

KEY POINTS

- > Extensive literature shows that children who bear the highest burden of risk factors (conditions in the individual, family and social environments that predict developmental vulnerability) face the highest lifetime chances of poor educational attainment, poor physical and mental health, behavioural and relationship problems, and low social and economic participation.
- > High-quality Early Childhood Education (ECE) is one form of early intervention that has been shown to promote early learning and development and to reduce vulnerability. However, analysis in this paper shows that in 2007-08 there was a significant negative association between risk burden and the likelihood of participation in a formal preschool program. A similar relationship did not hold for participation in Long Day Care (LDC).
- > Children were less likely to participate in preschool when they had moved house frequently; had a sole parent or were in a two-parent family with the secondary carer (usually father) being unemployed; had a primary carer who had not finished high school or had difficulties speaking English; were identified as being Indigenous; or were seldom read to by a parent.
- > A positive finding is that controlling for other factors, children in a disadvantaged neighbourhood were more likely to participate in preschool than the rest of the sample. Policies designed to promote preschool attendance in such communities may have met with some success.
- > The relationship between risk burden, attendance at ECE and developmental outcomes is important for demonstrating the extent to which ECE mitigates the vulnerability associated with risk burden. There was a strong positive relationship between the chance of a poor rating on one of the outcome measures and the number of risk factors. The effect was largest for the measure of non-cognitive skills.
- > Without controlling for risk factors, there was a strong positive relationship between participation in preschool and better outcomes. However, this relationship all but disappeared after controlling for the number of risk factors present. On the other hand, there was a significant negative association between LDC attendance and developmental outcomes.
- > Boys in the study had a small but significantly higher number of risk factors than girls. They were also more likely than girls to obtain a poor outcome on all measures, with or without controls for risk burden or participation in either preschool or LDC.
- > There was also a large difference in risk burden between Indigenous and non-Indigenous children. Participation in either preschool or LDC did not reduce the significantly increased likelihood that Indigenous children obtained poor outcomes on Overall Achievement, Literacy and the Strengths and Difficulties Questionnaire (SDQ), but these differences were no longer significant once controls for risk burden were introduced.
- > In terms of policy, the analysis reveals the importance of preventing, or addressing through early intervention, early childhood risk factors. The analysis also indicates that the standards of ECE that applied prior to the introduction of the National Quality Standards for ECE were not adequate to mitigate developmental vulnerability and that LDC, at the time, may have been harmful. Ensuring high ECE quality and access is particularly important for children bearing the highest risk burden.

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EXECUTIVE SUMMARY

High-quality Early Childhood Education (ECE) facilitates higher female workforce participation and promotes early learning and development.

Research on brain development has shown that the period from birth to school age includes uniquely sensitive periods in which the foundations for cognitive learning, self-regulation and social interaction are laid. Children from backgrounds that fail to provide them with the warm, responsive care and the stimulation they need during this period, are unlikely to meet developmental milestones—they become ‘developmentally vulnerable’.

Certain conditions in the family and social environments of young children increase the risk of developmental vulnerability. Children who bear the highest burden of risk factors face the highest risk to their learning, development and health. They also face the highest lifetime chances of poor educational attainment, poor physical and mental health, behavioural and relationship problems, and low social and economic participation.

Interventions to reduce risk and to increase the prevalence of factors that enable children to respond positively or resiliently to risk, reduce subsequent costs to education, health, welfare and criminal justice systems.

High-quality ECE is one form of early intervention that has been shown to promote early learning and development and to reduce vulnerability. However, there is evidence that children from ‘special needs’ groups—Indigenous, low SEIFA (Socio-Economics Indexes for Areas), Language Background Other Than English, children living in remote and very remote areas, and children with a disability—are simultaneously more likely to be developmentally vulnerable and less likely to participate in ECE. The greater the degree of vulnerability, the more pressing is the need for early intervention. Vulnerability that is not addressed during periods of peak developmental sensitivity becomes more difficult and more costly to reverse as a child ages and falls further behind his or her peers.

This study used a data set from the Longitudinal Study of Australian Children (LSAC) to identify the extent to which the most vulnerable children in terms of risk burden were participating in ECE—either preschool or long day care (LDC)—during the year before compulsory school. It identified the prevalence of risk factors amongst special needs groups. Finally, it examined the relationship between risk factors, participation in ECE and developmental outcomes.

Of the 25 identified risk factors for which data was available, those most prevalent in the LSAC sample were: the primary carer was not in employment (38.9 per cent); the primary carer had low educational qualifications (32.2 per cent); child was low birth weight or not breast fed at one month (24.6 per cent); and child was read to less than three times per week (24.3 per cent). The average number of risk factors per child was 3.9, and the number of risk factors per child ranged from zero (just under 8 per cent of the sample) to 15 (under 0.5 per cent).

The analysis showed that in 2007-8, when the data for Wave 3 of the first LSAC Cohort was gathered and the subject children were aged 4-5, there was a significant negative association between risk burden (number of identifiable risk factors present during a subject child’s life) and the likelihood of participation in a formal preschool program, whether in a special-purpose facility or as part of a program in an LDC centre. A similar relationship did not hold for participation in LDC. No single risk factor was significantly associated with both participation in preschool and with participation in LDC in the same direction. This indicates that strategies to encourage greater participation in preschool and LDC will need to differ.

Children in a disadvantaged neighbourhood were more likely to participate in preschool. This could mean that state policies designed to promote preschool attendance in low-SEIFA communities met with some success, even though these policies did not ensure the highest participation rates amongst children bearing the highest risk burdens.

Children with an unemployed primary carer—usually mother—were also more likely to participate in preschool, but less likely to participate in LDC. These results may represent a preference for preschool as opposed to other forms of ECE, possibly related to perceived educational benefits of preschool or to its lower cost, and because these families are less likely to need the extended hours of care available in a LDC. This explanation seems consistent with the finding that children with a primary carer who works long hours (over 40 hours per week) are less likely to go to preschool.

Children were also less likely to participate in preschool when they had moved house frequently; had a sole parent or were in a two-parent family with the secondary carer (usually father) being unemployed; had a primary carer who had not finished high school or had difficulties speaking English; were Indigenous children; or were seldom read to by a parent,. Given that low income was controlled for (and not found to be associated with) participation, it seems likely that barriers other than financial constraints were responsible for reduced preschool participation in these groups.

Qualitative research may be needed to clarify whether preschool fails to meet the needs of such families because of barriers created by operating hours, location and transport, costs or perceived lack of benefit for the child. Greater effort may be required to reach out to many of these families, using national and state administrative systems (eg, Centrelink, supported accommodation services, Medicare, migration and settlement databases).

The picture is quite different for the relationship between individual risk factors and LDC participation. The factors that were positively associated with LDC participation were difficult temperament, sole parent, primary carer works long hours, and child seldom read to by parents. The secondary carer being unemployed was positively associated with LDC participation at the 1 per cent level. The negative associations were with competition for parenting time (families with over three children and same-age siblings), disadvantaged neighbourhood, high TV watching (four or more hours per day), and the primary carer being unemployed. The negative association for biomedical risk factors (child has a disability or chronic ill health) and parental conflict was significant at the 1 per cent level.

Different risk factors emerged as significantly associated with hours of participation in ECE. For example, although neighbourhood disadvantage was positively associated with participation in preschool, it was negatively associated with the number of hours of attendance (for those who were attending). Similarly, children whose primary carer worked long hours were less likely to participate in preschool, but where they did so, they were more likely to attend for longer. This later finding suggests that for this group, preschool is used as much as a form of care as a form of early childhood education. Children whose primary carer had difficulties speaking English and Indigenous children were similarly less likely to participate in preschool, but those who did attend were also more likely to attend for longer hours.

Children from larger families, and those whose primary carer was not in employment, were less likely to attend LDC and those who did attend were more likely to attend for fewer hours. On the other hand, children with a difficult temperament, children who were seldom read to, and children whose primary carer worked long hours were more likely to attend LDC and to attend for longer hours.

The relationship between risk burden, attendance at ECE and developmental outcomes is important for demonstrating the extent to which ECE mitigates the vulnerability associated with risk burden. Given that only high-quality ECE promotes learning and development, and that longer duration of

participation (in months rather than hours of attendance) is associated with better developmental outcomes, it would have been desirable to have data on these variables included in the analysis. However, there was no available data on ECE quality and thus no expectation that longer periods of participation would necessarily lead to better outcomes. Moreover, although preschool programs met higher standards, including teacher qualifications, at the relevant time, such programs are delivered only in the year before school.

For this study the relationship between risk burden, participation in the ECE in the year before preschool and developmental outcomes in the first year of school, was examined.

There was a strong positive relationship between the chance of a poor rating on one of the outcome measures and the number of risk factors, except for the self-assessed school adjustment measure, where there was a smaller effect. The effect was largest for the rating on the Strengths and Difficulties Questionnaire (SDQ), a measure of non-cognitive skills.

Without controlling for risk factors, there was a strong positive relationship between attendance and better outcomes. The association tended to be higher with a greater number of hours of attendance and was highest for Maths and Literacy outcomes. However, this relationship all but disappeared after controlling for the number of risk factors: only a reduction in the probability a poor outcome on Maths remained, and then only for children who attended for 21 hours per week or more.

Without controlling for risk factors, children who attended LDC for more than 21 hours per week were found to be more likely to obtain a low score on the SDQ. However, after controlling for the number of risk factors, this association between low score on the SDQ and attendance for over 21 hours per week remained and a significant association was found between hours of attendance and low scores on Maths, Literacy (at the 10 per cent level only) and self-rated School Adjustment (also at the 10 per cent level). Such a finding would be consistent with poor ECE service quality.

Although being male was not treated as a risk factor in calculating risk burden, the evidence showing boys may be more negatively affected by exposure to risk than girls prompted a special examination of the comparative impact on boys and girls of risk burden and ECE participation on developmental outcomes. Boys in the study had a small but significantly higher number of risk factors than girls. They were also significantly more likely than girls to obtain a poor outcome on all measures, with or without controls for risk burden or participation in either preschool or LDC.

These findings show that maleness is either a residual risk factor or a factor that sensitises response to risk. They are also consistent with recent findings that parents spend less time reading and teaching boys than girls, and raise the possibility that ECE services and their teachers may replicate parental behaviour. There is clearly a need to undertake further research on the reasons for the increased vulnerability of boys and to examine ways in which it might be addressed in the home and in ECE settings.

A similar examination of the interaction between risk burden, participation in ECE and outcomes for Indigenous children highlighted the large difference in risk burden between Indigenous and non-Indigenous children. The risk factors most strongly associated with poor outcomes were much more prevalent amongst Indigenous children: they were more than twice as likely as their non-Indigenous peers to have a parent experiencing psychological distress or depression; to have one or two parents in poor physical health; to have moved house frequently; to have a teenage mother; or to have experienced a number of changes of parents. These children were also nearly twice as likely to have a poorly educated primary carer, to be read to seldom, to be in poverty, to be in a large family, and to live in a disadvantaged neighbourhood.

Participation in either preschool or LDC did not reduce the significantly increased likelihood of Indigenous children to obtain poor outcomes on Overall Achievement, Literacy and SDQ, but these differences were no longer significant once controls for risk burden were introduced.

A table of risk factor prevalence amongst the range of special needs groups provides information that may be helpful in finding opportunities to engage with families and explore ways of overcoming barriers to accessing ECE.

Above all, the analysis shows the standards of ECE that applied prior to the introduction of the National Quality Standards for ECE were not adequate to help address developmental vulnerability and, for LDC at the time, may have been harmful. The analysis also reveals the importance of preventing, or addressing through early intervention, risk factors in families—through engaging with parents and informing them about the ways in which they can promote learning and healthy development in their children—and in communities—through social and economic development, raising levels of education amongst girls before they start families, and providing access to good jobs, stable housing, and good-quality maternal child and health services.

1 INTRODUCTION AND OVERVIEW OF CURRENT RESEARCH

Participation in high-quality Early Childhood Education (ECE) has gained prominence in social policy. This is because of its dual role in enabling carers, particularly women, to participate in the workforce, secure in the knowledge that their children are in a safe and stimulating environment, and also in promoting the healthy learning and development of children. This second role of ECE is of particular importance for those who, for a variety of reasons, are at risk of falling behind their peers in one or more of the domains of normal development. That is, those who are developmentally vulnerable.

The aim of this paper is to provide an up-to-date analysis of the three-way relationship between developmental risk exposure, participation in ECE and early childhood outcomes. The paper makes use of the most recent waves of data from the Longitudinal Study of Australian Children (LSAC), also known as *Growing Up in Australia*. This unique and highly valuable data source provides longitudinal information on two cohorts of children who were born in the late 1990s and early 2000s.¹ The first cohort of roughly 5,000 children was aged zero to one year in 2003–2004 when the study commenced, with the second cohort of roughly 5,000 children aged four to five years. This study focuses on the first cohort and identifies a set of risk factors for the children in Wave 3 of the survey (when they were aged 4–5 years), compares these risk factors to their ECE participation at the time, and then compares both risk factors and ECE participation to outcomes in Wave 4 when the children are aged six to seven years and commenced full-time schooling.

In the remainder of this section of the paper, we look at the current research on risk factor burden, ECE participation and developmental vulnerability. In Section 2, we outline the data used in the analysis, our approach, as well as some descriptive statistics. This is followed by Section 3, which looks at the factors associated with ECE participation, defined separately as participation in preschool and/or attendance at a long day care (LDC) centre. Section 4 of the paper looks at the relationship between ECE attendance and five measures of developmental vulnerability, with analysis undertaken before and after controlling for risk factor burden. In Section 5 of the paper we turn our attention to a number of policy-relevant population sub-groups that have been shown to have either low levels of ECE participation or high rates of developmental vulnerability. Section 6 of the paper concludes the analysis and provides a discussion of the policy relevance of the findings.

1.1 Early childhood and developmental vulnerability

The period between zero and five years of age is a period of peak sensitivity for the cognitive systems that form the foundations of subsequent learning, social interaction and self-regulation. Developmental vulnerability² results when genetic abnormality, environmental insult or deficit threatens the trajectory of normal maturation (Shonkoff & Marshall 2000). As brain development occurs in a sequential fashion, compromised development of an earlier stage puts subsequent stages at risk.

The consequences of neglecting developmental vulnerability during early childhood go well beyond the tragedy of unrealised individual potential—the loss to the world of an Einstein, Mozart or Mandela. Rather, developmental vulnerability can lead to educational underachievement for a significant minority of the population, a potential cause of Australia’s long tail of poor results in international tests at primary and secondary levels (Zyngier 2012). It is also potentially associated

¹ <http://www.growingupinaustralia.gov.au/>

² ‘Vulnerability is the preferred term because the same genetic or environmental insults can have different observed effects depending on the degree of support offered the developing child.’

with increased morbidity and mortality during childhood; an increased lifetime risk of chronic physical and mental health problems; elevated incidence of problem behaviour in childhood and higher rates of criminal behaviour in adolescence and adulthood; a greater risk of relationship problems; poor attachment to the labour market; and, ultimately welfare dependency (Shonkoff et al, 2012).

Risk factors

Over the last decade research across a range of disciplines in Australia and internationally has identified a number of conditions that contribute to developmental vulnerability. Those that increase it can usefully be labelled as risk factors. These conditions include: low birth weight; poorly educated or unemployed parents; family poverty and housing stress; unresponsive or insensitive parenting; unstimulating or impoverished surrounding; and exposure to conflict or abuse.

Exposure to a single risk factor in isolation seems to have only a small effect on subsequent outcomes. What distinguishes the high-risk child from other children is not so much exposure to a specific risk factor but rather a life history that is characterised by multiple familial disadvantages that span the factors mentioned above (Fergusson & Horwood 2003). The impact on the developing child of exposure to adverse events is cumulative over time with the negative effects of exposure to additional risk factors compounding existing vulnerability. For example, Barth et al (2008) showed that amongst a large group of maltreated children ranging in age from zero to 36 months, only 5 per cent of those exposed to a single additional risk factor (additional to maltreatment) demonstrated developmental delay, whereas proportions exhibiting developmental delay amongst those exposed to five, six, or seven additional risk factors were 76, 92 and 99 per cent respectively).

Concentration of developmental vulnerability

Certain population sub-groups in Australia are more highly exposed to the risk factors and are therefore more likely to be found amongst those identified as being developmentally vulnerable. The Australian Educational Development Index (AEDI) is designed to assess development across five domains³ in the first year of formal schooling. Results from the first administration of the AEDI in 2009 confirm developmental vulnerability is more concentrated in, but not confined to, certain socio-demographic groups. This is shown in Table 1 below.

³ Physical health and well-being, social competence, emotional maturity, language and cognitive skills (school based), and communication skills and general knowledge.

Table 1 Prevalence of Developmental Vulnerability on AEDI 2009

Characteristic	Group	Vulnerable ⁴ on 1 or more domains	Vulnerable on 2 or more domains
All Australian children	-----	23.6%	11.8%
Sex	Boys	30.2%	16.2%
	Girls	16.8%	7.4%
Language Background Other Than English ⁵ (LBOTE)	Not Proficient in English	93.6%	59.0%
	Proficient in English	21.8%	9.6%
English Language background	Not proficient in English	93.8%	75.2%
	Proficient in English	19.3%	8.7%
Indigeneity	Indigenous	47.4%	29.6%
	Non-Indigenous	22.4%	11.0%
Remoteness	Very remote	47.1%	30.5%
	Major cities	22.5%	11.0%
SEIFA	Lowest quintile	32.0%	17.5%
	Highest quintile	16.2%	7.2%

Source: Centre for Community Health & Telethon Institute for Child Health Research (2009)
Table 3.6, p 24

1.2 Patterns of participation in ECE

Factors that appear to promote resilience in the face of adversity are called protective or resilience factors (Rutter 1985). They include sensitive, nurturing parenting; a rich, stimulating environment; opportunities to gain mastery and self-esteem; and well-educated parents who have jobs that suit their circumstances.

Fergusson and Horwood (2003) established that protective factors operate as main effects on development outcomes. They are not simply the converse of risk factors and they do not interact with or simply mitigate risk factors, but have direct influence on the formation of competencies that convey resilience in the face of accumulated adversity.

The protective influence of high-quality ECE

One potential protective factor is participation in high-quality ECE. However, quality is critical, as low-quality services may have the effect of increasing developmental vulnerability (Magnuson, Ruhm & Waldfogel 2007). Dose is also important, with research from the United Kingdom indicating that

⁴ Below 10th percentile

⁵ Speak a language other than English at home and/or have English as a second language.

two years of high-quality ECE of 15 hours per week gives the same protective effect as having a tertiary-educated mother (Sylva et al 2010, p 99).

Evidence about what constitutes quality in ECE services is well reflected in the National Framework for Early Learning and in the National Quality Standards that began to take effect from 1 January 2012. However, exposure to a sufficient amount of high-quality ECE is far from universal across the population.

Jurisdictional factors

Conditions such as population density and socio-demographic characteristics, geographic accessibility, affordability, quality and models of service delivery might be expected to affect participation rates across jurisdictions. Approaches to the administration of ECE across Australia also reflect differences in historical experience (Brennan 1998), as well as differences in current political, economic and social conditions. Under the National Partnership on Early Childhood Education⁶, universal access to a year of ECE before the start of full-time schooling is to be achieved by 2013. As shown in the following table, however, each jurisdiction in Australia has slightly different names and rules for the two years that precede Year 1. This is summarised in Table 2 (adapted from ABS 2012a), which gives the name and age of the early childhood education programs as of 2011 that existed in the year before full-time schooling (labelled as ‘preschool’ in the rest of this paper) as well as the first year of full-time schooling (labelled as ‘kindergarten’). The second year of full-time schooling is called Year 1 in all States and Territories.

Table 2 Name and age of entry of early childhood education programs by State or Territory

State/Territory	Year before full-time schooling (henceforth ‘preschool’)		First year of full-time schooling (henceforth ‘kindergarten’)	
	Name	Age of entry	Name	Age of entry
	New South Wales	Preschool	3 and 4 year olds	Kindergarten
Victoria	Kindergarten	4 (by 30 April)	Preparatory	5 (by 30 April)
Queensland	Kindergarten/Pre-Preparatory (Pre-Prep)	4 (by 30 June)	Preparatory	5 (by 30 June)
South Australia	Preschool/ Kindergarten	Continuous entry after 4 th birthday	Reception	Continuous entry after 5 th birthday
Western Australia	Kindergarten	4 (by 30 June)	Pre-Primary	5 (by 30 June)
Tasmania	Kindergarten	4 (by 1 January)	Preparatory	5 (by 1 January)
Northern Territory	Preschool	4 by 30 June(b)	Transition	5 (by 30 June)
Australian Territory	Capital Preschool	4 (by 30 April)	Kindergarten	5 (by 30 April)

Source: ABS (2012a)

⁶ An Agreement made by the Council of Australian Government in 2008.

The descriptions and cut-offs in Table 2 show a complex and varied system of preschool and kindergarten education in Australia. This is further complicated in the Northern Territory and South Australia where Indigenous children can commence preschool at the age of three. Furthermore, in the latter jurisdiction, continuous entry into preschool (in 2013) and Reception (in 2014) has been phased out. Not surprisingly, therefore, as reported in the 2009 AEDI, participation in the preschool year of ECE varied from 94.5 per cent in the Australian Capital Territory to 83.1 per cent in Queensland. There is greater variation in the participation rates for younger ages across jurisdictions.

Urbis Social Policy (2011) noted that although actual patterns of service provision across jurisdictions were quite complex, of one of two models predominated in each jurisdiction:

- > where the state/territory government owns, funds and delivers 70 to 90 per cent of preschool services, that are treated similarly to primary and secondary schools, and funding is generally not given for preschool programs in LDC centres, which are expected to rely on federally subsidised user fees.
- > where less than 20 per cent of preschools are owned by the government and these are generally sited in disadvantaged areas, the state subsidises non-government provided services, and preschools in LDC centres charge federally subsidised fees.

It could be argued that the first model is the best description for South Australia, Western Australia, the Northern Territory, Tasmania and the Australian Capital Territory (Group A), whereas the second model is the better fit for Victoria, New South Wales and Queensland (Group B) (Urbis Social Policy 2011). In 2008, the median weekly preschool costs in Group A jurisdictions were \$6, \$2, \$6, no cost, and no cost respectively; for Group B they were: \$19, \$64, \$50 respectively (Productivity Commission 2012, Table 3A.26). Quality, accessibility and costs that would not present a barrier to participation all form part of the National Partnership Agreement.

Family and child factors

Productivity Commission statistics on participation in government-approved ECE services show a disparity between representation in the community and participation rates for children from the following groups:

- > Indigenous children (4.7 vs. 2.0 per cent)
- > children with a non-English speaking background (20.1 vs. 15.0 per cent)
- > children with a disability (4.0 vs. 2.5 per cent)
- > children from low-income families (27.1 vs. 24.8 per cent)
- > children from remote areas (3.1 vs. 1.0 per cent) (Productivity Commission 2012, Table 3A.14).

These groups are consistent with the groups showing higher incidence of developmental vulnerability in the AEDI (see Table 1).

Harrison et al (2009 p ix) analysed data from Wave 1 of the Longitudinal Study of Australia's Children (LSAC), which sampled infants ranging in age from three to 19 months and preschool children ranging in age from four years and three months to five years and seven months. They found that just over one third (34.9 per cent) of parents used regular child care, but only 37.9 per cent of this was formal, government-regulated child care, with 62.1 per cent consisting of informal care provided by relatives, particularly grandparents, or non-relatives.

Across the whole sample they found the proportion of the subject children in parent-only care reduced with:

- > Mother's employment status (not working 83.3 per cent, 37.7 per cent working part time, 28.3 per cent working full time)

- > Mother's level of education (from 78.7 per cent for year 10 or less, to 55.2 per cent for university level)
- > Level of weekly household income (from 74.7 per cent at under \$600, to 50.0 per cent at over \$2,000)
- > Smaller family size (from 76.3 per cent for families of four or more children, to 59.6 per cent to one-child families)
- > Smaller number of financial stresses (from 70.2 per cent for three or more stressors, to 62.2 per cent for none)
- > SEIFA quintile (from 69.0 per cent at SEIFA 950 or lower, to 59.6 per cent to SEIFA 1070 and higher)
- > Mother's age (from 68 per cent under 25 to 65.4 per cent at 35 and over)
- > Child's age (from 82.0 per cent for 26 weeks or younger, to 50.2 per cent child older than 52 weeks) (Harrison et al 2009, pp 75-82).

