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# **Measuring the socio-economic position of families in HILDA & LSAC**

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The views expressed in the paper are those of the authors. They do not necessarily represent the views of the Minister for Families, Community Services and Indigenous Affairs, and are not to be taken, in any way, as expressions of Government policy. Responsibility for any errors lies entirely with the authors.

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**Abstract**

Socio-economic position contributes to the physical, economic and social well-being of individuals and families. Robust measures are therefore essential for describing and estimating the influence of social and economic position on family and child outcomes. Following the approach taken in the Canadian National Longitudinal Study of Children and Youth (NLSCY), this paper describes the development and application of a summary measure of 'socio-economic position' for Australian families participating in the Household Income and Labour Dynamics in Australia (HILDA) study and the Longitudinal Study of Australian Children (LSAC). The derived measure combines information about three distinct elements of the family's socio-economic position - the parents' educational attainments, their income and their occupational prestige. The resulting composite or summary measure can be calculated for populations of interest, for example families with one or two resident parents, or for all families. The measure can also be aggregated, to characterise all families within a community, and can be calculated cross-sectionally or longitudinally. While the component variables (education, income, prestige) can be used on their own to assess their unique contributions, the composite or summary measure provides a parsimonious, readily understood and interpretable measure that captures all three dimensions. Applying this measure to analyses of LSAC and HILDA datasets has the potential to increase research capacity and comparability between the two studies, thereby supporting policy-relevant research.

## **Introduction**

Different disciplines, adopting diverse conceptualizations and theoretical frameworks have variously defined and measured the social experiences and economic characteristics of families. Terms such as social class, social stratification, social inequality, social status, socio-economic status and socio-economic position have all been used to describe access to, and control over, resources derived from educational attainment, occupational prestige and income (Mueller & Parcel, 1981; Willms, 2003; Willms & Shields, 1996). Following the social epidemiology approach suggested by authors such as Lynch and Kaplan (2000), Krieger, Williams and Moss (1997) and Singh-Manoux, Clarke and Marmot (2002), this paper uses the term “socio-economic position” to refer to the relative position of families regarding the social and economic resources available to family members, including to children.

The objective of this technical working paper is to demonstrate and discuss the derivation of a measure of socio-economic position for families participating in the Household, Income and Labour Dynamics in Australia (HILDA) Survey and ‘Growing Up in Australia’: the Longitudinal Study of Australian Children (LSAC), following the methods established by Willms and Shields (1996) for the Canadian National Longitudinal Study of Children and Youth (NLSCY). This paper will focus on the development and application of the measure to the identified datasets and not upon the theoretical underpinnings of socio-economic position or its measurement. Given the implications for data analysis, however, it is important to begin by briefly reviewing the adopted conceptualization of socio-economic position, the importance of socio-economic position and how its measurement has been approached.

## **Conceptualization of socio-economic position**

The concept of socio-economic position adopted in this paper is a composite measure encompassing both resource and prestige based factors (Krieger, Williams & Moss, 1997). Resource-based factors can include income, wealth or educational attainments whereas prestige-based factors can include the prestige or status associated with different occupations (Krieger, Williams & Moss, 1997: see also Table 1 for a list of single and composite measures). The concept of socio-economic position is closely tied to that of human capital. Mayer, Duncan and Kalil (2004, p. 4) argue that human capital includes “acquired skills, knowledge and character traits”. Development of these skills, knowledge or resources in turn enables individuals or families to access other resources such as income and prestige, and all combine to describe socio-economic position. Socio-economic position can be measured at the individual level, the household or family level and the area or neighbourhood level (Krieger, Williams & Moss, 1997). The measure of socio-economic position developed in this paper is focused at the family level.

## **The importance of socio-economic position for families and children**

For children, the family is the primary source of the resources needed for optimal health and development for most outcomes and hence, the institution through which the impact of socio-economic position is experienced (Mayer et al. 2004; Conley & Glauber, 2005).

The socio-economic position families hold is found to have important implications for the well-being of family members, including children. In general terms “doing better improves the chances of well-being” (Offer, 2006, p. 233). The relative socio-economic position of an individual or group (including a family) describes not only their access to resources, but also the likelihood that they will be exposed to certain risks or harm. For example, relatively higher income means that families are more able to afford resources directly important to children’s wellbeing (e.g. adequate housing and nutrition, health and dental care) (Currie & Stabile, 2002) and to mobilize resources that reduce exposure to risks (e.g. living in safer neighborhoods) (Lynch & Kaplan, 2000).

Relationships between parent’s social and economic characteristics and their children’s well-being are well documented. Parents in higher socio-economic positions are able to provide better developmental environments for their children (Mayer et al. 2004). For example, compared with parents in lower socio-economic positions, parents in higher socio-economic positions are better able to provide more stimulating home environments, more able to afford better childcare or preschool facilities, and to access to better schools for their children (Mayer et al. 2004). Socio-economic position is related to a wide range of outcomes right across the lifecycle (Currie & Stabile, 2002; Mayer, Duncan & Kalil, 2004; Singh-Manoux, Clarke & Marmot, 2002; Willms, 2003; Yang & Gustafsson, 2004), although family socio-economic position may be particularly important for young children’s well being (Jencks & Mayer, 1990; Louis & Zhao, 2002). Children’s cognitive and behavioural problems are associated with lower levels of parent (or primary caregiver) education, income, unemployment or employment in low prestige positions (Bor, Najman, Anderson, O’Callaghan, Williams & Behrens, 1997; Hertzman, 1994; Hertzman & Weins, 1996; Mayer, 1997; Willms, 2002). Adolescents from families in low socio-economic positions are also noted to be less likely to complete secondary school (Raudenbush & Kasim, 1998), to be obese (Willms, Tremblay & Katzmarzyk, 2002), and to engage in negative health behaviours such as smoking, drug use, and unsafe sex (Duffy, 2000; Elliott, 1993; Jessor, 1992; Raphael, 1996; Jencks & Mayer, 1990). Adults in low socio-economic positions are similarly found to experience poor mental and physical health outcomes and to die at a younger age (Marmot et al. 1991; Ross & Wu, 1995).

The experiences of families at different positions along the socio-economic gradient are of significant interest to policy makers, and improving family resources has been a major focus of policy intervention. Better knowledge of the drivers of socio-economic position and the association between socio-economic position and children’s outcomes as well as their responsiveness to policy interventions is a key research need (Willms, 2003). Indicators of socio-economic position are therefore important as both explanatory and control variables in social policy research. However, the accuracy and applicability of this research will depend on the quality of the measure used to estimate socio-economic position, and the extent to which the same measure can be used in different datasets, or with different populations (Keeves & Saha, 1997; Mueller & Parcel, 1981; Willms & Shields, 1996; Willms, 2003).

### **Socio-economic position as measured by income, education and prestige**

Socio-economic position has usually been measured by some combination of income, education and occupational status (Mayer et al. 2004, Willms, 2003). Whilst often considered in isolation from one another, these indicators are closely inter-related, reflecting broader social and economic processes (Lynch & Kaplan, 2000). Income, whether measured at personal, family or household level, is an “intuitively meaningful metric for assessing relative social standing” and a fundamental measure of the family’s economic resources (Offer, 2006, p. 233). The significance of income as an indicator of socio-economic position is highlighted by the health implications of having a low income. Accordingly, income has often been used as the only indicator of socio-economic position (Bor et al. 1997; Lynch et al. 1997). However, income is not a simple concept and is influenced by broader social and economic forces. Income is not easy to measure: it can be derived from various sources and can fluctuate considerably over time (Krieger, Williams & Moss, 1997; Mueller & Parcel, 1981). It is also noted that in social surveys, individuals tend to under-, or over-report the actual value of their incomes or to refuse to answer, leading to problems of inaccuracy, missing data and non-representativeness (Krieger, Williams & Moss, 1997; Mueller & Parcel, 1981).

Like income, educational attainment has also been used as a single indicator of socio-economic position. Educational attainment is often measured by the years of education or schooling an individual has completed, indicative of their potential earnings, and the skills, information and knowledge they have acquired (Lynch & Kaplan, 2000). Individuals who attain higher levels of education are more likely to be employed in better jobs, be paid higher salaries and be able to afford better housing (Lynch & Kaplan, 2000). This measure is suggested to be one of the most reliable and valid indicators of socio-economic position because it is observed to have low levels of missing data, is not dependent on whether parents are currently in the labour force or at home caring for children, and tends to be more accurately reported (Berkman & Macintyre, 1997; Krieger, Williams & Moss, 1997). However, the returns to or rewards from education differ as a function of race, ethnicity and gender (Lynch & Kaplan, 2000). Educational attainment is also more fixed and stable across the adult years, having less variability and range than measures of income or occupational status, thereby diminishing measurement sensitivity and its capacity to describe changes in resources or status (Krieger, Williams & Moss, 1997).

