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Three-year-old Preschool Return on Investment Analysis

Royal Commission into Early Childhood Education and Care, Attorney-General's Department

August 2023

Deloitte Access Economics

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Glossary

Acronym	Full name
ABS	Australian Bureau of Statistics
AEDC	Australian Early Development Census
AERO	Australian Education Research Organisation
AIHW	Australian Institute of Health and Welfare
ANZSCO	Australian and New Zealand Standard Classification of Occupations
ATO	Australian Taxation Office
BCR	Benefit to cost ratio
CBA	Cost benefit analysis
CCS	Child Care Subsidy
CPC	Child-Parent Centre Education Program
DALY	Disability-adjusted life years
DfE	Department for Education
DTI	Department for Infrastructure and Transport
ECEC	Early childhood education and care
EPPE	Effective Provision of Preschool Education
ESL	English as a second language
GDP	Gross domestic product
IESP	Inclusive Education Support Program
IQ	Intelligence quotient
LAL	Language Arts and Literacy
LBOTE	Language background other than English
LDC	Long day care
LSAC	Longitudinal Study of Australian Children
MLOTE	Main language other than English
NAPLAN	National Assessment Program – Literacy and Numeracy
NCCD	Nationally Consistent Collection of Data
NESB	Non-English speaking background status
NPV	Net present value
NQS	National Quality Standard
NZSEI	New Zealand Socioeconomic Index
PISA	Programme for International Student Assessment
PPP	Perry Preschool Project
PRA	Preschool Reform Agreement
RCT	Randomised controlled trials
SA2	Statistical Area 2
SA3	Statistical Area 3
SD	Standard deviation
SEIFA	Socio-Economic Indexes for Areas

SES	Socioeconomic status
SOC	Social opportunity cost of capital
STP	Social rate of time preference
TN-VPK	Tennessee Voluntary Pre-kindergarten Program
UK	United Kingdom
US	United States
VSLY	Value of statistical life years

Executive summary

As one of its terms of reference, the Royal Commission into Early Childhood Education and Care has been tasked with understanding how universal quality preschool programs for three- and four-year-old children can be delivered in South Australia, including addressing considerations of accessibility, affordability, quality and how to achieve universality for both age cohorts.

To support this inquiry, Deloitte Access Economics has been engaged by the Royal Commission, with support from the Department of Treasury and Finance and the Department for Education, to conduct a return on investment analysis of a universal three-year-old preschool policy.

This work extends previous modelling undertaken by Deloitte Access Economics, as reported in the Royal Commission's Interim Report in April 2023, which estimated the upfront and recurrent costs, and the workforce requirements, of universal three-year-old preschool policy options. To determine the return on investment, this study presents a range of evidence from the literature as well as new empirical evidence to estimate the benefits associated with children's participation in a three-year-old preschool program.

Policy context and modelled scenario

Currently in South Australia, the majority of children become eligible for a formal preschool program in the year before full time schooling, which corresponds to the age of four. However, approximately two thirds of South Australian children participate in a long day care program or similar program while aged three. Moreover, Aboriginal or Torres Strait Islander children or children who are or have been in out-of-home care are eligible for a 12 hour per week preschool program once they have turned three. Where capacity in local preschools is available, children with a disability or additional needs and children who have been identified as gifted may also access early entry into preschool.

For South Australian children who do not meet these eligibility criteria, preschool formally commences at the age of four, with an entitlement to a 15 hour per week, 600-hour program of a teacher-led, play-based preschool program. This is predominantly delivered through Department for Education government preschools, though children may receive their preschool entitlement at eligible long day care (LDC) centres or non-government preschools.

In adopting a model of universal three-year-old preschool, all South Australian children aged three would become eligible for preschool two years before full time schooling, implying an additional year of formal preschool for most children.

Features of the modelled scenario

In the Royal Commission's Interim Report, four potential models of universal three-year-old preschool delivery were explored, including all three-year-old preschool taking place in government settings, all in LDC settings, or two versions of mixed market models.[1]

The Royal Commission ultimately favoured Scenario 3B, under which three-year-old preschool is delivered through government preschools, non-government preschools and LDC services, reflecting the current mix in the four-year-old market, with the addition of commissioned services for some cohorts. That is, three-year-old preschool for most South Australian children is delivered through government preschools and LDC services, with additional purpose-built, commissioned integrated services in areas of high developmental vulnerability.

In this analysis, the costs and benefits of a universal three-year-old preschool policy calculated for Scenario 3B and compared to a *base case*. This base case is the counterfactual for the three-year-old preschool policy and models a world in which the policy is not introduced, but children in the growing population continue to access three-year-old services in line with current patterns of behaviour.

Under the universal three-year-old preschool policy, preschool is a high-quality product with features in line with current four-year-old preschool policy: the play-based program is delivered by a degree-qualified early childhood teacher registered with the Teacher's Registration Board of South Australia and, at a minimum, meets National Quality Framework qualification requirements, with a teacher to child ratio of 1 to 11. Further key assumptions underpinning the cost and benefits modelling are outlined in Figure i.

Figure i: Key assumptions for cost and benefits modelling

Source: Deloitte Access Economics (2023).

Academic evidence on the benefits of three-year-old preschool

To understand the academic evidence on the benefits of three-year-old preschool, a detailed literature review was undertaken, examining contemporary evidence from Australian and international studies on the effects of an additional year of preschool. There is extensive, though not comprehensive, research that has explored the benefits of preschool attendance to children's outcomes in school and in later life.

The earliest research on three-year-old preschool effects is based on small scale demonstration programs, such as the Perry Preschool Project. These have found large and sustained benefits to preschool, particularly in terms of later life outcomes. Many of these programs were targeted at disadvantaged children for whom the benefits of preschool attendance have generally been found to be more substantial.

Following from the early success of demonstration programs, broader programs were implemented involving both larger targeted programs and universal programs. The impacts of universal programs have generally been found to be positive, particularly in terms of learning outcomes, but smaller than those found in small scale demonstration programs. A prominent explanation for this is that universal programs are not able to achieve the same level of quality as smaller scale programs.

Some studies have found a negative effect of ECEC on outcomes, although this has commonly been associated with cases where children from more affluent families with highly enriching home environments have shifted to lower quality ECEC settings.

Based on the findings of a range of meta-analyses, expanded access to preschool is generally found to increase cognitive outcomes by between 0.1 to 0.2 standard deviations. Where larger impacts are found, these generally reflect targeted programs benefitting more disadvantaged cohorts or programs where a higher quality of delivery has been achieved.

Overall, the literature supports the view that an additional year of preschool leads to better academic outcomes and there is promising evidence in relation to cognitive and language outcomes. In comparison, there is less evidence in support of positive benefits from additional years of ECEC attendance on social and emotional outcomes. It is noted, however, that these outcomes can be more challenging to measure than cognitive outcomes.

Finally, there is evidence that some of the cognitive impacts of preschool exposure 'fade out' in later years of school. This could reflect the extent to which the school system allows those who did not attend preschool to catch up, including by providing additional supports. Nonetheless, there remains evidence of preschool impacting other later life outcomes beyond schooling – although few studies have been undertaken over a sufficiently long time horizon to measure these later life outcomes.

Empirical evidence on three-year-old preschool in South Australia

This study sought to build on the existing academic evidence by undertaking new empirical analysis to estimate the benefits of three-year-old preschool. This analysis drew on two separate data sources:

1. **The Longitudinal Study of Australian Children (LSAC):** LSAC is a longstanding study involving two representative cohorts of Australian children. Based on the years of the LSAC data, this provides evidence on the longer-term schooling and education outcomes of Australian children, which can be analysed with respect to their ECEC participation at age three.
2. **Department for Education data in South Australia:** outcomes data held by the South Australian Department can be compared for children based on their preschool participation status in order to provide local and more contemporary evidence on the benefits of three-year-old preschool.

Both datasets have their respective advantages and disadvantages. The methodology, results and limitations of the analysis conducted with these datasets is explored in the sub-sections that follow.

Evidence from the Longitudinal Study of Australian Children

The LSAC dataset follows a cohort of children born between January 2003 to February 2004, who mostly commenced school in 2009, and may have taken part in a four-year-old preschool program in the year before school in 2008 and, less commonly, may have partaken in a three-year-old preschool program in 2007.

Children included in the dataset went to preschool prior to national efforts to increase the standard and unify the approach to preschool education in Australia, as targeted through the November 2008 National Partnership Agreement on Early Childhood Education. Programs were of differing characteristics and quality across Australia, with less prescriptive and consistent staff to child ratios, typically lower qualification requirements for staff, and without the mechanism of the National Quality Standard in place. This limits what can be inferred about the programs children participated in, though it may be assumed that programs overall were of a lower quality relative to the aspirations of the Royal Commission's universal three-year-old preschool policy.

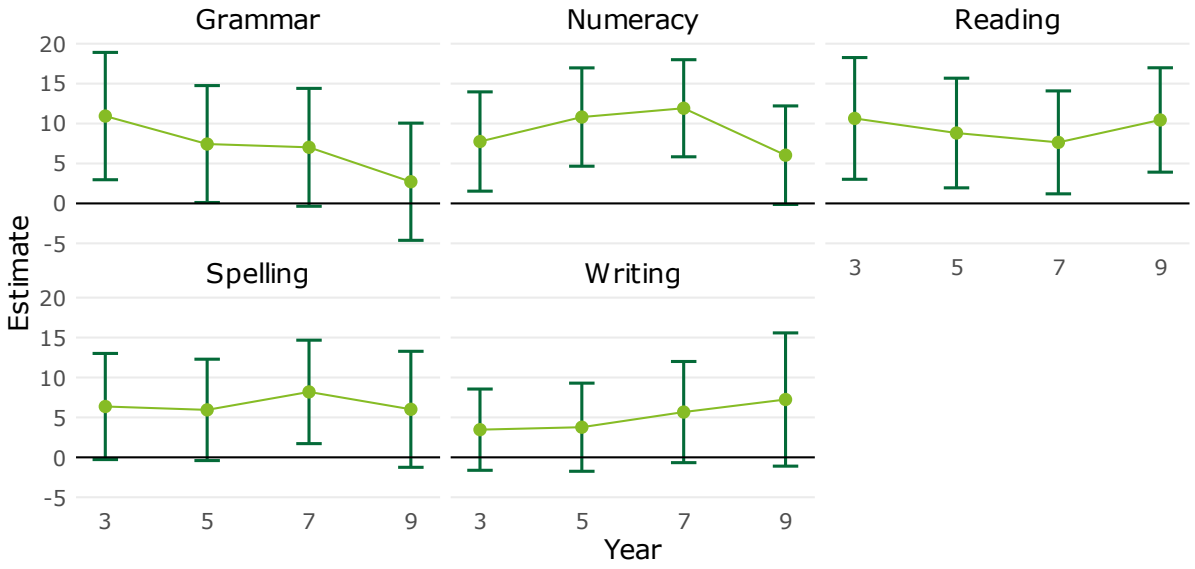
In the LSAC data, children's primary and any secondary ECEC arrangements are captured, and analysis is conducted on a cohort of children attending both three- and four-year-old preschool, and those attending four-year-old preschool only. Estimates are undertaken after controlling for observed characteristics of the children that are determined to be relevant to their outcomes, to disentangle the preschool participation effects from other confounding factors. This includes controlling for factors such as parental education and income, location, birth order effects, and advantage. As a limitation, it is noted that the quality of the preschool program attended is unobserved in the data, as is the child's actual level of attendance at the preschool services.

The analysis employed ordinary least squares or logistic linear regressions to determine the outcomes for children attending both three- and four-year-old preschool, relative to children attending only four-year-old preschool.

From the analysis, there are found to be statistically significant benefits of three-year-old preschool on children's language and cognitive skills scores in the Australian Early Development Census (AEDC, a national data collection in a child's first year of schooling). There are also benefits

to children's National Assessment Program – Literacy and Numeracy (NAPLAN) scores in the domains of grammar, numeracy and reading in Year 3 (see Chart i).

Chart i: Estimated effect sizes over time for the five NAPLAN domains. Point estimates displayed with 95% confidence intervals.



Source: Deloitte Access Economics (2023).

Benefits to NAPLAN scores persist for numeracy and reading through to Year 9 NAPLAN results. Translating the increase in children's NAPLAN scores into equivalent months of learning, using the estimation approach from the Grattan Institute, results in the estimates in Table i.[2] Overall, the results suggest that the impact of an additional year of preschool on NAPLAN outcomes is relatively sustained over a child's schooling period.

Table i: Average effect on NAPLAN scores in terms of equivalent months of learning

NAPLAN Domain	Year 3	Year 5	Year 7	Year 9
Grammar	4.65***	4.11*	4.77*	2.44
Numeracy	1.89**	4.56***	6.19***	3.98*
Reading	5.20***	4.92**	5.30**	6.50***
Spelling	2.30*	2.10*	4.49**	3.89
Writing	2.11	1.77	4.43*	3.88*

Significance levels: * 10%, ** 5%, *** 1%.

Source: Deloitte Access Economics (2023) using LSAC data and conversion based on the Equivalent Years of Learning measure developed by the Grattan Institute (Goss et al. (2016)).[3]

Estimations from LSAC data also provide some evidence of improved health outcomes. Regarding mental health, there is a significant effect of three-year-old preschool on self-reported scores measured using the Kessler 10+ Psychological Distress scale. Attendance at three-year-old preschool was also found to be positively related to self-assessment of health at age 15 to 16. In contrast, there was no evidence to suggest that attendance at three-year-old preschool led to significantly better behaviour or measures of emotional maturity or social development in mid high school.

Evidence from South Australian Department for Education data

The Department for Education (DfE) provided preschool participation and later schooling outcomes data for children taking part in preschool between 2016 and 2022. Similar to the LSAC data, the DfE data allows the exploration of children's outcomes in NAPLAN and AEDC. Additionally, South Australian children undertake a phonics screening test in Year 1, allowing an additional domain of student outcomes to be explored.

This dataset provides a relatively contemporary view of the returns to attending preschool in South Australia. However, the key limitation of the data is that it is not possible to conclusively determine that children who did not attend three-year-old government preschool did not instead attend a non-government preschool program (including a LDC service with a preschool equivalent program) at age three.