Harrison et al (2009) also found parent-only care to be higher amongst families with the following characteristics:

- > Indigenous (73.9 per cent) vs. non-Indigenous (64.6 per cent)
- > Language other than English spoken at home (69.5 per cent) vs. English only (64.0 per cent)
- > Lone parent (67.9 per cent) vs. couple family (64.6 per cent) (Harrison et al 2009, pp84-86).

Of the preschool-aged children in the sample, 95.1 per cent were in a centre or school-based ECE program, with others cared for at home, with a relative or in family day care (Harrison et al 2009, p156). Harrison et al found that 'families reporting a higher level of risk on a number of child, family and community factors' (Harrison et al 2009, p163) were less likely to be using ECE. These factors were:

- > lower maternal education
- > lower family income
- > more financial stresses
- > more children in the household
- > unemployed mother
- > living in a less-advantaged neighbourhood
- > growing up in a lone-parent or Indigenous family
- > speaking a language in the home other than English
- > having a mother with higher levels of psychological distress or poorer parenting behaviour (Harrison et al 2009, p156).

Choice of ECE was also related to risk factors associated with socio-economic disadvantage:

These analyses showed that families more at risk were not only least likely to use formal care/early education services, but also more likely to use programs on offer at school settings. Low fees and ease of access to these programs (in states and territories with universal preschool provision within the public school system) are likely to make them attractive options for less economically advantaged families (Harrison et al 2009, p156).

The study found that children who did not attend centre-based preschool ECE programs had comparatively poorer outcomes in language, literacy and numeracy (Harrison et al 2009, p156).

The authors concluded that:

Future investigations need to investigate the incidence and implications of children growing up 'outside the early childhood care and education system' to identify why the system is not working for them and how to best provide means of support. Matching needs according to

factors such as age, cultural background, languages spoken, religion and length of residence in Australia may also enhance parents' sense of security and self-confidence in their caring and educating of their young children (Harrison et al 2009, p163).

AIFS study

A study designed to identify the variables associated with lower rates of ECE participation in the preschool year in Baxter & Hand (2013) analysed three national data collections. The largest of these, the AEDI (2009), with 236,206 subject children (in effect obtained by a census of all children in their first year of full-time school), did not collect data on some variables which the literature suggests would have a relationship to child development or participation—household income, employment status of primary carer, single parent vs. couple, and educational attainment of parent. The other two collections were much smaller: the National Survey of Parents' Child Care Choices (2009) with 1,637 subjects, and LSAC (B Cohort, Wave 3, 2008) with 3,005 subjects, had more variables but much smaller sample sizes.

Multi-variate analysis of AEDI data revealed significantly lower odds of participating in ECE for each of the following variables: remoteness; low SEIFA; eastern states (Victoria, New South Wales and Queensland); Indigenous child; non-English speaking background; and child with special health needs (AEDI 2009, Table 7 p27).

Using NSPCCC (National Society for the Prevention of Cruelty to Children) data, parental education at post-secondary or tertiary level, and the primary carer's employment part time or full time were both associated with higher participation (AEDI 2009).

Using LSAC data, outer regional areas, eastern states, Indigenous child, and tertiary education and part-time employment of primary carer, were all significantly associated with increased participation (AEDI 2009).

Household income (divided into bottom 20 per cent vs. the rest) was not significant in either of the two collections in which it was measured (NSPCCC and LSAC). However, by re-estimating the models without parental education and parental employment—both of which are strongly associated with income—being in the bottom-income quintile was significantly associated with reduced odds of ECE participation for both collections (AEDI 2009, Table C4 pC2).

For the purpose of this study, participation in a preschool program, whether in a special-purpose facility or in a LDC centre, counted as access (AEDI 2009, p 52). It confirmed once again that the children most likely to miss out on ECE 'are more often represented among disadvantaged families and among children who are perhaps in greatest need of ECE in respect of preparing for school' (AEDI 2009).

There were greater differences in the participation rates of the most and the least disadvantaged children in the eastern states of Victoria, New South Wales and Queensland—those states with the lowest proportion of State government-provided and funded preschool. (AEDI 2009, p xiv⁷; Table 6 p 12).

The overlap of factors makes it difficult to draw firm conclusions about the most important influences on participation. As the authors pointed out, the lower participation rates found in remote and regional areas may be primarily a reflection of the populations of those areas (AEDI 2009, pxviii).

The authors concluded the design of their study did not lend itself to determining why some children miss out on ECE in the preschool year. They noted the large differences in the cost to parents associated with different models of delivery and speculated about the impact of cost of access to

⁷ "ECE programs in Australia tend to be delivered along two broad models of ECE—one a predominantly government model and the other a predominantly non-government model. In the former, it is more typical for ECE to be accessed through standalone preschools or preschools attached to schools. Preschool is often free (with a voluntary levy) under this model. In the latter, there is more diversity in the arrangements, with LDC also playing a significant role, and costs tending to be higher. The eastern states of NSW, Victoria and Queensland generally are more closely aligned with the non-government model, with the other states/territories looking more like the government model."

participation amongst low-income families, while noting the reasons given by parents for non-participation were most likely to relate to the availability of a parent to care for the child or to a belief in parental child care (AEDI 2009, p24). They advocated use of a methodology that explored decision-making in more disadvantaged and vulnerable families (AEDI 2009, p40).

ECE participation amongst Indigenous children

There have been some additional studies that have looked at particular population sub-groups. Using data from the 2001 Census, Biddle (2007) found the difference in attendance at preschool for four-year-old Indigenous children (46.1 per cent) and four-year-old non-Indigenous children (57.1 per cent) could be explained by the following factors:

- > Household income
- > Family education
- > State/Territory
- > Remoteness of area
- > Indigenous preschool worker in the area⁸ (Biddle 2007).

Analysing the Longitudinal Study of Indigenous Children Waves 1 and 2, Hewitt B & Walter M (2011) found the following relationships amongst child and parent variables and participation in preschool ECE:

Study Children were more likely to attend preschool:

- > in very remote or extremely remote areas (but once dominant language of primary parent is controlled this becomes non-significant)
- > the longer they had lived in their current house
- > the more books in the household
- > if the primary parent is dominant in an Indigenous language (also linked to remoteness—parents in remote areas more likely to be bilingual or dominant in indigenous language) or
- > if they had diagnosed problems with their ears (but participation itself may lead to diagnosis).

Study children were less likely to attend preschool:

- > if government benefits were the main source of household income
- > if the primary parent had concerns over their learning and development or
- > if they had poor health compared with excellent health.

Biddle (2011) analysed the factors associated with ECE attendance of three, four and five year olds who were not in a Year 1 or pre-Year 1 school program. The author found a significantly higher probability of participation amongst children who:

- > often attended cultural events
- > identified with a tribal group, a language group or clan; or
- > lived in an area with an socioeconomic ranking in the second or third quintile (perhaps because of lack of access in the most disadvantaged areas)

and significantly lower rates of participation amongst children:

- > who had lived in two or more homes since birth; or
- > whose main carer had been subjected to discrimination on the basis of being Indigenous.

Some of the variables found to be related to participation in the general population studies above did not emerge as significant in the analysis of Indigenous children, perhaps because of the relatively small sample size of the child cohort in Wave 1 (Biddle 2011, p24). However, the analysis did reveal

⁸ Note that the data did not specify whether a child attended an ECE service with an Indigenous child care worker.

that factors specific to Indigenous families may promote participation (child's cultural participation or identification with a tribal or language group) or discourage it (carer's experience of anti-Indigenous discrimination).

Qualitative studies—influences on individual decision making

The characteristics of families that affect participation in ECE have been described in a number of small, qualitative studies carried out in particular states. For example, a study of 101 disadvantaged families in New South Wales (Children and Families Research Centre 2010) found a number of considerations relevant to the use of ECE services. These could be categorised as barriers or facilitators. The former include:

- > pragmatic issues (cost, transport, opening hours, availability, complex paperwork)
- > service issues (quality, leaving children vulnerable to becoming sick, teacher/child ratios)
- > personal family issues (poor fit with family values, trust).

Facilitators include:

- > service features (flexible hours, close to home, parent education programs, co-located with primary school, LDC includes a preschool program, meals provided, integrated with other services)
- > staff features (highly trained, welcoming, culturally diverse)
- > family features (good staff/child relationships, good parent/child relationships, involvement with the New South Wales Department of Human Services, older sibling attended, cultural diversity) (Children and Families Research Centre 2010, pp 8-9).

The authors concluded that, although in published studies reasons for non-participation are broken into major categories for ease of understanding:

In real life, decisions around engagement with early childhood services are influenced by a complex and interwoven mix of values and beliefs, available information, perceptions influenced by past experiences, individual characteristics, services available and whether or not the family can afford them (Children and Families Research Centre 2010, p 33).

2 DATA AND METHODS

2.1 Calculating risk burden in The Longitudinal Study of Australian Children (LSAC)

Analysis presented in this paper is based on the Longitudinal Study of Australian Children (LSAC), also known as *Growing Up in Australia*. According to the Data User Guide for the survey (AIFS 2011: 8), 'LSAC aims to provide a database for a comprehensive understanding of children's development in Australia's current social, economic and cultural environment'. The LSAC was constructed around two cohorts—the B cohort (born March 2003–February 2004), which is the focus of this paper, and the K cohort (born March 1999–February 2000).

Harris et al (2011) noted that many of the factors significantly related to reduced participation in ECE were risk factors for developmental vulnerability. Also noted above were two significant features of risk exposure: it accumulates, and children exposed to multiple risk factors have a significantly heightened chance of developmental delay.

This study will look at the relationship between accrued risk exposure or risk burden and participation in ECE—a known protective factor when it is of sufficient quality and dose. It will also examine the relationship between risk exposure and developmental vulnerability, and examine whether children of similar risk exposure have reduced vulnerability associated with prior participation in ECE.

Garnezy's 1971 paper on vulnerability research and primary prevention provides a convenient starting point for considering the literature on risk and protection factors that now form part of an established, multidisciplinary 'prevention science'⁹ literature and research program. The problem Garnezy identified was how to account for the existence of individuals who appeared well adapted and fully functioning in adolescence and adulthood despite a childhood characterised by extremely adverse circumstances, including a presumed genetic susceptibility to schizophrenia inherited from a mother or father. What he called 'vulnerability research' focused on the study of high-risk groups—selected on the basis of four putative sources of psycho-pathology:

- > genetic transmission of the predisposition or the diathesis¹⁰;
- > pathological disorganisation within the near environment (the family); or
- > within the molar (sociocultural) environment of the child; and a
- > fourth model coming into prominence [...] one stressing deprivation within the prenatal and neonatal period in which faulty maternal care and inadequate nutrition can serve to render the infant vulnerable to subsequent stressors (Garnezy 1971, p108).

Garnezy supported a research program that would—through the use of appropriate control groups, long- and short-term longitudinal studies together with cross-sectional studies—reveal the processes underlying 'invulnerability'/positive adaptation on the one hand, and vulnerability/negative adaptation on the other. This would in turn enable development of evidence-based interventions to

⁹ See for example the web site of the Society for Prevention Research (SPR), which was founded in 1991 and is 'dedicated to advancing scientific investigation on the aetiology and prevention of social, physical and mental health, and academic problems and on the translation of that information to promote health and well-being. The multi-disciplinary membership of SPR is international and includes scientists, practitioners, advocates, administrators, and policy makers who value the conduct and dissemination of prevention science worldwide.' at <http://www.preventionresearch.org/about-spr/> (accessed 19/3/13). The first edition of its journal *Prevention Science* was published in 2000.

¹⁰ Hereditary predisposition to a disease

promote resilience and to prevent the vulnerability associated with high exposure to risk from developing into mental illness.

Nearly 30 years later, research along the lines he recommended has yielded a wealth of material on the factors that increase developmental vulnerability and somewhat less on factors that promote resilience. Having noted that socio-economic status was the 'best single variable for predicting children's cognitive competence and an important, if less powerful, predictor of social-emotional functioning', Sameroff (1998) found 10 risk factors related to, but not identical with, economic conditions, that acted as high-risk factors for poorer developmental health in four year olds¹¹ and their converse—treated as protective factors.

In determining which variables to classify as factors that would be counted as contributing to risk burden for the purpose of the analysis in the current study, the following criteria were applied:

- > The variable had to have been identified in the published literature as a condition leading to developmental vulnerability, and
- > A good approximation of the variable could be established from suitable coding of data in the LSAC data dictionary.

Risk factors used in the analysis are listed below with a brief indication of the rationale for inclusion. Note that 'P1' refers to the primary carer—most often, but not always the subject child's mother—while 'P2' refers to the other parent.

Poverty

Exposure to financial stress is prejudicial to the physical and mental health of parents, impairs their ability to give children the responsive care they need for normal development, and is independently associated with poorer outcomes for children (UCL Institute of Health Equity 2012, pp 45 et seq, 51).

The impact of poverty varies in large part by the duration (short spells are significantly less harmful) and by the timing (poverty in the earliest years has a greater impact than in later life) (UCL Institute of Health Equity 2012, p51).

The poverty threshold was set at 60 per cent of equivalised household income in keeping with the standard used by the European Commission and the United Kingdom (European Commission 2011), and supported by New Zealand research on an expenditure and community consensus-based threshold for poverty and hardship (Stephens, Waldegrave & Frater 1995).

In an attempt to capture the dimensions of duration and severity an additional criterion, experience of financial hardship, was applied: at least one of: gone without meals; been unable to heat or cool home; pawned or sold something; sought assistance from welfare/community organisation in the last year; or self-identified as poor or very poor.

¹¹ These factors were: 1) history of maternal mental illness; 2) high maternal anxiety; 3) parental perspectives that reflected rigidity in the attitudes, beliefs, and values that mothers had in regard to their child's development; 4) few positive maternal interactions with the child observed during infancy; 5) head of household in unskilled occupations; 6) minimal maternal education; 7) disadvantaged minority status; 8) single parenthood; 9) stressful life events; and 10) large family size.

Housing instability

Lack of secure housing tenure deprives families of ‘a sense of autonomy, certainty and control that leads to lower levels of stress and increases residential stability.’ (Stephens, Waldegrave & Frater 1995) Housing stability influences ‘the mental health of parents and family stability, which is associated with children attending fewer schools and having better educational performance and rates of school completion.’ (Australian Housing and Urban Research Institute 2006).

Taylor and Edwards (2012) found statistically significant differences in both receptive vocabulary and emotional and behavioural problems in children aged four to five years who had experienced high levels of housing mobility—three or more moves over their lifetime. The criterion employed in this analysis was having moved two or more times in the last two years.

Housing stress

Crowded housing conditions are associated with higher levels of infectious disease transmission and higher levels of stress. A major United Kingdom review found, *inter alia*, that housing occupancy of more than 0.75 persons per room was associated with higher rates of mental illness; rates of more than 1.0 person per room were associated with higher rates of child maltreatment; and rates of more than 1.5 per room were associated with poorer results in reading and mathematics. Occupancy beyond the two-persons-per-bedroom standard used in this analysis was associated with poorer school performance (Office of the Deputy Prime Minister Publications 2004, cited in US Department of Housing and Urban Development 2004 p 8).

Competition for parenting time

Research on a number of aspects of family formation and composition indicates that a child who has to compete for maternal attention in the first two years of life is at higher risk of developmental delay. A child born as a twin is at higher risk than a singleton, and a triplet member is at higher risk than a twin (Feldman & Eidelman 2005). This outcome appears consistent with the findings that a between-child gap of under two years is associated with developmental vulnerability in the older child, and that being a household where there are more than four children is a developmental risk (Sameroff 1998).

The criterion to capture this risk factor is having a same-age sibling or living in a household with more than four children. It does not capture the risk to the older child who acquires a younger sibling before the age of two (Buckles 2012).

Neighbourhood disadvantage

A disadvantaged neighbourhood is one where there are high concentrations of many of the known risk factors such as low incomes, unemployment, poor education, housing stress, etc. However, living in a disadvantaged neighbourhood most often entails reduced access to the level of amenity, personal security, and sources of professional and social support enjoyed by those who reside in higher socio-economic areas. The more homogenous the disadvantage, the higher is the developmental risk for children living in these neighbourhoods (Hertzman 2010).

Low accessibility (remoteness)

Remote areas may be neighbourhoods where disadvantage is exacerbated by the long distances, lack of public facilities including transport, and low levels of educational and economic opportunity. Although the majority of Indigenous Australians live in urban areas, remote and very remote communities contain high proportions of Indigenous families. The gaps in educational attainment and health of young children growing up in these areas have been well documented and are evidenced in the higher levels of vulnerability found in their AEDI scores (see Table 1).

Difficult temperament

In their study of temperament-related factors associated with adjustment problems in preschool children, Sanson et al (1991) found the strongest single predictor of adjustment problems in preschool children was the mother's assessment that her child was more difficult than average, although its effect was modest in isolation. Sameroff's finding that more difficult temperament was more common amongst the poorest families in his study raises questions about the extent to which difficult temperament is a variable that is intrinsic to the child, a description of the relationship between mother and child, or causally related to environmental conditions (Sameroff 1998).

Biomedical risk factors

A factor called 'biomedical risk condition' is included in Barth's study of the impact of additional risk factors on the development of children who were victims of, or at high risk of, maltreatment (Barth et al 2008, p 11). In this analysis a serious health problem or a disability requiring treatment for longer than six months counts as a biomedical risk factor.

Low birth weight and short/no breastfeeding (early childhood risk factors)

Low-birth-weight infants (widely considered as under 2,500 gms):

exhibit increased rates of neurodevelopmental, health and academic problems. These include developmental delays and behavioural difficulties in the first three to five years of life, with continuing behavioural problems and academic difficulties at later school ages. All these problems are more pronounced for the lowest birth weight infants (Mallik & Spiker 2004).

Breastfeeding, particularly for children who are premature or of low birth weight is such a positive influence on healthy-child development that its absence has been counted as a risk factor (Horwood & Fergusson 1998; Kramer et al 2008).

Excessive television viewing

Watching four or more hours of television per day is associated with a higher cardio-metabolic risk score in children from six to 16 (Carson & Janssen 2011). It seems reasonable to treat this level of sedentary, passive activity as a risk factor for developmental health in early childhood.

Sole parent

An association between sole-parent family and developmental vulnerability has been found in a number of longitudinal studies (Sameroff 1998). The environmental mechanism through which it affects normal development could operate through financial- or time-related stress or, in the case of conflicted relationships that end in separation, exposure to conflict.

Low P2 employment

Living in a jobless family is associated with poorer outcomes for children, partly as a result of its impact on family finances, but also through its effect on individual stress and on the relationship between parents (Kalil 2009). The observed relationship between time spent in a jobless household and poorer developmental outcomes might be influenced by factors such as parental style, mental health and neighbourhood disadvantage (Gray & Baxter 2012).

Low P1 employment

In addition to the findings of living in a jobless household discussed above, early maternal employment has been associated with better scores on maths and with lower anxiety, somatic, hyperactivity, oppositional, and conduct problems at the age of seven. However, this advantage did not apply with unstable employment, working more than one job, or working long hours (see below) (Coley & Lombardi 2012).

P1 employed long hours

An association has been found between P1's working long hours—over 40 hours per week—during the period of a child's infancy and lower reading and maths skills for that child at the age of seven (Coley & Lombardi 2012).

Teenage mother

The children of teenage mothers are at greater risk of physical, cognitive and emotional problems (Hechtman 1989).

Low P1 education

Low education in the primary carer has been identified as a risk factor for the developmental health of children, most probably through its effect on the quality of parent-child interactions (Sameroff 1998).

Potential language difficulties

Children of parents with a non-English-speaking background were at increased risk of vulnerability as assessed in the AEDI (see Table 1 above).

Parental psychological distress

Depression, particularly post-natal depression, is well-established as a condition in the child's proximal environment that threatens normal child development (Walker et al 2007). However, frequent feelings of depression in either parent can constitute a risk factor (Sabates & Dex 2012).

P1 or P2 poor health

Chronic poor health on the part of either parent is likely to limit the scope for responsive interaction with the young child. Sabates and Dex (2012, p 9) identified elevated risk in families where 'either the mother or partner has a longstanding illness that limits daily activities'.

Indigenous child

Indigenous children's 2009 AEDI scores showed an incidence of vulnerability in one or more domains of 47.4 per cent and of 29.6 per cent in two or more domains, compared with 22.4 per cent and 11.0 per cent respectively for non-Indigenous children. This elevated vulnerability is associated with a heavier risk burden, as is shown below, however membership of a minority subject to disadvantage or discrimination can itself be an independent risk factor (Sameroff 1998).

Poor parenting skills

Sameroff identified two risk factors related to approaches to parenting: parental perspectives that reflected rigidity in the attitudes, beliefs, and values that mothers had in regard to their child's development; and few positive maternal interactions with the child observed during infancy (Sameroff 1998). A hostile, authoritarian, punitive or low-warmth approach to parenting is associated with poorer cognitive skills and increased behaviour problems (Smart et al 2008, p4; Linver, Brooks-Gun & Cohen 2002; Pettit, Bates & Dodge 1997).

Infrequent reading to child

It is not surprising that the extent to which the home environment provides children with educational opportunities plays an important role in their cognitive development (Sameroff 1998, pp 4-5).

However, it is counter-intuitive that research establishes it as 'a stronger predictor of cognitive abilities than family income, maternal vocabulary and stimulation, and a range of child care characteristics' (Early Child Care Research Network 2000). Parental interactions such as regular reading constitute an important part of this environment, as they provide opportunities for emotional as well as cognitive stimulation, and have a significant effect on literacy skills and school readiness (Early Child Care Research Network 2000, p4). In this analysis low levels of reading to children have been used to indicate a home environment that provides low levels of cognitive stimulation.

Parental conflict

Studies indicate that exposure to high levels of stress is damaging throughout life, and is particularly damaging to the early development of children (Lupien et al 2009). Pre-natal exposure to high levels of maternal stress hormones affects the developing child's regulation of stress (Lupien et al 2009, pp 434-436). In early infancy exposure to toxic levels of stress further affects stress hormone regulation (Lupien et al 2009, p 436 et seq), negatively affects the architecture of the developing brain (National Scientific Council on the Developing Brain 2003), and impedes the development of cognitive ability (Koenen et al 2003).

Sabates and Dex (2012, p 9) used this risk factor in their analysis: 'Either mother or partner often gets in violent rage.'

Children in a household where there is violence between partners are at greater risk of abuse themselves. One United States review estimated that between 40 per cent to 60 per cent of children in households where domestic violence was known to have occurred were victims of neglect or abuse (Edelson 2001, cited in Laing 2003).

Parental substance abuse (drug or alcohol)

Where the quality of parenting is impaired by addiction to alcohol, child development is placed at risk. Addiction to alcohol appears as a risk factor to developmental health in Sabates and Dex (2012), and in Werner and Smith (1992). Parental alcohol problems, criminality, and use of illicit drugs were used as measures of parental adjustment in the compilation of risk factors in Fergusson and Horwood (2003).

Parental instability

The separation of parents or the formation of a new relationship may be associated with the risk factor of conflict or violence (above). Parental change and conflict appears as a risk factor in Fergusson and Horwood (2003) and change of mother's partner is a risk factor in Najman et al. (1997). Harm caused by family instability may well be via its effect on adjustment and emotional regulation (Milan & Pinderhughes 2006) rather than cognitive development (Schoon et al 2012).

Table 3 below documents the incidence of these risk factors in the LSAC. It should be noted the table incorporates population weights in the analysis, which means the final column represents our best estimates of the incidence of the risk factor in the population, not just the sample. Given the LSAC is a sample survey, however, it should be kept in mind that there is sampling variation around these estimates. This sampling variation is incorporated in the remainder of the analysis with conclusions restricted to differences that were estimated to be statistically significant.

Table 3 Risk factors related to Early Childhood Education and child outcomes, Baby cohort, Wave 3, 2008

Risk factor	Associated variables	Percentage of population
Poverty	Equivalised household income below 60% of median; experienced a selected financial hardship in previous 12 months; ¹² or self identifies family as being poor or very poor	0.224
Housing instability	Study child moved twice or more in the previous two years	0.058
Housing stress	More than two persons per bedroom; or Unmet need for housing services in last 12 months	0.044
Competition for parenting time	Four or more children in the household; Study child has same age siblings; or P1 receives carer allowance	0.183
Neighbourhood disadvantage	Study child lives in the most disadvantaged 20% of neighbourhoods	0.152
Low accessibility	Study child lives in a moderately accessible or remote/very remote area	0.182
Difficult temperament	Study child is more or much more difficult than average to get on with	0.066
Biomedical risk factors	Study child has a long-term medical condition or disability	0.104
Early childhood risk factors	Study child was not breastfed at one month; or Study child had a birth weight of less than 2,500 grams	0.246
High TV watching	Child watches four or more hours of TV per day	0.100
Sole parent	There is no P2 present in the household	0.135
Low P2 employment	P2 is present in the household but is not employed	0.059
Low P1 employment	P1 is not employed	0.389
High P1 employment	P1 works 40 hours or more per week	0.096
Teenage mother	Mother was less than 20 years old in Wave 1 (when child was 0/1)	0.030
Low P1 education	P1 has not completed Year 12 and does not have a Certificate III or higher	0.322
Potential language difficulties	P1 speaks a language other than English at home and speaks English not well or not at all; or	0.127

¹² Hardships included are: gone without meals; been unable to heat or cool home; pawned or sold something; or sought assistance from welfare/community organisations.