Linking the income individuals receive and their educational attainments are the characteristics of their employment (Lynch & Kaplan, 2000). Although an individual’s educational attainments shapes the jobs available to them and hence the incomes they receive, neither income nor education directly measure socially derived ascriptions of status or prestige (Lynch & Kaplan, 2000, Western, McMillan & Durrington, 1998). For these reasons occupations and the prestige associated with them supply another important dimension to the measurement of socio-economic position (Lynch & Kaplan, 2000; Offer, 2006). Indeed, some argue that occupation based measures offer the most reliable and valid indication of socio-economic position (Keeves & Saha, 1997; Mueller & Parcel, 1981, Singh-Manoux, Clarke & Marmot, 2002). The prestige associated with

various occupations appears to be robust over time, but can differ across countries, making international comparisons difficult (Berkman & Macintyre, 1997; Offer, 2006).

Rankings of occupational prestige have been established through general social surveys capturing the socially legitimated place in the social order. These measures constitute an evaluation of the status associated with occupations, often taking into account the educational qualifications required and the incomes associated with various occupations (Keeves & Saha, 1997; Mueller & Parcel, 1981). Such measures represent a move away from singular measures and towards a composite or summary approach to the measurement of socio-economic position. The premise underlying these measures is that “there is a fundamental relationship between education and income and that this relationship is mediated through occupational structure” (Davis et al. 1999). Measures derived through modeling this relationship have also been referred to as 'socio-economic indices' (Krieger, Williams & Moss, 1997). Key early examples of these indices include Duncan's Socioeconomic Index (SEI) (1961), and the Hollingshead Index of Social Position (1958).

In Australia, a series of scales named the ANU<sup>2</sup>, the ANU<sup>3</sup>/ ANU<sup>3</sup>R and most recently the ANU<sup>4</sup>, have been developed to rank the prestige of occupations based on social, economic and demographic indicators (Jones & McMillan, 2001). Each of these scales draws upon census data and classifies occupations by skill level and occupation type, taking into account the indirect effect of education and income. Similarly, in New Zealand the authors Davis, McLeod, Ongley, Pearce and Howden-Chapman (1999) using data from the 1991 Census of Population and Dwellings, developed a similar index of occupational structure called the NZSEI.

Following the work of Lynch and Kaplan (2000), Table 1 provides a brief overview of indicators of family and individual socio-economic position from the international and Australasian literature. It should be noted that apart from individual-level measures of socio-economic position a number of area-based measures also exist. Area-based measures of socio-economic position such as those developed using census data, are often used as a substitute measure for individual or household socio-economic position, allocating the characteristics of the census collection district to individuals in those districts (Berkman & Macintyre, 1997). Area-based measures suffer from a number of conceptual and methodological problems. Jencks and Mayer (1990) note that one of the most problematic issues when using area-based or neighbourhood measures is trying to disentangle influences specific to the area or neighbourhood from influences specific to the group or family unit. The authors also identify that family characteristics can affect the area in which they live but that these characteristics can also exert a major effect upon individual family members irrespective of where they live (Jencks & Mayer, 1990). This highlights that, while useful at a global level, area-based measures can be misleading if interpreted at an individual level; as such these measures are not noted within Table 1.

### **Measuring socio-economic position in the NLSCY**

Willms and Shields (1996) developed a summary measure of 'socio-economic status (SES)' for the Canadian NLSCY (see Table 1). This measure assesses the relative social

position of a child's family, based on their access to wealth, prestige and power by combining parent's income, education and occupational prestige. The authors have argued that this measure provides a parsimonious analytic tool to characterise families, predict children's outcomes, and to help disentangle overlapping influences between family socio-economic position, and the quality of children's care, school, or neighbourhood environments (Willms & Shields, 1996). The measure overcomes some of the difficulties inherent in using the component variables separately and can accommodate missing data, yielding output for more cases. As a summary measure it tends to have less error associated with it than component variables alone and is intuitively simple (Offer, 2006). The measure has been used in Canadian social policy research. Willms (2002), for example, observed SES gradients in children's temperament during infancy, with the gradients becoming steeper as children age, suggesting a strengthening of SES influences on children's outcomes. The SES composite score has also been used as a predictor of parent-child interactions, which are a risk or protective factor for children. Low SES acted as a key family stressor and amplified the influence of other family stresses, such as marital dissatisfaction on parent-child relationships (Jenkins, Rasbash & O'Connor, 2003).

**Table 1: Indicators of socio-economic position**

Income in Relation to Poverty Level (USA) (Lynch et al. 1997)	A score based on income expressed as a percentage of the formal poverty-level income for a given year.
Low Family Income (LFI) (Australia) (Bor et al., 1997)	A measure of adversity or disadvantage based on participants reported income in the Mater University Study of Pregnancy.
Self-reported Education (USA) (Feldman et al. 1989; Elo & Preston 1996)	Continuous information collected from self-reports of total number of years of education, or categorically as attainment of particular educational milestones such as completing high school.
ANU4 (Australia) (Jones & McMillian, 2001)	A collapsed version of ASCO Second Edition created to maximise the indirect effect of educational achievement and earnings.
Siegel (USA) (Siegel, 1971)	A continuous score of occupation prestige derived from the U.S. National Opinion Polls.
Index of Occupational Socio-Economic Status (USA) (Hauser & Warren, 1997)	A Socio-Economic Index of occupational prestige based on a 5% sample for each state and the District of Colombia from the 1990 Census.
New Zealand Socio-Economic Index (NZSEI) (New Zealand) (Davis et al., 1999)	Status scores for 97 occupational groups based on the 1991 New Zealand Census.
Elly & Irving, 1972 (New Zealand)	The average level of education, and income reported in the New Zealand 1966 census were combined with equal weighting in order to create a scale of occupation status.
Duncan Socioeconomic Index (SEI) (USA) (Duncan, 1961)	A continuous score based on the ranking of the prestige of 45 occupations from the U.S. National Opinion Polls. Income and education weights were used to create scores for all occupations. Commencing from the 1950's Occupational Classification Systems-updated to 1980 Census.
Hollingshead (USA) (Hollingshead & Redlich, 1958)	Based on the sum of the weighted components, occupation and education. Education and occupation are categorised into 7 groups each. The occupation score is weighted by 7 and education by 4 and they are summed.
International socio-economic index (SEI) (USA) (Ganzeboom, de Graaf & Treiman, 1992)	Following on from the work of Duncan (1961), the authors constructed an occupational scaling method using path analytic techniques correcting for age (a proxy for experience and education).
Socio-Economic Position (SEP) (England) (Singh-Manoux, Clarke, & Marmot, 2002)	A measure of Socio-Economic Position based on the composite of education, occupation and income data from phase five of the Whitehall II study.
Mayer, Duncan, & Kalil (USA) (2004)	A measure of Socio-Economic status based on education, occupation and income based on data from the NLSCY.
Socio-economic Status (SES) (CANADA) (Willms & Shields, 1996)	A standardised, unweighted measure of Socio-Economic Status based on education, occupation and income data from the NLSCY.



## **Summary and aim**

Following this brief review of the history of the ways in which socio-economic position has been conceptualised and measured, this technical working paper examines the derivation of a robust and parsimonious measure of socio-economic position for families participating in the HILDA and LSAC studies. As noted, family socio-economic position describes access to, and control over, key resources for families – education, income and occupational prestige. Socio-economic position influences family and child outcomes, with associations observed over the life course, and so has been an important focus for policy and intervention.

HILDA and LSAC are both large-scale longitudinal studies funded by the Australian Government Department of Families, Community Services and Indigenous Affairs (FaCSIA). These studies differ in their scope, nature and purpose, but both provide information about the lives and experiences of a representative sample of Australians. They are a valuable asset for social policy research; efforts to maximize their use are clearly warranted and measures which make the studies consistent and able to be used in a complementary fashion are important. Derivation of a single summary measure of the socio-economic position of families within HILDA and LSAC may overcome limitations currently observed with indicators available for these studies. While both studies currently contain some indicators of socio-economic position, these are primarily orientated at the individual, rather than the family level. Derivation of a new measure will importantly increase the capacity of these datasets to be used for social policy research focussed on families and children.