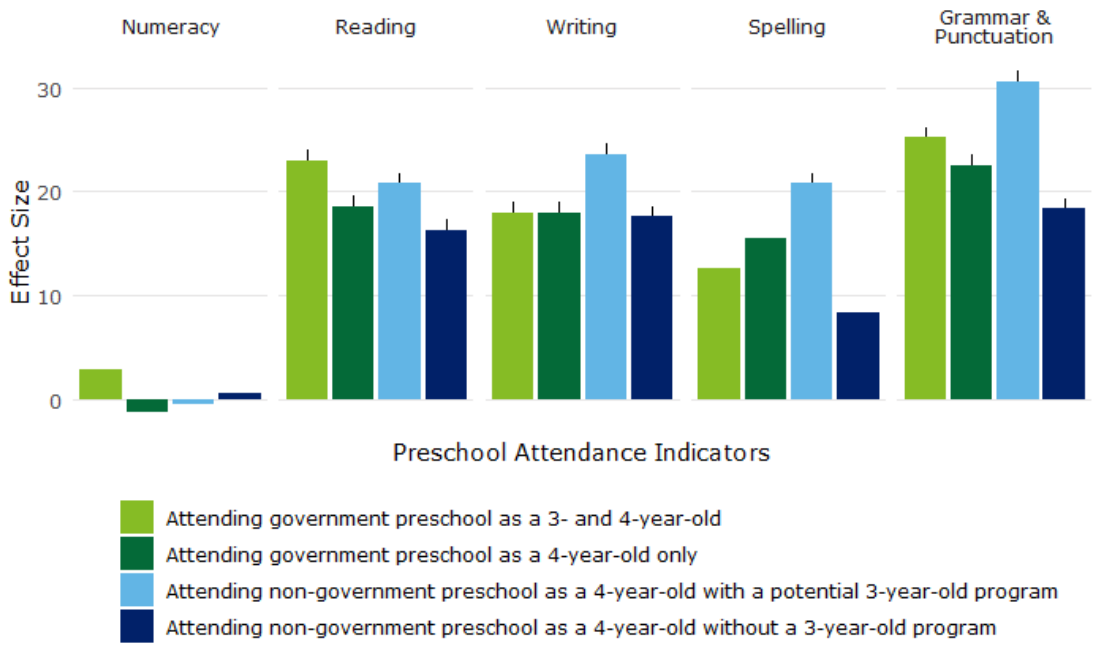
The cohort attending three-year-old government preschool is also, by definition, a selected sample of children who are either Aboriginal or Torres Strait Islander children, have been in out of home care or who have additional needs. This implies that the findings of analysis for this cohort may differ from the impacts of a universal program.

The regression analysis of the DfE data was conducted on five different groups of children:

1. Those who attended three- and four-year-old government preschool (the main cohort of interest)
2. Those who attended four-year-old government preschool only
3. Those who attended an LDC preschool program as a four-year-old — which did not have a three-year-old preschool program
4. Those who attended an LDC preschool program as a four-year-old — which did have a three-year-old preschool program
5. Those who attended no preschool program as a three-year-old or as a four-year-old.

The NAPLAN results (set out in Chart ii below) show that attendance at all types of preschools is associated with statistically significant improvements in NAPLAN outcomes in reading, writing and grammar relative to those who did not attend any form of preschool. Statistically significant improvements in spelling were also observed for those attending a non-government preschool as a four-year-old at a preschool which also had a three-year-old preschool program. The finding that children who attended preschool had more positive outcomes than those who did not attend any form of preschool was observed for other outcomes measures including the South Australian Year 1 phonics test and a number of AEDC domains.

Chart ii: Estimated effect sizes for the five NAPLAN domains in Year 3 (relative to those who did not attend any form of preschool).



Note: Significant effect sizes are indicated by a vertical line above a bar and include significance levels below 10%.
Source: Deloitte Access Economics (2023).

However, across the various outcomes considered, there were generally no statistically significant differences in outcomes for those who attended government preschool as a three-year-old and four-year-old relative to those who only attended government preschool as a four-year-old or attended a non-government preschool as a four-year-old. How much can be drawn from this finding on the incremental benefits of an additional year of preschool is unclear. However, a few important observations can be made:

3. It is possible that many children who attended government preschool as a four-year-old as well as those who attended a non-government preschool as a four-year-old may have attended a non-government preschool, or at least an ECEC program, as a three-year-old. Thus, many children in other groups may have also received two years of preschool.
4. The cohort attending two years of government preschool were, on average, relatively disadvantaged compared to other cohorts. While a large set of demographic controls were used to account for differences between these groups, it is possible that the range of controls available may not have fully accounted for differences in the characteristics of these children.
5. Many of those attending government preschool as a three-year-old attended only for a few terms (after they turned three) and/or attended for relatively few hours per week.
    - Interestingly, the analysis indicates that learning outcomes are stronger for those who attend at least eight hours a week of preschool across the school year and stronger still for those who attend at least 12 hours week on average. This is evident both for those who attend government preschool as a four-year-old only, and for those who attended government preschool as both a three-year-old and a four-year-old.

While acknowledging that these observations limit the definitiveness of conclusions that can be drawn from this analysis on the incremental benefits of three-year-old preschool, the analysis does support the view that attendance at preschool (in any form) is associated with improved outcomes on a range of measures. It also points to the potential role that hours of attendance may play in securing improved learning outcomes.

Methodology for estimating costs and benefits

As previously outlined, the costs modelled for the Royal Commission's Interim Report, and the benefits calculated for this additional analysis, draw upon a common set of assumptions regarding the eligible population, the uptake of preschool, the period of transition, and the attributes of the program delivered under the universal three-year-old preschool model.[i]

For the costs and benefits, the analysis provides a calculation relative to the counterfactual, or base case. In this work, this is a continuation of the current policy parameters in which some cohorts of South Australian children are eligible for three-year-old government preschool, but a majority participate in another form of early childhood education and care, and the remaining do not participate in any form of ECEC at age three.

The costs modelled are restricted to those borne by the South Australian Government for the universal three-year-old preschool rollout. While the South Australian Government is expected to bear the majority of the costs of the reform, there may be additional costs borne by other parties that are not captured in the modelling. In contrast, the benefits modelling considers the benefits to all parties resulting from universal three-year-old preschool. This comparison of costs and benefits is consistent with the purpose of considering the return from the South Australian Government's investment in the policy reform.

Costs of three-year-old preschool

In calculating the costs of three-year-old preschool, two streams of costs were considered:

1. Initial capital costs, and
2. Recurrent costs of delivery

In considering capital costs, locations with an excess of demand relative to supply were determined to require additional preschool provision to meet the universal three-year-old preschool policy aspirations. This could be through the expansion of existing services, where possible, or through new builds.

Non-government preschools and long-day care services were asked in a survey to report whether they could physically expand to cater to additional enrolments, with the results used to estimate additional capacity through expansion. For government preschools, it is assumed that physical expansions are not possible, and all new government supply would require new builds. For the additional demand beyond that met through capital expansions, new build preschools were estimated, based on the remaining demand, patterns of mobility to access services, and based on the median size of existing service types. These new builds are a mix of non-government preschools, government preschools, and long day care services, based on the profile of demand.

With the profile of expanded services and new builds modelled, the capital costs associated with expansions and new builds are derived from Rawlinsons Australia Constructions Guide (2021) and data from the Department for Education. This was used to derive the total upfront capital costs. However, costs of land acquisition and any demolitions have not been considered for the cost estimates.

The recurrent costs of delivery borne by the South Australian Government correspond with the total costs of government preschool services, and the incremental costs the South Australian Government would meet for three-year-old preschool delivered in long day care services. To estimate the recurrent costs for government preschool services, Department for Education data was used to estimate base costs and additional needs-based funding provided for students and services.

For LDCs, the incremental cost of employing a teacher, relative to an educator, was calculated and supplemented with the costs of additional modifications to working conditions supported by the

[i] For a comprehensive set of data and assumptions used for the cost modelling, see the published Model specification document.

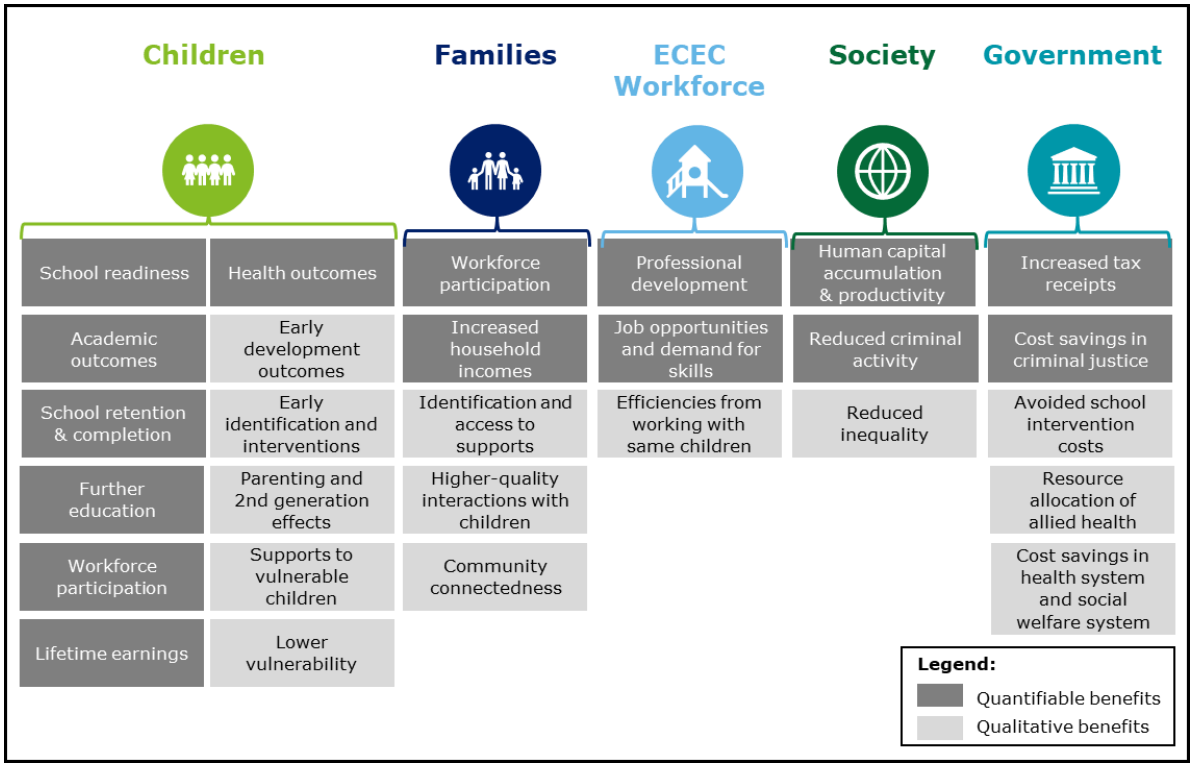
Royal Commission's recommendations, including adjustments for additional non-contact time and professional development.

Benefits of three-year-old preschool

By adopting a policy of universal, high-quality three-year-old preschool, in line with the key assumptions laid out in Figure i, five groups of South Australians are anticipated to benefit (Figure ii):

1. Participating children, both in their early years and later life
2. Families of participating children, principally through increased scope for labour force participation (as well as greater engagement in their children's learning)
3. The ECEC workforce, through increased demand for skilled employees
4. Society, through increasing economic activity and improved health and welfare outcomes for citizens
5. The South Australian and Australian Government, through cost savings and increased taxation revenue

Figure ii: Beneficiaries and benefits of universal three-year-old preschool in South Australia



Source: Deloitte Access Economics (2023).

Where possible, these benefits have been quantified drawing on the empirical analysis described above and insights from the literature. Consistent with the cost modelling, benefits have been estimated for cohorts undertaking three-year-old preschool between 2026 and 2045. However, the benefits for each child are based on the benefits of preschool to lifetime earnings. The dividends of improvements in learning outcomes from three-year-old preschool continue to accrue over a child's education and later working life and thus should be captured across the lifecycle. Consistent with convention for applied cost-benefit analysis (CBA), future benefits are expressed in net present value terms.

Benefits to children

The benefits to children draw principally on the findings of the analysis of LSAC. Attending three-year old preschool is associated with an uplift in NAPLAN results throughout school, when compared to the results of children only attending preschool at four years old. The analysis uses this finding to separately estimate the relationship between (i) NAPLAN scores and high school completion and (ii) NAPLAN scores and university attendance.[ii] This is in turn used to estimate the impact of three-year-old preschool on the relative likelihood of completing Year 12 and separately completing a university qualification, as a result of improved NAPLAN outcomes. Based on the LSAC analysis, attending preschool as a three-year-old was estimated to lead to a 0.5 per cent increase in the likelihood of attending Year 12 and a 3.1 per cent increase in the likelihood of attending university.

These estimates are then combined with separate estimates of the change in lifetime earnings associated with (i) completing Year 12 where an individual would not otherwise have done so and (ii) completing university where an individual would otherwise only completed Year 12 (after controlling for other demographic characteristics which may affect lifetime earnings for those who completed Year 12). Furthermore, some of the other benefits to individuals from participating in three-year-old preschool, such as improved mental health outcomes, accrue partly to the children themselves and partly to the government through avoided service delivery costs.

Benefits to families

The main benefit to families from participation in the ECEC sector is through the greater earnings that families receive as the expansion of three-year-old preschool allows them to either enter the workforce or increase their hours of work as a consequence of their children attending preschool. Primary carers who enter the workforce as a result of the reform also benefit through a slight increase in wages as a result of a shorter period out of the workforce, receiving a relative wage premium which is assumed to apply for the next twenty years based on evidence of these effects in the literature.

Benefits to the ECEC workforce

For the ECEC workforce, a move to a universal three-year-old preschool policy would result in an uplift in demand for qualified early childhood teachers, creating opportunities for an upskilling of the current ECEC workforce, incentivising employees in other sectors to shift into the sector, and creating job opportunities for those currently unemployed or not in the labour force.

Benefits to society

For society more broadly, the benefits accrued by individuals from having participated in three-year-old preschool – such as higher educational attainment and earnings – will have spillover productivity benefits for the employers of these children, further benefitting the economy. Over the longer term, better outcomes for children who have attended three-year-old preschool – including higher levels of educational attainment – are likely to result in social benefits including a reduction in the costs of crime to society (as well as reduction in the cost of crime to government captured through avoided social costs to government).

Benefits to government

For the Australian Government and South Australian Government, the benefits of participation in three-year-old preschool is captured through (1) the increase in tax receipts associated with higher incomes and increased economic activity, and (2) reduced expenditure on government services, including in education, health and the criminal justice systems as a result of three-year-old preschool.

[ii] There was limited evidence of a strong relationship between NAPLAN scores and vocational education attendance.

Results and conclusions

While the cost of providing universal three-year-old preschool in South Australia under Scenario 3B can be determined with a reasonable degree of accuracy, there is greater uncertainty regarding the benefits.

While the most relevant and contemporary evidence has been used to inform estimates of the benefits of three-year-old preschool in this study, no analysis will be perfectly applicable to the South Australian context and to the vision established by the Royal Commission.

The academic literature has consistently pointed to the degree to which benefits are likely to vary based on the:

- quality of preschool delivery; and
- characteristics of children who enter three-year-old preschool under the reform (and, relatedly, the quality of learning they would receive in alternative environments), with preschool being generally found to be more beneficial for disadvantaged cohorts.