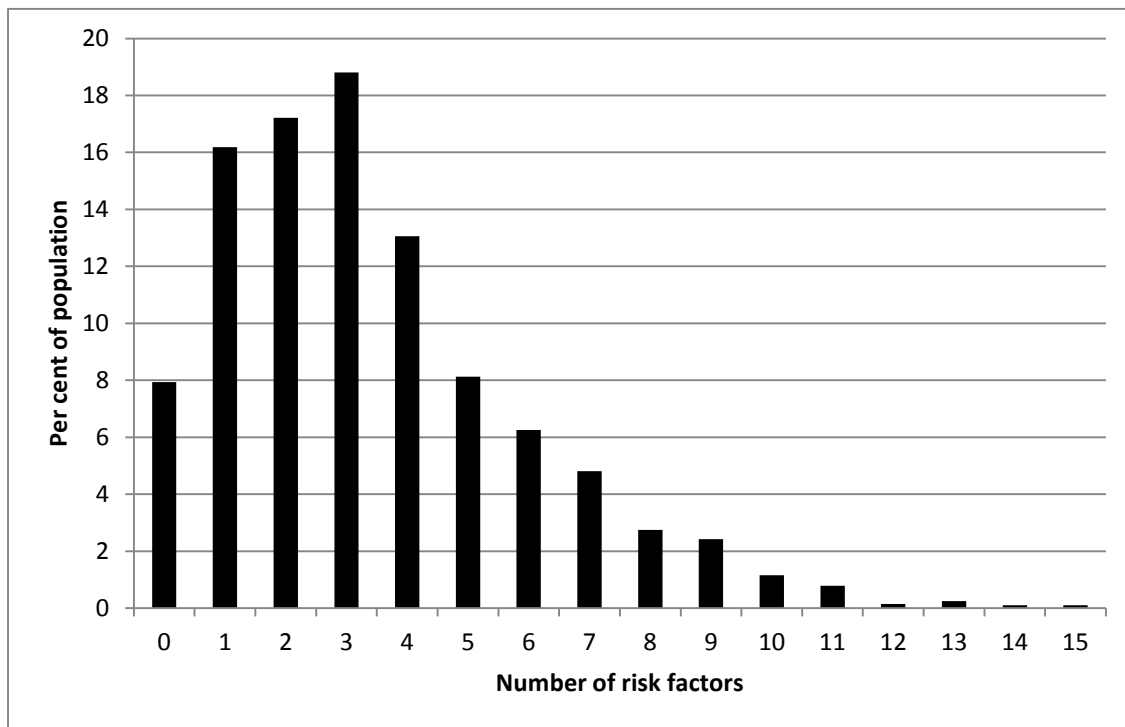
	Study child speaks a language other than English at home	
Parental psychological distress	P1 had a high value on the K-6 psychological distress scale; or mother of	0.135
P1 or P2 poor health	P1 or P2 has a long term medical condition or disability	0.133
Indigenous child	Study child is identified as being Indigenous	0.047
Poor parenting skills	P1 reports low parental warmth; or P1 reports high hostility with regards to parenting	0.193
Low reading	Study child was read to by parents less than three days in past week	0.243
Parental conflict	P1 reports anger or hostility between themselves and their partner	0.108
Parental substance use	In the last year, someone in the household had an alcohol or drug problem	0.019
Parental instability	At least one of P1 or P2 changed between Wave 2 and Wave 3	0.046
Average No. risk factors		3.925

Source: Wave 3 of the LSAC

Table 3 demonstrates significant variation in the incidence of the 25 risk factors. Around 38.9 per cent of the main carers of the baby cohort in the LSAC in Wave 3 were estimated to be not employed. Clearly, many of the children of these carers will be thriving and developing at or close to their full potential. However, low employment has been shown to be a risk factor. There is a similarly large incidence of low P1 employment (0.322), early childhood risk factors (0.246), a low reading environment (0.243) and income poverty (0.224). Some of the risk factors with a much lower incidence were parental substance use (0.019), having a teenage mother (0.030), housing stress (0.044) and parental instability (0.046). While these latter variables had a relatively low incidence and hence a low sample in the LSAC, they have the potential to have a significant impact on developmental outcomes.

The final line of the table shows that each child in the LSAC had, on average, 3.9 of the potential risk factors. However, as shown in Figure 1, there is considerable variation across the sample with the modal response being three risk factors and many children in the sample having two or less. At the upper end of the distribution, around 12.5 per cent of the population were estimated to have seven or more of the risk factors.

Figure 1 Number of risk factors related to Early Childhood Education and child outcomes, Baby cohort, Wave 3



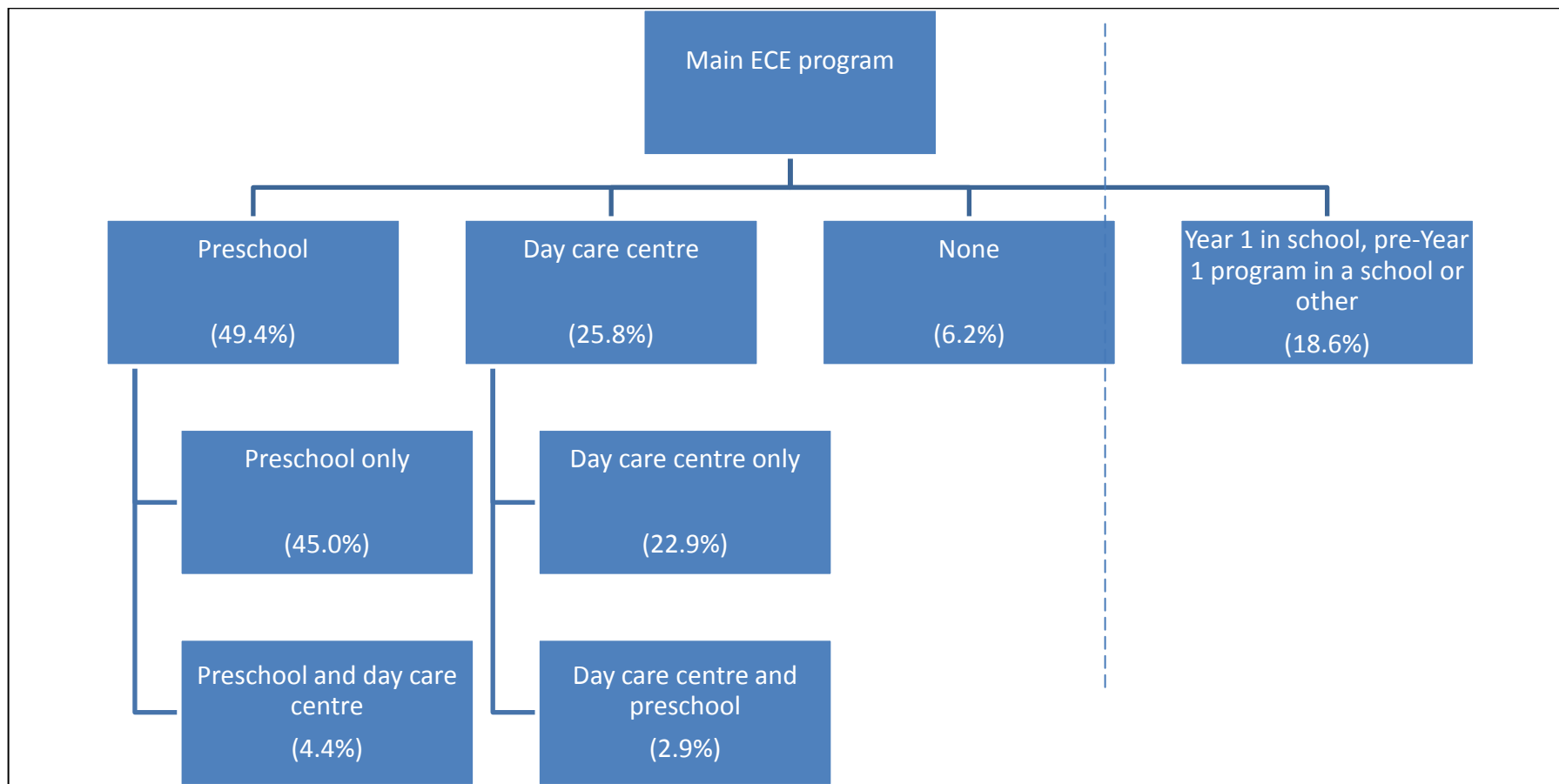
Source: Wave 3 of the LSAC

2.2 Measuring Early Childhood Education

A second component of the analysis was identifying who in the sample was participating in some form of ECE. Carers of each child in Wave 3 in the survey are asked: 'Does the child currently go to a school, kindergarten, preschool or a long day care centre?'. Of those who answered yes to this question, a further question was asked: 'Which one does the child go to for the most hours each week? (Choose program child is in for the most hours each week. If two of equal hours, choose the one child has been in longest.) Which one does child go to?' The following options were available to the respondent: Day care centre; Preschool; Pre-Year 1; Year 1; Other.

After answering a set of questions on the main form of ECE that the child participates in, respondents were then asked about whether the child participated in any other form of care or ECE. The following diagram summarises the answers to these questions, beginning with the main program and then followed by whether the child participated in that program only or whether a preschool student also attended long day care or vice-versa.

Figure 2 Patterns of Early Childhood Education participation – Baby cohort, Wave 3



Source: Wave 3 of the LSAC

Figure 2 shows that for a little under half of the (weighted) sample, a preschool program is the main form of ECE. Within this population, 45.0 per cent of the total population were participating in a preschool only with 4.5 per cent participating in both a preschool and a long day care centre. A little over a quarter of the weighted sample were identified as participating in a day care centre as their main form of ECE. Most of these, once again, were participating in a long day care centre only, with only 2.9 per cent of the total population using a long day care centre as their main form of ECE but also participating in preschool.

Around 6.2 per cent of the (weighted) sample were not participating in any form of ECE program when their carers were interviewed. The final part of the sample were participating in Year 1 in school, a pre-Year 1 program (referred to variously as Kindergarten, Preparatory, Reception, Pre-Primary or Transition) or some other form of ECE. We excluded these individuals from the analysis as it is not possible to obtain comparable information on the prevalence of risk factors before they commenced full-time schooling. The sample used in the analysis is therefore every child to the left of the dotted line in Figure 2.

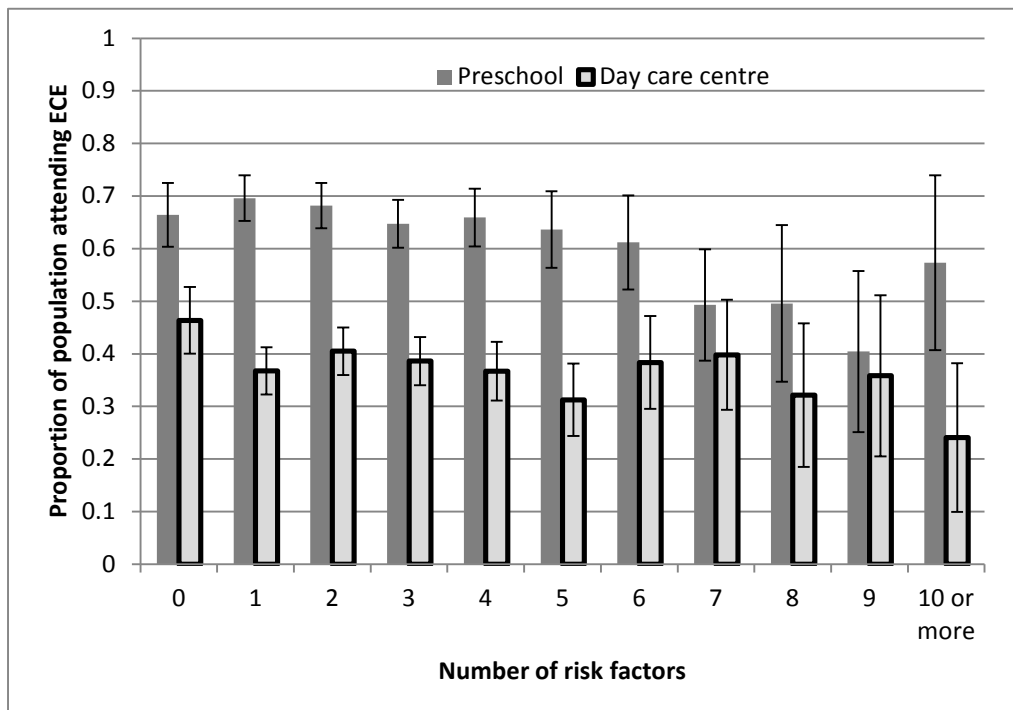
3 ANALYSIS – FACTORS ASSOCIATED WITH EARLY CHILDHOOD EDUCATION

3.1 Relationship between the number of risk factors and early childhood education

We begin the analysis in this paper by looking at the proportion of the population who were participating in the two main forms of ECE by the number of risk factors identified. The darker grey bars in Figure 3 below are for the proportion participating in preschool, which includes the 49.4 per cent of the sample for whom preschool was the main form of ECE, as well as the 2.9 per cent who participated in preschool despite a long day care centre being their main form of ECE. The lighter grey bars with the black border are for the proportion of the relevant (weighted) sample who were participating in a day care centre. This, once again, includes the 4.4 per cent of the (weighted) sample whose main form of ECE was a preschool but who also participated in a day care centre.

For these and similar figures in this paper, the lines around the bars give the 95 per cent confidence interval for the estimates. These give an indication of the precision of the estimates, taking into account the relevant sample size. Such confidence intervals are constructed such that if the true value of the proportion was equal to the point estimate, then across many repeated samples of that size, 95 per cent would fall within that range. If the confidence intervals for two sets of individuals do not overlap, then we can be reasonably sure that the difference between them is not driven by sampling variation.

Figure 3 Relationship between number of risk factors and participation in early childhood education



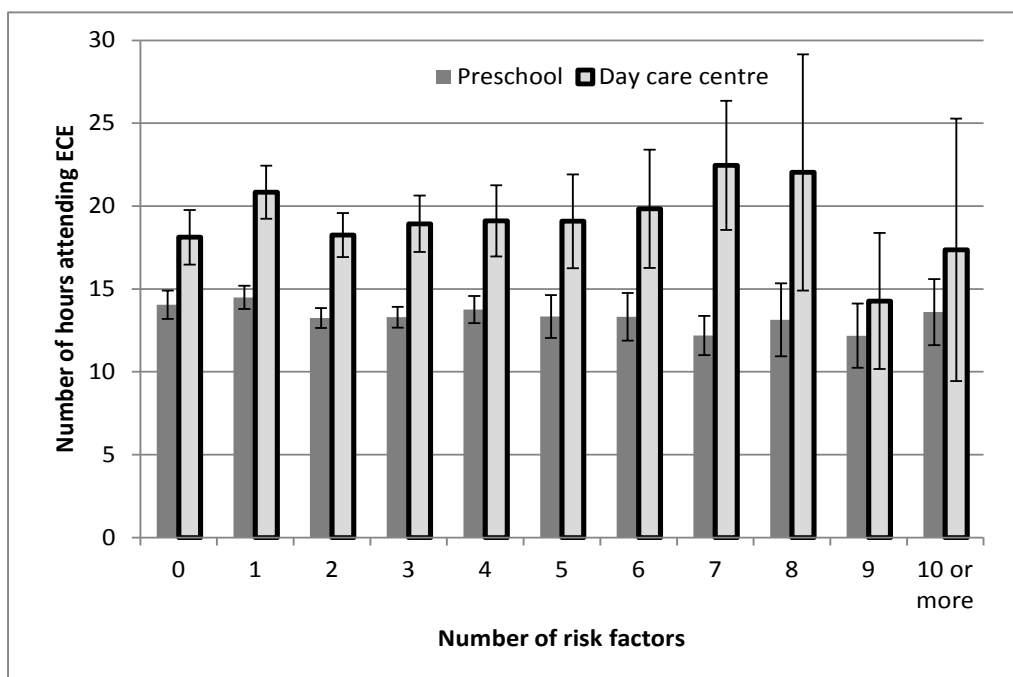
Source: Wave 3 of the LSAC

Although the level of preschool and long day care centre participation amongst those with a large number of risk factors is measured with a fair degree of imprecision, there appears to be somewhat of an inverse relationship between risk factor burden and participation in preschool. A linear prediction of the relationship between the two suggests that, on average, an additional risk factor is associated with a decrease in the probability of participating in preschool equal to -0.019 (with a p-value that is substantially less than 0.01). There appears to be much less of a relationship between risk factor burden and participation in LDC with a linear coefficient of -0.009 and a p-value of 0.032 .

Given risk burden is a strong predictor of developmental vulnerability (as documented previously and shown empirically later in this paper) then there should ideally be a positive association between participation in preschool if those children who would most benefit from ECE are gaining access to it. However, the converse seems to be the case. Similarly, assuming that LDC is of sufficient quality to confer a benefit on the vulnerable, then children with the highest risk burden should participate. The fact that the highest levels of participation for both forms of ECE were found amongst children with the lowest risk burdens emphasises that the policy at the time of Wave 3 of the LSAC (2008) was not succeeding in providing needs-based access.

Focusing on those who were participating in the relevant form of ECE, Figure 4 shows the relationship between risk factor burden and the number of hours the child usually attended each of the two forms of ECE. Figure 4 shows that across the spectrum of risk burden, children who were accessing preschool did so for less than 15 hours per week—much less than the hours found to benefit children from low income groups (Loeb et al 2007, p 64).¹³ Hours of weekly attendance were greater for LDC overall, but did not appear to bear a systematic relationship to risk burden.

Figure 4 Relationship between number of risk factors and number of hours of early childhood education (for those participating)



Source: Wave 3 of the LSAC

¹³ The authors found that full day attendance (more than 30 hours per week) was needed to boost pre-reading skills of children from a low income group, without detrimental effect on behaviour. However, children from a high income group experienced no additional benefit from 30 hours plus attendance and exhibited increasing negative behaviour as hours increased.

3.2 Relationship between early childhood education and specific risk factors

It would appear from the previous two figures that rather than stimulating needs-based access to ECE, at least some of the risk factors included in the analysis in this paper appear to have been barriers to ECE education participation. However, as shown in the following table, when all the risk factors are included in a single analysis, many of them are not found to be associated one way or the other with ECE participation, whereas others are positively associated with participation. Specifically, the results present an analysis of the probability of a child in Wave 3 attending either preschool (the first column of results) or LDC (the second column). The analysis is undertaken using maximum likelihood estimation of the Probit model with those who had already commenced full-time schooling excluded from the analysis.

Results are presented as marginal effects or the difference in the probability of attending compared to the base case individual while holding all other variables constant. In addition to having none of the risk factors, the base case individual is female and aged 57 months (the average for the dataset). The final point to note is that variables for which the coefficient is statistically significant at the 1 per cent level of significance are labelled ***; those statistically significant at the 5 per cent level of significance only are labelled **; whereas those statistically significant at the 10 per cent level of significance only are labelled *.

Table 4 Factors associated with the probability of attending Early Childhood Education, Baby cohort, Wave 3

Characteristic	Preschool	Day care
Study child is male	-0.015	0.014
Age of study child (months)	0.018***	-0.014***
Poverty	-0.002	0.030
Housing instability	-0.089**	0.023
Housing stress	-0.086	-0.101
Competition for parenting time	0.016	-0.072***
Neighbourhood disadvantage	0.076***	-0.073**
Low accessibility	0.007	-0.041
Difficult temperament	-0.033	0.147***
Biomedical risk factors	0.041	-0.060*
Early childhood risk factors	-0.027	0.038
High TV watching	-0.011	-0.088**
Sole parent	-0.108***	0.168***
Low P2 employment	-0.121**	0.091*
Low P1 employment	0.084***	-0.200***

High P1 employment	-0.102***	0.127***
Teenage mother	-0.017	-0.054
Low P1 education	-0.055**	0.017
Potential language difficulties	-0.077**	0.011
Parental psychological distress	-0.009	-0.007
P1 or P2 poor health	-0.019	0.011
Indigenous child	-0.152***	-0.001
Poor parenting skills	0.030	0.014
Low reading	-0.129***	0.081***
Parental conflict	0.042	-0.053*
Parental substance use	-0.017	-0.092
Parental instability	-0.063	0.021
Probability of the base case	0.715	0.411
Pseudo R-squared	0.0536	0.0678
Number of observations	2,702	2,703

Note: The base case individual has none of the included risk factors, is female and aged 57 months. Variables for which the coefficient is statistically significant at the 1 per cent level of significance are labelled ***; those statistically significant at the 5 per cent level of significance only are labelled **, whereas those statistically significant at the 10 per cent level of significance only are labelled *.

Source: Customised calculations using Wave 3 of the LSAC

Table 4 shows that no risk factor is significantly associated with participation in both preschool and LDC, or is significantly associated in the same direction. In other words, strategies to increase participation in preschool will need to be different from those aimed at increasing participation in LDC.

The only risk factors with a positive association with participation in preschool were neighbourhood disadvantage and P1 not employed. The former could mean that policies designed to promote attendance in low-SEIFA communities have met with some success, even though they have not ensured that children bearing the greatest risk burden are those with the greatest participation rates. The latter result can potentially be explained through a comparison with the low rates of participation in LDC for those children for whom P1 is not employed. Taken together, these results probably represent a relative preference for preschool as opposed to other forms of ECE for this group who are less likely to need the extended hours of care available in a long day care centre. This explanation seems consistent with the finding that P1 working long hours (over 40 hours per week) is negatively associated with participation in preschool.

There were many more risk factors that were found to be associated with a lower probability of preschool participation. These include: housing instability, sole parent family, P2 in a couple family not employed, low P1 education, potential language difficulties, Indigenous child, and child seldom read to by parents. Given that low income was controlled (and not found to be significant), it is likely that financial constraints are not the only barriers to preschool participation for these groups. Rather, there is a strong possibility that preschool education is not seen by these parents as being relevant

or meeting their needs. This suggests a greater effort may be required to reach out to many of these families, perhaps through national data systems (Centrelink, Supported Accommodation, Medicare, migration and settlement databases) that could all offer opportunities to communicate with local education/welfare officials who could make contact and explore ways of overcoming barriers to participation. Many such systems are already in operation, and they may need to be expanded.

Compared to preschool, the picture is quite different for the relationship between individual risk factors and LDC participation. The factors that were positively associated with LDC participation were: difficult temperament, sole parent, P1 works long hours, and child not read to by parents. P2 not employed was positively associated with LDC participation at the 10 per cent level. The negative associations were with competition for parenting time (family with over three children or subject child with same-age sibling) disadvantaged neighbourhood, high TV watching (four or more hours per day), and P1 not employed. The negative association for biomedical risk factors (disability or chronic ill-health) and parental conflict was at the 10 per cent level.

The risk profile of children attending LDC is weighted towards the difficult child, who lives in a crowded house with a mother working long hours, and, possibly, a father who is not employed, with neither parent prepared or able to spend time on educational activities such as reading. By contrast, the profile of those most likely to miss out is that of a child, possibly with a disability, who lives in a large family in a disadvantaged neighbourhood, who spends long periods being babysat by the TV, and whose parents may have a relationship marred by conflict.

The following table replicates this analysis by focusing on those who were participating in the relevant form of ECE and looking at the factors associated with the number of hours of participation. Results are presented in a similar way, however in Table 5 the coefficients are estimated using a linear model and presented as the difference in the number of hours of attendance from the base case or omitted category.