The measure developed for HILDA and LSAC follows the methods established by Willms and Shields (1996) for the NLSCY. The work of Willms and Shields (1996) is particularly relevant in developing a measure of socio-economic position for families in HILDA and LSAC given the similarities in purpose between the studies. The NLSCY has in particular, strong conceptual links to the Australian LSAC. Like the LSAC, the NLSCY is designed to collect information about the influences on child's social, emotional and behavioural development, to inform policy development and service provision. Apart from the usefulness of the NLSCY measure in relation to social policy research it also has a number of methodological benefits that warrant its replication for HILDA and LSAC. The composite or summary nature of the measure for example, is better able to capture the dimensions of socio-economic position than single indicators such as income, education and occupational prestige. It also reduces some of their methodological problems. Deriving a measure of socio-economic position for the LSAC and HILDA studies using the same methodology as the NLSCY may also enable international comparisons to be made between these studies. The following sections of the paper describe the data sources for the paper (the HILDA and LSAC studies) in more detail, outline the social and economic parameters used in the construction of the measure, and the data analysis undertaken to validate the constructed measure.

## **Method**

This paper represents the first effort to maximize the potential of the HILDA and LSAC studies by considering the two datasets simultaneously. In doing so, the specifics of the studies as data sources need to be considered carefully.

## **Data Sources**

HILDA is a household-based panel study designed and managed by The Melbourne Institute of Applied Economic and Social Research, the Australian Council for Educational Research and the Australian Institute of Family Studies. Collecting data about Australian families' demographic characteristics, income, employment and well-being, HILDA provides an overview of individual experiences at different points across the lifespan. The HILDA sample represents a national probability sample of Australian households occupying private dwellings. All members of sampled households are defined as members of the study sample. Since 2001, data has been collected annually via four survey instruments: a household form, household questionnaire, person questionnaire and self-completion questionnaire. Information for the household form and questionnaire is obtained from any adult member of the household, preferably the person identified as most knowledgeable about the household finances. If possible, the section on childcare is also given to the person most knowledgeable about those arrangements. Collectively, the four survey instruments obtain information about dwelling and household characteristics, employment, income, family and background information, and attitudes on health and relationships. The person questionnaire instrument is completed for each household member via interviews conducted with those aged 15 years and older. Once this interview and the person questionnaire are completed, individuals are given the self-completion questionnaire to complete in private. Data for use in this paper were collected at Wave 4 of the HILDA study where overall, data were available for 6,987 households and 12,408 individuals.

In contrast to the HILDA study, LSAC is focused on the experiences of children and their families at particular phases of the life course. LSAC commenced in 2004 and is managed by the Australian Institute of Family Studies (AIFS). The LSAC sample consists of two cohorts of children sampled from Australian residential households. These cohorts are referred to as the 'infant' or 'B' cohort, and the 'child' or 'K' cohort. Families within the 'infant' cohort at the time of interview had a child aged between 3 months and 1 year and 7 months. Families within the 'child' cohort at the time of interview had a child aged between 4 years and 5 years 5 months. Data is collected using face-to-face interviews with the primary caregiver of infants or children; with self-complete questionnaires for parents; with direct assessment of infants and children; and observations recorded by interviewers. The main source of information is the infant or child's primary caregiver or the person 'most knowledgeable about the child'. This person is referred to as 'Parent 1'. Parent 1 provides basic demographic information about all household members; demographic and socio-economic information about him or herself and his or her spouse; as well as extensive information about the development of the selected infant or child. In LSAC, 'Parent 1' and 'Parent 2' are mostly, but not always, the mother and father of the subject child. In this paper, data from release 2.5 of

Wave 1 were used. At Wave 1, data were available for 4,983 children (from the 'child' or 'K' cohort) and 5,107 infants (from the 'infant' or 'B' cohort).

Taking into account the differences between the two studies, to use the two datasets simultaneously this paper selects out a sub-population from the HILDA sample for comparison with the LSAC sample. This sub-population consists of those families with a resident dependent child aged 15 or 16 years at the time of the Wave 4 interview<sup>1</sup>. Individuals aged 15 and 16 years at Wave 4 of HILDA were matched to other members of their households, identifying those classified as the mother and father. A small number of cases (n=20) were excluded as no mother or father was identified within the household. For the purpose of this paper, consistent with LSAC where there was a mother present, they were identified as 'Parent 1' or 'P1' and if a father was present, they were identified as 'Parent 2' or 'P2'. In the discussion that follows, the term 'parent' will be used to refer to 'Parent 1' and 'Parent 2', noting that in the LSAC study this term is not accurate for a small percentage of cases.

Manipulation of the HILDA dataset in this way effectively allows the socio-economic position of families to be calculated for three cohort groups of Australian families, those with infants (LSAC) those with young children (LSAC) and those with teenagers (HILDA). It is important to note, however, that these three groups of families are not mutually exclusive. The 'infant' group of families may also have other children, who will usually be older than the subject 'infant' child, while the 'young child' and 'teenage' groups of families may have other children who are younger or older than the subject child.

Working from the NLSCY model, the socio-economic parameters of interest include the educational attainment of the parents of children within the three cohorts or samples, the occupational prestige associated with the jobs parents hold and their combined annual family income. The following sections describe how these parameters were measured in HILDA and LSAC and what modifications were made in order to construct a measure of socio-economic position. Further details of variable specifics can be found in Table A1 in the appendix.

## **Variables and Measures**

### **1. Combined annual income**

Combined annual income for families in LSAC was calculated by adding the values of the derived variables measuring 'P1' and 'P2's weekly income from all sources. This combined weekly value was then converted to an annual income value. Although an annual income variable was available in LSAC, it was provided in income ranges and was not suitable for use in this project. For families with a 15 or 16-year-old child in HILDA, the derived variable 'total household income for the financial year' was used to

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<sup>1</sup> This particular group were selected in light of other, on-going research examining the relationship between work and family characteristics and the well-being of parents and children from families at different life-cycle stages.

ensure that all sources of income were counted; this meant that in a small proportion of cases income from other people such as an independent adult child was included. (To smooth the distribution of income values for families in both studies, the combined annual income variable was transformed using natural logarithms (i.e.  $\ln(x)$ .)

## 2. Educational attainment

Parents' educational attainment was measured in both HILDA and LSAC by estimating the number of 'years of schooling' or education each parent ('P1' and 'P2') had completed. In HILDA this information was gained from the variables 'highest level of schooling completed' and 'highest educational qualification obtained' whereas in LSAC, data from three variables ('highest level of schooling completed', 'completed other qualification' and 'highest level of qualification obtained') were used. For both studies, estimated actual years of schooling were allocated to approximate a continuous measure ranging from zero years of schooling, for those who had never attended school, to 20 years of schooling, for those who had completed a post-graduate degree<sup>2</sup>. Where a parent had completed a post-graduate degree they received a value of 20 years of schooling, irrespective of what other qualifications they had obtained. Table 2 presents the estimated number of years of schooling for the highest years of schooling completed or highest qualification obtained.

**Table 2. Educational attainment as measured by years of schooling or education**

Highest level of schooling completed or highest qualification obtained	Years of schooling or education value allocated
Never attended school	0
Year 8 or below	9
Year 9 or equivalent	10
Year 10 or equivalent	11
Year 11 or equivalent	12
Year 12 or equivalent	13
Still at school	13
Completed other qualification	14
Certificate or other	14
Advanced diploma/diploma	16
Graduate diploma/certificate or Bachelor degree	17
Postgraduate degree	20

## 3. Occupational prestige

Parents' occupational prestige was estimated using the ANU4 score measure established by Jones and McMillan (2001). As noted previously, this measure was developed using census data to group occupations by skill level and occupation type, taking into account the indirect effect of education and income as well as the social perceptions of the status and prestige associated with various occupations. The Jones and McMillan (2001)

<sup>2</sup> The Australian Bureau of Statistics (ABS) and the LSAC Consortium Advisory Group were consulted in the construction of this measure and the allocation of years of schooling to the possible combinations of years of schooling completed and highest qualification obtained.

publication details the correspondence between four digit ASCO<sup>3</sup> codes and ANU4 'scores'. The ANU4 measure allocates a continuous score ranging from zero (lowest prestige) to 100 (highest prestige) to occupations. Wave 4 of the HILDA dataset includes an ANU4 score matched to current occupations and occupations held within the past five years. Where an individual had not been in paid employment for the past five years the value for the ANU4 score is set to missing. Similar conventions were followed for LSAC (note: the ANU4 score is not included with LSAC data, and so rating occupations according to the ANU4 score was undertaken as part of the present study). For both HILDA and LSAC a summary ANU4 Score variable was calculated for 'P1' and 'P2'. If the respondent had a valid current main occupation they received the ANU4 score associated with that occupation and if there was valid data for their last main occupation (but no current main occupation) they received the ANU4 score associated with their last main occupation.

