/14 and in school years 7-9. Year 5 of the project is May 2009-April 2010, with sample members age 17/18 and the final wave completing school year 11 and permitted to leave school or stay on into Further Education.

The full data collection project would allow for (i) annual parent and pupil surveys each year through the 5 years of the project, (ii) teacher questionnaires about classrooms for 2 teachers every year, (iii) teacher questionnaires about sample members for school years 8 and 10 (ages 12/13 and 14/15), (iv) classroom testing in school year 9 (age 13/14), (v) head-teachers questionnaires in school year 10, and, (vi) clinic-based testing and interviews at ages 14, 16 and 17.

This current proposal to NICHD is not for the full funding of the AADP. We aim to facilitate a process in which we will work with a range of funding organizations to secure the necessary support and ensure value-for-money. The annual cost of proposed data collection for the full AAD project is £918,275, p.a. or $1,657,500 p.a. at current exchange rates (£1=$1.805, Sept 26, 2004).

The specific elements for which we are seeking funding in this proposal to NIH are: (i) annual parent surveys each year through the 5 years of the project, (ii) teacher questionnaires about classrooms for 2 teachers every year, (iii) (v) head-teachers questionnaires in school year 10, and, (vi) clinic-based testing and interviews at ages 14 and 17. The overall plan is as follows:

Year 1

1. Collect parent responses on age 13 and 14 year olds
2. Collect teacher responses "about the class" from 2 teachers per wave in school years 7, 8 and 9

3. Collect 11 minutes of age 14 clinic data on older age group (12/21)

Year 2

1. Collect parent responses on age 14 and 15 year olds
2. Collect teacher responses "about the class" from 2 teachers per wave in school years 8, 9 and 10
3. Collect 11 minutes of age 14 clinic data on younger age group (9/21)
4. Collect and code head-teacher data on year 10 pupils in eldest school wave (24%)
5. Code Year 7 schools data "about the class"

Year 3

1. Collect parent responses on age 15 and 16 year olds
2. Collect teacher responses "about the class" from 2 teachers per wave, school years 9, 10 and 11
3. Collect and code head-teacher data on year 10 pupils in middle school wave (57%)
4. Code age 14 clinic data
5. Code parent responses on age 13 and 14 year olds
6. Code Year 8 schools data "about the class"

Year 4

1. Collect parent responses on age 16 year olds
2. Collect teacher responses "about the class" from 2 teachers per wave, school years 10 and 11
3. Collect and code age 10 minutes of age 17 clinic data from elder cohort (12/21)
4. Collect and code head-teacher data on year 10 pupils in youngest school wave (19%)
5. Code parent responses on age 15 year olds
6. Code Year 9 schools data "about the class"

Year 5

1. Collect teacher responses "about the class" from 2 teachers per wave, school year 11
2. Collect and code 10 minutes of age 17 clinic data from younger cohort (9/21)
3. Code parent responses on age 16 year olds
4. Code Year 10 and 11 schools data "about the class"

The costs for these elements are reported in Form Page 5 and subsequent continuation pages.

The specific questions and instruments selected to assess these constructs will be chosen by the study team of PI and co-applicants. All questionnaire and clinic items will be approved before use by the ALSPAC Cognitive, Educational and Social Development Advisory Committee (CESDAC). Measures will be assessed in terms of construct validity and reliability as well as in terms of its scientific value and relevance to the key research questions of the AADP and wider ALSPAC study. This Committee comprises senior scientists in the fields described, namely:

- Professor Michael Beveridge, (Dean of Human Science, University of Plymouth; Chair);
- Professor Peter Bryant (Department of Experimental Psychology, Oxford);
- Professor Judy Dunn (MRC Research Professor, Social Genetic and Developmental Psychiatry Research Centre, Institute of Psychiatry, London);
- Dr Leon Feinstein (Institute of Education, London);
- Professor Jean Golding (Institute of Child Health, Bristol);

- Prof Susan Golombok (City University, London)
- Professor Philip Graham (London);
- Prof Barbara Maughan, (Institute of Psychiatry, London)
- Professor Terezhina Nunes (Oxford Brookes University, UK);
- Professor Marcus Pembrey (Dept. Paediatric Genetics, Institute of Child Health, London).
- Professor Kathy Sylva (Department of Educational Studies, Oxford);

Access to the data

Access to the linked developmental and social science data resulting from the collection exercise will be available via an approach to this committee. The committee will review proposals for data access on scientific grounds. Data will be provided to NIH-approved researchers without costs other than those for the preparation of data files.

D. HUMAN SUBJECTS

D.1 Risks to Subjects

D.1.1 Human Subjects Involvement and Characteristics (applies to ALSPAC, University of Bristol site)

This data collection will focus on the adolescent development of all the children in the study as of May 2005, currently 11,300 children. All mothers resident in the county of Avon within the geographical region around Bristol up until the time of delivery were eligible for inclusion provided their expected date of delivery was within the 21 month period between April 1, 1991 and December 31, 1992.

The mothers were contacted as early as possible and invited to participate entirely on a voluntary bases. The strict regulations governing confidentiality of the data were explained at that time. No material (financial) incentives were offered but compliance is very high. Signed permission to use various biological samples was obtained when members of the survey team interviewed mothers at the time of their first ultrasound clinic. Permissions are currently available for 13,485 mothers in regard to themselves and their children.