Table 5 Factors associated with the number of hours of Early Childhood Education (for those who were participating), Baby cohort, Wave 3

Characteristic	Preschool hours	Day care hours
Study child is male	-0.264	1.066*
Age of study child (months)	0.347***	-0.068
Poverty	0.027	-0.238
Housing instability	0.263	0.368
Housing stress	0.874	4.982**
Competition for parenting time	0.247	-1.962**
Neighbourhood disadvantage	-0.981**	-0.031
Low accessibility	-0.513	-2.034**
Difficult temperament	-0.398	3.359***
Biomedical risk factors	0.199	-1.130
Early childhood risk factors	-0.421	0.222
High TV watching	-0.125	-0.566
Sole parent	-0.122	3.869***
Low P2 employment	0.177	-2.349
Low P1 employment	-0.336	-5.422***
High P1 employment	2.568***	7.637***
Teenage mother	-1.053	2.480
Low P1 education	-0.329	-1.759**
Potential language difficulties	1.570***	-0.090
P1 psychological distress	-0.751**	0.959
P1 or P2 poor health	-0.065	1.145
Indigenous child	1.944**	4.051**
Poor parenting skills	0.115	-0.965
Low reading	-0.593	2.022***
Parental conflict	0.289	0.787
Parental substance use	0.323	1.512
Parental instability	1.687*	2.895*
Predicted number of hours for the base case	14.024	17.972
Adjusted R-squared	0.0526	0.1858
Number of observations	1,799	1,019

Note: The base case individual has none of the included risk factors, is female and aged 57 months. Variables for which the coefficient is statistically significant at the 1 per cent level of significance are labelled ***; those statistically significant at the 5 per cent level of significance only are labelled **, whereas those statistically significant at the 10 per cent level of significance only are labelled *.

Source: Customised calculations using Wave 3 of the LSAC

The relationship between risk factors and hours of participation highlights different factors than emerged in the participation presented earlier. This is partly because it includes only the group that participated, but also because it would appear that the factors that influence (or inhibit) participation impact differently on decisions made about hours of participation. For example, although neighbourhood disadvantage was positively associated with participation in preschool it was negatively associated with the number of hours. Similarly, children of P1 working long hours were less likely to participate in preschool, but where they did so, they were more likely to attend for longer. This later finding suggests that for this group, preschool is used as much as a form of care as opposed to early childhood education. Finally, children from a language background other than English and Indigenous children were less likely to participate in preschool, but those that did attend were more likely to attend for longer hours.

4 ANALYSIS – RELATIONSHIP BETWEEN RISK FACTORS, EARLY CHILDHOOD OUTCOMES AND CHILD DEVELOPMENT

The previous section of the paper showed that there tended to be a negative relationship between ECE participation and risk factor burden. We argued that this distribution has the potential to exacerbate rather than ameliorate social and economic differences in school readiness and other measures of child development. Such a conclusion, however, is predicated on the assumption that those with a high risk factor burden were likely to have poorer outcomes later in life whereas those who participated in ECE were likely to have better outcomes. In this section of the paper, we use data from Wave 4 of the LSAC to test some of these assumptions.

We begin with a descriptive analysis of the relationship between risk factors and five child outcomes across a range of domains. We then turn to an analysis of the relationship between preschool and child outcomes, followed by analysis of the relationship between LDC participation and child outcomes. In these last two sets of analysis, we look at differences with and without controlling for the number of risk factors identified for each individual.

4.1 Relationship between risk factors and child outcomes

Table 6 below introduces five measures of child outcomes based on data from Wave 4 of the LSAC. The first column of the table gives the labels and description of the variables with the second column giving the proportion of Wave 4 of the population who were reported to have that characteristic. These proportions are calculated only for those who were not participating in full-time schooling during Wave 3 of the survey.

Table 6 Description and sample characteristics of child outcomes, Baby cohort, Wave 4, Children not attending full-time school in Wave 3

Characteristic	Weighted value
Low achievement—Teacher rates the child's academic skills, compared to other children of the same grade level as below average or far below average.	0.187
Low maths—Child scores one-standard deviation below the mean value for Academic Rating Scale of Mathematical thinking	0.188
Low literacy—Child scores one-standard deviation below the mean value for Academic Rating Scale of Language and Literacy	0.175
Poor SDQ (Strengths and Difficulties Questionnaire) ranking—Child ranks relatively lowly (score 12 and above) on the SDQ	0.242
Poor school adjustment—Child ranks relatively lowly (score 1.8 or higher) on self-assessed school adjustment index	0.235

Source: Customised calculations using Wave 4 of the LSAC

While the five outcome measures capture different aspects of development, there is clearly a relationship between them. This is demonstrated by the following table which gives the bivariate correlation between the measures.

Table 7 Bivariate correlations between the child outcomes, Baby cohort, Wave 4, Children not attending full-time school in Wave 3

	Low achievement	Low maths	Low literacy	Poor SDQ ranking
Low maths	0.512			
Low literacy	0.617	0.617		
Poor SDQ ranking	0.173	0.141	0.126	
Poor school adjustment	0.072	0.082	0.087	0.097

Source: Customised calculations using Wave 4 of the LSAC

Not surprisingly, the strongest bivariate relationships are between maths, literacy and school achievement. On the other hand, those with relatively poor rankings on the SDQ were slightly, but not substantially more, likely to be identified as having low school achievement and low maths/literacy test scores. The correlation between the self-assessed measure of low school adjustment and the other outcome variables was even lower still.

Despite the incomplete relationship between them, the results presented in Figure 5 below show that there was a strong positive relationship between the presence of one or more risk factors at the ages of four to five years and most of the negative child outcomes at the ages of six to seven years. Results are presented separately for each of the outcomes (from Figure 5a to 5e) as the proportion of the (weighted) sample with the relevant outcome conditional on the number of other risk factors. The bounds around the estimates once again represent the 95 per cent confidence intervals for that estimate.

Figure 5 Proportion of children in Wave 4 reported with low outcomes in Wave 4, by presence of risk factors in Wave 3

Figure 5a Low achievement

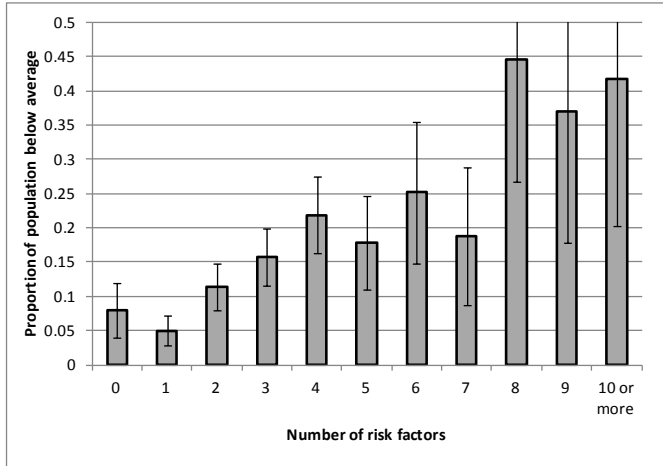


Figure 5b Low maths

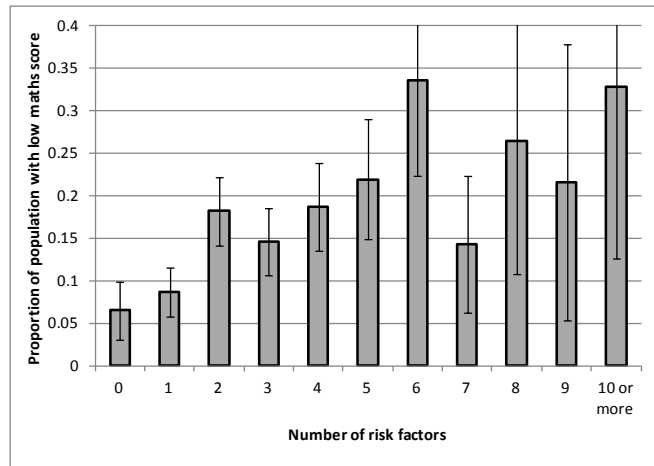


Figure 5c Low literacy

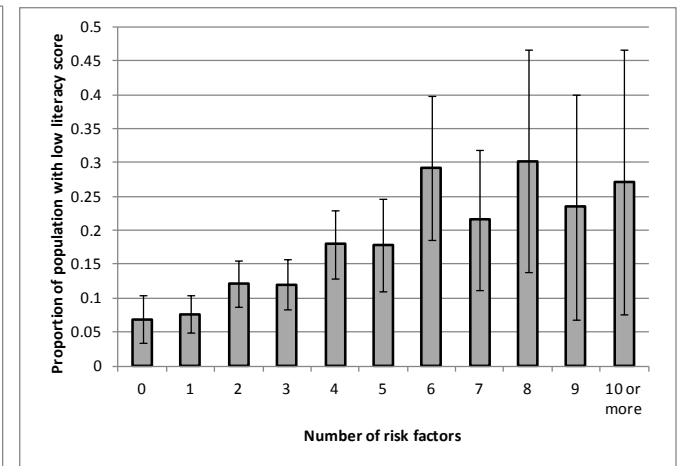


Figure 5d Poor SDQ ranking

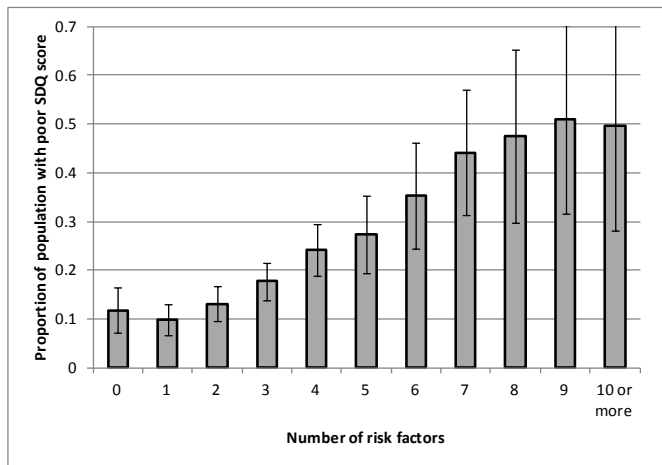
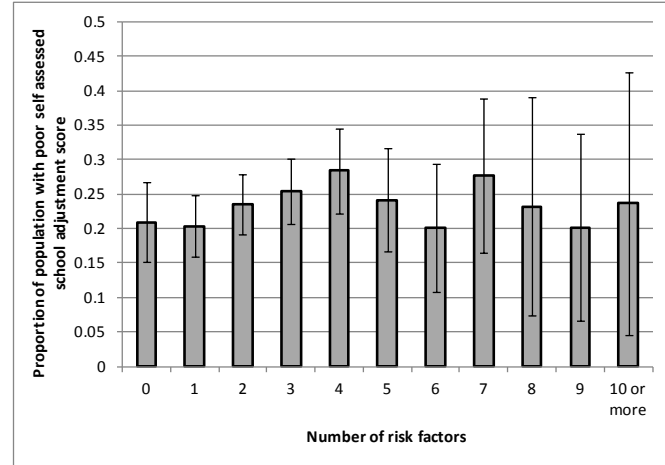


Figure 5e Poor school adjustment

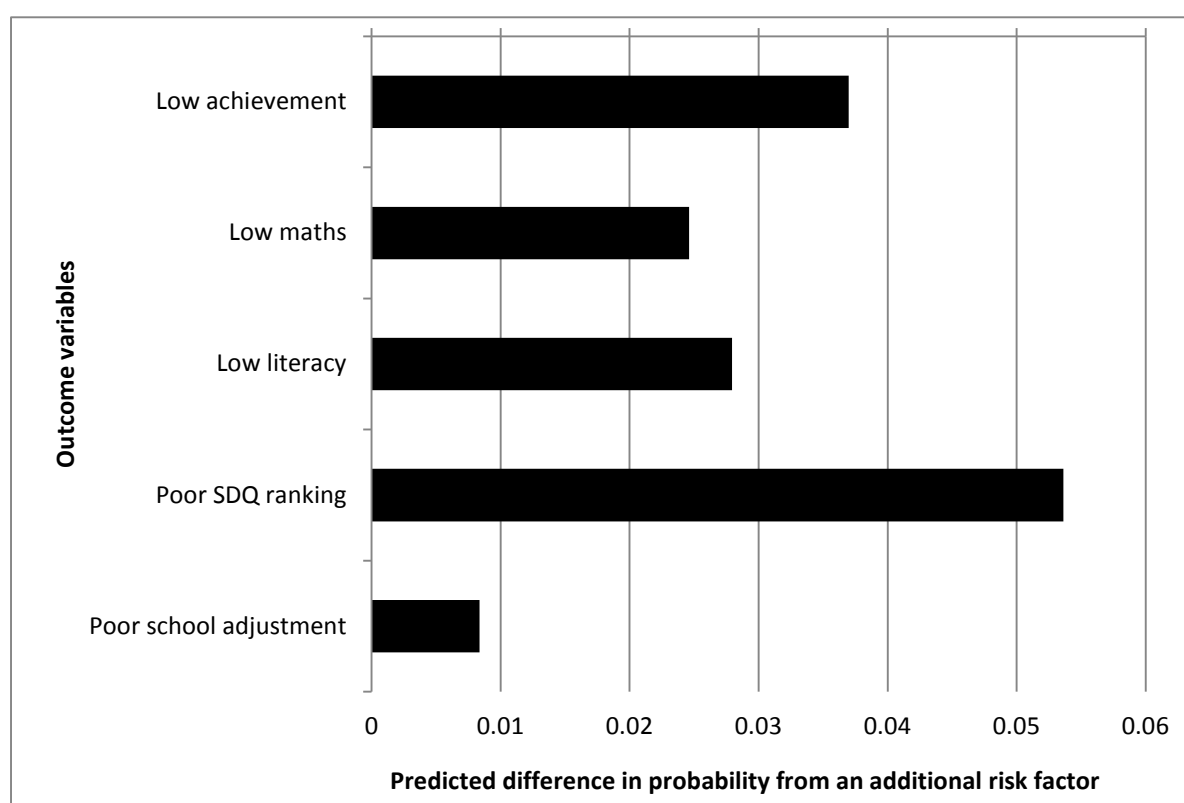


Source: Customised calculations using Waves 3 and 4 of the LSAC

Results presented in Figure 5 show that, although there is some variation and imprecision at the upper end of the risk factor distribution, for the first four of the five outcomes, those with a relatively higher number of risk factors tend to be more likely to report negative child outcomes. There does not, however, appear to be a linear relationship between risk factors and poor school adjustment.

Figure 6 confirms this relationship by presenting the predicted increase in the probability of reporting each of the negative child outcomes from an additional risk factor. As this relationship is estimated using a non-linear (Probit) model, it is necessary to evaluate this difference at a given number of risk factors. We evaluate this change in probability at four, which is the mean number of risk factors for the weighted sample. The figure shows, in essence, that for all of the outcomes an increase in the number of risk factors is associated with an increase in the probability of reporting negative outcomes. However, the relationship is smallest for school adjustment and largest for poor SDQ.

Figure 6 Predicted increase in probability of outcome in Wave 4 from the presence of an additional risk factor in Wave 3 (evaluated at 4 risk factors)



Source: Customised calculations using Waves 3 and 4 of the LSAC

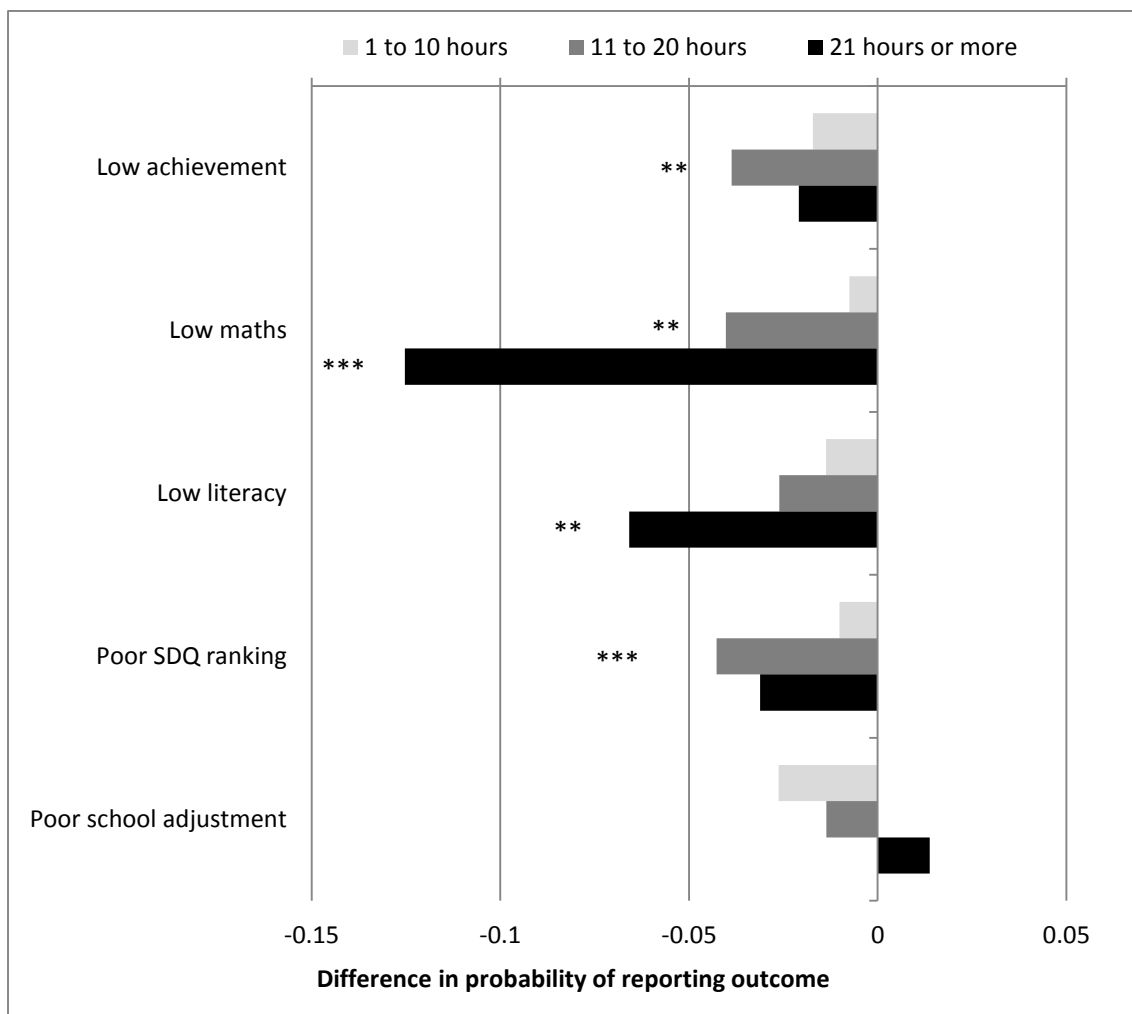
4.2 Relationship between preschool and child outcomes

The finding above strongly suggests the risk factors included in the analysis are, in aggregate, associated with child outcomes. While we demonstrated a strong association, and even that the number of risk factors is a strong predictor of poor child outcomes two years later, this does not necessarily demonstrate causality. It may well be the case that there are other variables outside of the model that determine both the presence of risk factors and also child outcomes. One potential mediating factor, however, is participating in ECE. We will return to the relationship between

individual risk factors and child outcomes in the next section of this paper. Before then though, we look at the relationship between ECE participation and the five outcomes previously introduced. We begin with an analysis of the relationship between preschool and child outcomes.

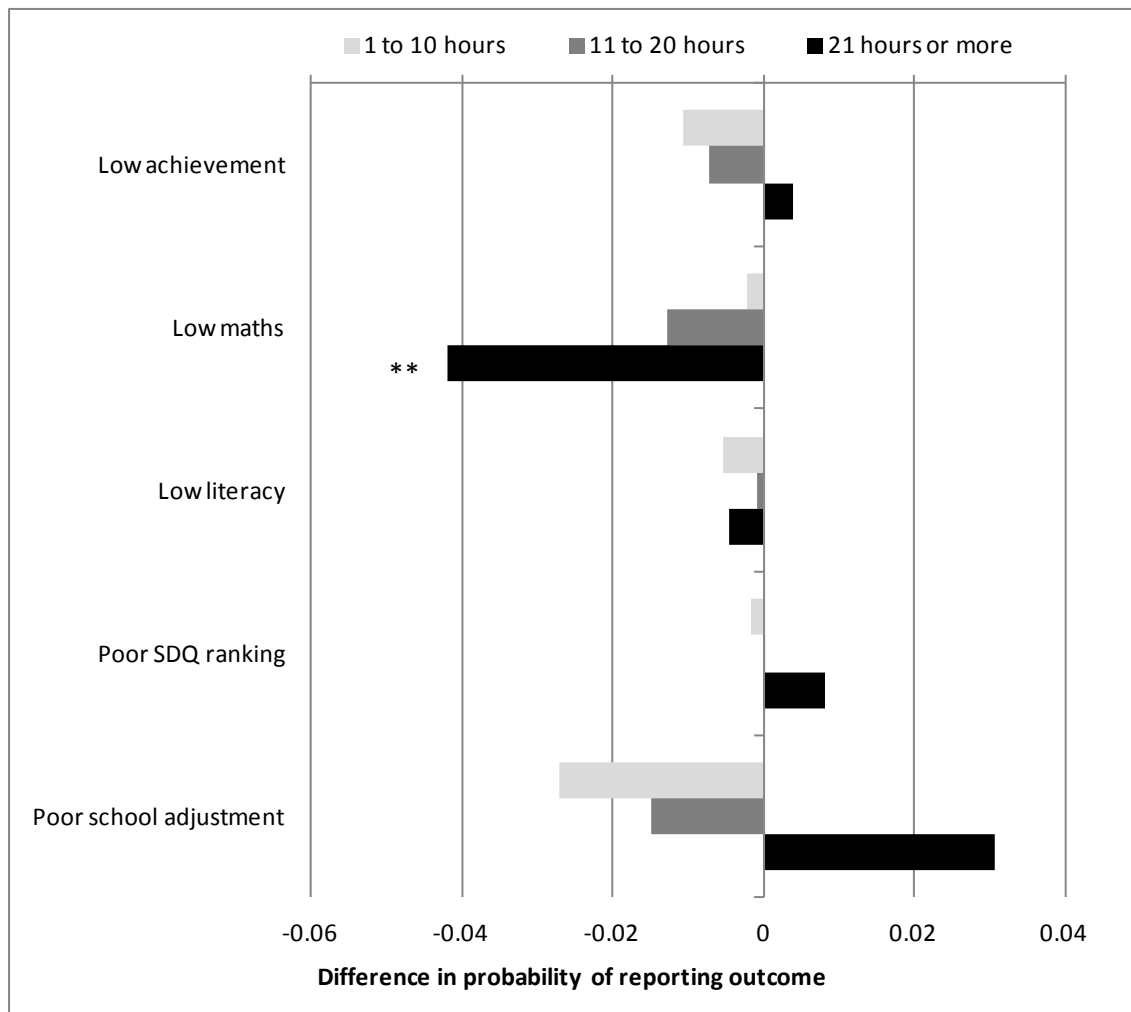
The first figure in this part of the paper looks at the predicted difference in the probability of reporting the particular child outcome (in Wave 4) by the number of hours of preschool participation in Wave 3. Results marked with a *** are statistically significant at the 1 per cent level of significance, those marked ** are significant at the 5 per cent level of significance and those marked * are significance at the 10 per cent level. The base case is those who were not attending preschool in Wave 3. The second figure also looks at the predicted difference in child outcomes. However, these results are after controlling for the number of risk factors in Wave 3, as well as the age and sex of the child.