### **Construction of a measure of family socio-economic position for HILDA and LSAC**

The components of the summary measure of socio-economic position include parental educational attainment, occupational prestige and combined annual income as described above. Once these component measures had been established, their values were standardised to a mean of zero and a standard deviation of one, so that they could be combined and their unweighted average calculated. This was done separately for each LSAC cohort and the HILDA sub-population. To represent family socio-economic position, an unweighted average was calculated relative to the number of parents present in the home. Where there were two resident parents the sum of the standardised component variables was divided by five and where there was only one resident parent the sum was divided by three. The averaged score was then re-standardised to a mean of zero and a standard deviation of one producing a final continuous measure of socio-economic position (see Willms and Shields, 1996 for a detailed rationale).

Willms and Shields (1996) advocate that where there are two resident parents, if two or more of the five component variables are missing, the final summary variable should be set to 'not stated' and similarly where there is only one resident parent, if one or more of the three component variables are missing the final variable should, be set to 'not stated'. However the distribution of missing data is life course sensitive. Compared with families with school aged children, occupational data is more likely to be missing for families with young children because one parent is more likely to be at home caring full-time. As such, a slightly less conservative strategy was adopted by this project in relation to missing data. For families with two resident parents, if no more than two of the five component variables were missing, the average was taken over the remaining variables; otherwise it was set to missing. For families with one resident parent, if no more than one variable was missing, the average was calculated over the remaining two variables; otherwise it was set to missing.

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<sup>3</sup> ASCO codes (Australian Standard Classification of Occupations 2<sup>nd</sup> Edition) are published by the Australian Bureau of Statistics (Cat No 1220.0).

The derived measure of socio-economic position ranks families relative to the sample it is calculated for, and as such, the social position described by the measure is variable and dependent upon the characteristics of that sample. For the purposes of this paper separate measures of socio-economic position families with one parent were developed and standardized relative to other one-parent families; for two parent families relative to other two parent families; and then for all families, i.e. with one- and two-parent families combined. While the summary measure of socio-economic position developed for each family group yields a continuous score, it is also possible to make an ordinal form of the variable by dividing scores into low, medium and high socio-economic position categories. In this paper an ordinal form of the variable was derived so that low socio-economic positions refer to relative socio-economic position scores ranging from 0-25%, medium socio-economic positions refer to scores from 26-75% and high socio-economic positions to scores from 76-100%<sup>4</sup>.

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<sup>4</sup> Quartile ranges were also investigated, but it was felt that the low, medium and high categorisation of socio-economic position was more easily interpreted and readily applied to the HILDA and LSAC datasets.

Figure 1 illustrates the conceptual integration of component variables to form a single composite or summary measure of socio-economic position for families in HILDA and LSAC.

**Figure 1: Measuring the socio-economic position of families in HILDA and LSAC**



### **Data analysis strategy**

A multi-stage data analysis strategy was formulated to guide preliminary examination and investigation of the socio-economic position measure. The first stage in this analysis strategy involved applying the ordinal form of the summary socio-economic position measure to describe the socio-economic circumstances of families with infants, children and teenagers. Within each family group, families with one parent were described separately from those with two parents. These analyses involved the calculation of measures of central tendency for each component variable and each family type. Pearson correlation statistics were computed and inspected to examine the relationship between the summary or composite measure of socio-economic position and its component variables. Gamma statistics were then computed to assess the relationship between the summary measure and other known indicators or outcomes of socio-economic position. Logistic regression analyses were also performed to explore the nature of the relationship between the summary socio-economic position measure and the identified known indicators and outcomes of socio-economic position.

Measures selected to represent other known indicators of socio-economic position included measures of disadvantage such as economic hardship score, key economic hardship indicators, receipt of income support payment, being a member of a household in which neither parent is working and the SEIFA advantage/disadvantage index (These indicators are described in detail in Table A1 in the appendix). Measures selected to represent known outcomes of socio-economic position include measures of adverse outcomes such as parental medical conditions and poor health, parental smoking, low birth weight in infants and children, and teenagers having left school early (see Table A2 in the appendix for more details of these measures). Further logistic regression analyses were conducted to investigate whether the summary socio-economic position measure showed the same relationship with known outcome measures as its component measures and whether, controlling for confounders, the summary measure maintained a significant relationship with known outcomes. Except where stated, all analyses conducted use the measure of socio-economic position calculated relative to all families (i.e., combining values for one and two parent families).



## Results

### Socio-economic position of families over the life course

Using the ordinal measure, the first set of analyses conducted describes the socio-economic characteristics of the three groups of families: those with an infant, those with a young child and those with a teenager. Tables 3a, 3b and 3c display the median educational attainment, occupational prestige and combined income of parents in families categorised as having low, medium and high socio-economic positions<sup>5</sup>.

In order to clearly demonstrate how families within each socio-economic position category differ according to the number of parents present, analyses presented are stratified and descriptions of the experiences of both one and two parent families are provided. In combining data regarding parental income, education and occupational prestige, the summary measure locates families differently than if any one socio-economic indicator were used on its own. For example, if income on its own were to be used as an indicator of socio-economic position, families with only one parent would tend to be located in low socio-economic positions. However, by considering other resources also available to these families, their relative socio-economic position might be found to be higher.

The results displayed in Tables 3a, 3b, and 3c provide an indication of the characteristics of families across different points in the stage of their child's development and across different socio-economic positions. As expected, families who have higher socio-economic positions are characterised by greater educational attainment, more prestigious occupations and higher incomes. Notably, annual income generally increases with the age of the subject child. Also as expected, families with two parents reported greater combined annual incomes than do those families with one parent.

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<sup>5</sup> For descriptive purposes median scores on component indicators were converted back to their original metric. For example, the median years of schooling value was converted back to provide an indication of primary caregivers' educational attainment. Similarly, median occupational prestige scores for each primary caregiver were converted back to the relevant ASCO category and the inverse of the log income value for families was taken and rounded to the nearest one hundred dollar value to provide an indication of annual income.

**Table 3a: Families in low socio-economic positions.**

		<b>INFANTS *</b> <b>(B COHORT LSAC)</b>	<b>CHILDREN*</b> <b>(K COHORT LSAC)</b>	<b>TEENAGERS*</b> <b>(HILDA)</b>
		<b>All Families – Low Socio-Economic Position</b>	<b>Families with one parent</b>	Parent 1 has a Year 12 education Parent 1 belongs to the occupational category of Elementary Clerical, Sales and Service Workers The annual income is \$20,400 (n = 363)
<b>Families with two parents</b>	Both parents have a Year 12 education Parent 1 belongs to the occupational category of Elementary Clerical, Sales and Service Workers Parent 2 belongs to the occupational category of Labourers and Related Workers The annual combined income is \$37,600 (n = 910)		Parent 1 has a Year 11 education Parent 2 has a Year 12 education Parent 1 belongs to the occupational category of Elementary Clerical, Sales and Service Workers Parent 2 belongs to the occupational category of Labourers and Related Workers The annual combined income is \$41,600 (n = 815)	Both parents have a Year 10 education Parent 1 belongs to the occupational category of Intermediate Transport and Production Workers Parent 2 belongs to the occupational category of Elementary Clerical, Sales and Service Workers The annual household income is \$58,700 (n = 57)

*\*The infant group comprises families from the B Cohort of LSAC; these families may also have other children, mostly older than the subject 'infant' child. \*The child group comprises families from the K Cohort of LSAC; these families may also have other children who may be either younger or older than the subject 'child'. \*The teenage group comprises families from the selected sub-population of HILDA. These families may also have other children who again may be younger or older than the subject 'teenage' child.*

**Table 3b: Families in medium socio-economic positions.**

All Families – Medium Socio-Economic Position		<b>INFANTS (B COHORT LSAC)</b>	<b>CHILDREN (K COHORT LSAC)</b>	<b>TEENAGERS (HILDA)</b>
	<b>Families with one parent</b>	Parent 1 has a diploma or advanced diploma Parent 1 belongs to the occupational category Associate Professionals The annual income is \$26,000 (n = 96)	Parent 1 has a certificate or other qualification Parent 1 belongs to the occupational category Intermediate Clerical, Sales and Service Workers The annual income is \$29,000 (n = 208)	Parent 1 has a certificate or other qualification Parent 1 belongs to the occupational category Associate Professionals The annual household income is \$58,100 (n = 42)
<b>Families with two parents</b>	Both parents have a certificate or other qualification Parent 1 belongs to the occupational category Intermediate Clerical, Sales and Service Workers Parent 2 belongs to the occupational category Tradespersons and Related Workers The annual combined income is \$55,500 (n = 2,450)	Both parents have a certificate or other qualification Parent 1 belongs to the occupational category Intermediate Clerical, Sales and Service Workers Parent 2 belongs to the occupational category Associate Professionals The annual combined income is \$62,600 (n = 2,275)	Parent 1 has a Year 12 education Parent 2 has a certificate or other qualification Parent 1 belongs to the occupational category Intermediate Clerical, Sales and Service Workers Parent 2 belongs to the occupational category Tradespersons and Related Workers The annual household income is \$ 95,800 (n = 187)	