Relatedly, relatively little is known about the impact of large scale expansions of three-year-old preschool programs on health and social outcomes into adulthood. The empirical evidence on health benefits presented in this report – drawing on the LSAC analysis – relies on measures that are constructed in a specific way and reliant on self-reporting (and, as such, bring additional levels of uncertainty).

Recognising that these factors will impact the ultimate benefits arising from the three-year-old preschool proposal being explored here, a range of results is presented. This range is presented with reference to four scenarios (in increasing order of the benefits realised):

1. Returns to children are based on the findings of LSAC with no benefits to improved mental health included.
2. Returns to children are based on the findings of LSAC with mental health benefits included based on the LSAC analysis.
3. This scenario assumes that, in addition to the mental health benefits, children in commissioned preschools achieve outcomes that are three times stronger than found in the LSAC analysis. This is based on evidence from a study of the benefits of preschool to disadvantaged children in the United States by Domitrovich et al (2014).
4. This scenario explores the benefits where the quality of delivery results in outcomes that are twice as strong as that found in the LSAC analysis, reflecting the findings of studies such as Blanden et al. (2022) and Australian studies such as Tayler et al (2016).

Across the four scenarios (see Table ii), total benefits range from $2.9 billion to $5.4 billion in net present value terms (using a discount rate of 3.5 per cent). The benefits to children range from $665 million to $2.065 billion as mental health benefits and improved quality is included in the analysis. Families and the ECEC workforce experience benefits of $490 million in net present value terms while the benefits to government and society range from $1.7 billion to $2.8 billion across the scenarios. On a per child basis, total benefits range from $10,900 to $20,600 in net present value terms.

The cost of the proposal in net present value terms is estimated at $3.7 billion or approximately $14,000 per child. This results in a benefit-to-cost ratio (BCR) that ranges between 0.78 to 1.47 across the scenarios.

Given the time period over which benefits from preschool are realised, the magnitude of benefits is sensitive to the discount rate used to present results in net present value terms. Herein, in line with the South Australian *Treasurer's Instructions 17* and advice from the Royal Commission for the purposes of this study, a central discount rate of 3.5 per cent has been used (consistent with a social rate of time preference approach and advice in the United Kingdom guidelines, *The Green*

Book)[4].[iii] Further sensitivities at 3 per cent and 7 per cent are included in the appendix of this report.

Table ii: Benefit and costs under alternative scenarios (Net Present Value, 3.5% discount rate)

	Benefits without mental health effects	**Benefits with mental health effects**	**Benefits with mental health effects and stronger impacts for equity cohorts**	**Benefits with mental health effects and higher quality delivery**
Benefits	Total ($ million)	Total ($ million)	Total ($ million)	Total ($ million)
Children	665	1,399	1,504	2,065
Families	343	343	343	343
ECEC workforce	147	147	147	147
Government	838	937	1,026	1,493
Society	895	895	973	1,387
Total	2,889	3,722	3,993	5,435
Costs				
Recurrent costs	1,170	1,170	1,170	1,170
Capital costs	1,105	1,105	1,105	1,105
IESP	1,121	1,121	1,121	1,121
SSS	181	181	181	181
Case management	109	109	109	109
Total	3,688	3,688	3,688	3,688
Net results	- 799	34	305	1,747
Benefit-cost ratio	0.78	1.01	1.08	1.47

Source: Deloitte Access Economics (2023).

The range of results demonstrates that whether the benefits outweigh the costs (and the degree to which they do so) depends on whether preschool leads to better longer term health outcomes but, perhaps even more so, on the extent to which the reforms provide a quality learning environment for all children. If the reform is able to achieve a higher quality of delivery such that the learning outcomes associated with attending three-year-old preschool exceed those received by children in LSAC prior to the national quality reforms, the benefits of the reform are likely to exceed the costs.

Separately, the evidence from analysis of the South Australian Department for Education data points to the importance of ensuring consistent, sustained attendance in order to maximise children's learning outcomes.

[iii] Note: the Department of Treasury and Finance has noted a preference of a 7 per cent discount rate to be used for a central case for this analysis. This has been tested as a sensitivity.

Finally, there are a number of costs and benefits which this exercise has not been able to quantify. On the costs side, the reform may involve a degree of additional childcare subsidy (CCS) funding and parental contributions for non-government preschool and LDC. On the benefits side, a key benefit that has not been captured is the potential savings to the school system as a result of three-year-old preschool helping to better prepare children for school. This benefit is potentially significant and likely to accrue earlier than many of the benefits to children captured here. There is also a range of social and emotional outcomes, including resilience, which are potentially impacted by greater levels of preschool exposure. The evidence of the impact of universal programs on these outcomes is limited at present but this remains an important area of future research and one in which linkages in child level administrative data can potentially help shed new light.

Overall, the evidence presented in this report supports the view that there are benefits from attending preschool, and that there are likely to be additional benefits to children's development from attending a second year of preschool, as well as benefits from consistent attendance at a high-quality preschool program. It is hoped that these findings help build on the existing evidence base regarding the benefits to investments in the early years, while also highlighting the importance of ongoing longitudinal research into the longer term benefits to children from participation in three-year-old preschool.

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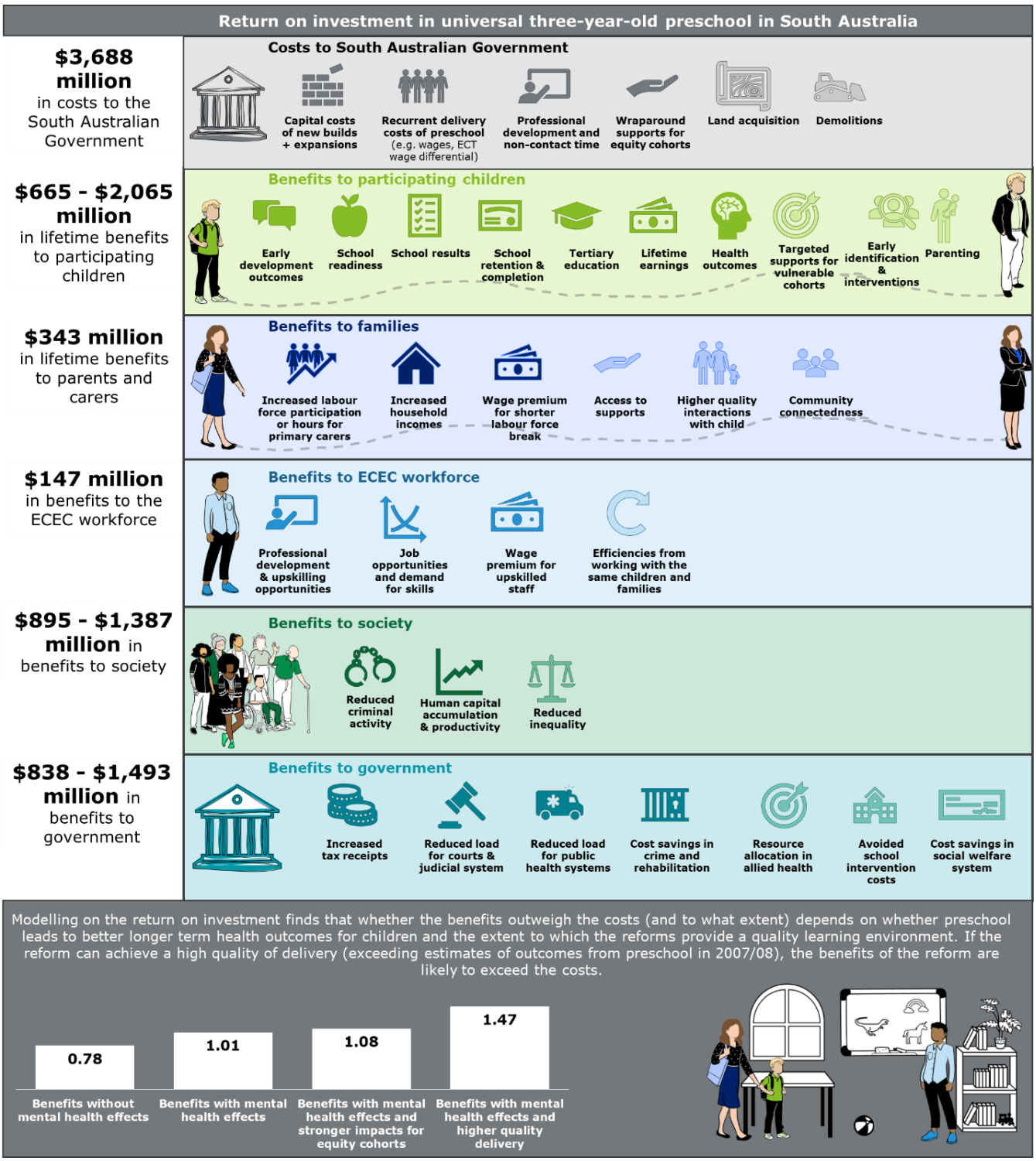
Figure iii: Overview of costs, benefits and estimated outcomes of a universal three-year-old preschool policy in South Australia



Note: the figure above outlines the identified costs and benefits of a universal three-year-old preschool policy in South Australia. Lighter coloured costs and benefits (e.g., land acquisitions, parenting) have not been estimated in the CBA modelling, but have been considered qualitatively in the conclusions of the analysis.
Source: Deloitte Access Economics (2023).

1 Introduction

The South Australian Government has committed to the introduction of universal three-year-old preschool commencing from 2026, amidst a suite of proposed reforms to the early childhood education and care (ECEC) and schooling sectors in South Australia.

On 16 October 2022, the Royal Commission into Early Childhood Education and Care (the Royal Commission) was established by order of the Governor of South Australia, with the Hon. Julia Gillard AC appointed as the Commissioner. The Commission's Terms of Reference include inquiry into how universal quality preschool programs for three- and four-year-old children can be delivered in South Australia, including addressing considerations of accessibility, affordability, quality and how to achieve universality across both age cohorts.[5]

Against this backdrop, Deloitte Access Economics was initially engaged by the Royal Commission to develop a model capable of simulating alternative scenarios for delivering universal three-year-old preschool in South Australia and estimating the associated costs (recurrent and up front) and workforce demand at a state-wide and regional level. This modelling is intended to provide an initial appraisal of the impact and relative costs of alternative delivery options and, in doing so, inform the deliberations of the Royal Commission.

Components of this cost model were incorporated in the Royal Commission's *Interim Report* published in April 2023.[6] Further outputs of this modelling are also published on the Royal Commission's website.

The cost of delivering universal three-year-old preschool is an important consideration in the context of the Royal Commission and the South Australian Government's deliberations. However, considering the costs without exploring the benefits anticipated to be gained from the reform provides only half of the story.

To this end, the Royal Commission, in collaboration with the Department of Treasury and Finance and the Department for Education, engaged Deloitte Access Economics to conduct an extension of the modelling to explore the benefits of universal three-year-old preschool. By bringing together the previous cost modelling with new benefits modelling, cost-benefit analysis (CBA) modelling can be undertaken to allow the consideration of the *return on investment* to universal three-year-old preschool.

This work builds upon the 2018 Deloitte Access Economics work undertaken on behalf of the South Australian Department of Premier and Cabinet, the *Three year old preschool cost benefit analysis.* In the years since this 2018 work, there have been developments in the literature and data available relating to both the costs and benefits of three-year-old preschool. Moreover, the vehicle of the Royal Commission had provided unprecedented access to data and evidence for the analysis. As such, this work updates the data and modelling approach to benefits estimation in line with the emerging evidence.

1.1 South Australian context

Calculations of the costs and benefits associated with children participating in three-year-old preschool have been undertaken with respect to South Australia's current delivery of ECEC and preschool programs. All calculations are considered relative to a *base case* of what is expected to happen in the absence of the universal three-year-old preschool policy.

1.1.1 The current preschool and three-year-old education and care landscape

In considering the costs and benefits of the delivery of universal three-year-old preschool, current activity in South Australia's three-year-old ECEC sector presents a point of reference to compare the relative impact of different policy scenarios.

In South Australia, ECEC comprises long day care services, preschools, other centre-based day care services, and smaller sub-groups of education and care, such as family day care and in-home care. It is delivered through a mixed market of government and non-government services, with a high proportion of standalone preschools owned and operated by the Department for Education.[7]

In South Australia, preschool is a play-based program designed and delivered by a qualified teacher. It is an optional program for children in the year before school, typically for children aged four.

Under the Preschool Reform Agreement with the Australian Government, children are entitled to a 15 hour per week program for 40 weeks, or 600 hours of a funded preschool program. In South Australia, children who turn four years old from 1 May are eligible to start preschool at the beginning of the year.

In 2021, around 90 per cent of four-year-old children in South Australia were enrolled in a specific preschool program.[8] The vast majority (80 per cent) of this preschool delivery (associated with government funding through the Preschool Reform Agreement) is delivered at South Australian Government preschools, run as standalone or school-based preschools by the Department for Education.[9]

1.1.1.1 Additional preschool entitlement

While most South Australian children are entitled to four terms of preschool at the age of four, some cohorts of children have access to additional preschool entitlements.

In 2005, the Aboriginal Three-year Old Resource Allocation Program commenced, which extended the entitlement for preschool to three-year-old children who were Aboriginal or under the guardianship of the Minister for Families and Communities, allowing up to four preschool sessions per week from age three and extending the eligibility for sessions until the age of six.[10] These additional entitlements for Aboriginal children and children who have been in-care remain in place in 2023.

When a child turns three, children in these cohorts become eligible to attend a government preschool facility for up to 12 hours per week. This rolling entry is to align with staff to child ratio requirements and means three-year-old children access differing volumes of preschool in the second year before schooling, based on birth date. From anecdotal evidence, some preschool services allow three-year-old children to take part in 15 hours per week (in line with four-year-old program hours), if the child attends on these additional days. Three-year-old children are typically integrated within the four-year-old preschool program, though may have separate group time or other activities.

In addition to these two cohorts, children with disability or additional needs may be eligible for early entry into preschool, if there are places available.[11] Similarly, children identified as academically gifted may also commence preschool early, subject to availability.

From 2023, South Australian preschools offer mid-year entry, allowing children turning four between 1 May and 31 October to commence preschool through mid-year intake (in July) and complete four terms of preschool, prior to commencing school through the mid-year school intake.

In this context, the introduction of a universal three-year-old preschool entitlement would be an additional year of preschool on top of the year of preschool already undertaken in the year before school. This means the benefits of the universal three-year-old entitlement would be the incremental benefits of an additional year of preschool.

1.1.1.2 Broader ECEC activity

While only a small cohort of South Australian children is eligible for three-year-old preschool currently, a majority of families choose to send their three-year-old children to a formal ECEC program.