Figure 7 Predicted difference in reporting child outcome in Wave 4 by number of hours of preschool attendance in Wave 3



Source: Customised calculations using Waves 3 and 4 of the LSAC

Figure 8 Predicted difference in reporting child outcome in Wave 4 by number of hours of preschool attendance in Wave 3, after controlling for number of risk factors



Source: Customised calculations using Waves 3 and 4 of the LSAC

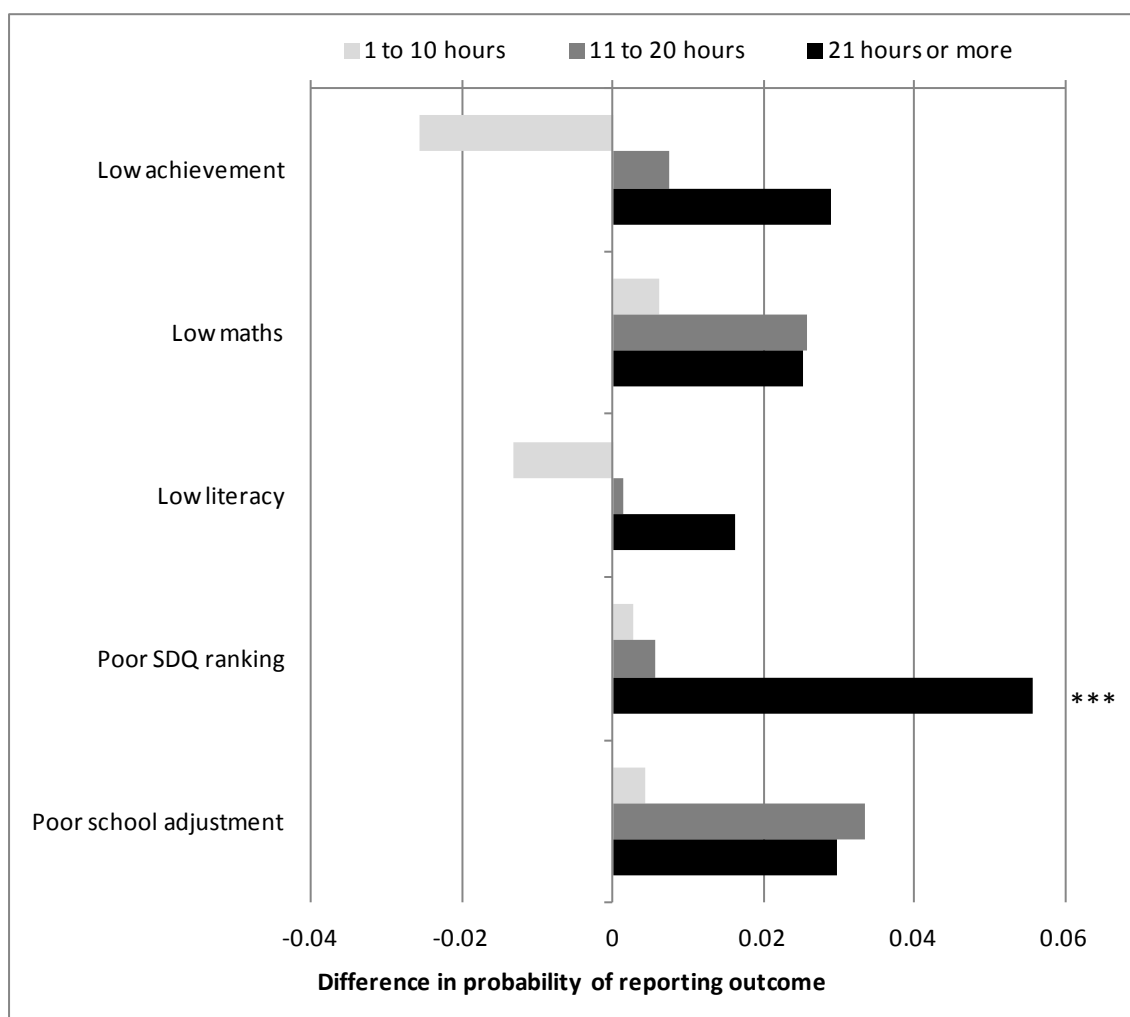
The results presented in Figure 7 demonstrate a strong positive association between attendance at preschool and better outcomes. The association tends to be higher with a greater number of hours of preschool participation and is highest for maths and literacy. However, this relationship for the most part disappears when the influence of risk factors is taken into account. The only significant difference in outcomes for children who had attended preschool and those who had not (in Figure 8) was a reduction in low outcomes for mathematics, and that applied only to those children who attended for 21 hours per week or more.

What these results imply is that the lower risk burden of preschool participants explains most of the difference in outcomes. The policy implications of these results are that Australia as a society needs to do more to address risk factors in the quality, duration and resourcing of ECE (OECD 2011, p 4), and do more to prevent exposure to risk in the first place (Shonkoff 2011).

4.3 Relationship between day care and child outcomes

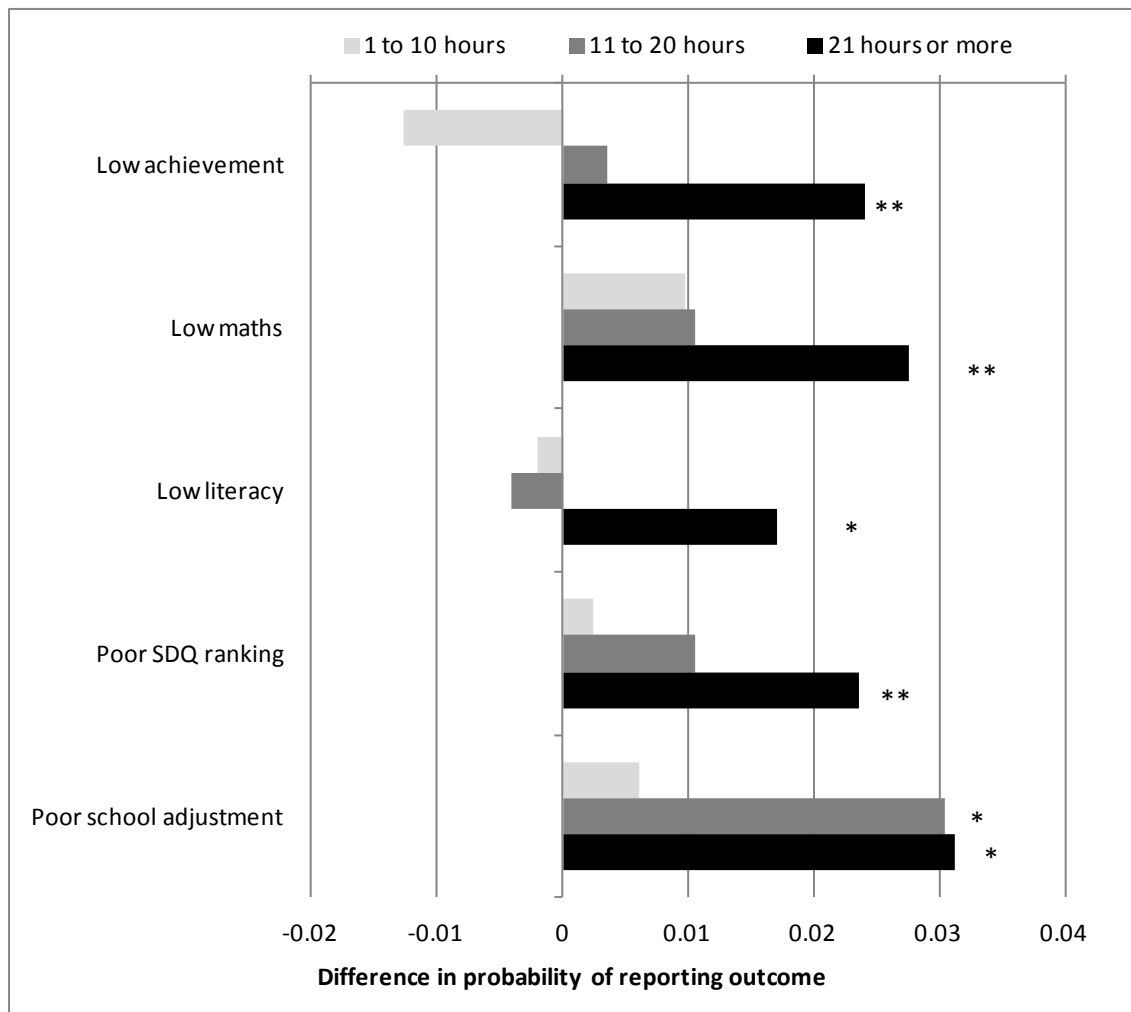
The results presented in Figures 9 and 10 replicate those from the previous analysis but focus on the relationship between day care participation and child outcomes. The first of the two figures once again looks at the predicted difference in the probability of reporting the particular child outcome (in Wave 4) by day care participation in Wave 3. Results marked with a *** are statistically significant at the 1 per cent level of significance, those marked ** are significant at the 5 per cent level of significance and those marked * are significance at the 10 per cent level. The base case is those who were not attending day care in Wave 3. The second figure also looks at the predicted difference in child outcomes. However, these results are after controlling for the number of risk factors in Wave 3.

Figure 9 Predicted difference in reporting child outcome in Wave 4 by number of hours of day care attendance in Wave 3



Source: Customised calculations using Waves 3 and 4 of the LSAC

Figure 10 Predicted difference in reporting child outcome in Wave 4 by number of hours of day care attendance in Wave 3, after controlling for number of risk factors



Source: Customised calculations using Waves 3 and 4 of the LSAC

Figure 9 shows that without controlling for risk burden, the probability of the child being reported as having a relatively low score on the SDQ was higher for children who participated in LDC for 21 plus hours per week. There was no significant association for lower levels of participation and no association for any of the other child outcomes. When the number of risk factors is included, the significance of the association between 21 plus hours participation in LDC and a poor outcome in SDQ remains. However, in Figure 10, a large number of hours of day care attendance was also associated with a higher probability of low achievement, low maths, low literacy (at the 10 per cent level of significance only) and poor school adjustment (also at the 10 per cent level of significance).

Although we cannot draw conclusions regarding causality, a negative impact of longer hours would be consistent with poor-quality LDC services—participation of the subject children occurred prior to the implementation of the National Quality Standards. Whatever the causal relationship, it seems reasonably clear that LDC participation did not reduce vulnerability and long hours predicted the worst results. One potential avenue of further work is to analyse not only the number of hours of LDC attendance per week at the time of the survey, but also the number of years in total the child participated in LDC.

5 EARLY CHILDHOOD EDUCATION AND RISK FACTORS FOR SPECIAL NEEDS GROUPS

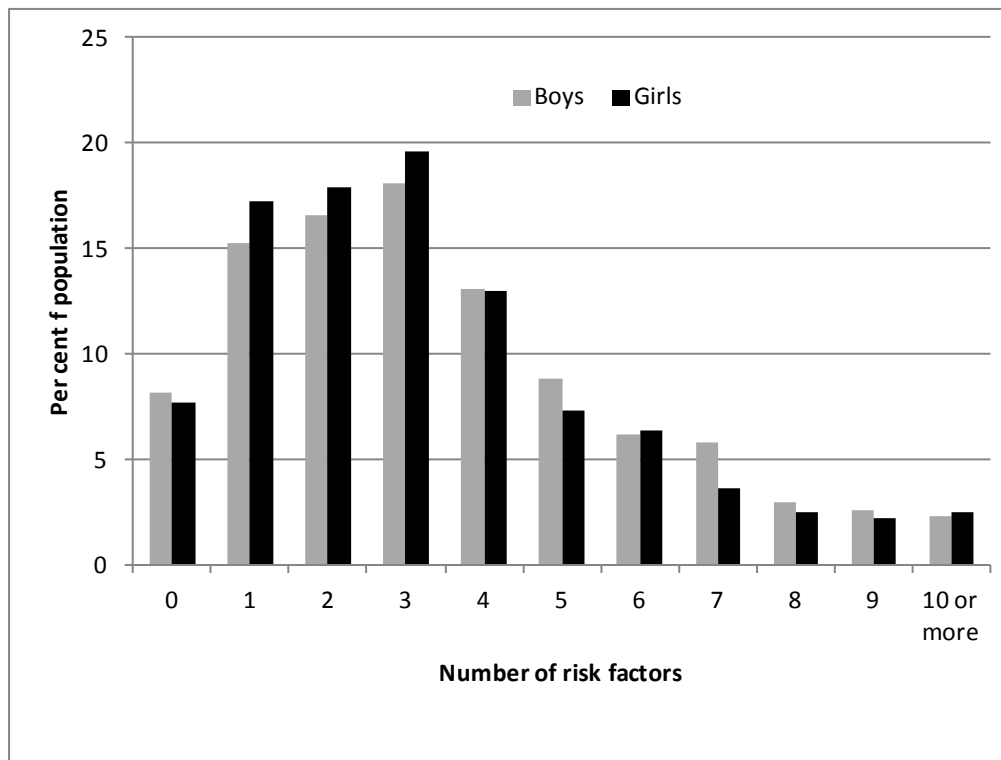
In the previous section of the paper, we showed that those children who had a greater number of risk factors when aged four to five years were significantly and substantially more likely to be reported as having a range of negative outcomes. There was some evidence that the probability of having poor outcomes was reduced to a certain extent by participating in 21 hours or more of preschool. However, participation in that many hours of LDC (in 2008) appears to be more likely to have worsened child outcomes rather than improved them.

One of the potential determinants of child outcomes that has not yet been examined closely in this paper is the child's sex. While we have included it in many of the models, it has not been the focus of discussion. In the first part of this section we consider this issue in more detail by looking at the relationship between gender, risk factors and child outcomes. In particular we consider whether boys or girls have a greater number of risk factors and whether the outcomes of boys or girls vary after controlling for risk factors and participation in early childhood education. We then turn our attention to a range of other special needs groups that have been included in the analysis thus far as risk factors and look at the comparative size of their remaining risk factor burden. In the final set of analysis in this section and this paper, we pull the results together and look at the relationship between specific risk factors, ECE participation and child outcomes.

5.1 Boys and girls

The following figure shows the number of risk factors for boys (the grey bars) and girls (the black bars). The figure shows there is a reasonably consistent distribution of risk factors for males and females. This is not surprising as many of the risk factors are calculated for the child's parents or at the household level. Some of the risk factors are calculated for children though, and this may explain why boys are slightly more likely to be at the upper end of the distribution. Specifically, 13.8 per cent of boys had seven or more risk factors compared to 10.8 per cent of girls.

Figure 11 Number of risk factors related to Early Childhood Education and child outcomes, boys and girls, Baby cohort, Wave 3



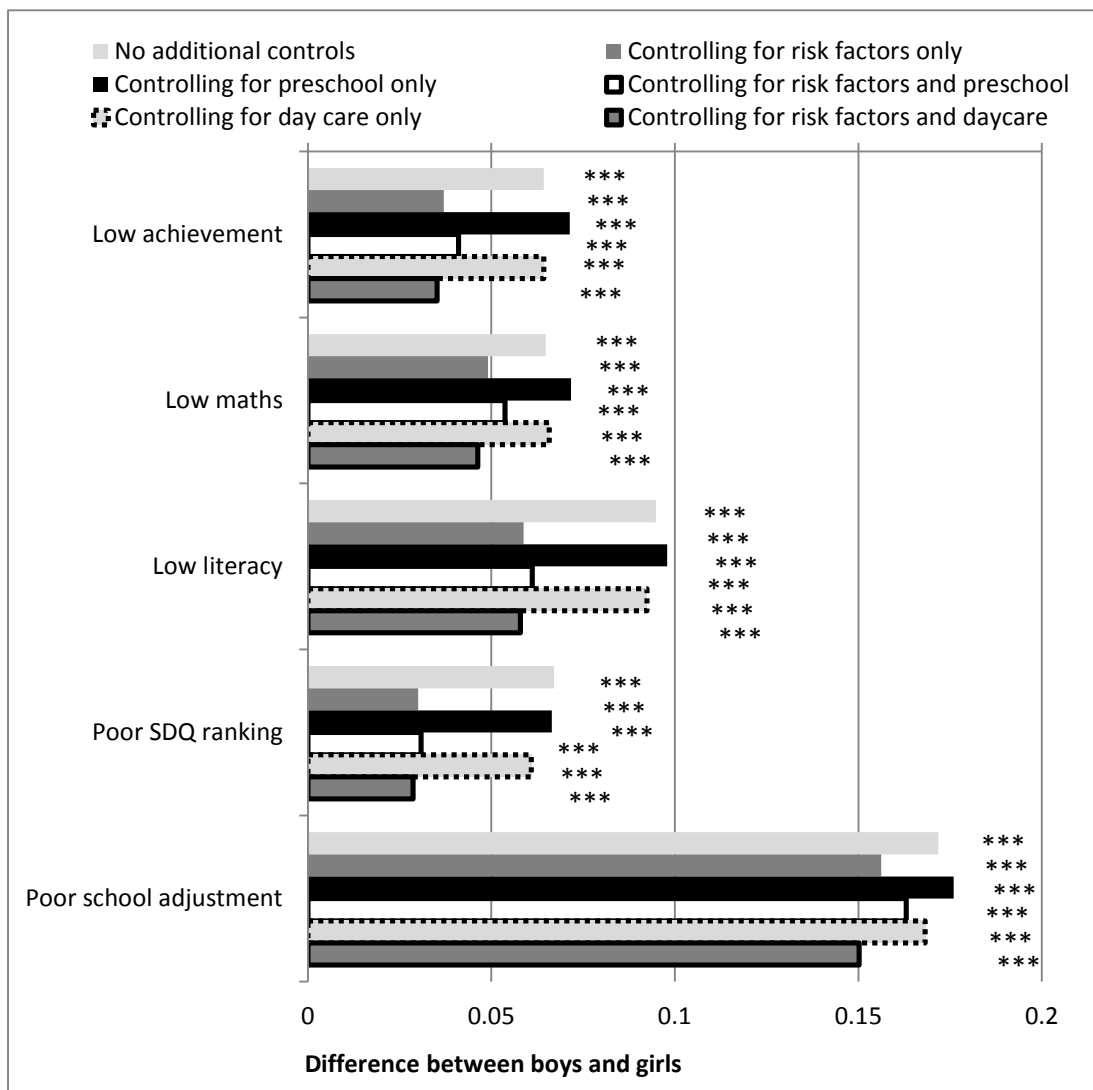
Source: Customised calculations using Wave 3 the LSAC

The previous figure showed boys are slightly (but significantly in a statistical sense) more likely to have a relatively large number of the risk factors included in the analysis for this paper. However, the following figure goes further than this and shows that with and without controlling for these risk factors, boys are significantly and substantially more likely to report the negative outcomes introduced and analysed in the previous section of this paper. For each outcome variable, six separate estimates are undertaken with different combinations of additional control variables. These are listed below with all estimations containing age and a binary variable for whether or not the child is male:

- > No additional controls
- > Controlling for risk factors only
- > Controlling for preschool only
- > Controlling for risk factors and preschool
- > Controlling for day care only
- > Controlling for risk factors and LDC

Results are presented once again as marginal effects or the difference in the probability of the outcome occurring. Statistical significance of that difference is indicated by the presence and number of stars next to the predicted difference. Results marked with a *** are statistically significant at the one per cent level of significance, those marked ** are significant at the five per cent level of significance and those marked * are significance at the 10 per cent level. The base case for the relevant models that include the following variables is those who were not attending preschool in Wave 3, those who were not attending LDC and those who do not have any of the previously identified risk factors.

Figure 12 Predicted difference in reporting child outcome in Wave 4 by sex of child



Source: Customised calculations using Waves 3 and 4 of the LSAC

Figure 12 shows boys were significantly more likely than girls to obtain a poor outcome on all measures, regardless of what additional controls are included. The difference was of the order of 4 per cent for overall achievement, just under 5 per cent for maths, about 6 per cent for literacy, about 3 per cent for SDQ and over 15 per cent for self-rated poor school adjustment. This is consistent with the findings on the association of maleness with developmental vulnerability that suggest:

- > maleness is itself a residual risk factor that has not been counted in the analysis
- > maleness acts as a sensitising condition that exacerbates the influence of risk factors
- > parents spend less time reading to infant boys and teaching them the rudiments of letters and numbers than they do girls of the same age.

Baker and Millikan (2013) found that mothers and fathers invest less time in reading and teaching boys the use of numbers and letters than girls and proposed this difference might account for a 'non-trivial' proportion of the frequently observed difference between boys and girls in preschool reading and maths. They suggested the increase in time spent teaching boys after they commenced

day care was consistent with the possibility that parents find boys less rewarding to teach and are 'more willing to persevere with boys once they are not responsible for their care throughout the day'.

The findings in Figure 12 are also consistent with the finding reported in the introduction to this paper that boys are much more likely to show developmental vulnerability on the AEDI: 30.2 per cent (vs 16.8 per cent) are vulnerable on one or more domains, and 16.2 per cent (vs 7.4 per cent) are vulnerable on two or more domains. However, what we have demonstrated in this paper is that this difference remains regardless of whether preschool or a range of other risk factors are controlled for. What this means is that regardless of whether boys or girls participated in preschool or LDC and regardless of their early childhood and familial circumstances, the average performance gap between them remains. This raises questions about whether preschool and LDC educators are less able to meet the developmental needs of boys than girls.

5.2 Risk factors across other special needs groups

Results presented in Section 4 of this paper highlight the major role that risk factors play in predicting subsequent developmental vulnerability and delay. Indeed, controlling for these risk factors ended up explaining much of the difference between those who did and did not attend preschool. However, one of the points that has not been considered until now is the strong relationship between the risk factors themselves. Specifically, many of the children with a particular type of risk factor are more likely to report other forms of risk factors. This relationship is demonstrated in Figure 13, which gives the number of additional risk factors for a range of other special needs groups.

Figure 13 Number of additional risk factors related to Early Childhood Education and child outcomes, Baby cohort, Wave 3