**Table 3c: Families in high socio-economic positions.**

All Families – High Socio-Economic Position		<b>INFANTS (B COHORT LSAC)</b>	<b>CHILDREN (K COHORT LSAC)</b>	<b>TEENAGERS (HILDA)</b>
	<b>Families with one parent</b>	Parent 1 has a graduate diploma/certificate or Bachelor degree Parent 1 belongs to the occupational category Professionals The annual income is \$52,300 (n = 15)	Parent 1 has a graduate diploma/certificate or Bachelor degree Parent 1 belongs to the occupational category Professionals The annual income is \$46,400 (n = 53)	Parent 1 has a graduate diploma/certificate or Bachelor degree Parent 1 belongs to the occupational category Professionals The annual household income is \$73,100 (n = 19)
<b>Families with two parents</b>	Both parents have a graduate diploma/certificate or Bachelor degree Both parents belong to the occupational category Professionals The annual combined income is \$90,600 (n = 1,258)	Both parents have a graduate diploma/certificate or Bachelor degree Both parents belong to the occupational category Professionals The annual combined income is \$101,200 (n = 1,188)	Both parents have a graduate diploma/certificate or Bachelor degree Parent 1 belongs to the occupational category Professionals Parent 2 belongs to the occupational category Managers and Administrators The annual household income is \$111,300 (n = 96)	

### Assessing the relationship between the summary measure and its components.

The next analysis investigated the relationship between the summary socio-economic position measure and its component indicators. Pearson correlations were computed using the continuous form of the summary variable and component indicators. Table 4 displays the Pearson correlation values for the association between the summary socio-economic position measure calculated for all families and its component indicators.

**Table 4: Correlation between summary socio-economic position measure and its component indicators or variables.**

	Years of Schooling (P1)	Years of Schooling (P2)	Occupational Prestige (P1)	Occupational Prestige (P2)	Combined Income (Log)
<b>Socio-Economic Position Families of INFANTS</b>	0.78**	0.76**	0.76**	0.77**	0.67**
<b>Socio-Economic Position Families of CHILDREN</b>	0.76**	0.75**	0.75**	0.76**	0.67**
<b>Socio-Economic Position Families of TEENAGERS</b>	0.72**	0.77**	0.76**	0.76**	0.60**

\*\* Pearson correlation is significant at the 0.01 level (2-tailed).

The results displayed in Table 4 indicate that across each of the three sample groups there is a strong positive correlation between the summary socio-economic position measure and each component indicator or variable. The direction of this relationship is such that for the component variables higher values were associated with higher socio-economic position values. Having established this relationship, it was also important to identify the nature and extent of the relationship between the summary socio-economic position measure and other known indicators and outcomes of socio-economic position.

### Assessing the relationship between the summary measure and known indicators and outcomes

As noted previously, measures selected to represent other known indicators of socio-economic position included measures of disadvantage such as economic hardship score, key economic hardship indicators (Bray, 2001), receipt of income support payment, living in a household where neither parent is working and the SEIFA advantage/disadvantage index. Measures selected to represent known outcomes of socio-economic position included measures of adverse outcomes such as parental medical conditions and poor health, parental smoking, low birth weight in infants and children, and teenagers having left school early. Consideration of the structure of these measures and the ordinal form of the summary socio-economic position measure informed the decision to use an ordinal test (gamma) to explore this relationship. This test has a power advantage over more general tests such as  $\chi^2$  or  $G^2$  (Agresti, 2002). Tables 5a and 5b present the gamma statistics calculated to assess the association between the summary

measure of socio-economic position and (i) other known indicators of socio-economic position (ii) known outcomes of socio-economic position.

**Table 5a: Association between summary socio-economic position measure and measures of disadvantage.**

	Measures of disadvantage				
	Experience of economic hardship	Experience of hardship on key indicators	Receipt of income support	Jobless parents	SEIFA advantage / disadvantage
<b>Socio-Economic Position Families of INFANTS</b>	-0.45**	-0.51**	-0.75**	-0.87**	0.66**
<b>Socio-Economic Position Families of CHILDREN</b>	-0.50**	-0.55**	-0.70**	-0.83**	0.69**
<b>Socio-Economic Position Families of TEENAGERS</b>	-0.39**	-0.42**	-0.56**	-0.21*	0.50**

\*\* Gamma Statistic is significant at the 0.01 level. \* Gamma Statistic is significant at the 0.05 level.

The summary measure shows strong and consistent associations with related indicators. The gamma statistics reported in Table 5a indicate that across the three groups of families, the summary socio-economic position measure has strong negative associations with measures of disadvantage. The direction of this association indicates that families who are categorised as holding lower socio-economic positions are more likely to experience economic hardship, more likely to receive income support payments and more likely to live in a household where neither parent is working. The positive association between socio-economic position and the SEIFA index of advantage/disadvantage shows that families who hold higher socio-economic positions are more likely to live in neighbourhoods characterised by advantage rather than disadvantage. While these results are generally consistent across the family groups, the weaker negative association identified between socio-economic position and the indicator ‘jobless parents’ for families with teenagers, reflects the fact that few teenagers have parents who are not working.

Investigation of the association between the summary measure of socio-economic position and adverse outcomes revealed a more complicated pattern of results. As displayed in Table 5b where at least one parent has ever been, or is a smoker, a moderate negative relationship with the summary measure of socio-economic position was observed for all groups of families. In contrast, for families with an infant or young child, only a weak negative relationship (-.09 to-.17) was observed between the summary measure of socio-economic position and parent medical condition or poor health, whereas this relationship was observed to be much stronger (-.37 to -.48) for families with a teenager. This finding may reflect the fact that parents of teenagers are on average older and may experience poorer health and more medical conditions, which are in turn also associated with lower socio-economic position. Low birth weight had a modest negative

association with the summary measure of socio-economic position. Having left school early showed a stronger negative association, but this relationship failed to reach significance at the 0.05 level.

**Table 5b: Association between summary socio-economic position measure and adverse outcomes of socio-economic position.**

	Adverse outcomes				
	At least one parent has a medical condition	At least one parent has poor health	At least one parent is or has been, a smoker	Infant or child had low birth weight	Teenager left school early
<b>Socio-Economic Position Families of INFANTS</b>	-0.09**	-0.09*	-0.46**	-0.23**	N/A
<b>Socio-Economic Position Families of CHILDREN</b>	-0.12**	-0.17**	-0.42**	-0.11*	N/A
<b>Socio-Economic Position Families of TEENAGERS</b>	-0.37**	-0.48**	-0.38**	N/A	-0.39

\*\* Gamma Statistic is significant at the 0.01 level. \* Gamma Statistic is significant at the 0.05 level.

To further explore the nature of the relationship between low, medium and high socio-economic positions and indicators of disadvantage and adverse outcomes, logistic regression analyses were performed. The dependent variables for these analyses were the binary forms of the variables economic hardship, hardship as assessed by key indicators, receipt of income support, jobless parents, SEIFA advantage/disadvantage, parent health condition, poor health or smoking, child low birth weight and teenager left school early (see Table A2 of the appendix). Tables 6a and 6b display the odds of families in low or medium socio-economic positions relative to families in higher socio-economic positions experiencing hardship or adverse outcomes

**Table 6a: Logistic regression models exploring the relationship between socio-economic position and indicators of disadvantage.**

	Indicators of disadvantage					
		Experience of economic hardship	Experience of hardship on key indicators	Receipt of income support	Jobless parents	SEIFA advantage / disadvantage
<b>Socio-Economic Position Families of INFANTS</b>	<b>Low SEP</b>	5.19**	6.15**	28.00**	58.05**	14.81**
	<b>Med. SEP</b>	2.26**	2.17**	5.00**	4.48**	4.01**
<b>Socio-Economic Position Families of CHILDREN</b>	<b>Low SEP</b>	6.45**	7.42**	20.39**	56.59**	30.68**
	<b>Med. SEP</b>	2.48**	2.22**	4.71**	6.73**	6.36**
<b>Socio-Economic Position Families of TEENAGERS</b>	<b>Low SEP</b>	3.74**	2.82**	7.67**	1.97	18.73**
	<b>Med. SEP</b>	1.86*	1.57	1.66	1.11	5.07**

\*\* Odds ratio is significant at 0.01 level \*Odds ratio is significant at 0.05 level

The results presented in Table 6a, indicate a consistent pattern with those families who have low socio-economic positions being more likely to experience a particular type of disadvantage or hardship than those having higher socio-economic positions. This result is most strongly observed in relation to the receipt of income support and jobless parents. Observation of the results across the family groups reveals that families of teenagers appear less likely to experience disadvantage. Evidence from prior analyses suggests this may be because families of teenagers have higher incomes than families of young children or infants. Also consistent with the results of prior analysis, families holding low socio-economic positions were also found to be more likely to have a parent who had experienced poor health or had a medical condition compared to families having higher socio-economic positions (see Table 6b). Little difference was observed between medium and high socio-economic position groups. Again, differences were observed across the cohort groups with families of teenagers categorised as holding low socio-economic positions being more likely to experience adverse outcomes (Odds ratio = 4.14) than either families of infants (Odds ratio = 1.36) or young children (Odds ratio = 1.49).