Of the 19,100 three-year-old children in South Australia, two-thirds are estimated to be enrolled in a centre-based ECEC program.[12] From the South Australian Early Childhood Education and Care Sector Survey, conducted for the Royal Commission, 45 per cent of LDC services report that they

deliver a preschool-equivalent program to their three-year-old enrolees.[13] Although these programs are not funded as preschool, they are reported to meet the minimum regulatory requirements defined for a four-year-old preschool program.[iv]

Children taking part in a formal preschool program at a government preschool while aged three and/or four may also attend a long day care service for additional hours. Where these long day care programs meet the requirements of a formal preschool program, this further alters the proposition of a formal preschool entitlement for children.

These features of the current ECEC market were considered in developing the options modelled for the Royal Commission.

1.2 Return on investment analysis

Considering the costs and workforce requirements of universal three-year-old preschool, four options were modelled. These were:

- **Scenario 1: Government preschool only,** all three-year-old preschool is assumed to be delivered through government preschools and non-government preschools currently funded for four-year-old preschool delivery by the Department for Education.[v]
- **Scenario 2: Long day care and non-government preschool only,** all three-year-old preschool is delivered through non-government services, including LDC centres and non-government preschools.
- **Scenario 3A: Mixed approach to delivery,** a mixed model is used, and three-year-old preschool is delivered through government preschools, non-government preschools and long day care services, reflecting the current settings in the four-year-old market.
- **Scenario 3B: A mixed approach for delivery, with equity targeting,** a mixed model is used as per 3A, with the addition of commissioned services for some cohorts. That is, three-year-old preschool for most South Australian children is delivered through both government preschools and LDC services, with some purpose-built, commissioned integrated services in areas of high developmental vulnerability.

As agreed with the Royal Commission and in line with the Royal Commission's interim recommendations, this work focusses on the costs and benefits associated with Scenario 3B.

1.2.1 Features of the modelled scenario

The cost and benefit modelling is underpinned by a set of assumptions, held consistent between the two components of the analysis.

These assumptions outline the number of three-year-old children eligible to participate in preschool, the enrolment rate of these children, and regions in which a targeted approach would be adopted under Scenario 3B. Key assumptions relevant for this analysis are outlined in Table 1.1. For a comprehensive set of data and assumptions used for the cost modelling, see the Model specification document.[14]

[iv] I.e., the program is delivered by a degree qualified early childhood teacher registered with the Teacher's Registration Board of South Australia that at a minimum, meets National Quality Framework qualification requirements, with a teacher to child ratio of 1 to 11.

[v] These are distinct from LDCs designated by ACECQA as preschools not run by the Department for Education, as referred to in Deloitte Access Economics, Mapping long day care and non-government preschool in South Australia, (report commissioned by the Royal Commission into Early Childhood Education and Care, South Australia).

Table 1.1: Underlying data and general assumptions

Information input into the model	Data source(s)[vi]	Notes and assumptions	Central scenario parameter
Number of three-year-old children residing in each SA2 in each year	Australian Bureau of Statistics (ABS) Census data and Department for Infrastructure and Transport (DTI) population projections		21,489 three-year-old children by 2032
Mobility of children accessing ECEC across SA2 regions	Child Care Subsidy System (LDC services) Department for Education, South Australia 2023, provided data (government services, PRA non-government services)	Demand is limited to the SA2, SA3 or DTI region based on the degree of mobility across regions and the ease with which families can access services outside their preferred SA2s.	Demand for children in 50 SA2s restricted to home SA2 (29%). Demand for children in 75 SA2s restricted to home SA3 region (43%) Demand for children in 49 SA2s limited to home DTI region (29%)
Targeted enrolment rates	Assumption	Based on a marginal increase on the enrolment rate for existing-four-year-old children (pre-COVID).	97%
Period of transition to reach target enrolment rate	Assumption		7 years linear growth (2026-2032)
Regions in which a targeted approach is required for equity cohorts	BetterStart Health and Development Research centre modelling	Used only a set of SA2s identified as highly predictive and highly specific. Represents approximately 8% of state population.	27 SA2 regions (See Appendix A).

Source: Deloitte Access Economics (2023)

These underpinning assumptions provide parameters for the modelled participation of children under a universal model of three-year-old preschool, from which costs and benefits can be derived.

It is noted, this modelling is associated with an enrolment target, and may not reflect how families would respond to such a reform. For example, the model adopts a universal 97 per cent enrolment target. In practice, it is anticipated that families from different regions and with different characteristics may have higher or lower participation rates. For example, the location and proximity of services, the family's cultural background, and features of employment - including employment sector, hours of employment, and the income structure of the family, such as the number of earners.

Under Scenario 3B, funded three-year-old preschool for South Australian children is delivered through both government preschools and LDC services, similar to the current delivery profile of four-year-old preschool in South Australia. In areas of high developmental vulnerability, three-year-old preschool would be delivered through purpose-built integrated hubs that provide

[vi] Note that the South Australian Early Childhood Education and Care Sector Survey uses non-government preschool to refer to services defined by ACECQA as preschools that are not operated by the Department for Education. The model and this document considers non-government preschools to be services that currently receive some funding from the Department for Education to deliver preschool.

preschool (integrated into a long day care offering as appropriate), health, and family support services, with a doubling of the entitled hours to 30 hours per week.

Under this scenario:

- Children currently enrolled in in non-government and government preschools are expected to remain in their existing programs.
- Children who are already accessing LDC would receive a funded preschool program in the setting they are already enrolled in.
  - Of these, some three-year-old children are already receiving a preschool-equivalent program. The primary change for this cohort would be the funding arrangements, with no implications for workforce or costs.
  - For children enrolled in an LDC service receiving a program that is not equivalent to preschool, some services are assumed to be able to convert these programs, primarily by employing an Early Childhood Teacher, with no capital costs. Therefore, three-year-old children enrolled in LDC services and not currently receiving a preschool-equivalent program would largely access a new preschool program at their existing service.
- Some services are assumed not to offer a preschool program under all scenarios, including Scenario 3B.
  - Children at these services would largely access a new preschool program at another LDC service that does offer preschool.
- Additional demand would be created by three-year-old children not currently accessing centre-based care or preschool, and those families seeking preschool in addition to LDC services
  - Those residing in areas of high developmental vulnerability would have access to a commissioned place in a specialist service, where ECEC provision is delivered collocated with other family services in an integrated hub model.
  - These services would be commissioned, and children enrolled in these services are assumed to receive a higher dosage of 30 hours preschool.
  - In areas without high levels of developmental vulnerability, demand would be met by additional places in LDC services, non-government and government preschool.
    - This demand would first be met by additional places in existing service providers.
    - Where these additional places cannot be met by existing services, new services would be opened by both government and non-government providers to meet this demand.

1.3 Structure of this report

The remainder of this report is structured as follows:

- Section 2 provides an overview of the literature on three-year-old preschool impacts
- Section 3 discusses two empirical approaches taken to estimate the benefits of three-year-old preschool
- Section 4 outlines the methodology for estimating the costs and benefits of the analysis
- Section 5 presents the results from the cost-benefit analysis (CBA).

2 Literature on three-year-old preschool impacts

Summary of key findings

- An extensive range of research has explored the benefits of preschool attendance to children's outcomes in school and later life outcomes.
- Early research was based on small scale demonstration programs such as the Perry Preschool Project. These have found large and sustained benefits to preschool, particularly in terms of later life outcomes. Many of these programs were targeted at disadvantaged children for whom the benefits of preschool attendance have been found to be more significant.
- The impacts of universal programs have generally been found to be smaller than small scale demonstration programs with a prominent explanation for this being that universal programs are not able to achieve the same level of quality as smaller scale programs.
- Some findings of a negative effect of ECEC on outcomes may reflect cases where children from affluent families have shifted from home care to ECEC settings.
- Based on the findings of a range of meta-analyses, expanded access to preschool is generally found to increase cognitive outcomes by between 0.1 to 0.2 standard deviations. Where larger impacts are found these generally reflect targeted programs or those benefitting more disadvantaged cohorts.
- Overall, the literature supports the view that an additional year of preschool leads to better academic outcomes and there is promising evidence in relation to cognitive and language outcomes. In comparison, there is less evidence in support of positive benefits from additional years of ECEC attendance on social and emotional outcomes.
- Finally, there is evidence that some of the cognitive impacts of preschool exposure 'fade out' in later years of school. This could reflect the extent to which the school system allows those who did not attend preschool to catch up. Nonetheless, there remains evidence of preschool impacting other longer life outcomes beyond schooling.

This section discusses the relevant academic and policy literature relating to ECEC effectiveness, in generating positive outcomes for children and families. This review builds on the 2018 Deloitte Access Economics work undertaken on behalf of the South Australian Department of Premier and Cabinet, along with the Howells et al. (2022) rapid review completed for the Royal Commission.[15]

Given the way the academic literature has evolved, most studies focus on ECEC participation overall, rather than distinguishing one vs two years of enrolment. However, the broader set of literature is informative for several key issues: impact fade-out, variability in quality, and differential effects by socioeconomic background.

Table 2.1 provides a snapshot of quantitative estimate of the impacts of an additional year of preschool, across the relevant domains. Given the spread of estimates that have been found in the literature, this snapshot is presented with three scenarios: high, medium and low. These are not intended to span the full variation of findings from existing studies, but reflect findings closer to quartile thresholds: i.e. the $25^{th}/50^{th}/75^{th}$ percentiles.

Table 2.1: summary of evidence for universal provision of two years vs one year of ECEC

Domain	Low	Middle	High
Cognitive skills at school entry: effect size in standard deviations	0	0.075 (Halving the Ulferts & Anders, 2016 result)	0.22 (Barnett & Jung, 2021; Blanden 2022)
Cognitive skills during school: effect size in standard deviation	0	0.05 (Halving the Ulferts & Anders, 2016 result)	0.20 (Barnett & Jung, 2021)
Socio-emotional skills: effect size in standard deviations	-0.22 (Ansari et al., 2019)	-0.052 (Loeb et al., 2007)	0
School progression and attainment: increase in high school certificate	0	3% (Havnes and Mogstad, 2011)	11% (McLeod et al., 2018)
labour market outcomes: increase in incomes	0	3% (Dumas and Lefranc, 2010)	5.5% (McLeod et al., 2018)
Health, crime and welfare benefits:	0	0	5% lower crime rate (Arteaga et al. 2014)

Source: Deloitte Access Economics (2023).

2.2 A taxonomy of ECEC impact evaluation

ECEC research is longstanding. Researchers have been evaluating ECEC programs for over 50 years, to understand their impact on child and parent outcomes. Research has focussed on three different types of programs:

- ***Small scale demonstration programs,*** the most notable being the Perry Preschool Project (PPP), which examined 58 children entering preschool between 1962-1967. This has enabled researchers to conduct long-term follow-up analysis, to determine labour market outcomes, as well as impacts on subsequent generations (e.g. Garcia, Heckman & Ronda, 2021, Schweinhart et al., 2005). Other notable examples are the Abecedarian Project in Carolina, USA in 1972-1977 (Reynolds, 2011).
- ***Large-scale targeted programs***, such as Head Start, in USA (e.g. Shager et al., 2013). These can be dedicated service providers or can take the form of means-tested subsidies for ECEC and were prompted by the apparent success of small scale demonstration programs. They are large scale in the sense that they are rolled out to all eligible children in a state or country, hence they reflect a feasible level of provision in terms of quality and resource intensity.
- ***Universal programs***, with no means-based targeting or other eligibility criteria. Studies on universal ECEC program effectiveness have examined reforms in France (Dumas & Lefranc, 2010), Norway (Havnes & Mogstad, 2015), Quebec (Baker, Gruber & Milligan, 2019), Spain (Van Huizen, Dumhs & Plantenga, 2016), and state-based universal programs in the United States.

Along with the three different types of ECEC programs previously mentioned, there are three types of research designs for evaluation. The first, naturally associated with demonstration programs, is ***randomised controlled trials (RCTs).*** This design identifies a relevant target population, often within a given geography and/or socioeconomic group, then selects a sample from that population. This sample may be selected entirely at random, or stratified such that certain characteristics are selected proportionally. Then, within the sample, participants are randomly assigned 'treatment' or 'control' status. Provided both aspects of randomisation are achieved, the comparison between treatment and control provide a causal estimate of the effect of ECEC on outcomes. Elango et al. (2015) point out that the randomisation can fail, if, for example, parental consent is sought post randomisation, causing selective attrition.[16] This was the case for the initial pilot evaluation of the Tennessee Voluntary Pre-kindergarten Program (TN-VPK) (Lipsey et al., 2018).[17] RCTs also typically have relatively few observations, often with fewer than a hundred, making differential analysis by subgroup less feasible.

Rather than sampling and allocating formal ECEC at random, ***observational studies*** record children's ECEC experience, and then subsequent outcomes. This may be through longitudinal studies of birth cohorts, such as the Longitudinal Study of Australian Children (LSAC); or studies based on censuses of particular age groups, such as the Australian Early Development Census (AEDC). These studies generally have many more observations than RCTs, which allow precision in measuring effect sizes. The major drawback of observational studies is 'selection bias': that the children attending ECEC are different to those not attending. For example, parents who choose formal ECEC may make other investments towards their child's school preparedness. The potential for selection bias can be mitigated by adding variables as controls in a regression analysis, along with other techniques, such as inverse probability weighting or propensity score matching. These latter methods have been used in some of the more rigorous observational studies, however they do not completely remove the possibility of selection bias. ***Quasi-experimental studies*** are not random by design, but some aspect of the program means that eligibility is `as-good-as-random'. This may be an arbitrary birth date cut-off, or a staggered program roll-out to different regions in different years, for example. Provided children each side of the eligibility cut-off are sufficiently comparable, then this approach will generate causal estimates of the program.

The measures used to determine outcomes vary by age. Short term outcomes, when children are approaching school age, are typically tested using established metrics such as the Peabody Picture Vocabulary Test, or the Woodcock-Johnson Letter-Word/Oral Comprehension/Applied Problems tests. They have been developed through dedicated research on the best way to detect cognitive ability or school readiness in pre-school children. Subsequent tests of academic or cognitive ability are typical within the school setting, such as National Assessment Program – Literacy and Numeracy (NAPLAN) tests in Australia. Socio-emotional outcomes are generally tested using a 'strength and difficulties' questionnaire, completed by teachers and/or parents. These questionnaires generally report on emotional and conduct symptoms, hyperactivity/ inattention, peer relationships, and prosocial behaviour. Long term follow-up studies can provide measures of broader effects, such as employment outcomes, health, crime rates, and family formation (e.g. Garcia, Heckman & Ronda, 2021).[18] Because of the necessary lead times, the evidence on longer term outcomes is generally limited to the first wave of demonstration programs, such as PPP or CPC, and the 1960s-70s reforms in France: for example, Dumas and Lefranc (2010) find that those who attended preschool at age three, as opposed to age four, had a 3 per cent increase in their monthly wages.[19] Rather than observing employment outcomes, Van Huizen, Dumhs & Plantenga (2016) model the likely employment impacts using earlier observed Programme for International Student Assessment (PISA) score outcomes.[20]

In order to compare estimated program impacts across measures and domains, results are expressed as a standardised effect size, or Cohen's d statistic. Provided the outcome measure itself is standardised, the regression coefficient reported will be a Cohen's d statistic. The interpretation of an effect size ***x*** is as follows: treatment leads to a change in the measured outcome by ***x*** standard deviations.