Figure 13a Low income

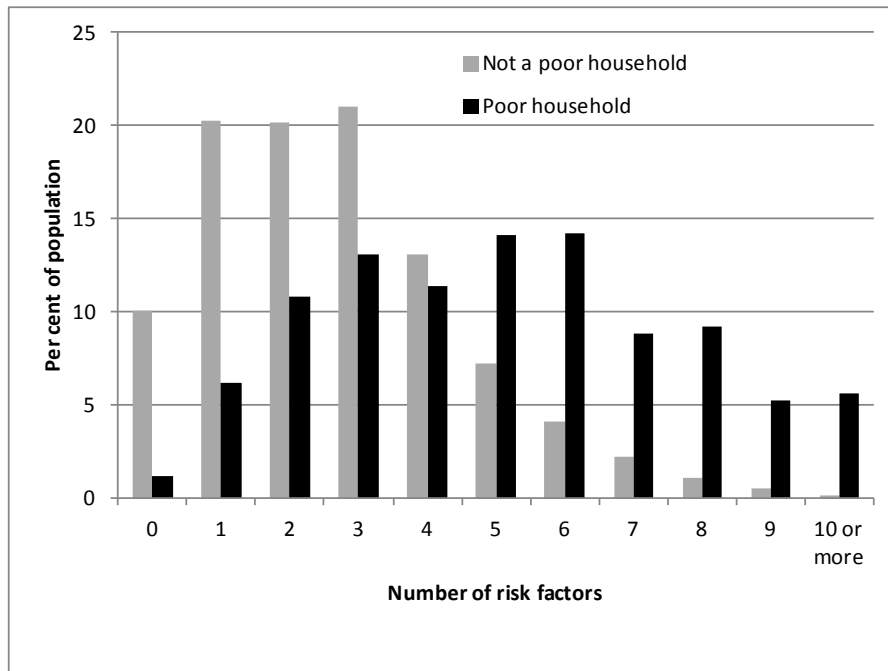


Figure 13b Indigenous

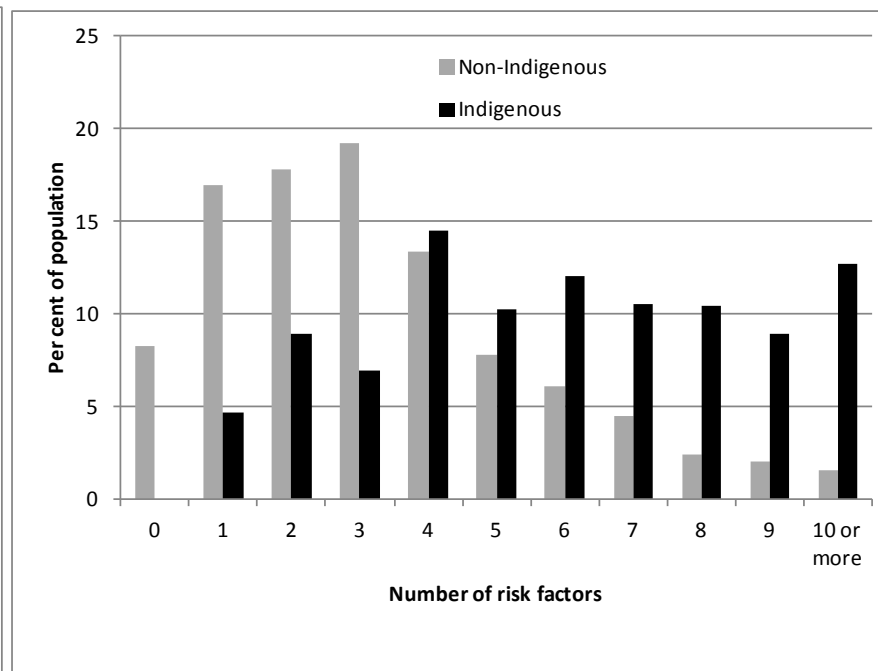


Figure 13c LBOTE

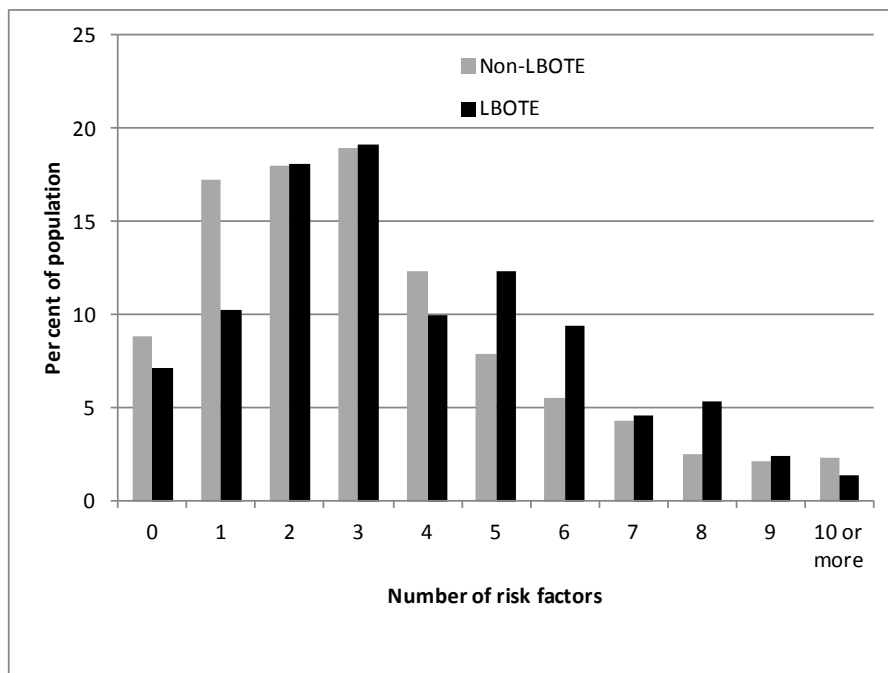


Figure 13d Accessibility

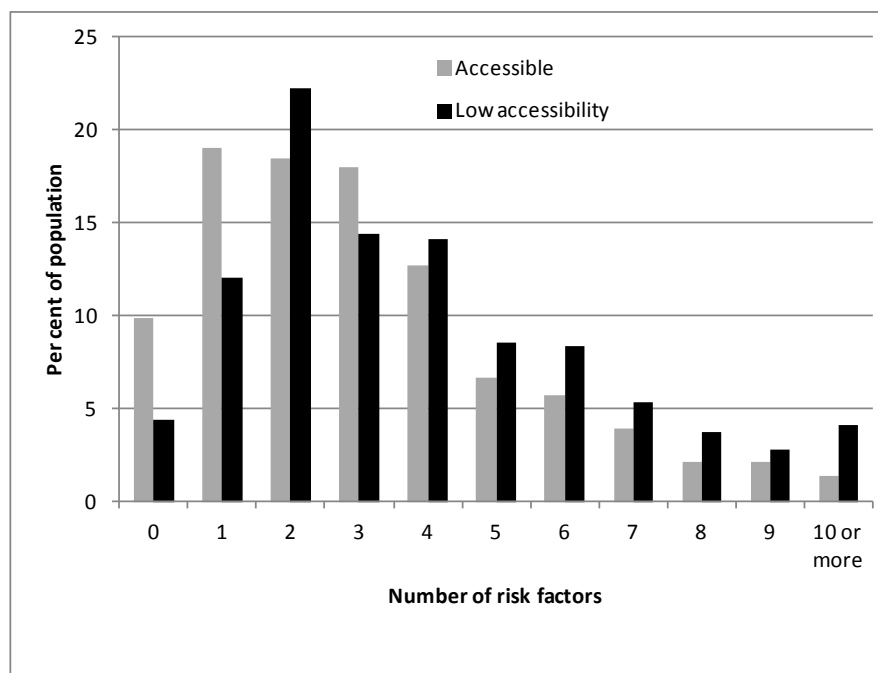


Figure 13e Area disadvantage

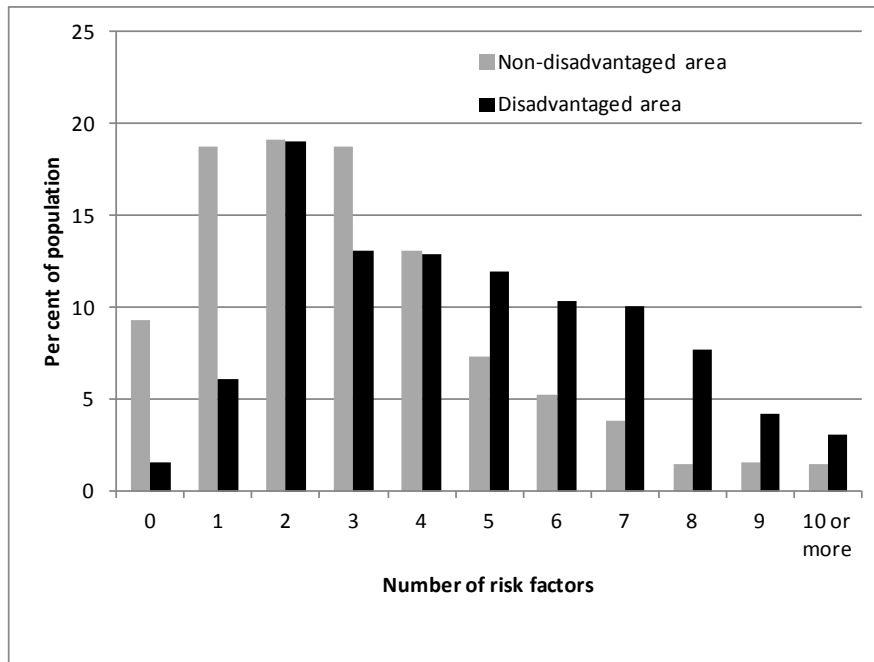


Figure 13f Low parental employment

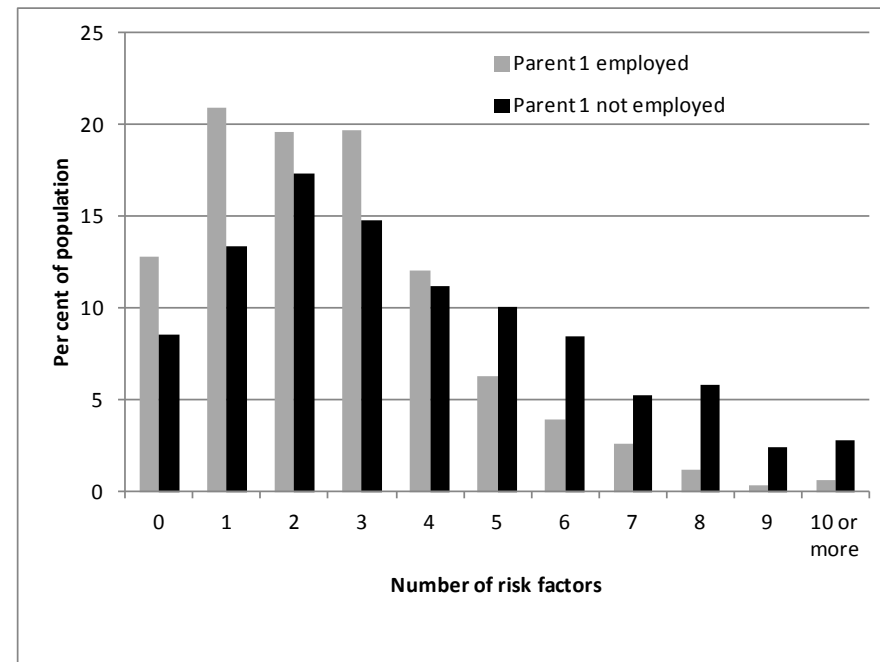


Figure 13g Low parental education

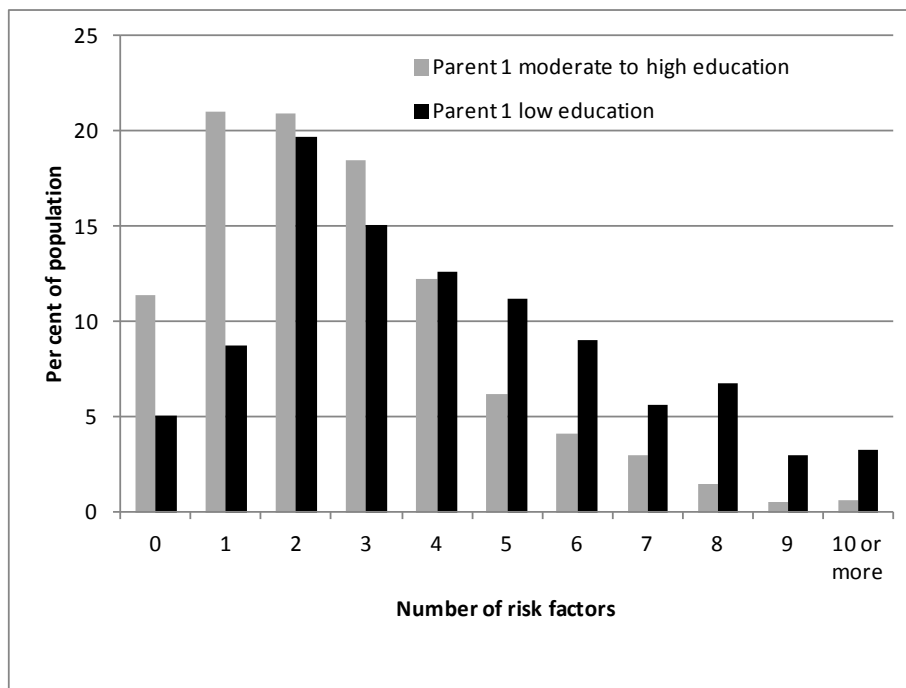
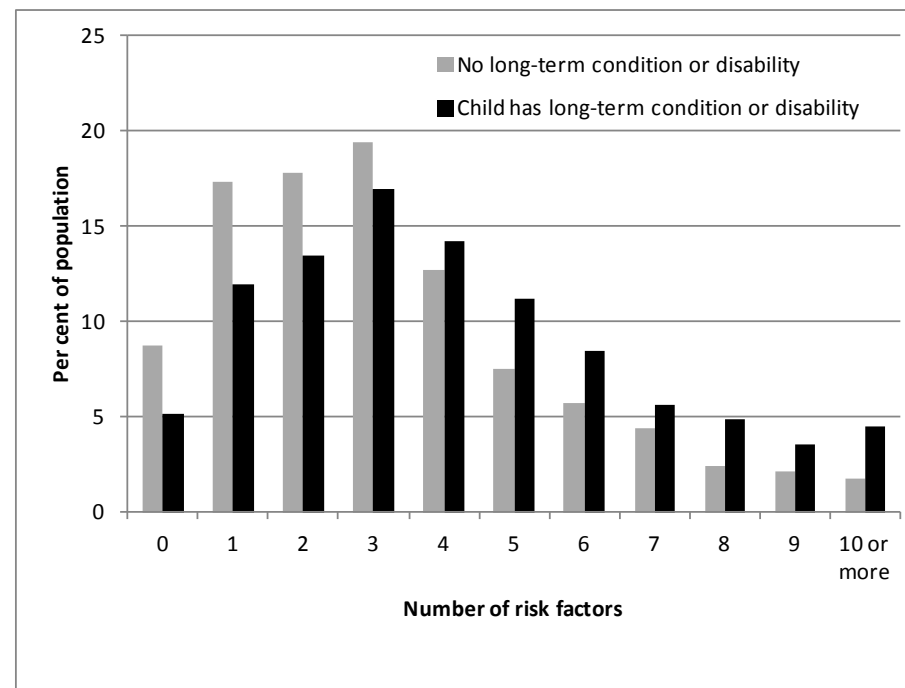


Figure 13h Long-term condition or disability



Source: Customised calculations using Wave 3 of the LSAC

In the following table, we show in more detail the specific additional risk factors that are most common amongst males, as well as the eight special needs groups summarised in Figure 13. However, a set of simple means presented in the last two lines of the table highlights the additional risk burden faced by all of these groups. Specifically, the second-last line of the table gives the mean number of additional risk factors for those in the special needs group with the last line of the table giving the mean number of risk factors for the rest of the population. While all special needs groups have a higher number of risk factors than the rest of the population, the difference is greatest amongst those with low incomes, Indigenous children and those with a high level of neighbourhood disadvantage. These groups are likely to benefit particularly from additional support both in the years leading up to school and in the first few years of schooling to ensure the risk burden they face does not lead to worse outcomes throughout their life.

Table 8 Prevalence of other risk factors amongst special needs groups

Risk factors	Special needs groups								
	Male	Poverty	Indigenous child	Potential language difficulties	Low accessibility	Neighbourhood disadvantage	Low P1 employment	Low P1 education	Biomedical risk factors
Poverty	0.213	-	0.432	0.322	0.281	0.337	0.356	0.328	0.299
Housing instability	0.064	0.093	0.170	0.020	0.080	0.068	0.082	0.071	0.053
Housing stress	0.046	0.099	0.136	0.125	0.065	0.053	0.070	0.057	0.048
Competition for parenting time	0.184	0.287	0.377	0.197	0.214	0.236	0.242	0.235	0.294
Neighbourhood disadvantage	0.149	0.244	0.299	0.222	0.408	-	0.198	0.223	0.202
Low accessibility	0.201	0.265	0.516	0.055	-	0.532	0.217	0.276	0.195
Difficult temperament	0.079	0.085	0.008	0.031	0.057	0.057	0.082	0.080	0.216
Biomedical risk factors	0.122	0.135	0.175	0.047	0.093	0.126	0.124	0.109	-
Early childhood risk factors	0.240	0.334	0.357	0.213	0.243	0.313	0.284	0.389	0.298
High TV watching	0.089	0.177	0.177	0.147	0.125	0.138	0.127	0.143	0.137
Sole parent	0.126	0.329	0.354	0.089	0.138	0.173	0.164	0.192	0.177
Low P2 employment	0.055	0.169	0.176	0.103	0.060	0.072	0.076	0.081	0.088
Low P1 employment	0.385	0.632	0.543	0.449	0.407	0.485	-	0.503	0.485

High P1 employment	0.100	0.047	0.063	0.131	0.093	0.106	0.000	0.059	0.105
Teenage mother	0.031	0.059	0.114	0.017	0.047	0.057	0.052	0.057	0.031
Low P1 education	0.300	0.478	0.585	0.265	0.428	0.450	0.414	-	0.351
Potential language difficulties	0.110	0.163	0.064	-	0.030	0.155	0.128	0.092	0.052
Parental psychological distress	0.256	0.371	0.375	0.260	0.255	0.300	0.292	0.277	0.330
P1 or P2 poor health	0.139	0.223	0.306	0.143	0.156	0.180	0.170	0.152	0.224
Indigenous child	0.045	0.087	-	0.026	0.111	0.084	0.062	0.081	0.078
Poor parenting skills	0.187	0.217	0.191	0.247	0.198	0.216	0.212	0.187	0.232
Low reading	0.230	0.338	0.506	0.327	0.249	0.322	0.246	0.335	0.252
Parental conflict	0.123	0.126	0.075	0.178	0.098	0.122	0.109	0.109	0.109
Parental substance use	0.019	0.041	0.063	0.021	0.022	0.018	0.018	0.029	0.014
Parental instability	0.054	0.113	0.109	0.033	0.046	0.050	0.048	0.065	0.052
Number of observations	1,687	587	98	261	700	465	1,135	704	290
Mean additional risk factors	3.50	5.12	5.98	3.73	3.87	4.65	3.75	4.11	4.20
Mean risk factors for rest of population	3.32	2.68	3.25	2.27	3.06	3.03	2.60	2.68	3.23

Source: Customised calculations using Wave 3 of the LSAC

5.3 Child outcomes by specific risk factors

The analysis presented in the paper up until now has identified a few key findings—those with a higher risk factor burden are less likely to attend ECE; attendance at ECE is not positively associated with child outcomes once risk factor burden is controlled for; and boys, as well as a range of other special needs groups, have a higher risk factor burden than girls and the rest of the population. In the final set of analysis presented in the paper, we look at the joint relationship between the set of child outcomes introduced in Section 4 on the one hand, and gender, age, ECE participation and specific risk factors on the other. We do this through a modelling approach with five dependent variables estimated separately and a full set of explanatory variables. Results are once again presented as marginal effects.

Table 9 Child outcomes by sex, age and specific risk factors, Wave 4

Explanatory variables	Low achievement	Low maths	Low literacy	Poor SDQ ranking	Poor school adjustment
Study child is male	0.034***	0.045***	0.053***	0.023***	0.156***
Age of study child (months)	-0.001	-0.007***	-0.004***	-0.001	0.000
Attended 1 to 10 hours of preschool	0.000	0.008	0.003	0.008	-0.001
Attended 10 to 19 hours of preschool	0.004	0.001	0.008	0.012	0.013
Attended 20 or more hours of preschool	0.012	-0.025	0.001	0.030	0.063**
Attended 1 to 10 hours of LDC	-0.009	0.006	-0.001	0.000	0.009
Attended 10 to 19 hours of LDC	0.004	0.010	-0.003	0.019	0.035
Attended 20 or more hours of LDC	0.029*	0.031	0.022	0.028*	0.030
Poverty	0.020*	0.049***	0.020**	0.008	0.018
Housing instability	-0.024**	0.046**	-0.005	0.037**	0.009
Housing stress	0.021	0.025	-0.007	0.024	0.081**
Competition for parenting time	0.010	0.003	0.021**	-0.009	-0.003
Neighbourhood disadvantage	0.029**	0.006	0.007	0.019*	-0.018
Low accessibility	-0.011	0.008	-0.005	0.015*	0.023
Difficult temperament	0.037**	0.015	0.021	0.182***	0.015
Biomedical risk factors	0.065***	0.048***	0.040***	0.042***	-0.008
Early childhood risk factors	0.004	0.024**	0.009	0.020**	-0.016

High TV watching	0.020	0.001	0.005	0.029**	0.008
Sole parent	-0.011	-0.018	-0.010	0.021	0.127***
Low P2 employment	-0.003	-0.020	0.001	0.026	0.025
Low P1 employment	0.006	0.010	0.009	0.008	-0.020*
High P1 employment	0.033**	0.030*	0.021	-0.009	-0.005
Teenage mother	0.070**	0.028	0.017	0.093**	-0.063
Low P1 education	0.048***	0.018	0.025***	0.021**	0.011
Potential language difficulties	0.007	-0.015	0.008	0.010	-0.049***
Parental psychological distress	-0.002	0.002	-0.009	0.049***	-0.020
P1 or P2 poor health	0.016	0.007	0.007	0.020*	-0.012
Indigenous child	0.037*	-0.017	0.024	0.013	0.018
Poor parenting skills	0.018**	0.010	0.003	0.050***	0.029*
Low reading	0.014	0.043***	0.028***	0.009	0.016
Parental conflict	-0.001	-0.010	-0.006	0.026**	0.035**
Parental substance use	-0.004	-0.015	-0.003	-0.022	-0.003
Parental instability	0.053**	-0.024	0.055**	-0.005	-0.042
Probability of the base case	0.041	0.062	0.039	0.050	0.110
Pseudo R-squared	0.0937	0.0650	0.0791	0.1202	0.0616
Number of observations	2,109	2,077	2,112	2,575	2,563

Source: Customised calculations using Wave 3 and Wave 4 of the LSAC

Two of the main points from Table 9 reinforce findings identified earlier in the paper. Specifically, boys were found to have a higher probability of all of the negative child outcomes and ECE was not found to reduce the probability of any of the outcomes once risk factors were controlled for. However, there were two further general points of interest from Table 9. Firstly, there were only two instances where the risk factors were associated with a lower probability of the negative child outcomes (at the 5 per cent level of significance or above): housing instability (for low school achievement), and potential language difficulties (for self-reported poor school adjustment). This highlights the fact that individual risk factors do not guarantee poor outcomes, but increase the likelihood of vulnerability and poor outcomes, particularly when compounded with other risk factors. Related to this, there were only four risk factors that were not significantly associated with a higher probability of at least one negative child development outcome compared to the base case.

The final point to note from Table 9 is that the risk factors tended to have a different association with the five outcome variables—if not in direction, then at least in terms of size and significance. Apart from boys, there were only three risk factors that had a significant positive association with three or more of the poor child outcome categories: poverty, biomedical risk factors, and low parental education. Because of this consistency, these three variables seem prime candidates for particular attention from governments and other service providers. However, the main point is that each development outcome should ideally be considered separately with its own unique correlates and determinants.

6 SUMMARY AND CONCLUSIONS

The aim of this paper is to provide an up-to-date analysis of the three-way relationship between developmental risk exposure, participation in ECE, and early childhood outcomes. For many years, this would not have been possible as Australia lacked the good-quality longitudinal datasets that other countries like the United States and the United Kingdom had available. With the maturation of the Longitudinal Study of Australian Children (LSAC), also known as *Growing Up in Australia*, it is now possible to look not just at the factors that are associated with child outcomes, but also at what predicts them. This study focuses on the first cohort of the LSAC and identifies a set of risk factors for the children in Wave 3 of the survey in 2008 (when they were aged four to five years), compares these risk factors to their ECE participation at the time, and then compares both risk factors and ECE participation to outcomes in Wave 4 when the children are aged six to seven years and commenced full-time schooling. In this final section of the paper, we provide a summary of the main findings from the paper, talk about some limitations and future work, and then provide some policy and research recommendations.

6.1 Summary of the relationship between risk factors and early childhood education

Much of the research discussed in the introductory section of this paper suggested those children who are likely to benefit most from high-quality ECE are those with the greatest number of risk factors that would potentially lead to later development vulnerability, delays, and poor outcomes. An ECE system that reflects this would ideally have a higher level of ECE participation amongst those who are most vulnerable. Results presented in this paper showed this was not the case.

Focusing on preschool education, which, at the time the survey was undertaken, was likely to have the greatest level of quality in terms of the learning and development environment provided, there was an inverse relationship between risk factor burden and participation. Although there is variation across the distribution, it is instructive to note that 66.3 per cent of the weighted sample with six risk factors or less participated in preschool education compared to 60.6 per cent of those with seven risk factors or more.

Those specific risk factors that were associated with a lower level of participation (after holding all else constant) were: housing instability, sole parent family, P2 in a couple family not employed, low P1 education, potential language difficulties, Indigenous child, and child seldom read to by parents. Rather than preschool being a force for social integration, it has the potential to exacerbate the social gradient in school readiness and subsequent child development outcomes if the most vulnerable are the least likely to access it. There was, however, one encouraging result from the analysis: after controlling for other factors, those living in a disadvantaged neighbourhood were more likely to be participating in preschool compared to those in other neighbourhoods. Given this group was found to have a lower level of participation in LDC, this may represent a lack of other care options. However, the result nonetheless shows preschool education may be reducing to a certain extent the geographic determinants of developmental vulnerability.

6.2 Summary of the relationship between early childhood education and later child outcomes

A simple comparison of child outcomes in the first few years of full-time schooling and previous participation in preschool showed those who participated in preschool had a lower probability of being rated by their teachers as doing poorly in school; having low maths or literacy levels; and being rated by their carer as having poor social and emotional development based on the Strengths and Difficulties Questionnaire (SDQ). This is the limit of what a cross-sectional survey would have been able to show. However, what we show in this paper is that when the number of risk factors present at the time of preschool participation is controlled for, those relationships for the most part disappear. Furthermore, there is also some evidence that those who participated in a large number of hours in LDC have worse outcomes than those who did not participate at all, all else being equal.

What these results suggest is that the accumulation of negative risk factors, or the risk burden, that children bring to preschool and full-time schooling is the main driver of their early school outcomes. Preschool and LDC, as they were structured in 2008, were not able to mitigate the effects of these predictors and may even have widened social and economic variation in outcomes. Most of the benefits of ECE that have been demonstrated in randomised controlled trials (that by definition hold the characteristics of the child constant) have come from very high-quality ECE. We have not looked at the variation in the quality of ECE in this paper, but it would appear that at the time the baby cohort of the LSAC was being surveyed in Wave 3, the overall quality of services was not sufficient to meet the aim of improving later child outcomes.

6.3 Specific risk factors associated with child outcomes

In our analysis, we found that boys had a higher probability than girls on all of the negative child outcomes and that neither ECE nor controlling for risk factors reduced this difference. Another major finding was that specific risk factors tended to have a different association with the five outcome variables—if not in direction, then at least in terms of size and significance. Apart from being male, there were only three risk factors that had a significant positive association with three or more of the poor child outcome categories—poverty, biomedical risk factors, and low primary carer education.