Where one parent has been or is a smoker, the relationship is similar across the three cohort groups. Parents in families having low socio-economic positions have higher odds of having been or currently being a smoker compared with parents in families having higher socio-economic positions. Infants with parents of either low or medium socio-economic positions are twice as likely to have low birth weight as infants from high socio-economic position families. The parameter estimates associated with the dependent variable: teenager has left school early, failed to reach statistical significance. The collective results of the analyses presented in Tables 6a and 6b demonstrate that families having low socio-economic position were at particular risk of disadvantage and the experience of adverse outcomes.

**Table 6b: Logistic regression models exploring the relationship between socio-economic position and adverse outcomes.**

	Adverse outcomes					
		At least one parent has a medical condition	At least one parent has poor health	At least one parent is or has been, a smoker	Infant or child had low birth weight	Teenager left school early
<b>Socio-Economic Position Families of INFANTS</b>	<b>Low SEP</b>	1.36**	1.35*	5.06**	2.40**	N/A
	<b>Med. SEP</b>	1.12	0.99	2.75**	2.11**	N/A
<b>Socio-Economic Position Families of CHILDREN</b>	<b>Low SEP</b>	1.49**	1.76**	4.26**	1.45*	N/A
	<b>Med. SEP</b>	1.18*	1.15	2.45**	1.21	N/A
<b>Socio-Economic Position Families of TEENAGERS</b>	<b>Low SEP</b>	4.14**	5.80**	5.10**	N/A	3.75
	<b>Med. SEP</b>	0.71	1.32	1.18	N/A	1.47

\*\* Odds ratio is significant at 0.01 level \* Odds ratio is significant at 0.05 level

### **Examining whether the summary measure performs in the same way as its component indicators**

Having found that the summary socio-economic position measure was strongly related to its components and also to indicators of disadvantage and adverse outcomes, it was also important to investigate how the summary measure performed in relation to the components. For each family group, this was explored by carrying out a series of logistic regression analyses where the dependent variables were the binary forms of the four adverse outcome variables previously identified (parent health condition, parent poor health or smoking, child low birth weight and teenager left school early). The explanatory variables for these analyses were the continuous form of the summary socio-economic position variable and the continuous forms of each component variable. For families with two parents where there are two possible values for ‘years of schooling’ and ‘occupational prestige’, the larger value of the two was selected. The results of these analyses are presented separately for each family group in Tables 7a, 7b and 7c.



**Table 7a: Comparison of the effect of the summary socio-economic position measure and component variables upon adverse outcomes for families of infants.**

			At least one parent has a medical condition		At least one parent has poor health		At least one parent is or has been, a smoker		Infant or child had low birth weight	
			B	S.E	B	S.E	B	S.E	B	S.E
<b>INFANTS</b>	<b>Summary measure</b>	Socio-economic position	-0.13**	0.03	-0.15**	0.04	-0.67**	0.04	-0.27**	0.07
			R Square = 0.01 (n=5,092)		R Square = 0.01 (n=3,932)		R Square = 0.12 (n=3,850)		R Square = 0.01 (n=5,058)	
	<b>Component indicators</b>	Highest Yrs School	-0.06	0.05	-0.04	0.07	-0.41**	0.06	-0.11	0.10
		Highest O/Prestige	-0.03	0.04	-0.04	0.07	-0.26**	0.05	-0.14	0.09
		Combined Income	-0.10**	0.04	-0.09	0.05	-0.08	0.04	-0.11	0.07
		R Square =0.01 (n=4,183)		R Square = 0.00 (n=3,284)		R Square = 0.11 (n=3,213)		R Square = 0.01 (n=4,156)		

\*\* Estimate is significant at 0.01 level \* Estimate is significant at 0.05 level

**Table 7b: Comparison of the effect of the summary socio-economic position measure and component variables upon adverse outcomes for families of children.**

			At least one parent has a medical condition		At least one parent has poor health		At least one parent is or has been, a smoker		Infant or child had low birth weight	
			B	S.E	B	S.E	B	S.E	B	S.E
<b>CHILDREN</b>	<b>Summary measure</b>	Socio-economic position	-0.13**	0.03	-0.20**	0.04	-0.56**	0.04	-0.14 *	0.06
			R Square =0.01 (n=4,964)		R Square = 0.01 (n=3,833)		R Square = 0.09 (n=3,653)		R Square =0.00 (n=4,880)	
	<b>Component indicators</b>	Highest Yrs School	-0.05	0.05	-0.03	0.07	-0.39**	0.06	0.09	0.09
		Highest O/Prestige	-0.06	0.04	-0.06	0.06	-0.23**	0.05	-0.13	0.09
		Combined Income	-0.05	0.05	-0.11**	0.05	0.01	0.04	-0.11	0.06
		R Square = 0.01 (n=4098)		R Square = 0.01 (n=3,242)		R Square = 0.08 (n=3093)		R Square =0.00 (n=4,030)		

\*\* Estimate is significant at 0.01 level \* Estimate is significant at 0.05 level

**Table 7c: Comparison of the effect of the summary socio-economic position measure and component variables upon adverse outcomes for families of teenagers.**

			At least one parent has a medical condition		At least one parent has poor health		At least one parent is or has been, a smoker		Teenager left school early	
			B	S.E	B	S.E	B	S.E	B	S.E
<b>TENAGERS</b>	<b>Summary measure</b>	Socio-economic position	-0.49**	0.10	-0.68**	0.11	-0.47**	0.12	-0.51	0.33
			R Square=0.07 (n=458)		R Square =0.13 (n=429)		R Square =0.06 (n=458)		R Square =0.04 (n=169)	
	<b>Component indicators</b>	Highest Yrs School	-0.01	0.14	-0.13	0.14	-0.03	0.16	-0.69	0.40
		Highest O/Prestige	-0.26*	0.13	-0.29*	0.14	-0.48**	0.15	0.10	0.39
		Combined Income	-.46**	0.13	-0.60**	0.14	-0.04	0.14	-0.23	0.27
			R Square =0.10 (n=453)		R Square =0.15 (n=420)		R Square =0.07 (n=453)		R Square =0.07 (n=168)	

\*\* Estimate is significant at 0.01 level \* Estimate is significant at 0.05 level

Taken together the results presented in Tables 7a, 7b and 7c suggest that, compared with its component variables, the single summary measure of socio-economic position shows similar or stronger associations with other indicators of disadvantage or adverse outcomes. For all family groups, the estimated parameters (B) for the summary socio-economic measure and component indicators are consistent and in the expected direction. The magnitude of the estimated parameters is however, greater for the cohort of families of teenagers than for the cohorts of families of young children or infants. The direction of the relationships observed is in accordance with the results of previous analyses with low socio-economic position being associated with a higher probability of the family experiencing an adverse outcome.

For all family groups, the pseudo R squares (a measure of the proportion of variance explained) associated with models testing the summary measure and those testing the component indicators are comparable, although very small. Willms (2002), similarly found that the summary measure of socio-economic position developed for the NLSCY on its own, accounted for very little of the variance in child and family outcomes. One key finding identified within the above tables is that the models testing the summary measure of socio-economic position are able to use a larger number of cases and have less standard error associated with them than models testing the effect of the component indicators upon adverse outcomes. This finding may be explained by the fact that a certain amount of missing data is accommodated in the construction of the summary socio-economic position measure. As a consequence, within the models testing the effect of component indicators upon adverse outcomes, the parameters associated with the components often fail to reach significance at the 0.05 level.