2.3 Review of reviews: summary perspectives

The role of ECEC in developmental outcomes has been an active area of research for five decades. As such, there are several meta-analyses and policy summaries that attempt to synthesise research findings and compile empirical evidence. These vary in their focus, but collectively represent the full range of findings from the primary research literature. Importantly, they offer explanations of apparently contradictory findings.

The most recent was a literature scan by Howells et al. (2022); this is also the most relevant by design, as it was undertaken on behalf of the Royal Commission.[21] They interpret the literature to show "generally improved long-term outcomes from attendance in a universal ECEC". Shorter term outcomes are more mixed in their summary, due to methodological challenges for some studies, and the lack of complementary educational supports into primary school. They also find children from poorer households benefit most from universal programs. These conclusions are qualitative: neither point estimates nor quantitative ranges are provided.

- *"Data from meta-analyses, systematic reviews and quasi-experimental studies showed generally improved long term outcomes from attendance in a universal ECEC;*

- *beneficial effects were found for various long-term educational, income and employment outcomes;*
- *mixed results were noted for shorter-term cognitive and non-cognitive outcomes however various factors may be impacting on these results including methodological challenges, and lack of persisting educational supports into the primary years;*
- *universal programs that are high quality provide the greatest benefit;*
- *some support for higher intensity programs;*
- *children from lower SES backgrounds benefit more relative to their peers from universal programs;*
- *more research is needed comparing different program modalities as they relate to outcomes."*

Source: Howells et al. (2022) 21[22]

Cattan et al. (2022) distinguish the evidence from small-scale intensive demonstration programs, from that of major large-scale childcare programs.[23] In their summary, demonstration programs in the United States and United Kingdom have been shown to boost cognitive development and reduce emotional and behavioural problems. However, their interpretation of studies on major large-scale childcare programs is more mixed, citing ECEC programs in Italy and Canada that led to negative outcomes, whereas programs in Germany, Norway, Spain, and England tend to report positive outcomes. They explain this by the quality of the ECEC provided as a result of the reform, compared to what would have been provided in the absence of the reform. See Section 2.5 for further discussion of differential quality.

Warren et al. (2016) review the Australian and international evidence on the impact of preschool on later outcomes.[24] They discuss the findings of the UK effective provision of preschool education (EPPE) program, Head Start, universal expansions of preschool in France and Norway, along with earlier programs including the Perry Preschool Study and Child-Parent Centre (CPC) Education Program. Overall, their interpretation of the international evidence is that "the provision of a high quality three-year-old preschool program provides long-term benefits for some children". However, they urge caution in applying the findings from these studies to the Australian context, due to the age of the early evidence such as Perry Preschool and CPC; the small scale of many of the RCT studies; and the potential for selection bias with larger scale observational studies.

Fox & Geddes (2016) review similar primary evidence as Warren et al. (2016), but reach stronger conclusions supporting two years of preschool as a policy.[25] Their interpretation of international studies is that they show "modest but consistent" benefits from a second year of preschool. However, it is important to note this is not a peer-reviewed journal article – it is more prescriptive in its policy recommendations. It is also less cautious in making inferences about an additional year of preschool based on work comparing formal ECEC with no preschool. Like other reviews, they find that a) disadvantaged children benefit the most from in-centre ECEC, and b) low quality programs deliver very little short or long-term impacts.

"An abundant literature has documented the largely positive impact of targeted early intervention programs … Studies of typical large-scale preschool programs also find evidence of significant short-term benefits for cognitive outcomes. However, universal access programs often reveal weaker effects than the generally higher quality targeted programs … Most studies of preschool participation find a significant benefit for cognitive outcomes in the short-term. However, evidence about the long-term cognitive and social benefits of preschool programs is mixed. Some studies, such as those of Siraj-Blatchford, Taggart, Sylva, Sammons, and Melhuish (2008) and Berlinski, Galiani, and Manacorda (2008) have concluded that preschool attendance has long-term academic and social benefits for all children. Others, including Magnuson, Ruhm, and Waldfogel (2007a, 2007b), have found that the academic benefits of preschool attendance tend to fade over time, and that preschool attendance may be associated with poorer behavioural outcomes in the long-term."

Source: Warren et al. (2016) 1-2.[26]

Molloy et al. (2019) assess largely the same body of literature, qualitatively rather than with formal meta-analysis.[27] They classify the evidence for universal ECEC programs as in Table 2.2. Howells et al. (2022) perceived this to be the best summary of the relevant literature, also reproducing the table.[28]

Table 2.2: summary of evidence for universal provision

Starting age	Cognitive & Language	Academic	Social-Emotional
0-2 years	*Supported*	*Promising*	*Mixed*
2-3 years	*Supported*	*Promising*	*Mixed*
3-4 years	*Promising*	*Promising*	*Insufficient evidence*
4-5 years	*Insufficient evidence*	*Insufficient evidence*	*Insufficient evidence*
Duration			
<1 year	*Insufficient evidence*	*Supported*	*Insufficient evidence*
1-2 years	*Promising*	*Supported*	*Insufficient evidence*
2-3 years	*Supported*	*Supported*	*Not supported*
>3 years	*Supported*	*Supported*	*Not supported*
Dose			
Part time	*Supported*	*Supported*	*Insufficient evidence*
Full time	*Mixed*	*Insufficient evidence*	*Not supported*

Source: reproduced from Molloy et al. (2019) table 2, p. 8, also reproduced in Howells et al. (2022).

Holla et al. (2021) conduct the most comprehensive meta-analysis to date, with a total of 798 estimated effect sizes from 50 studies in 19 countries, across a variety of settings, interventions and outcome measures.[29] They focus on experimental or quasi-experimental studies, such that the observed effects are plausibly causal. The authors included interventions that expanded access and/or improved the quality of pre-primary education. They construct so-called 'forest plots', to show the cross-study variation in findings – the most relevant are replicated in Appendix B. When compared to no formal ECEC, the studies in high-income countries found an average 0.17 standard deviation (SD) increase in cognitive skills at school entry, and a 0.14 SD increase in executive functions and social-emotional skills. Cognitive skills during primary school were positive on average (0.06 SD), but not statistically significant. Their measures of preschool expansion include studies from both high-income and low-income countries, but the average effect on cognitive skills is 0.095 SD. Executive functions and social-emotional skills are positive on average (0.049 SD), but not statistically significant. While these estimates are not specific to an extension of ECEC from one to two years, the estimates are generalisable to different policy contexts.

Ulferts & Anders (2016) focus on longitudinal studies, rather than experimental research designs. They assessed 226 separate findings of 22 European studies, collating data on developmental outcomes for over 43,000 children in Europe.[30] ECEC increased developmental outcomes by 0.12 SD, with maths growing by 0.13 SD, and literacy by 0.12 SD. They found some evidence of fadeout: outcomes measured during preschool increased by 0.15 SD, while measures recorded at primary school or later increased by 0.10 SD. Studies focussing on relative increases in ECEC yielded effect sizes of 0.15 SD, while studies focussing on ECEC compared to no ECEC yielded effect sizes of 0.09 SD, with the latter being statistically insignificant. While the authors do not perform meta-analysis specific to the one-year vs two-year policy question, they perceive the evidence to be mixed, particularly regarding socio-emotional outcomes, as highlighted in the quote below:

"With regard to the effects of the "dose" of ECEC participation of children under the age of three years the many US-American and European studies reported beneficial effects of an early starting age and advantages of institutional care compared to informal care settings on the development of language and cognitive skills (NICHD, 2005; Sammons et al., 2002; Loeb, Fuller, Kagan, & Carrol, 2004; Bernal & Keane, 2007; Gregg, Washbrook, Propper, & Burgess, 2005; Hansen & Hawkes, 2009; Love et al., 2003; Sylva et al., 2011b; Broberg, Hwang, Lamb, & Bookstein, 1990; Broberg, Wessels, Lamb, & Hwang, 1997). However, some large European studies also report inconsistent effects (Driessen, 2004; Sammons et al., 2008). Research evidence on socio-emotional outcomes is even more heterogeneous. A number of studies, comprising the well-known, large and comprehensive US- American NICHD-study found evidence for negative effects of early institutional

care on developmental aspects such as problem behaviour and less prosocial behaviour (NICHD, 2002c, 2003a). Other authors reported null effects (Bornstein, Hahn, Gist, & Haynes, 2006; Votruba-Drzal, Coley, Maldonado- Carreño, Li-Grining, & Chase-Lansdale, 2010; Love et al., 2003; Bassok, French, Fuller, & Kagan, 2008)."

Source: Ulferts & Anders (2016) p. 17.[31]

McCoy et al. (2017) complement the other meta-analyses discussed by focussing on longer-term outcomes.[32] They perform meta-analysis of 22 experimental and quasi-experimental studies conducted in the United States between 1960 and 2016. They find that on average, participation in ECEC leads to statistically significant reductions in special education placement (0.33 SD) and grade retention (0.26 SD) and increases in high school graduation rates (0.24 SD). It is important to note that the studies included are mainly demonstration programs, which are generally thought to be higher quality than what would feasibly be rolled out in a universal setting.

Meloy, Gardner, & Darling-Hammond (2019) examine evidence from evaluations of the Tennessee Voluntary Pre-Kindergarten and US Head Start programs.[33] They find that "well-implemented programs support substantial early learning gains and can have lasting impacts throughout school." In particular, they report the following:

School readiness:
- Literacy skills increased in 17 out of 18 studies;
- maths skills increased in 14 out of 18 studies;
- socio-emotional skills increased in 4 out of 6 studies.

School progression:
- Rates of special education placements declined in 4 of 7 studies;
- rates of grade retention declined in 6 of 10 studies.

Persistence:
- Half the studies found increases in literacy persist in elementary school;
- 3 of 7 studies found persistence in improvements in language skills through elementary school;
- 10 of 13 studies found maths persist throughout elementary school, sometimes into middle school.

Their interpretation of the evidence is more positive than other studies. They argue this is because they identify the correct counterfactual: they carefully compare children who attend a specific preschool program to similar children who did not attend preschool at all, as opposed to those who attended another program.

Rather than a meta-analysis, Phillips et al. (2017) offer a review of other studies, then provide a qualitative assessment of the evidence supporting different preschool programs.[34] The report is framed as a "consensus statement", acknowledging there are some areas of disagreement within the academic literature. Their synthesis is outlined below.

"Convincing evidence shows that children attending a diverse array of state and school district pre-k programs are more ready for school at the end of their pre-k year than children who do not attend pre-k. Improvements in academic areas such as literacy and numeracy are most common; the smaller number of studies of social-emotional and self-regulatory development generally show more modest improvements in those areas…

Convincing evidence on the longer-term impacts of scaled-up pre-k programs on academic outcomes and school progress is sparse, precluding broad conclusions. The evidence that does exist often shows that pre-k-induced improvements in learning are detectable during elementary school, but studies also reveal null or negative longer-term impacts for some programs."

Source: Phillips et al. (2017) p. 9. Note "pre-k" is the equivalent of preschool in the US.[35]

Cascio (2015) conducts a policy review, focussing on weighing the positive and negative empirical findings of ECEC on child outcomes.[36] They find a growing research base suggesting that universal early education can benefit both children and families, but "quality matters". These points are summarised in table 1.2 below.

Table 2.3: Cascio (2015) key findings from universal early education

Positive empirical findings:	Negative empirical findings:
High-quality universal early education raises test scores.	The test score advantage from universal early education declines as children progress through school.
High-quality universal early education improves other markers of school readiness that may be critical for generating long-term impacts.	For children from more advantaged families, the costs of universal early education may exceed the benefits.
High-quality universal early education may increase adult educational attainment and employment and reduce welfare dependency.	Universal early education that is oriented more toward childcare than preschool and is lower quality may make even disadvantaged children worse off.
The benefits of high-quality universal early education are larger for disadvantaged children.	Maternal labour supply impacts are larger for programs that are less beneficial for children.
Availability of early education can increase maternal employment, providing revenue to offset program costs.	Universal early education provides income support to relatively high-income families where mothers are already working.

Source: taken from Cascio (2015), p. 1

Elango et al. (2015) provide a rigorous framework with which to assess evidence from different types of ECEC programs, using different research methods.[37] As with Meloy, Gardner, & Darling-Hammond (2019), Elango and co-authors highlight that many studies attempt to quantify the causal effect of ECEC relative to home care, but instead they identify the causal effect of adding a program to the available choice set. If the control group of a study has access to alternatives that are good substitutes for the program being studied, and if the researcher erroneously assumes that the relevant alternative to the program being evaluated is home childcare and not some higher quality alternative, then there would appear to be no causal effect of the program's availability—even though the program may be highly effective.

"Our main conclusion is that at current levels of quality provided, disadvantaged children benefit the most from early childhood education. The services offered improve on what is offered to them at home. The high-quality means-tested demonstration programs that we have examined are socially efficient as measured by benefit-cost ratios and rates of return. There is a strong case for high-quality means-tested early childhood education (using a broad definition of means-tested). The evidence for universal programs is somewhat ambiguous. The evidence from Quebec suggests that standard childcare programs supporting the market labor supply of affluent women may harm their children, but may aid the children of disadvantaged families."

Source: Elango et al. (2015) p. 71

Coley, Lombardi & Sims (2014) focus on Australian data, finding similar patterns to the United States and other international studies.[38] They use nationally representative data from the Longitudinal Study of Australian Children (LSAC; N = 5,107), born in 2003-04. They find that greater duration and intensity of exposure to formal ECEC was associated with heightened fluid intelligence but also decreased behavioural functioning. Contrasting this, Goldfeld et al. (2016) find more positive results from the Australian Early Development Census (AEDC).[39] The AEDC is a teacher-rated checklist that provides data on ECEC experiences in the year before starting school, as well as five domains of child development at school entry: physical health and wellbeing, social competence, emotional maturity, language and cognitive skills, and communication skills and general knowledge. Logistic regression analyses revealed that attendance at preschool was associated with reduced odds of being in the vulnerable range (<10th percentile) on physical health and wellbeing, social competence, language and cognitive skills, and communication skills. Being in the vulnerable range for emotional maturity was also less likely, but not to the same level of statistical confidence.