Despite these inconsistent relationships, there were a number of instances where specific risk factors had a large predictive association with negative outcomes on a particular development outcome measure. Teenage motherhood was associated with low school achievement (as rated by the teacher), whereas a poor reading environment and housing instability was associated with low levels of numeracy as assessed at age six to seven years. A low reading environment at home was also associated with low literacy skills, as was parental instability. There were a greater range of predictors of social and emotional development (as measured by the SDQ) including teenage motherhood, parental psychological distress, and poor self-assessed parenting skills.

A low rating on the final child outcome considered—self-assessed school adjustment—was not found in the descriptive data analysis to be strongly correlated with the other outcome variables. It is not surprising, therefore, that the predictors of this variable were also different. Importantly, children from a language background other than English were found to have a lower probability of having negative school adjustment. However, single parenthood and housing instability had a positive association.

6.4 Why not resilience or protection factors

This analysis has focused primarily on identifying risk burden and its relationship to participation in ECE and to child development outcomes at the age of five years. By definition, resilience factors assist children to adapt positively to the experience of environmental adversity. Hertzman (2010) describes the role of early childhood development (ECD) programs, which include high-quality ECE programs, in promoting resilience and healthy development:

ECD programs promote the quality of human capital; that is individuals' competencies and skills for participating in society and the workforce (Knudsen et al 2006, cited in Hertzman 2010a). The competencies and skills fostered through ECD programs are not limited to cognitive gains but also include physical, social and emotional gains—all of which are determinants of health over the life course (Carneiro & Heckman 2003).

Although resilience factors are not merely the converse of risk factors, there seems to be some advantage in treating risk and resilience as opposite ends of the spectrum in relation to a number of environmental conditions (for example, poor- and good-quality parenting, very short or no breastfeeding, high versus low educational home environment).

To make the best estimate of the impact of cumulative risk burden on outcomes for children, the countervailing influence of accumulated resilience/protection factors should also be taken into account. In the absence of a suitable model, including settled definitions of resilience (Luther, Cicchetti & Becker 2000) to enable that, this analysis is confined to the influence of risk burden, and notes that such an addition would be fruitful ground for further investigation.

6.5 Recommendations for future research

There has been a great deal of research in Australia and abroad on the factors that predict or are associated with developmental success or vulnerability. Much of this research has been cited here. In this paper, we have attempted to use a 'risk factor' approach in our analysis to gain additional insights into the conditions that influence both ECE participation and early child development outcomes. However, there is important additional research that could be undertaken to broaden our understanding.

One potentially rewarding avenue of additional work would be to focus on particular sub-groups, including but not limited to those identified in this paper as having 'special needs.' We included some focused analysis on Indigenous children. However, it needs to be recognised that the Indigenous sample in the LSAC is small and not necessarily representative of all Indigenous children. It is important, therefore, to undertake analysis on Indigenous-specific data collections like the Longitudinal Study of Indigenous Children (LSIC), also known as *Footprints in Time*. While the LSIC does not have a clear non-Indigenous comparator, it does still enable a detailed analysis of Indigenous-specific factors that predict or inhibit healthy child development.

Another policy-relevant sub-group is those children who themselves have a long-term condition or disability, as well as those children who have a carer who does. At the time of writing this paper, there was a great deal of debate around the forthcoming National Disability Insurance Scheme (NDIS), also known as *Disability Care Australia*. The NDIS represents a significant increase in funds going to those with certain types of disabilities, as well as greater control by recipients over how those funds are to be spent. As part of the data collection and evaluation of this new program, a particular focus should be on the impact on the developmental vulnerability and later learning and development outcomes for children touched by disability.

We have already talked about the potential usefulness of further research that focuses on positive aspects of development and resilience factors. However, an additional set of analysis could investigate the characteristics of the ECE that predict improved developmental outcomes. There is information on the LSAC regarding how many children are usually present in the same class as the child as well how many adults there usually are. In addition there is a range of self-report data on the carer's view of the quality of the service provided. While there is a strong potential for biases in these self reports (parents who are more engaged with the preschool may identify a greater number of issues), by combining information provided by the teacher it might be possible to investigate variation in certain (but not all) quality measures across risk factors, as well as the association with later outcomes.

In addition to analysing the characteristics of the ECE experienced by different children (including by risk factor), another further avenue of research is to look at participation in formal care and other forms of ECE across the ages of birth to five years. It may be, for example, that children who are attending a long day care centre when aged four to five years were also more likely to attend one when they were aged birth to three years. This, however, may be the time at which potential negative consequences of long hours or poor-quality care develop, rather than in the year or two preceding full-time schooling.

The above suggestions focus on analysis of existing datasets. However, one of the major policy changes around ECE over the last few years is the introduction and adoption of the National Quality Framework (NQF). One of the motivations for this policy change is ensuring more children have access to ECE and that the quality of services is sufficiently high to confer significant benefit on participating children. The analysis presented in this paper suggests that at the time the baby cohort in the LSAC were attending ECE (around 2007-08), these benefits were not universally accruing. Notwithstanding the fiscal pressure on all levels of government in Australia, the benefits of recruiting a new cohort of children into the LSAC and testing the comparative learning and development outcomes for participants and non-participants would shed considerable light on the impact of the NQF.

Even with a new cohort in the LSAC, however, it would not be possible to test definitively whether the NQF had any effect whatsoever: the policy was not set up in such a way as to enable its impact to be evaluated. However, it would be of great interest to be able to compare the findings of a post-NQF study with those presented here. Moreover, there is still the potential to evaluate the success of specific interventions designed to increase the ECE participation of vulnerable children or to improve the outcomes for children who do participate. Ideally this should involve a measure of randomised control, in order to minimise the selection issues that plague education research and constrain inferences about causality.

In their review of early learning programs for Indigenous children, Harrison et al. 2012 state: 'There have been no rigorous trials or evaluations of early childhood programs in Australia, particularly programs for Indigenous and at-risk children.'(Harrison et al 2012) This is a sad indictment of the ECE research and policy community in Australia.

A recent article by Dr Ben Goldacre (2013) outlines the potential for the insights from randomised trials in medicine to be incorporated into education research. He argues that 'by collecting better evidence about what works best, and establishing a culture where this evidence is used as a matter of routine, we can improve outcomes for children, and increase professional independence.' In the same article, Dr Goldacre canvasses the limits to such trials (including applying insights from one trial to another country or context) and the role of qualitative research in understanding the details of why and how a program might be achieving its aims. However, he makes a convincing case for much greater use of studies with treatment and control of schools or students to help teachers and school administrators effectively test what works well and what does not work so well in education

provision. He also, it should be noted, makes a strong case for academics and policy makers to work more closely with education providers to answer the questions they are actually interested in and would support their work.

6.6 Recommendations for policy and practice

Abundant research indicates that the future educational achievement, skill levels, health and wellbeing of a country depend on meeting the early childhood needs of each new cohort of children. All children, regardless of genetic endowment, become less and less likely to reach their potential the greater their accumulated burden of identified risk factors. Although protective factors, such as nurturing, responsive parenting, strong attachment to a parent or other carer, or the experience of high-quality ECE can mitigate the negative effects of risk burden, research has not yet identified ways to reverse the effects of exposing young children to high levels of stress during their critical early years.

Below are some proposals to improve outcomes for Australian children in their early years based on the findings in this paper.

1. Take a public health approach to the reduction of risk

Just as the biggest reductions in mortality and morbidity have been achieved through public health measures such as sanitation and immunisation, so the biggest gains in reduction of developmental vulnerability are likely to be obtained through reducing the prevalence of major risk factors.

In an advanced country such as Australia it should be possible to ensure parents are accorded the social and economic conditions necessary to enable them to meet the needs of their children, including those born with disabilities and other specific needs. Such conditions include: access to a livelihood and to stable housing; neighbourhoods that incorporate a mixture of socio-demographic characteristics rather than concentrating disadvantage; widespread understanding of the factors that promote healthy child development and learning, and of those that put it at risk; and support for parents who may struggle with physical or mental illness or the consequences of their own childhood abuse or neglect.

2. Promote protection factors

While negative risk factors continue in the population, public policy should enable and evaluate programs that promote protection factors. This includes: enabling mothers to offer their children the benefits of long breastfeeding (eight months plus); enabling parents to earn a livelihood in jobs that are suitable for their circumstances, providing access to evidence-based parenting programs; providing ready access to family planning; and enabling and encouraging all parents to read regularly to their children.

Given the importance of effective parenting techniques in promoting attachment, self-regulation and executive control, and in providing a favourable environment for establishing the foundations for literacy and numeracy, consideration could be given to providing parents with a payment on completion of an accredited parenting program, or making family payments contingent on completion of such a program. At the very least, such initiatives should be trialled for their effectiveness.

Policy to increase school completion amongst girls from disadvantaged families and encouraging them to postpone pregnancy until after school completion might also provide a stronger basis for parenting of their children.

3. Use knowledge of the prevalence of risk factors in special needs groups to engage with families

The table of risk factor prevalence amongst special needs groups can be used as a basis for finding opportunities to engage with families and encourage them to offer their children the benefits of ECE.

For example, for poor families:

- > Clinics providing Health and nutrition programs for expectant mothers
- > GPs providing health care to parents and young children, particularly those using a health care card
- > Mental health services
- > Supported housing and accommodation services
- > Family Court services dealing with very young children
- > Child protection services (already in use)—could be used to identify children who may be facing a high risk burden even where there is no substantiated charge of neglect or abuse
- > Foster family support services
- > Centrelink
- > Employment services
- > Welfare organisations, such as Smith Family, Red Cross;
- > Poor families living in remote areas or on urban fringe areas with poor public transport may need free transport—of the sort provided for attendance at school—to enable participation in ECE.

Translation services may be required to engage with some parents of special needs children and bilingual services may be needed to assure some parents that a service is culturally appropriate for their child.

Language background other than English families (the risk factor is called ‘potential language difficulties’ in this study) have a high prevalence of many of the same risk factors as poor families but show a higher prevalence of family conflict. In addition to the suggestions above, they might be engaged through:

- > Multi-cultural or ethnic organisations, or
- > Family counselling or domestic violence services (including the police).

Indigenous families have high incidence of low parental reading to children, poverty, unemployment, living in disadvantaged and less accessible locations, low education of the primary carer, low birth weight/low breastfeeding, parental psychological distress, poor parental health, poor parenting skills, and higher incidence of factors such as large families, housing instability, parental instability. They need to be engaged in those surroundings where they feel most comfortable—in many cases this will be in services that are Indigenous controlled and staffed. Provision of transport may need to be considered in less-accessible areas. Trusted and competent health, mental health, and family support services can be used to engage families—but in many areas there is a shortage of such services.

Schools as well as health clinics can be used as engagement points for young mothers to be. Hospital outpatients can be used as contact points for families seeking help for young children with infections and childhood illnesses.

Families with children who have disabilities have a very high prevalence of poverty, neighbourhood disadvantage, parental distress, mothers who are not in employment, low reading, and poor parenting skills.

GPs, hospitals, and specialists, as well as mental health services could provide contact points for engagement with parents, but ECE services need to have the expertise, programs and staff ratios to offer places to children with disabilities.

4. Develop stronger ECE programs and parental support for boys

Current research suggests boys are more sensitive to adversity and this analysis indicates that ECE programs in place in 2008 were not sufficient to meet their needs. Parents and educators may have more difficulty in undertaking basic educational activities such as reading to boys and parent support programs may need to focus on the special needs of boys. There is clearly a need to undertake further research on the reasons for the increased vulnerability of boys and to examine ways in which it might be addressed in the home and ECE settings. For example, trials of programs focusing on the development of executive control (through techniques such as energetic exercise and meditation (Diamond & Lee 2011)) may help reduce developmental vulnerability in boys.

5. Implement social and economic development programs in the most disadvantaged communities

The concentration of social and economic disadvantage in particular communities compounds risk factors in individuals and families. The development of economic enterprises and social programs, such as mixed housing, better public transport and better local facilities in those areas could attract a greater mix of families and improve community amenity. Access to good jobs and housing provides an essential foundation for parents to be able to meet the needs of their children.

Policy to increase school completion amongst girls from disadvantaged families and encouraging them to postpone pregnancy has the potential to reduce a major risk factor for such children.

Social and economic programs that work with Indigenous communities to empower them and generate social as well as economic capital are urgently needed to reduce the prevalence of risk factors.

This task is a large one and can only be undertaken through co-operation across all levels of government and all sectors of the community.

It is worth repeating Shonkoff's dictum (Shonkoff 2011) that it is as important to prevent damage to young brains as it is to stimulate young minds if we seek to optimise the development of human capital and minimise the negative educational, health, behavioural and economic consequences of ignoring or neglecting the needs of children during a critical phase of their development.

APPENDIX TABLES AND FIGURES

The following table gives the mean proportion of males who attended the two forms of ECE used in this study, as well as the means for each of the 25 risk factors. The second column of numbers for the two forms of ECE gives the relevant standard errors.

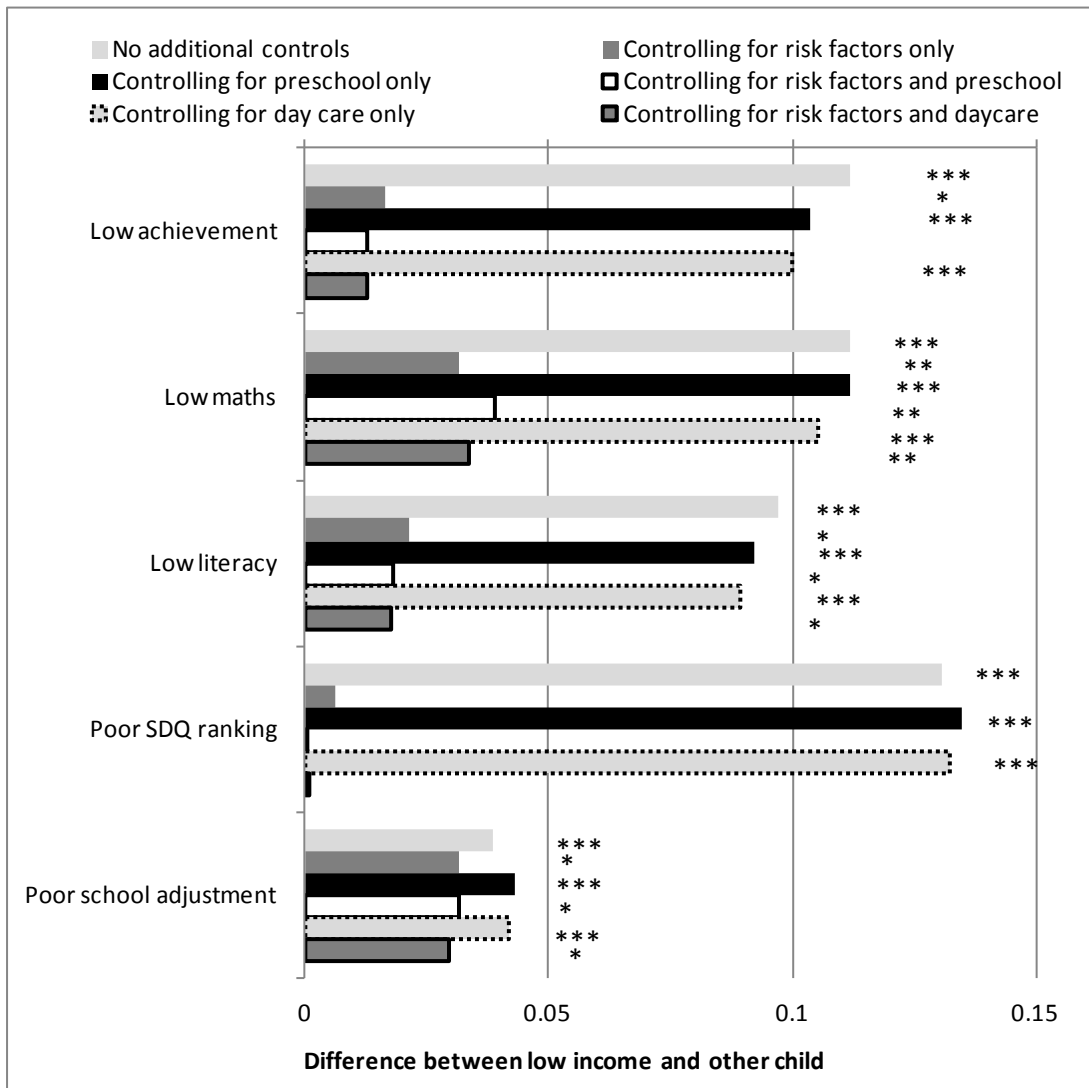
Table A1 Participation in Early Childhood Education for males and by risk factor, Baby cohort, Wave 3

Characteristic	Preschool		Day care	
	Mean	Standard error	Mean	Standard error
Study child is male	0.630	0.013	0.388	0.012
Poverty	0.581	0.022	0.339	0.021
Housing instability	0.496	0.041	0.429	0.040
Housing stress	0.488	0.053	0.301	0.050
Competition for parenting time	0.617	0.022	0.325	0.021
Neighbourhood disadvantage	0.666	0.024	0.287	0.022
Low accessibility	0.652	0.020	0.313	0.019
Difficult temperament	0.650	0.039	0.447	0.040
Biomedical risk factors	0.663	0.029	0.356	0.029
Early childhood risk factors	0.604	0.020	0.379	0.019
High TV watching	0.589	0.032	0.278	0.029
Sole parent	0.511	0.029	0.503	0.029
Low P2 employment	0.530	0.045	0.294	0.040
Low P1 employment	0.685	0.015	0.243	0.014
High P1 employment	0.479	0.029	0.573	0.029
Teenage mother	0.584	0.067	0.315	0.064
Low P1 education	0.611	0.019	0.351	0.018
Potential language difficulties	0.552	0.030	0.372	0.029
Parental psychological distress	0.614	0.019	0.383	0.019
P1 or P2 poor health	0.626	0.026	0.352	0.026
Indigenous child	0.437	0.050	0.384	0.049
Poor parenting skills	0.662	0.022	0.379	0.022
Low reading	0.537	0.021	0.405	0.020
Parental conflict	0.707	0.026	0.313	0.025
Parental substance use	0.668	0.074	0.303	0.073
Parental instability	0.493	0.046	0.531	0.046

Source: Customised calculations using Wave 3 of the LSAC

The figures below show additional interactions between ECE participation, risk burden and early child development outcomes.

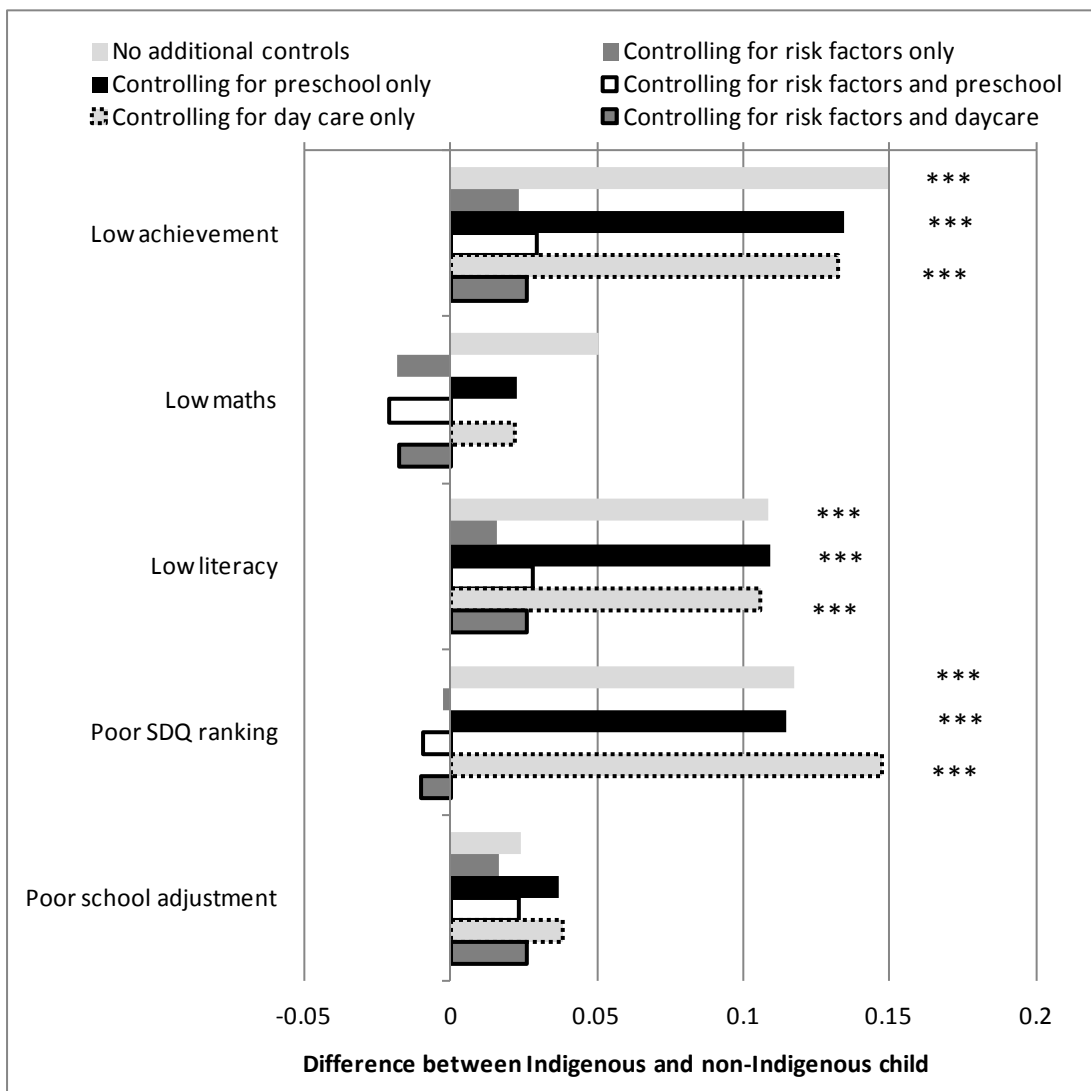
Figure A1 Predicted difference in reporting child outcome in Wave 4 by low income



Source: Customised calculations using Waves 3 and 4 of the LSAC

Figure A1 shows that children in the low income group were significantly more likely than their non-low income peers to receive a poor outcome on all measures, that participation in preschool or LDC did not reduce the extent of this difference and that significant additional vulnerability remained even after controlling for risk factor burden—at the 5 per cent level for maths and at the 10 per cent level for all other outcomes except SDQ.

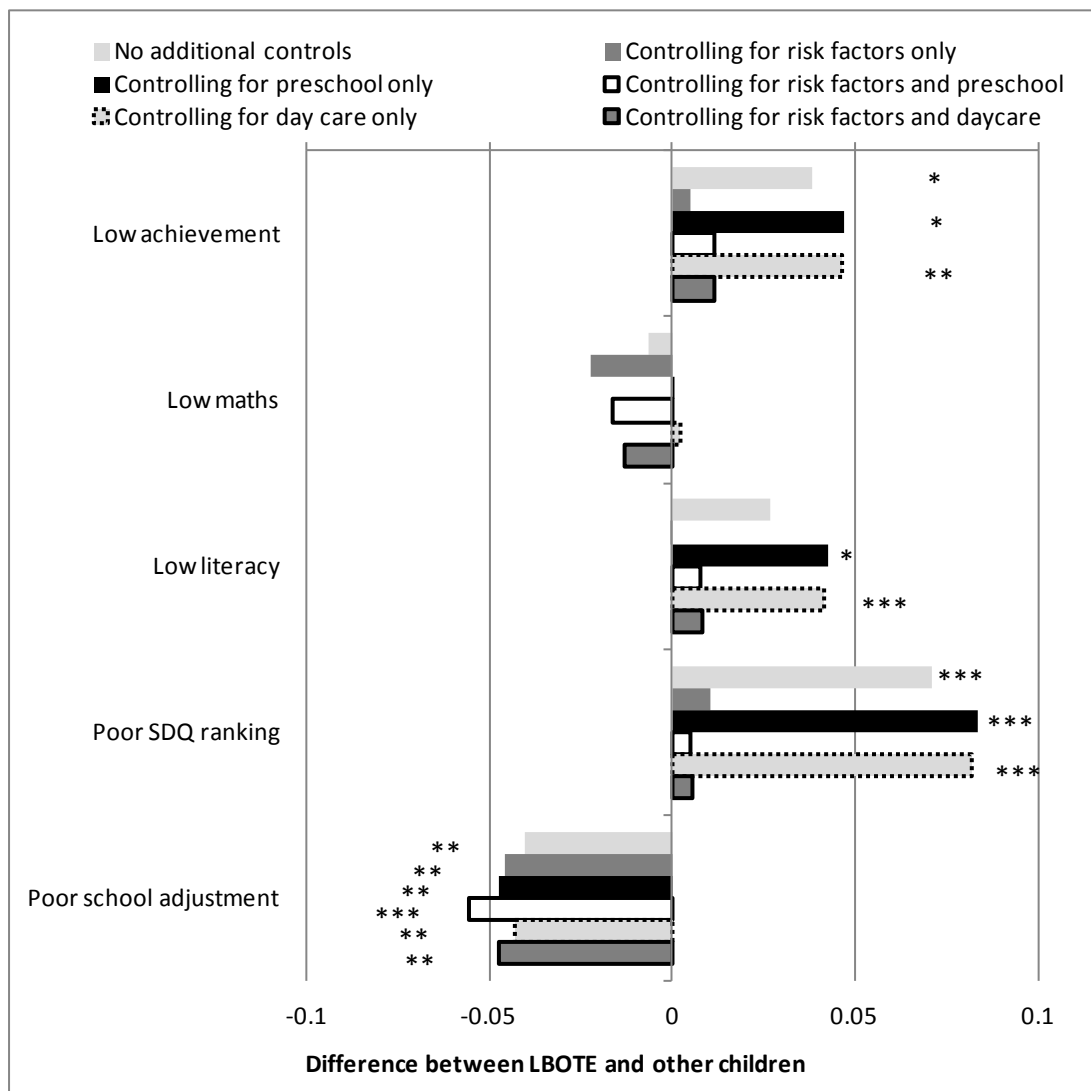
Figure A2 Predicted difference in reporting child outcome in Wave 4 by Indigenous status



Source: Customised calculations using Waves 3 and 4 of the LSAC

Figure A2 shows that, without controlling for other factors, Indigenous children are more likely than non-Indigenous children to be reported by their teachers to have low achievement and low literacy, as well as by their parents to have a poor SDQ ranking. Controlling for preschool or LDC attendance does not appear to influence this association. However, the association appears to disappear once other risk factors are controlled for.