### **Examining the effect of potential confounders.**

The final analysis explored whether the summary socio-economic position measure maintained its significant association with adverse outcomes, when the effects of potentially confounding factors are accounted for. Potential confounders of the relationship between socio-economic position and adverse outcomes include family size (number of children), parental age and the number of parents in the home. Willms and Shields (1996), note that incorporating such factors into a general measure of socio-economic position is not practical, but suggest that where the measure is to be used as a control variable in regression analyses these potential confounding factors may be added to the equation as covariates.

The results of analyses controlling for the effect of potential confounders are displayed in Table 8. Compared with the unadjusted estimates reported in Table 6b, these results show very little change in effect sizes after adjusting for confounders. Of interest in the analyses, the odds ratios associated with potential confounders often fail to reach statistical significance. Indeed, amongst the results reported in Table 8 there is no easily discernible pattern in the relationship between the adverse outcomes and the identified potential confounding factors. This supports Willms and Shields (1996) suggestion that their incorporation into a general measure of socio-economic position is not justified but that in any modelling exercise their inclusion as covariates is warranted.

**Table 8: Logistic regression analyses controlling for the effect of potential confounding factors.**

		Adverse outcomes				
		Either parent has a medical condition	Either parent has poor health	Either parent is or has been, a smoker	Infant or child had low birth weight	Teenager left school early
		Odds Ratios	Odds Ratios	Odds Ratios	Odds Ratios	Odds Ratios
<b>INFANTS</b>	<b>Low SEP</b>	1.42**	1.49**	5.04**	2.28**	N/A
	<b>Med. SEP</b>	1.12	1.01	2.73**	2.15**	N/A
	<b>Average age of parents</b>	1.00	1.00	1.00	1.02	N/A
	<b>Number of parents (1)</b>	0.88	0.72	0.97	1.49*	N/A
	<b>Number of children (2)</b>	0.88	1.07	0.85*	0.95	N/A
	<b>Number of children (3+)</b>	1.08	1.10	1.05	1.07	N/A
<b>CHILDREN</b>	<b>Low SEP</b>	1.73**	2.13**	4.60**	1.31	N/A
	<b>Med. SEP</b>	1.23*	1.22	2.50**	1.19	N/A
	<b>Average age of parents</b>	1.01*	1.03**	1.01	1.00	N/A
	<b>Number of parents (1)</b>	0.71**	.71*	0.82	1.43*	N/A
	<b>Number of children (2)</b>	0.90	0.84	0.70**	1.42	N/A
	<b>Number of children (3+)</b>	0.91	0.83	0.76*	1.17	N/A
<b>TEENAGERS</b>	<b>Low SEP</b>	4.45**	6.29**	4.54**	N/A	3.12
	<b>Med. SEP</b>	0.79	1.47	1.12	N/A	1.25
	<b>Average age of parents</b>	1.03	1.03	0.98	N/A	0.94
	<b>Number of parents (1)</b>	N/A <sup>+</sup>	N/A <sup>+</sup>	N/A <sup>+</sup>	N/A <sup>+</sup>	N/A <sup>+</sup>
	<b>Number of children (2)</b>	0.57	0.57	0.66	N/A	0.90
	<b>Number of children (3+)</b>	0.39**	0.47	0.37	N/A	1.11

\*\* Odds ratio is significant at 0.01 level \* Odds ratio is significant at 0.05 level

<sup>+</sup> Inclusion of this variable within the model resulted in a poorly specified model fit.

## Discussion

Family socio-economic position refers to key resources in families that parents and their children can access. This paper describes the development and application of a comparable and robust measure of socio-economic position for families in HILDA and LSAC. It represents the first effort to maximise the potential of the two studies by considering the two datasets simultaneously. Given the differences between the two studies the socio-economic position measure was calculated only for those families within HILDA who had a 15 or 16-year-old child at Wave 4 of the study. Manipulation of the HILDA dataset to select out only this sub-population effectively allowed the socio-economic position of families to be calculated for three cohort groups of Australian families, those with infants, those with young children and those with teenagers. The methodology used to guide the derivation of the summary measure of socio-economic position was based upon the work of Willms and Shields (1996) and incorporates measures of parental educational attainment, occupational prestige and combined annual income. The summary measure created by combining data from these variables was calculated and standardised relative to distinct populations, for example families with infants, families with young children and families with teenagers. The measure can be used for all families (combining values for one and two parent families), or, depending on the research question, used to calculate socio-economic position within family types (e.g., families with one parent, or families with two parents).

A multi-stage data analysis strategy was developed to guide preliminary investigation of the summary measure. Analyses conducted revealed the summary measure of socio-economic position to be a useful tool for describing the socio-economic experiences of families. As expected, analyses revealed that families with higher socio-economic positions are characterised by greater educational attainment, higher prestige occupations and greater combined annual incomes. The annual combined income reported by families was found to increase with both the age of the subject child and the number of caregivers in the home. Preliminary investigations also revealed that the summary measure of socio-economic position was strongly associated with its component variables and other known indicators and outcomes of socio-economic position. The nature of these relationships was such that lower socio-economic positions were associated with greater experience of disadvantage and/or adverse outcomes for families and children. Further analyses indicated that the single summary measure of socio-economic position gave estimates consistent with the component variables, but proved a more parsimonious and powerful measure, yielding smaller standard errors and minimising loss of sample due to missing data. The strength of its association with adverse outcomes was not diminished when the influence of potential confounding factors was accounted for. Taken together, the results of the analyses performed provide in-principle support for the derived measure and its application to the HILDA and LSAC datasets.

Application of this summary measure of socio-economic position can facilitate a range of social policy research. It could be used, for example, to estimate how the socio-economic position of families directly interacts with developmental outcomes, or the extent to which low socio-economic positions may be considered a risk factor for adverse child

outcomes. In addition, it allows researchers to examine the impact of other child, family or environmental risk factors while controlling for the effect of socio-economic position in a parsimonious way. Because the summary measure of socio-economic position can be calculated relative to distinct populations, the measure can be used to compare the socio-economic characteristics of different family types, and to define subgroups whose trajectories can be tracked over time. For HILDA, and eventually the LSAC, with increasing waves of data it will also be possible to map trajectories that show change in socio-economic position over time. Other research currently being undertaken by the authors, which examines the influence of family and work characteristics upon the well-being of families and children, will also be able to use the measure to control for the effect of socio-economic position while examining the influence of other variables of interest.

Despite the exciting potential of the measure, some caution must be exercised as the analyses conducted highlight some of the conceptual and methodological difficulties inherent in calculating a summary measure of socio-economic position. One of the most common problems encountered is the conceptualisation of socio-economic position for parents not currently in the labour force. This problem is especially relevant for the population group of mothers with young children where the allocation of an occupational prestige score is often difficult. This issue was addressed in the paper by allocating an occupational prestige score to the last main occupation held, providing this occupation was held not more than five years prior to the survey. This approach seems reasonable, since while being out of the labour force will immediately impact upon income, the resources represented by occupational prestige may not disappear as rapidly.

A further issue which remains to be explored in relation to measures of occupation, is the impact upon occupational prestige and socio-economic position when individuals return to work after being out of the labour force, but return to occupations of lower status because of work/family balance considerations. At present there is no measure within the HILDA and LSAC datasets of how common this is and investigation of this issue would require examination of changes to occupational prestige over time using longitudinal data and data analysis methods.

The measurement of educational attainment via years of schooling completed also raises some conceptual and methodological issues. Lynch and Kaplan (2000), note that measures of years of education tell us nothing about the quality of the education received and the social or economic value of that education within particular social, historical and cultural contexts. Analyses conducted for this paper also revealed that educational attainment contributed little to the understanding of the experiences of those in high socio-economic positions because virtually all members of this group had tertiary qualifications.

As noted, the measure of socio-economic position developed ranks families relative to the sample it is calculated for, and is thus sensitive to and dependent upon the characteristics of that sample. For example, when considered in relation to all families, those families with one parent may be clustered within lower socio-economic positions.

However, re-calculating the socio-economic position of these families relative to other one parent families only could dramatically alter their socio-economic position. For this reason it is important that researchers specify the sample or relevant social grouping for which the socio-economic position measure they use is constructed (for a more detailed discussion see Sloat & Willms, 2002).

Further, in this paper measures of socio-economic position were developed and standardized for families with one parent, for two parents and for all families. Where data is available for each of the component variables and the appropriate mean and standard deviation could be estimated, it would also be possible to standardize a measure of socio-economic position for any population of interest. Thus, while not the focus of this paper, it would be possible to standardize the scores for the group of teenagers to the mean and standard deviation of all families with children in HILDA.