Perhaps the most relevant international study is by McLeod et al. (2018).[40] They use the Christchurch Health and Development Study, a 1977 birth cohort (N=1,098) in New Zealand, to estimate effects of formal preschool attendance on long-term outcomes. They find formal ECEC to

be associated with greater attainment of high school and university qualifications, and higher adult socioeconomic wellbeing – see Table 2.4. They adjust for family background and child characteristics using regression analysis.

Table 2.4: Educational attainment and economic outcomes by duration of ECE attendance

Measure	Duration Of ECE (years)				P-value (vs none)
	None	<1	1-2	2-3	
High school educational attainment					
Mean number of School Certificate pass grades	2.8	3.0	3.2	3.4	0.024
% Attained 6th form certificate	59.6	63.9	68.0	71.9	0.026
% Attained higher School Certificate (Form 7)	33.6	37.8	42.1	46.5	0.025
% Attained university bursary	21.7	24.7	27.9	31.4	0.067
Tertiary educational attainment					
% Enrolled in university by age 25	28.8	33.8	39.2	44.8	0.007
% University degree by age 30	22.7	25.3	29.2	33.4	0.030
Mean highest academic attainment by age 30	3.7	4.0	4.2	4.3	0.001
Socioeconomic wellbeing (30 years)					
% Working in paid employment	75.2	79.3	82.9	85.8	0.047
Mean occupational status (NZSEI)	43.4	45.4	47.4	49.3	0.006
Mean personal gross income NZD, 000 (past 12 months)	42.9	45.4	47.9	50.4	0.046

Note: Associations were adjusted for: Gender, Family type; Birth order in family; Breast feeding (months); Parental educational attainment; Family SES at cohort member's birth; Maternal emotional responsiveness, Child ethnicity, Early child behaviour problems.

Source: reproduced from McLeod et al. (2018), p. 269.

2.4 Focussing on one versus two years of preschool

The review by Fox & Geddes (2016) finds that studies from Europe, the United States and United Kingdom show "modest but consistent benefits from two rather than one year of preschool"; however, the studies they cite tend to use no formal preschool as the counterfactual.[41] The main study they cite that compares duration is Taggart et al. (2015), which shows an additional year of ECEC adds an additional 1.3-3.0 months of developmental advantage for literacy, depending on the quality of the preschool.[42] Similarly Taggart et al. (2014) find that the odds ratio of taking a higher academic route after 16 is 3.04/2.79=1.09 for those with two-to-three years of preschool, compared to those with one-to-two years of preschool. Conversely the odds ratio of taking a vocational route is 0.49/0.56=0.88.[43] Note these are unlikely to be statistically significant, and do not control for observables. They also cite Jenkins et al. (2016) that "the effect of the first year of preschool is generally greater in magnitude than the second year".[44]

Ansari et al. (2019) find less encouraging results for two years of preschool relative to one year.[45] They perform an observational study in a US county, with a total of 1,213 children. Measured at the end of the treatment, children who had some exposure to formal ECEC aged three (treated) outperformed those children who had only informal care aged three (untreated) (effect size: 0.20-0.30). However, by the end of the final preschool year, the untreated group had effectively caught up with the treated group. Further, children with earlier ECEC experiences demonstrated elevated levels of behaviour problems at the beginning and end of their four-year-old pre-K year, and demonstrated less optimal social competence by the end of the year. Importantly, the authors note that the latter finding may be a result of negative selection, where parents place more behaviourally challenging children into formal ECEC sooner. This is discussed further in 2.5.2.

In an observational study within a US school district, Infurna & Montes (2020) found that children who attend two years of formal ECEC were 34 per cent more likely to make a successful transition to school compared to their peers who only attended ECEC as four-year-olds.[46] Black students who attended two years experienced a greater benefit, with a 53 per cent increased likelihood of being school-ready. School-readiness is measured by an array of academic/cognitive test results. The

authors explain their more positive finding is because preschool dosage is more carefully measured than other work: the treatment they identify is the *actual* enrolment in ECEC, rather than the *eligibility* for enrolment.

Arteaga et al. (2014) use data from a cohort of 1,500 students in the Chicago Longitudinal Study who enrolled in the Chicago Public Schools in the mid-1980s.[47] This is a follow-up study to Reynolds (1995). They focus on enrolees of high-quality preschool programs called Child-Parent Centres (CPCs): while their data is observational rather than an RCT, they use propensity score weighting to mitigate the effect of selection bias. Comparing one versus two years of formal ECEC, there is indicative evidence of fewer grade retentions (7 per cent), fewer juvenile criminal complaints (11 per cent), and fewer felony arrests (5 per cent). Those with more ECEC are also less likely to experience some form of abuse (6 per cent). Broader outcomes of educational attainment or socioeconomic status are not statistically significant, however.

Domitrovich et al. (2014) examine two groups of children, N=116 in each, in a 2002-2004 US Head Start cohort. One group received two years of ECEC (treatment), and the other which received a single year of ECEC (control).[48] Treatment and control observations were matched based on a propensity score from family type and size, parental education, ethnicity, and income. The authors find significant and material effect sizes for cognitive ability on school entry: receptive vocabulary (effect size = 0.53 SD), letter-word skills and letter naming (effect size = 0.39 SD) and numeracy (effect size =0.33 SD). These relatively large effects stand in contrast to the remainder of the literature, perhaps because Head Start programs often target more disadvantaged households.

Blanden et al. (2022) examine quasi-experimental variation in eligibility for subsidised pre-school in England.[49] Their study is both large-scale and recent: with 265,679 children in private settings, starting school in 2008-2011. They use a regression discontinuity design, using date-of-birth discontinuities, meaning certain students are eligible for an additional term of subsidised pre-school. The identifying argument is that around date cut-off, children are otherwise identical, since date of birth is relatively random. They also control for centre quality rating and teacher qualifications. They find that an additional term of preschool leads to a 0.045-0.082 SD increase literacy and numeracy at age five. The impacts are not significantly different for those on free school meals or from deprived areas, but they are measurably greater for those attending a high-quality rated centre. Impacts are no longer detectable by age seven, at key stage 1. If we scale the effect of an additional term by four to consider an additional year of ECEC, these effects are similar in magnitude to those found in other work.

Loeb et al. (2007) examine the effects of different childcare arrangements on children's cognitive and social proficiencies at the start of school.[50] They use observational data from the Early Childhood Longitudinal Study on 14,162 children entering school in 1998, and identify effects using OLS, matching and instrumental variables methods. Overall, they find formal care raises reading and mathematics scores, but has a small negative effect for socio-behavioural measures. As shown in Table 2.5, children who started centre based ECEC aged 2-3 performed better than other intake ages on reading and maths, but the marginal effect size of an additional year is relatively small. Outcomes are standardised and scaled up by a factor of 10, so starting aged 2-3 compared to 3-4 yields an effect size of (1.952-1.324)/10=0.063 SD for reading, and (1.783-1.393)/10=0.039 SD for maths. The incremental gains are not likely to be statistically significant overall but are larger and likely significant for children from low-income households. Starting formal ECEC earlier is marginally worse in terms of behavioural outcomes: those starting between 2-3 score 0.0072 SD lower on average, compared to those starting between 3-4. This pattern is monotonic: starting at 0-1 is worse than 1-2, which is worse than 2-3, and so on. This pattern is also relatively stable across household incomes.

Table 2.5: Loeb et al. (2007) Effects of age at entry, by income group

Income group	**All**	**Low**	**Middle**	**High**
	(11,577)	(2670)	(5891)	(3061)
Reading				
Started centre age 0-1	0.999***	0.473	1.351**	0.242
	(0.374)	-0.965	(0.534)	(0.752)
Started centre age 1-2	1.306***	1.161	1.171**	0.552

Income group	All	Low	Middle	High
	(0.415)	(1.023)	(0.589)	(0.820)
Started centre age 2-3	1.952***	2.111***	1.944***	1.338**
	(0.328)	(0.799	(0.485)	(0.669)
Started centre age 3-4	1.324***	-0.009	1.700***	1.001
	(0.26)	(0.555)	(0.359)	(0.619)
Started centre age 4-5	0.728***	0.71	0.776**	0.296
	(0.260)	(0. 509)	(0.351)	(0.681)
Started centre age >5	0.475	0.244	0.814	-0.37
	(0.557)	(1.164)	(0.737)	(1.323)
R-squared	0.36	0.28	0.30	0.33
Math				
Started centre age 0-1	1.404***	0.303	1.590***	1.214*
	(0.359)	(0.986)	(0.508	(0.697)
Started centre age 1-2	1.103***	1.537	1.010*	0.471
	(0.398)	(1.046)	(0.560)	(0.761)
Started centre age 2-3	1.783***	2.731***	1.658***	1.285**
	(0.315)	(0.817)	(0.461)	(0.621)
Started centre age 3-4	1.393***	1.126***	1.357***	1.379**
	(0.250)	(0.567)	(0.341)	(0.574)
Started centre age 4-5	0.851***	1.0871**	0.889***	0.157
	(0.250)	(0.520)	(0.334)	(0.632
Started centre age >5	0.837	0.28	1.005	0.700
	(0.534)	(1.189)	(0.701)	(1.227)
R-squared	0.37	0.29	0.3	0.32
Behaviour				
Started centre age 0-1	-0.287***	-0.372***	-0.159***	-0.388***
	(0.044)	(0.119)	(0.061)	(0.087)
Started centre age 1-2	-0.209***	-0.203	-0. 157**	-0.303***
	(0.048)	(0.127)	(0.067)	(0.095)
Started centre age 2-3	-0.157***	-0.267***	-0.068	-0.233***
	(0.038)	(0.099)	(0.055)	(0.078)
Started centre age 3-4	-0.085***	-0.154**	-0.011	-0.157**
	(0.030)	(0.069	(0.041)	(0.072)
Started centre age 4-5	-0.026	-0.105*	0.04	-0.073
	(0.030)	(0.063)	(0.04)	(0.079)
Started centre age >5	-0.059	-0.159	-0.012	-0.056
	(0.065)	(0.144)	(0.084)	(0. 154)
R-squared	0.14	0.18	0.15	0.16

Note: results are effect sizes, scaled *10. Models include all child/family controls, zip controls and state fixed effects, well as dummy variables for Head Start participation, other non-parental care, and unknown centre start date. Standard errors in parentheses. *Significant at 10%. ** at 5%. *** at 1%.

Source: reproduced from Loeb (2007), p. 62.

2.5 Challenges to lasting positive impacts of ECEC

As the reviews and meta-analyses discussed in 2.3 suggest, the evidence for ECEC affecting later outcomes is generally positive. However, there are two main challenges to the conclusion that additional ECEC will result in beneficial outcomes for recipients. These are discussed in turn.

2.5.1 Persistent versus transitory effects

One of the more active questions in the literature is whether gains in outcomes persist throughout school, or 'fade out' over time. The mechanisms generating persistence versus fade-out are formalised by Duncan et al. (2022), in the concept of ***dynamic complementarity*** versus ***dynamic substitutability***.[51] The logic of dynamic complementarity is that skills developed in preschool – either cognitive or non-cognitive – make later skill development more achievable: that is, "skill begets skill". Conversely, dynamic substitutability indicates that formal schooling has a remedial or levelling effect on variations in readiness between children entering school. In this way, the learning in primary years will allow children to catch up to their more school-ready peers. Thus, positive treatment effects detected in pre-school will fade out as children progress through school; as the control group transforms into a second treatment group.

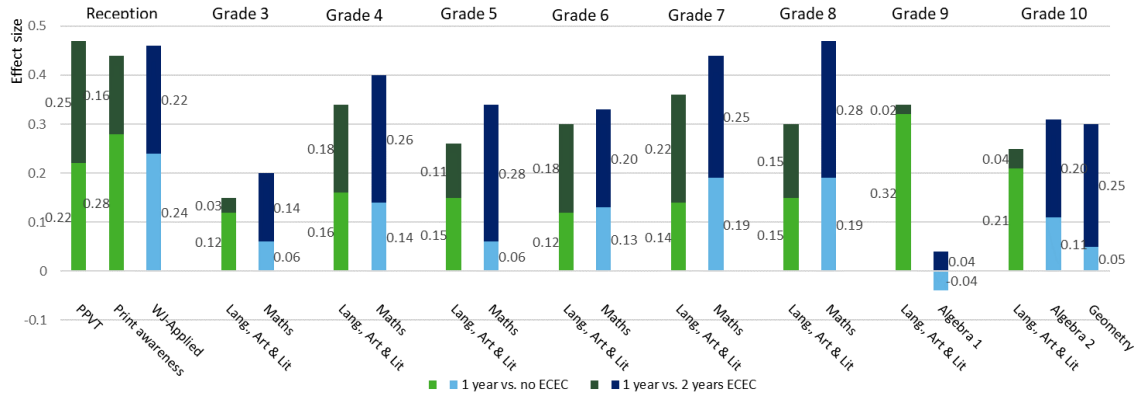
Whether dynamic complementarity or substitutability dominate depends on the ECEC program, and the subsequent school setting. Clearly the nature of the skills ECEC fosters will alter the longevity of impacts. Bailey et al. (2020) identify three important characteristics for longevity of skills:

1. the skills are foundational or fundamental for later development,
2. they are malleable through intervention, and
3. are unlikely to develop eventually in most counterfactual conditions.[52]

Regarding the subsequent school setting, one hypothesis is that primary teachers often focus on children with weaker skills. This would reduce the treatment effect for children who have additional ECEC experience. This argument is less compelling for universal ECEC settings however, since the primary school classroom will not be a mix of 'treated and untreated' children.

There are examples of studies with positive effects that persist throughout school, for example Barnett & Jung (2021).[53] Their observational study was in the context of a large unforeseen preschool expansion, as a result of a court ruling in New Jersey. The temporary capacity constraints created some (arguably) quasi-experimental variation. They found substantial positive effects for Language Arts and Literacy (LAL), mathematics, and science on state-wide assessments. As shown in the figure below, effects persist from school entry to grade 10, which is the oldest observed in the data. Those who received two years of preschool fared better on average than those who received one year. Grade retention was also significantly lower through to grade 10. This is essentially an observational study; the authors acknowledge that little is known about the way capacity was allocated at the start of the program. Indeed, it may be that the early adopters were most focussed on educational investments for their child.