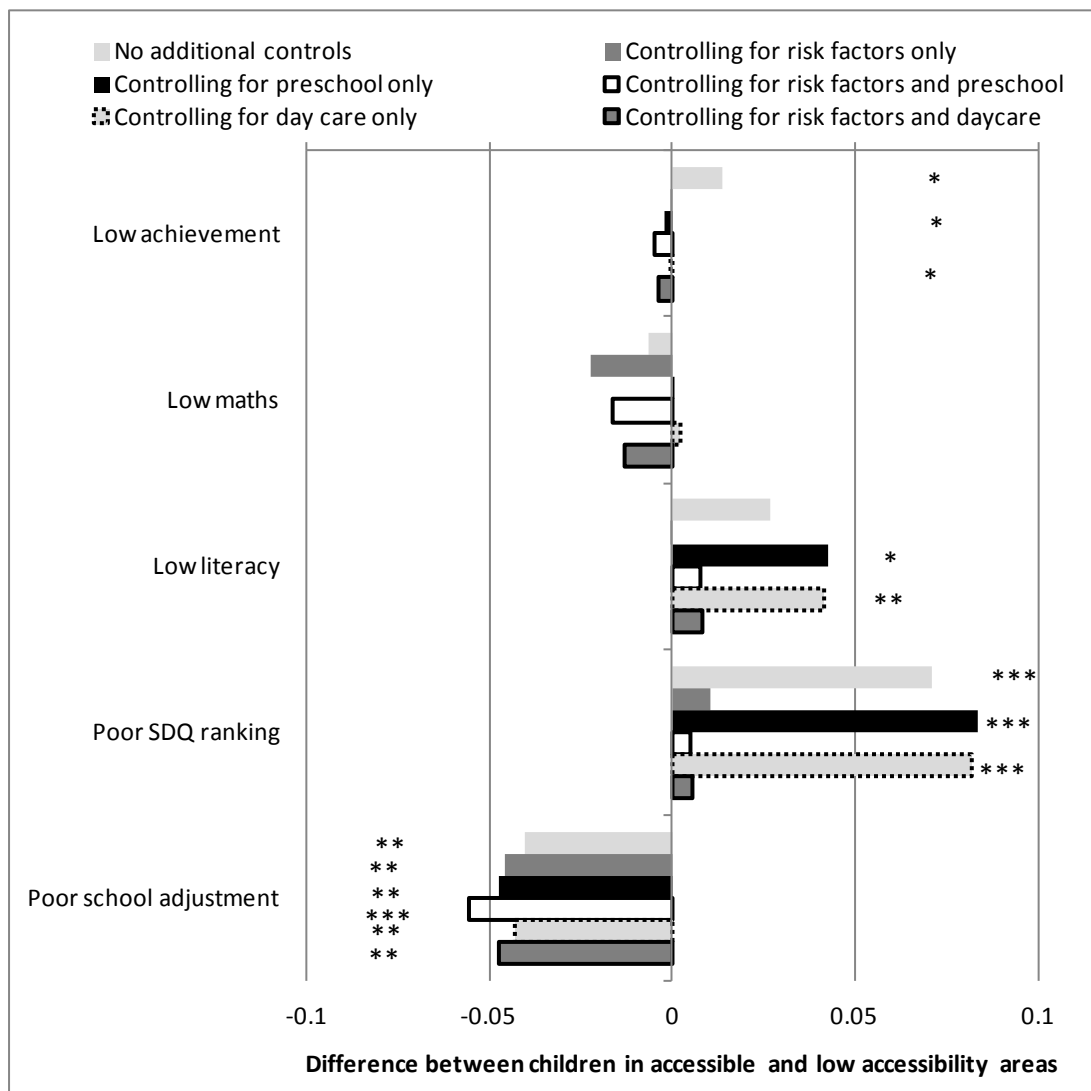
Figure A3 Predicted difference in reporting child outcome in Wave 4 by LBOTE



Source: Customised calculations using Waves 3 and 4 of the LSAC

Figure A3 shows the interaction between risk burden, participation in ECE and outcomes for language background other than English (LBOTE), and other children. Without controlling for risk or ECE participation, LBOTE children were significantly more likely (at the 1 per cent level) to receive a low rating on SDQ and a moderate (10 per cent level) increase in their likelihood of a low rating on overall achievement. Both differences remained after controlling for preschool participation. LBOTE children were significantly less likely (at the 5 per cent level) to rate themselves as poorly adjusted to school and this difference remained after controlling for ECE participation. However, after controlling for participation in LDC, LBOTE children were significantly more likely to obtain a low rating on all outcomes except self-rated school adjustment. This result raises questions about the quality of LDC attended by these children, and, together with the moderately increased probability of poor outcomes on overall achievement and literacy after controlling for preschool participation, the finding raises questions about the extent to which both forms of ECE catered to the learning needs of the LBOTE group. On the other hand, the strongly reduced probability of poor self-rated school adjustment became stronger after controlling for preschool participation.

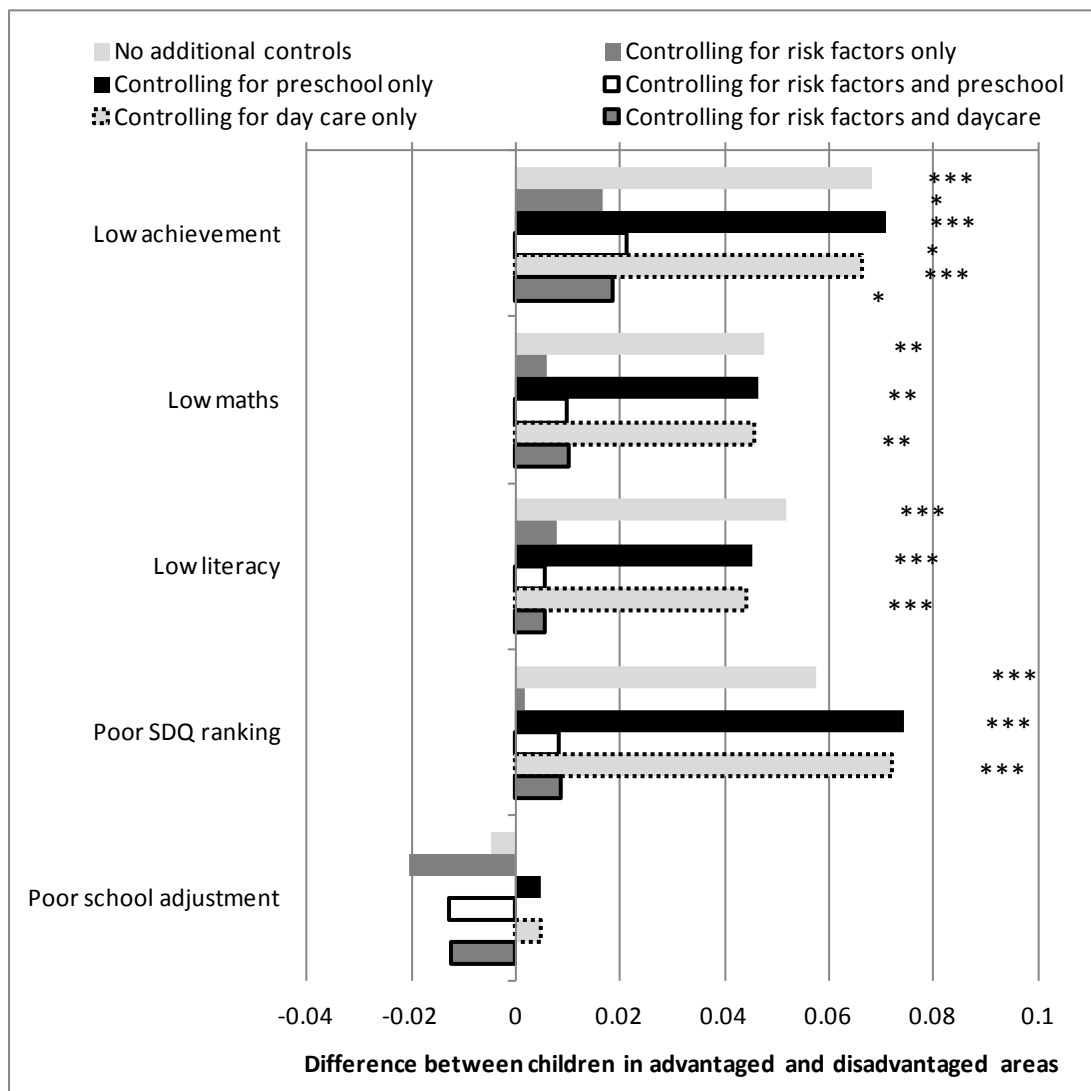
Figure A4 Predicted difference in reporting child outcome in Wave 4 by accessibility



Source: Customised calculations using Waves 3 and 4 of the LSAC

Figure A4 shows the interaction between risk burden, ECE participation, and outcomes for children in accessible and low-accessible areas. Strongly significant differences between the two groups were obtained on SDQ, with and without controls for ECE participation, but after controlling for risk burden this difference all but disappeared. Low-accessible-area children were significantly less likely than others to give themselves a poor school-adjustment rating, with or without controls for risk or ECE participation.

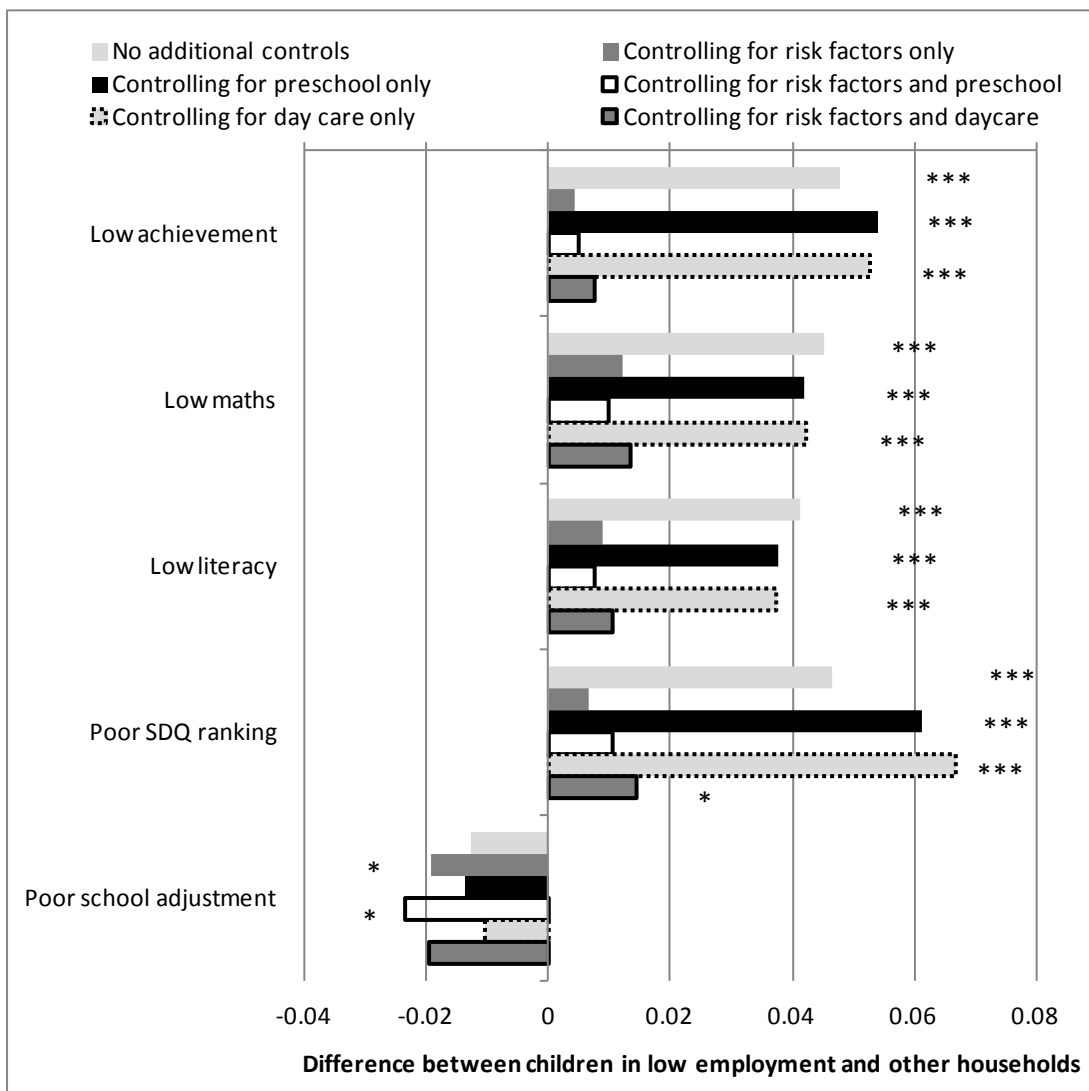
Figure A5 Predicted difference in reporting child outcome in Wave 4 by area disadvantage



Source: Customised calculations using Waves 3 and 4 of the LSAC

Figure A5 shows the interaction between risk burden, ECE participation, and outcomes for children living in disadvantaged areas and others. Without controlling for risk or ECE, children living in disadvantaged areas were significantly more likely to obtain a poor outcome on overall achievement, maths, and literacy, a difference that remained after controlling for preschool or LDC participation. A moderate difference (10 per cent level) in the chance of a low overall achievement rating remained after controlling for risk factors, but the other differences all but disappeared.

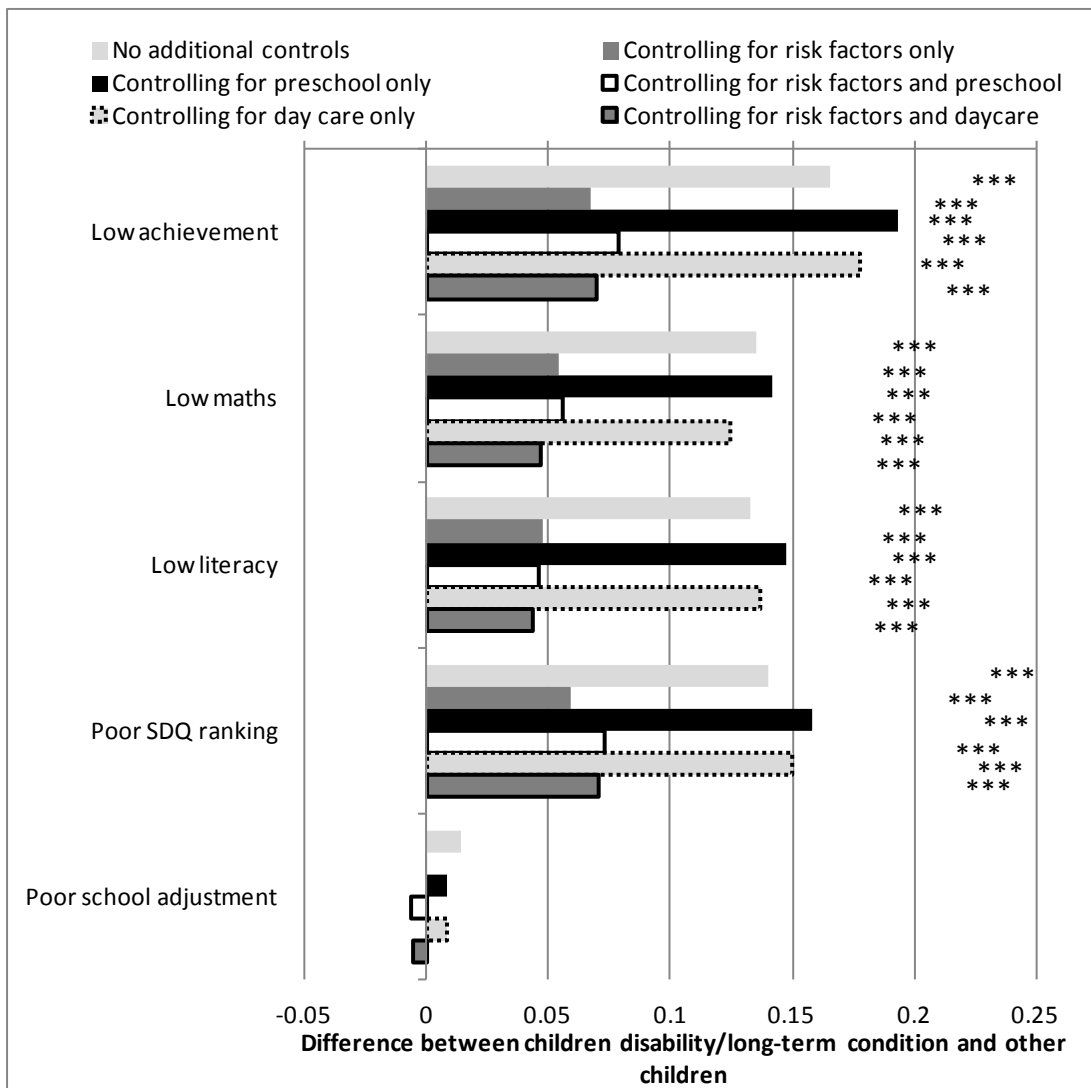
Figure A6 Predicted difference in reporting child outcome in Wave 4 by P1 employment



Source: Customised calculations using Waves 3 and 4 of the LSAC

Figure A7 shows the interaction between risk burden, ECE participation, and outcomes for children in households where the primary carer was and was not in employment respectively. Children in the former households were significantly more likely to receive a low rating on all outcome measures except self-rated school adjustment and these differences remained after controlling for ECE participation. They all but disappeared after controlling for risk burden, but a modest (10 per cent level) difference remained on SDQ after controlling for risk burden and preschool attendance.

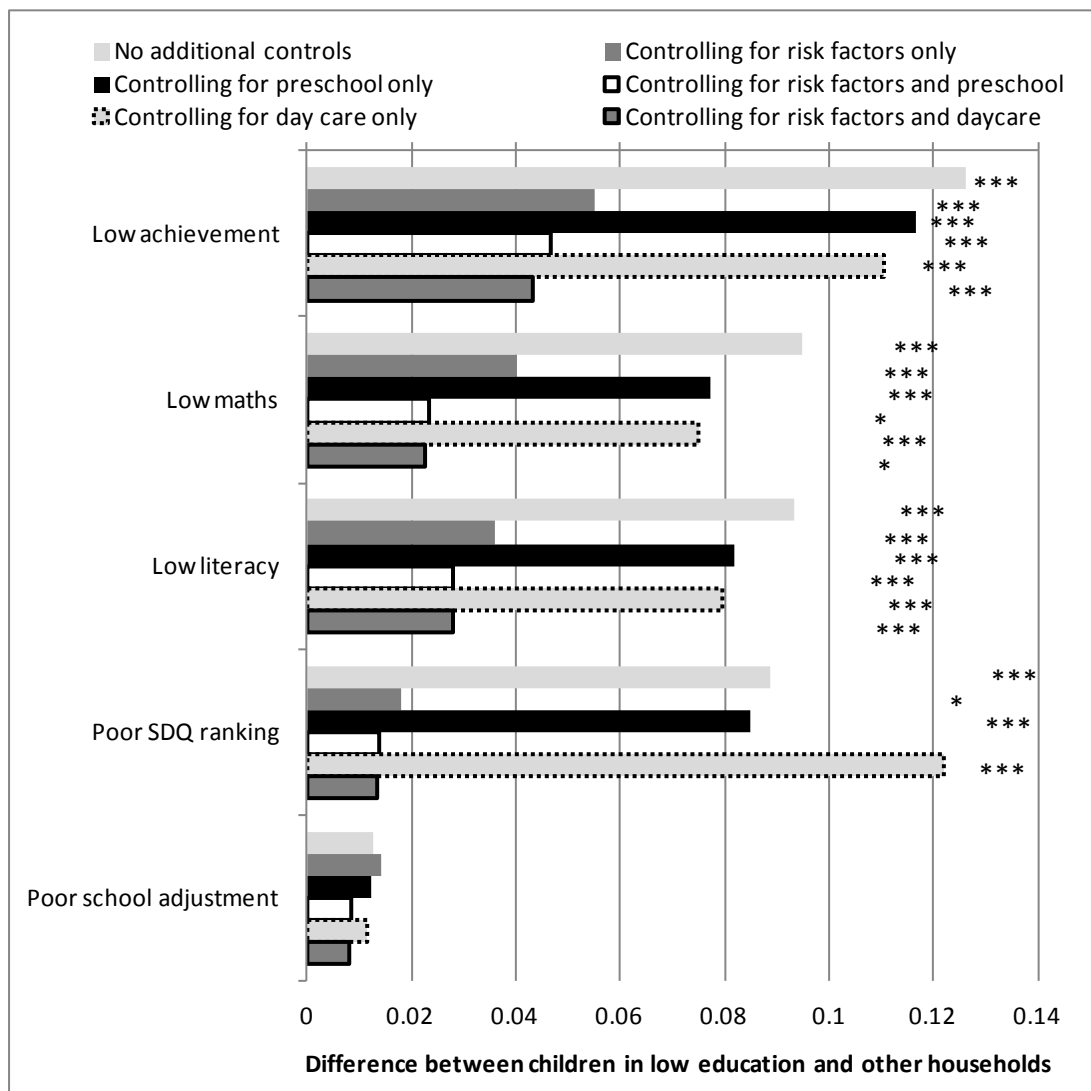
Figure A7 Predicted difference in reporting child outcome in Wave 4 by long-term condition or disability



Source: Customised calculations using Waves 3 and 4 of the LSAC

Figure A8 shows the interaction between risk burden, ECE participation, and outcomes for children with and without a disability respectively. Significant differences in the probability of a poor outcome on all measures except self-rated school adjustment were present with or without controls for risk burden and ECE participation.

Figure A8 Predicted difference in reporting child outcome in Wave 4 by P1 education



Source: Customised calculations using Waves 3 and 4 of the LSAC

Figure A8 shows the interaction between risk burden, ECE participation, and outcomes for children whose primary carer has a low level of education, and those children in other households. Without controls for any other factors, the children with a poorly educated primary carer were significantly more likely to obtain a poor outcome on all measures except self-rated poor school adjustment, and a significant difference remained after controlling for participation in either form of ECE alone. After controlling for risk factor burden, the significant differences remained on all measures except SDQ, where a moderate difference (10 per cent level) remained. However, after controlling for risk burden and preschool or LDC participation, the difference in maths was reduced to moderate level (10 per cent) and the differences in SDQ became not significant. This suggests that for this group of vulnerable children ECE participation did have a small effect of moderating vulnerability, but on its own it was not sufficient to outweigh the effects of risk burden. The strong residual difference in probability of obtaining a poor outcome after risk burden was controlled for this group suggests the presence of risk factors outside the scope of this study.

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