While these issues may be the catalyst for further work, they do not detract from the value of the summary socio-economic position measure described in this paper. One of the chief advantages of this summary measure of socio-economic position is that it provides a useful way to measure the socio-economic resources available to families and children over time and the influence of these resources upon short and long-term outcomes. Such issues are of key social policy interest and the succinct nature of the summary measure means it is uniquely suited to research that seeks to describe or control for the socio-economic position of families. Importantly, the measure can be calculated for different populations of interest and can be used in both cross-sectional and longitudinal research. Deriving this measure of socio-economic position for HILDA and LSAC can therefore broaden the scope of research questions that can be answered by the datasets as well as the capacity for the studies to be used simultaneously, ultimately benefiting their research potential and worth.

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**Table A1: Variables used in the construction of the summary socio-economic position measure.**

	Original variables			Modifications
	B Cohort	K Cohort	HILDA	
<b>Combined annual income</b>	P1- AP1INC	P1- AP1INC	DHIFEFP DHIFEFN DHIFWFLI	<b>LSAC*:</b>
	P2- AP2INC	P2- AP2INC <sup>c</sup>		<b>HILDA:</b>
<b>Educational attainment</b> ~ <b>Years of schooling for P1 and P2</b>	P1- B1CH3A B1CH4A B1CH5A	P1- K1CH3A K1CH4A K1CH5A	DEDHISTS DEDHIGH	<b>LSAC:</b>
	P2- B1CH3B B1CH4A B1CH5A	P2- K1CH3B K1CH4A K1CH5A		<b>HILDA:</b>
<b>Occupational prestige for P1 and P2</b>	P1- B1CJ16A B1CJ29A	P1- K1CJ16A K1CJ16B	DJBMOCCS DUJLJOCS DPJOTOCS	<b>LSAC:</b>
	P2- B1CJ16B B1CJ29B	P2- K1CJ16B K1CJ29B		<b>HILDA:</b>

*\*Preliminary work on this measure by the authors identified problems with income data in earlier LSAC data releases. These problems have now been resolved by AIFS.*

**Appendix**

**Table A2: Variables used in examination of the summary socio-economic position measure**

	Original variables			Modifications
	B Cohort	K Cohort	HILDA	
<b>Experience of economic hardship</b>	AHSHP (AIFS derived variable: calculated from B1ck22 B1ck24 B1ck25 B1ck26 B1ck27 B1ck28)	AHSHP (AIFS derived variable: calculated from B1ck22 B1ck24 B1ck25 B1ck26 B1ck27 B1ck28)	DFIPRBEG DFIPRBMR DFIPRBPS DFIPRBWM DFIPRBUH DFIPRBFH DFIPRBWO	<b>LSAC:</b> <ul style="list-style-type: none"> <li>• Missings removed</li> <li>• Variable was coded into none/some/ significant</li> </ul> * For logistic regression analyses this variable was dummy coded to represent the experience of none versus some or significant hardship.
				<b>HILDA:</b> <ul style="list-style-type: none"> <li>• For P1 and P2, the variables were re-coded into dummy variables, none/some/ substantial, and combined to create one variable by counting the number of yes's to each item</li> <li>• Only P1 was used in the validation analysis</li> </ul> * For logistic regression analyses this variable was dummy coded to represent the experience of none versus some or significant hardship.
<b>Experience of hardship on key indicators</b>	B1CK24 B1CK25 B1CK26 B1CK27	K1CK24 K1CK25 K1CK26 K1CK27	DFIPRBPS DFIPRBWM DFIPRBUH DFIPRBWO	<b>LSAC:</b> <ul style="list-style-type: none"> <li>• Missings removed</li> <li>• Variable coded into none/some/ significant</li> </ul>
				<b>HILDA:</b> <ul style="list-style-type: none"> <li>• For P1 and P2, the variables were re-coded into dummy variables, none/some/ substantial, and combined to create one variable by counting the number of yes's to each item</li> <li>• Only the P1 variable was used in the validation analysis</li> </ul>
<b>Receipt of income support</b>	B1CK7A B1CK8A B1CK10A B1CK11A B1CK14A B1CK16A	K1CK7A K1CK8A K1CK10A K1CK11A K1CK14A K1CK16A	DBNCAP DBNCOTH1	<b>LSAC:</b> <ul style="list-style-type: none"> <li>• Missings removed</li> <li>• Payments combined</li> <li>• Dichotomous variable formed; values are: payment/ no payment</li> </ul>
				<b>HILDA:</b> <ul style="list-style-type: none"> <li>• For single P1 and P2 and couple P1 and P2, the variables were combined into a dummy, neither versus either receiving payment</li> </ul>



**Table A2 (continued): Variables used in examination of the summary socio-economic position measure**

<b>Jobless parents</b>	P1- AEMPA	P1- AEMPA	DESDTL	<b>LSAC:</b> <ul style="list-style-type: none"> <li>• Missings removed</li> <li>• P1 and P2 combined</li> <li>• Variable coded to represent at least one parent employed or no parents employed/ unknown</li> </ul>
	P2- AEMPB	P2- AEMPB		<b>HILDA:</b> <ul style="list-style-type: none"> <li>• For single P1 and P2 and couple P1 and P2, this variable was re-coded into no-one working/either working/ both working</li> </ul>
<b>SEIFA disadvantage/ advantage</b>	ASEIFAAD	ASEIFAAD	DHHAD10	<b>LSAC:</b> <ul style="list-style-type: none"> <li>• Variable was re-coded to reflect living in either a low or high SEIFA area reflecting disadvantage or advantage using ABS national cut-offs</li> </ul> <p>* For logistic regression analyses this variable was dummy coded to represent living in a high versus low area.</p>
				<b>HILDA:</b> <ul style="list-style-type: none"> <li>• For single P1 and P2 and couple P1 and P2, this variable was re-coded into a dummy, high versus low</li> <li>• Only the P1 variable was used in the validation analysis</li> </ul> <p>* For logistic regression analyses this variable was dummy coded to represent living in a high versus low area.</p>
<b>At least one parent has a medical condition</b>	P1- B1CA14P1	P1- K1CA14P1	DHGLTH	<b>LSAC:</b> <ul style="list-style-type: none"> <li>• Missings removed</li> <li>• P1 and P2 combined</li> <li>• Variable coded to reflect neither parent has a medical condition, either or both have a medical condition</li> </ul>
	P2- B1CA14P2	P2- K1CA14P2		<b>HILDA:</b> <ul style="list-style-type: none"> <li>• For single P1 and P2 and couple P1 and P2, this variable was re-coded into a dummy, neither have medical condition versus either or both have a medical condition</li> </ul>

**Table A2 (continued): Variables used in examination of the summary socio-economic position measure**

<b>At least one parent has poor health</b>	P1- B1PD1 P2- B1SC1	P1- K1PD1 P2- K1SC1	DGH1	<b>LSAC:</b> <ul style="list-style-type: none"> <li>• Missings removed</li> <li>• P1 and P2 combined</li> <li>• Variable coded to represent neither parent in poor health or 1 or more parents in poor health.</li> </ul>
				<b>HILDA:</b> <ul style="list-style-type: none"> <li>• For single P1 and P2 and couple P1 and P2, this variable was re-coded into a dummy variable, neither in poor health versus either or both are in poor health</li> </ul>
<b>At least one parent is or has been, a smoker?</b>	P1- B1PD17 B1PD19 P2- B1SC17 B1SC19	P1- K1PD17 K1PD19 P2- K1SC17 K1SC19	DLSSMKF	<b>LSAC:</b> <ul style="list-style-type: none"> <li>• Missings removed</li> <li>• Past and present combined</li> <li>• P1 and P2 combined</li> <li>• Variable coded smoker? Yes/no.</li> </ul>
				<b>HILDA:</b> <ul style="list-style-type: none"> <li>• For single P1 and P2 and couple P1 and P2, this variable was re-coded into a dummy, neither have ever smoked versus either or both is or have smoked</li> </ul>
<b>Infant or child had low birth weight?</b>	B1CB4	K1CB2	N/A	<b>LSAC:</b> <ul style="list-style-type: none"> <li>• Missings removed</li> <li>• Variable coded No (2500gm or more) /Yes (less than 2500gm)</li> </ul>
<b>Teenager left school early</b>	N/A	N/A	DEDSSL	<b>HILDA:</b> <ul style="list-style-type: none"> <li>• For teenagers, this was re-coded into a dummy variable, not left versus has left school</li> </ul>