The small groups (6% of the total sample) of mothers in ethnic minorities who were resident in the area were included; interpreters were provided if requested. There are no exclusions, but families may opt out of the study at any time. Mothers are proactive in inviting their partners to take part. These may not always be the biological father of the study child. Nevertheless, it is considered by the ALSPAC IRB that it would be unethical to exclude them, although clearly for any statistical analyses, such individuals would be clearly identified. Similarly, non-biological mothers are examined (i.e., respond to questionnaires) as though they were the biological mothers but they are omitted from the genetic analyses. About half of ethnic minority study mothers are black Afro-Caribbean and the remainder are from the Indian sub-continent.

D.1.2 Sources of Materials (applies to ALSPAC, University of Bristol site)

Data collected in the project comprises information from parents (Years 1-5), teachers (Years 1-5), head-teacher (Years 2-4) and in the clinic (at ages 14 and 17). The resulting data will be linked to data previously obtained in confidence from the children and parents using anonymous self-completion questionnaires as well as from prior teachers using anonymous self-completion questionnaires, through maths tests conducted in schools and from clinic-based data collection and administrative school records.

These data are never linked to identifying information. Data is provided to researchers for analysis using identification codes that are unique for each dataset provided. The computer file will not reveal any information directly identifiable with individuals or families. Information gathered during the study will be published in a form from which no individuals or family can be identified.

From the outset of the ALSPAC study, parents were told that biological samples would be collected and among other features, the DNA would be analyzed. Consequently, the idea of genetic analysis is not seen as a major problem to these parents with consent given from over 90%. Maternal blood samples were collected at birth and stored as white cell pellets. Data have already been collected including the DNA extracted on ~10,400 ALSPAC mothers. The DNA has been banked from a similar number of children.

D.2 Adequacy of Protection Against Risks

Confidentiality has the highest priority at ALSPAC. On some self-administered questionnaires, mothers are asked to divulge sensitive information and case notes and

laboratory investigations are reviewed. All these data are confidential and are not divulged to any individual, agency or health service. On a few occasions, the study has involved the use of an interviewer to obtain information. Knowledge gained in this way by an interviewer will not be used to intervene in any particular family, but in response to severe distress within the family, the mother or father of the child may be guided to seek appropriate professional help.

A Parents Consultative Body was established in order to provide advice and information on sensitive matters and to develop detailed guidelines for individual research protocols at the planning stage of the ALSPAC study. No parent has ever been pressured into taking part in the study. Approval for the study has been received from three local district ethical committees, and the ALSPAC study has its own Ethics Committee which includes two parents.

The ALSPAC Ethics and Law sub-committee required computer linkage of maternal consent to the sample before DNA extraction. Blood (EDTA) samples were also requested, with maternal and child consent, from cohort children during the Focus @ 7 clinic. About 70% of children attending agreed to have a sample taken. The source, storage and processing of each sample is logged in a computer stock control database. DNA is extracted and processed to provide 96-well arrays containing DNA aliquots at a uniform concentration. These are distributed for analysis through the Genetics Advisory Committee.

D.3 Potential Benefits of the Proposed Research to the Subjects and Others

The overall ALSPAC study will not directly benefit the parents and children that take part. This is explained to the parents before they enroll in the study. The benefits are subtler and include the Hawthorne effect, whereby subjects benefit from being the center of interest. The study is well known in the Avon region and children self-identify as being part of the project.

However, if the research from the project is well-used by the 4 Local Education Authorities covered in the data it could form the basis of monitoring of the general education provision in the 4 areas leading to greater knowledge of local benchmarks and practices that could inform current policy provision with benefits to sample children and their younger peers or siblings.

D.4 Importance of the Knowledge to Be Gained

The AAD Project will provide data in which to help unravel the complex interactions and effects of the family, the school and other contexts on the pathways from infancy, mid and late childhood, imminently in teenage life and later into adulthood. The study provides a unique opportunity to study the factors underlying pupil's development in secondary school and their pathways through the multiple outcomes of adolescence and early adulthood in terms of educational success, health, well-being, personal development, social inclusion, youth offending, relationship formation and quality of life generally. These issues can be addressed by innovative, inter-disciplinary research within a robust and interesting multi-level, multi-period statistical framework.

The results will be of great interest to policy-makers who wish to understand the complex ways in which these different social, education and health institutions impact on the lives of children and families. The study is already in part funded by the UK Government's Department for Education and Home Office. Through these channels and others, the results of the study will lead to developments in policy and practice for adolescent youth leading to improvements in health and well-being throughout life. It will also advance scientific knowledge on the complex interactional relationships described.

D.5 Inclusion of Women

Female biological and non-biological mothers of study children are included in this study. The vast majority (61.6%) are in the 30-39 year age range, 6.4% are under 30 years of age, 31% are 40-49 years, and 1% is over 50 (based on a sample of 12,432 mothers).

D.6 Inclusion of Minorities

Minorities as represented in the Avon region are included in this study.

D.7 Inclusion of Children

Children as represented in the Avon region are included in this study.

E. Vertebrate Animals: Not applicable

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