Figure 2.1: Cognitive achievement from participation in the Abbot pre-K program



Source: adapted from Barnett & Jung (2021) p. 255

There is a large set of research evidence for both persistence and fade-out of effects from formal ECEC as children progress through school. Some variation may be due research design, but the types of skills developed in preschool clearly also matter. This is neatly summarised by Meloy,

Gardner, & Darling-Hammond (2019): "It is clearly possible for the academic benefits of preschool to persist into elementary and middle school, but the inconsistency of outcomes across programs illustrates the importance of understanding study methodologies and of investing in quality to support sustained gains."[54]

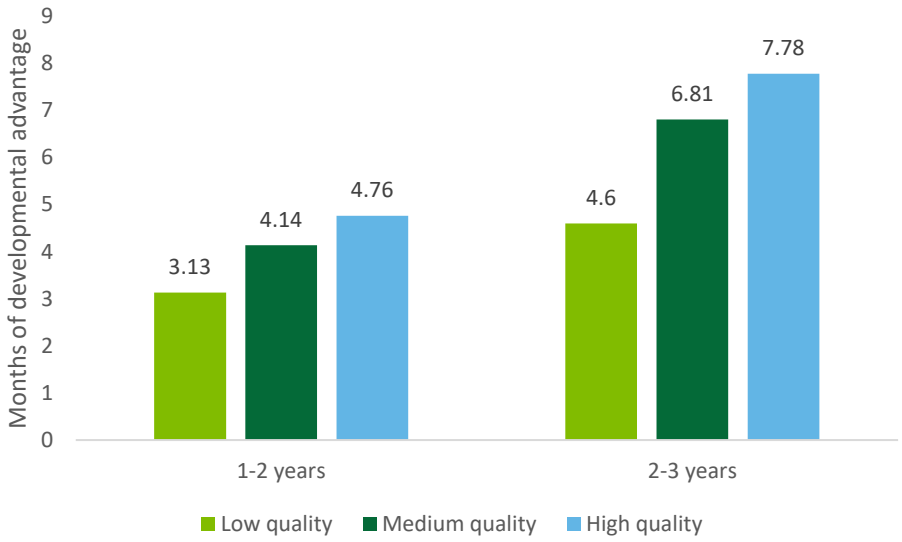
2.5.2 Negative effects from universal ECEC programs

Besides the issue of durability of treatment effects, there is considerable evidence for negative impacts from universal ECEC programs, particularly on socio-emotional measures. Two explanations are discussed in the literature. First, where negative outcomes arise from observational studies, there is a clear logic for selection effects. Ansari et al. (2019) note that they cannot exclude the possibility that parents place more behaviourally challenging children into formal ECEC sooner than otherwise.[55] In fact, Yazejian et al. (2015) found explicitly that very early entry into a formal ECEC program (at age 1-2) was associated with higher behavioural issues, although these diminished the longer children spent in the program, and "by the time children left [formal ECEC], initiative and self-control ratings were somewhat above average".[56] This is indicative of positive treatment effects overcoming negative selection effects.

There are instances of negative impacts where selection effects cannot be the explanation because the study has a RCT or quasi-experimental research design. For example, Fort, Ichino and Zanella (2020) use a regression discontinuity design to reveal a negative effect of formal childcare aged 0-2 in Italy on IQ (0.047 SD) and measures of personality characteristics.[57] Similarly, Baker, Gruber & Milligan (2019) find negative impacts on short- and long-term behavioural problems for subsidised childcare in Canada using a difference-in-difference design, comparing across provinces and over time.[58]

Elango et al. (2015) conceptualise these negative findings as lower quality programs crowding-out higher quality alternative forms of care: either informal care with family, or formal care that would have otherwise been paid.[59] This is particularly the case in the Quebec context, where the reform only targeted relatively high-income households.

Chart 2.1: Duration and quality of pre-school on literacy at school entry (home as comparison)



Source: adapted from Taggart et al. (2015) p. 9

To illustrate the importance of quality, Chart 2.1 shows the literacy gain of formal ECEC, by duration and centre quality. Quality is responsible for broadly as much variation in gains as an additional year of ECEC. These show how if a lower dose of high-quality ECEC is substituted for a larger dose of low-quality, the impacts may well be negative. The following excerpts from two recent review papers reinforce the role of quality in understanding the expected returns to formal preschool.

"Whether pre-primary education facilitates [skill acquisition] in practice, however, depends on the quality of the learning environment provided through pre-primary education and how it compares to what children would have experienced without formal pre-primary education—both during and after the pre-primary period. If children receive more cognitive and psychosocial stimulation from their interactions with caregivers in the home or informal care settings (for example, the homes of relatives or friends) than informal pre-primary education, then an expansion of formal services is unlikely to improve average skill development and may even set children back. That is what researchers suggest happened when Canada's province of Quebec extended subsidized coverage of childcare to less needy families (Baker et al., 2008; Baker et al., 2015)."

Source: Holla et al. (2021) p. 8[60]

[The] mixed evidence regarding the effectiveness of early-childcare-orientated policies likely reflects the high variability in the quality of childcare in different contexts, which is key to children's outcomes. Andrew et al. (2019) show that improvements in pedagogical methods can have a significantly positive impact on child development within a randomised controlled trial (RCT) framework. Blanden et al. (2022) find that an additional term of free pre-school education in England has a substantially larger impact on age 5 children's school achievement if this education is received in settings with the highest inspection ratings, though the authors are not able to pinpoint the specific practices which lead to enhanced child development. There is some evidence from the EPPSE project (Effective Pre-School, Primary and Secondary Education), a longitudinal UK study funded by the Department for Education, that attending high-quality pre-school (versus low- quality) is beneficial for children's academic and social outcomes through age 16, mainly for disadvantaged children (Department for Education, 2015).

Source: Cattan et al. (2022) p. 19[61]

As a final consideration of the identified negative socio-emotional impacts from universal ECEC programs, Cloney & Cleveland (2021) argue measurement issues are common within social and emotional outcomes measures, with lower precision and accuracy relative to domains such as cognitive outcomes.[62] This potential for measurement error may reduce confidence in the results estimated in socio-emotional domains.

3 Empirical evidence on three-year-old preschool in South Australia

This chapter sets out the empirical evidence on the returns to three-year-old preschool in South Australia, examining the Longitudinal Study of Australian Children and evidence from South Australian data.

3.1 Estimating three-year-old preschool effects from the Longitudinal Study of Australian Children

Growing Up in Australia: The Longitudinal Study of Australian Children (LSAC) follows the development of 10,000 young people ('study children') and their families from across Australia through survey data collected from a representative sample of children.[63] The study is conducted in partnership between the Department of Social Services (Commonwealth), the Australian Institute of Family Studies, and Roy Morgan.

The study has surveyed the study children and their families every two years since the first survey wave started its data collection in 2003-04. There were two cohorts of study children and their families:

- Cohort B – consisting of children who were aged 0-1 during the first survey wave, and
- Cohort K – consisting of children who were aged 4-5 during the first survey wave.

The most recent wave of data (Wave 9) collected during 2019 and 2020 was disrupted by the COVID-19 pandemic and was replaced with two half waves in 2020 and 2021.

The survey contains a rich set of questions which provide data on the study children's educational experiences, health status and outcomes, household life and context, and parental background. Later waves also include the study child's self-reports on their emotional outlook, their higher education prospects, and, for children aged over 15 years, their employment outcomes. The data can also be linked to NAPLAN and Australian Early Development Census (AEDC) education outcomes for the study children.

Of the two cohorts, only Cohort B is relevant to the effects of three-year-old preschool as study children in Cohort K were at least four years old at the commencement of the study and there is limited data on their early childhood education programs before primary school, such as preschool.

3.1.1 Overview of the cohorts of interest

To undertake this study, the Cohort B study children were classified into a series of subgroups based on their early childhood education program:

- **Three and four-year-old preschool**: Those who attended preschool in both of the two years prior to school entry
- **Four-year-old preschool only**: Those who attended preschool only in the year directly preceding school entry

- **Long day care (LDC)**: Those who attended a LDC program and did not attend preschool[vii]
- **No preschool or LDC**: those who did not attend a preschool program or LDC prior to school entry.

As outlined above, completion of three-year-old preschool was defined with reference to the year a child started school. This is due to the varying start dates and eligibility rules for preschool across different states in Australia, and due to the format of data which provides indicators of ECEC and schooling by wave rather than month. This means that the most consistent way to measure three-year-old preschool attendance is relative to the year school was started.

Policy and preschool context in 2007/2008:

For most children in Cohort B, three-year-old preschool participation would have taken place in 2007, prior to four-year-old preschool in 2008 and formal schooling commencement in 2009.

Participation in preschool and ECEC programs at this time immediately preceded the period of ECEC reform associated with the Council of Australian Government's Universal Access commitment to preschool education in November 2008, endorsed by the National Partnership Agreement on Early Childhood Education.[64] This reform established the 600 hour entitlement for children by a four-year university-qualified early childhood teacher.[65] Attending preschool at this time also preceded the establishment of the Australian Children's Education and Care Quality Authority (ACECQA) and the introduction of the National Quality Framework national quality standard in 2012.[66]

As such, the system of preschool and ECEC was disparate between Australian jurisdictions, and the quality of the data collection and consistency of information between states and territories is relatively low. The 2008 National Partnership Agreement further prompted several jurisdictions to review their early childhood and preschool legislation, further altering the ECEC landscape.[67]

In the period the Cohort B children would have been attending preschool, the ECEC market was mixed, with LDC, preschool, in-home care, and occasional care settings. Preschool programs were "usually play-based educational programs designed and delivered by a degree-qualified early childhood teacher", and could be offered in standalone preschools, integrated within LDCs, or offered in other community settings.[68]

The required staff qualifications and staff to child ratios were generally lower and more inconsistent than today.[69] Standalone preschools were typically staffed with qualified teachers who tended to be early childhood qualified, while LDC centres tended not to employ qualified early childhood teachers (except in New South Wales, where it was a legal requirement above a threshold of 29 children in a centre).[70]

In South Australia, Western Australia, Tasmania, the Australian Capital Territory, and the Northern Territory, the majority of preschools were government owned and funded in a similar fashion to government schools.[71] South Australia, Western Australia and Tasmania also had more formal approaches to preschool and childcare curriculum, though with an emphasis on play-based learning.[72] (The first national Early Years Learning Framework, Belonging, Being & Becoming, was not published until 2009).[73] In New South Wales, Victoria and Queensland, most preschools were non-government owned but subsidised by state and/or local government.[74]

Dowling and O'Malley (2009) argue there was a public perception that standalone preschools were of higher quality than long day cares, due to the patterns of teacher qualification.[75]

Considering the four outlined cohorts, the treatment effect of three-year-old preschool is measured as differences in the *three- and four-year-old preschool* treatment group relative to the control

[vii] The LSAC dataset includes primary and secondary education and care arrangements for children. Children classified in the *three- and four-year-old preschool* and in the *four-year-old preschool only* groups are defined with respect to their formally identified preschool participation. These children may also have attended an LDC. Children classified in the LDC group were not recorded as attending a formal preschool program at any stage, although it may be that they attended a LDC with an internal preschool program that was not recorded.

group of the *four-year-old preschool only* study children. This is because the treatment effect of interest is the effect of experiencing an *additional* year of preschool prior to school entry. Some study children were observed to attend preschool two years prior to school entry, but then only attended a LDC program or neither a preschool nor LDC program in the year before school entry. Consequently, what could be called the *three-year-old preschool only* group is not considered to be part of the treatment group.

Table 3.1 provides the sample size and composition of the sample between the different ECEC groups across various demographic and contextual observables of the study children. The *three-year-old preschool only* group is omitted from these summaries as it does not form part of the treatment group, and in the year before school straddles the *LDC* and *No preschool or LDC* groups.

Table 3.1: Sample characteristics breakdown by ECEC program attendance

Variable	Value	3- and 4-year-old preschool	4-year-old preschool only	LDC	No preschool or LDC
Sample size	Count	1,304	1,321	1,272	349
Highest parent education Level	Year 10 or below	2.8%	4.8%	4.9%	10.0%
	Year 12 or 11	6.4%	10.2%	9.1%	13.5%
	Certificate	26.0%	31.5%	34.7%	38.7%
	Advanced diploma/diploma	11.5%	9.8%	11.0%	8.0%
	Graduate diploma/certificate	7.8%	7.0%	6.5%	3.2%
	Bachelor degree	29.2%	24.8%	22.3%	18.6%
	Postgraduate degree	15.3%	10.8%	9.8%	6.0%
	Other	1.0%	1.0%	1.6%	2.0%
Sex	Female	47.7%	50.6%	47.1%	53.0%
	Male	52.3%	49.4%	52.9%	47.0%
Aboriginal or Torres Strait Islander	No	98.2%	97.2%	95.0%	88.8%
	Yes	1.8%	2.8%	5.0%	11.2%
Medical condition when starting school	No	90.4%	91.7%	91.3%	89.2%
	Yes	9.6%	8.3%	8.7%	10.8%

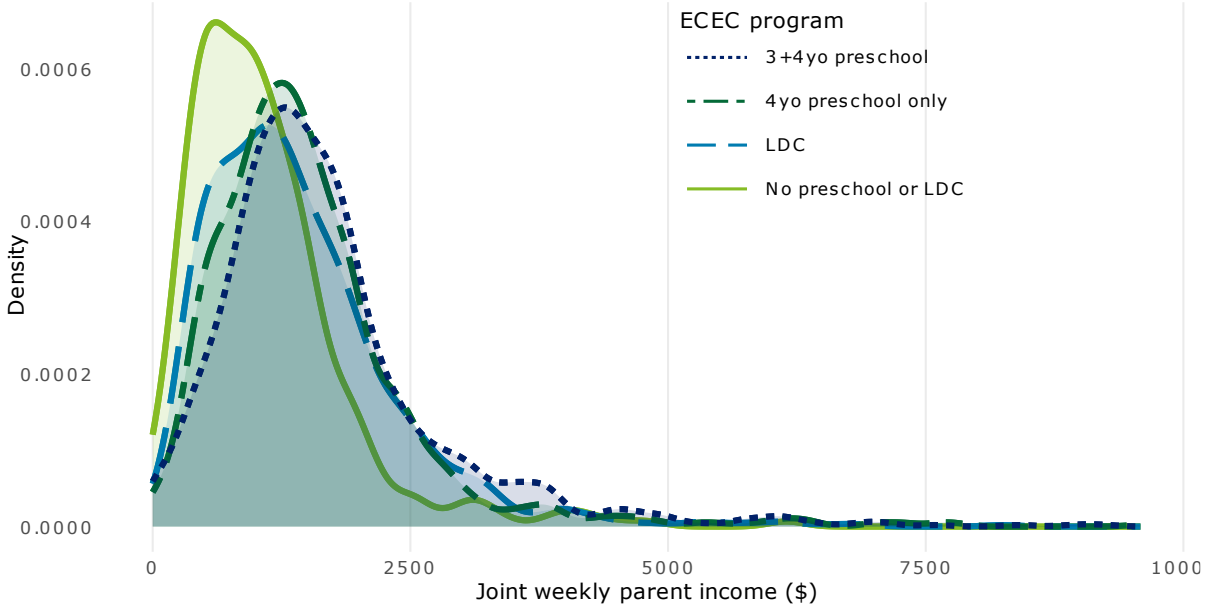
Birth order (1 = eldest)	Average	1.89	1.92	1.83	2.32
Number of younger siblings	Average	0.35	0.33	0.28	0.38
LOTE at home	No	85.7%	85.8%	82.8%	69.6%
	Yes	14.3%	14.2%	17.2%	30.4%
State	NSW	33.4%	15.6%	39.7%	40.4%
	VIC	35.2%	23.5%	14.7%	17.5%
	QLD	8.3%	18.0%	37.9%	27.2%
	WA	6.8%	24.1%	2.2%	8.9%
	SA	10.9%	8.1%	2.7%	2.3%
	TAS	2.6%	3.7%	0.9%	1.7%
	ACT	1.8%	4.5%	1.3%	1.1%
	NT	1.1%	2.5%	0.7%	0.9%
SEIFA at or before preschool	Average	1,023	1,002	1,007	985
Remoteness index at or before preschool	Major Cities of Australia	69.1%	61.9%	69.0%	63.9%
	Inner Regional Australia	20.5%	20.2%	20.5%	14.6%
	Outer Regional Australia	9.2%	14.9%	9.4%	17.2%
	Remote Australia	1.1%	2.5%	0.9%	2.6%
	Very Remote Australia	0.2%	0.5%	0.2%	1.7%
Joint weekly parent income	Average	1,690	1,516	1,426	1,088
Whether a parent lives elsewhere	No	94.2%	91.4%	81.7%	86.7%
	Yes	5.8%	8.6%	18.3%	13.3%
Hours per week of preschool	Average	12.61	12.60	0.00	0.00

Number of schools attended by Year 9	Average	2.40	2.58	2.56	2.87
School type in Year 9	A government school	43.5%	49.1%	53.6%	58.0%
	A Catholic school	27.5%	26.1%	24.5%	17.6%
	An independent or private school	28.5%	23.8%	21.3%	20.2%
	Not in school	0.5%	1.0%	0.5%	4.2%

Source: LSAC

Overall, the *three- and four-year-old preschool* group tends to display characteristics consistent with being a more advantaged cohort than the *four-year-old preschool only* cohort. In particular, differences are observed in the level of parent income, average SEIFA score[viii] of their home and a higher representation of university educated parents. To provide a more complete picture than just the mean of parent income, Chart 3.1 below depicts the distribution of weekly parent income across the different ECEC program groups, where it is apparent that study children in the *three- and four-year-old preschool* group tend to be more likely to have parents earning higher incomes that the other groups.

Chart 3.1: The sample distribution of joint weekly parent income by ECEC program (national)

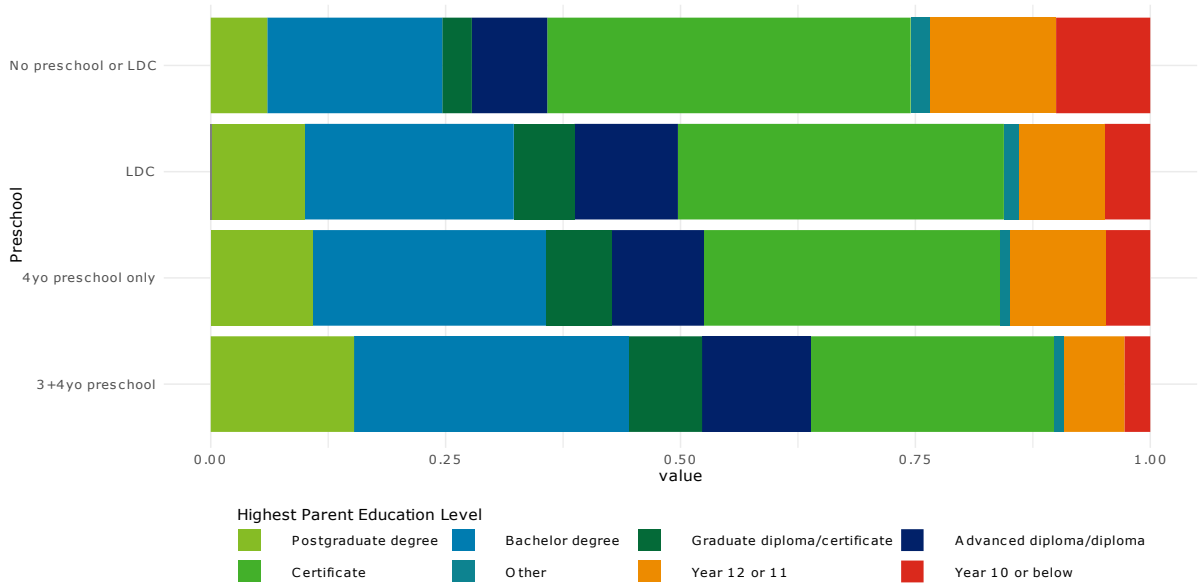


Source: Deloitte Access Economics (2023) using LSAC data.

This suggests that the treatment group is more advantaged on average than the control group. A similar pattern is reflected in the distribution of the highest level of parent education (Chart 3.2) where the treatment group has significantly more representation of at least one university educated parent. This may be expected, as parents with higher education levels may be more likely to invest in their child's education earlier through formal schooling institutions.

[viii] The Socio-Economic Indexes for Areas (SEIFA) is a measure used by the ABS to indicate the relative advantage of geographic areas. This is a measure from approximately 600 to 1300 with a higher score meaning more socioeconomic advantage.

Chart 3.2: Distribution of the level of the highest educated parent by ECEC group.



Source: Deloitte Access Economics (2023) using LSAC data.

Due to these innate differences between the cohorts, it would be misleading to compare outcome scores within each group at the average, or even in distribution, as the relative advantage evident in the treatment group also correlates to better outcomes. This means we would expect to see better outcomes within the treatment group relative to the control group, driven by factors other than the treatment effect of attending three-year-old preschool. As such, regression modelling was used to estimate the effect of three-year-old preschool while controlling for confounding factors that may drive surface level outcome differences between the groups.

3.1.2 Methodology and model specification

Linear regression models can be used to estimate the effect of attending three-year-old preschool as well as four-year-old preschool on a range of outcomes, while controlling for other differences between the treatment and control groups that may also drive observed differences in outcomes. The linear regression models for this analysis are specified with the functional form:

$$\boldsymbol{y} = \beta\, \boldsymbol{attended\ three\text{-}year\text{-}old\ preschool} + X\boldsymbol{\gamma} + \boldsymbol{\varepsilon},$$

where:

- $\boldsymbol{y}$ is the vector of the observed outcome scores upon which the impact of three-year-old preschool is being tested,
- $\boldsymbol{attended\ three\text{-}year\text{-}old\ preschool}$ is a binary vector which is 1 where the study child attended three-year-old preschool and zero otherwise,
- β is the coefficient of interest measured as the effect of a child attending three- and four-year-old preschool, relative to a child who only attended four-year old preschool,
- X is a matrix of control variable data with corresponding effect sizes captured in $\boldsymbol{\gamma}$ (see Table 3.3 for a list of control variables),
- $\boldsymbol{\varepsilon}$ is the random error vector – assumed to be normally distributed for ordinary least squares regressions and logistically distributed when testing binary outcomes. Standard errors are clustered by postcode to account for any heteroscedasticity introduced by the LSAC data collection method.

Numerous outcome variables have been considered to understand the benefits of three-year-old preschool. The outcomes sit broadly within three overarching spheres of education, health and social outcomes. Each outcome is detailed in Table 3.2.

Table 3.2: Outcome variables investigated for effects of three-year-old preschool

Outcome	Description	Scale
AEDC	AEDC scores as reported by primary school teachers on the first day on a scale from 0 to 10 of full-time school in five domains of: Physical Health and Wellbeing, Emotional Maturity, Social Competence, Language and Cognitive Skills, and Communication Skills and General Knowledge.	0-10
NAPLAN	The NAPLAN standardised assessment scores conducted across the five domains of Grammar, Numeracy, Reading, Spelling and Writing in the schooling years 3, 5, 7 and 9.	0-1000
Extra classroom support	Whether the student required additional support during schooling in terms of additional services in the classroom or an individual education plan.	Binary
Kessler 10+ psychological distress scale	A score from 10 to 50 based off a series of ten targeted questions designed to assess the study child's mental health. A higher score indicates the child presents more symptoms of psychological distress or depression. Scores of 10-19 suggest the subject is likely to be well, while scores above 20 or 30 indicate a likelihood of a mild or severe mental disorder respectively.	10-50
Self-reported health	The study child's self-assessment on their own health on a scale from 1 to 5 starting with 1 as poor, then going to fair, good, very good and excellent at 5. This is also investigated as a binary outcome of whether the child reported their health as very good or excellent, or not.	1-5; Binary
Self esteem	A binary indicator of the child's self-perception that if they really apply themselves, they can achieve anything they want to.	Binary
Crime and police interaction	A binary indicator for whether the child had been cautioned or arrested by police in the past year at the time of completing the survey.	Binary

Emotional problems	A score from 0 to 10 as scaled responses to a series of five questions about how often the child complains, is worried, is unhappy, is nervous or is scared, where a higher score indicates more problems.	0-10
Bad behaviour	A score from 0 to 10 as scaled responses to a series of five questions about how often the child is angry, is obedient, fights, lies or steals, where a higher score indicates more problems.	0-10
Social development	An overall score from 0 to 40 combining the emotional problems, bad behaviour, hyperactivity and peer (bullying) problems composite scale scores, where a higher score corresponds to a worse outcome.	0-40

Source: Deloitte Access Economics (2023).

Employment-related outcomes were also considered. However, due to the timing of the LSAC survey data collection, Cohort B children who can be identified as attending three-year-old preschool or not are only 18 years of age at most in the latest wave of survey data. Employment and income related questions only concern the final year of school, or for some study children, the first year following school, where employment outcomes are not reflective of lifetime earnings or employment, particularly for students who undertake further study before entering the labour force.

To control for confounding influences, a rich set of control variables were selected and included in the modelling. A list of these variables is provided in Table 3.3, broken down into controls at the time of treatment – the study child's context and advantage during early childhood, and controls at the time of outcome accounting for some external differences that reflect the child's experience between preschool and the measured outcome.

Table 3.3: Control variables used in regression specification models.

Controls at time of treatment	Later in life controls
• Child's sex • Home SEIFA • Childs Aboriginal or Torres Strait Islander status • Joint weekly parent income • Whether the child has an ongoing medical condition • Highest level of parent education • Child's birth order (1 = eldest) • Whether a parent is living elsewhere (fixed effect) • Number of younger siblings[ix]	• Age • School type (government, Catholic, private) • Number of schools attended • Joint weekly parent income • Home SEIFA

[ix] Number of youngest siblings was chosen to control for the total number of siblings as the birth order variable already contains the information around the number of older siblings, and therefore including younger siblings captures the full information for total number of siblings while being an independent covariate to birth order.

- Remoteness of home (fixed effect)
- Whether a language other than English is spoken at home
- State (fixed effect)

Source: Deloitte Access Economics (2023).

These control variables capture the relevant effects that social and socioeconomic advantage, geographic location, home environment and school properties may have on outcomes, to remove confounding factors that might otherwise inflate the estimates of the measured treatment effect.

This reduced set of controls was arrived at following rigorous testing and consideration of a broad array of model specifications. The choice of control variables was carefully calibrated to ensure that key controls were used while dropping variables with a large number of missing observations that did not materially effect the key coefficients of interest. The inclusion of variables with a lot of non-responses in the data can significantly reduce the sample that effects are measured on as the model can only use observations for which all outcome, treatment and control variables have complete observations.

While this analysis is intended to inform benefits of three-year-old preschool in a South Australian context, the LSAC data was collected nationally with only 9.5 per cent of the sample in South Australia. To preserve power of statistical tests, the analysis is conducted nationally, and includes state-based fixed effects, as it is not able to be reliably broken down into a South Australia specific context. Analysis of data from the South Australian Department for Education supplements the findings from LSAC to consider an alternate dataset in a specifically South Australian context (see Section 3.2).

A few key controls that were tested include: the hours per week of preschool, the academic qualification of preschool staff (as a proxy for quality of preschool education), parent occupation and a school facilities score (as a proxy for the quality or advantage of the school the child attended). Each of these were omitted from the specification for the reasons outlined below.

- **Hours of preschool:** In the case of hours of preschool, the distribution of the hours per week in preschool was practically identical and therefore accounted for no difference between the treatment and control group and did not impact the treatment effect estimate, whilst increasing the number of model parameters and reducing the available sample size for the model. A further study interested in the dosage of three-year-old preschool might consider interacting only the three-year-old preschool hours with the indicator for whether the child attended three-year-old preschool.
- **Staff qualification:** The qualification of preschool teachers recorded in the survey was tested to be used as a proxy for the quality of preschool education received. Whilst it may be debated whether the level of education of preschool teachers directly corresponds to the quality of the preschool education, the variable in the data had a low response rate leading to a significantly reduced sample size. At the same time there were also limited differences in the distribution of teacher qualification between the cohorts and therefore minimal impact on the estimated treatment effect.
- **Parent occupation:** Parent occupation was considered as another potential driver of advantage or correlated to outcomes, however, with classification at the Australian and New Zealand Standard Classification of Occupations (ANZSCO) one digit level of eight different occupations, this variable introduced a lot of parameters into the model, which were quite highly correlated with parent education level and income variables already included.

Furthermore, the effect of its inclusion was found to be relatively insignificant on the treatment effect once both parent income and the highest level of parent education was controlled for, suggesting the extra information this variable added was very limited.

- **School facilities score:** The data on school facilities was considered as an extra proxy for later in life effects of the advantage of the study child's school. However, this data had a very high rate of missing responses, often reducing the sample available to model by half.

A discussion of further model specifications and aspects of analysis tested but not reported here can be found at the start of Appendix C.

3.1.3 Results

Overall results indicate that, even controlling for the aforementioned factors, the *three- and four-year-old preschool* group experienced better outcomes in some areas of education and health, while evidence for social and other developmental outcomes was more limited and not detected to be statistically significant with the available sample.

Education outcomes

Considering evidence for short-term effects, the AEDC results indicate the school readiness for children upon commencing full-time school across the five domains of Physical Health and Wellbeing, Emotional Maturity, Social Competence, Language and Cognitive Skills, and Communication Skills and General Knowledge. As may be expected from the literature review, the only effect observed to be statistically significant at a 5 per cent significance level was in the Language and Cognitive skills domain (Table 3.4). Effects in other domains were all estimated to be positive, but only as large as the standard error of the estimate, meaning there is low statistical confidence in distinguishing these effects from zero.

Table 3.4: Regression estimates and effect size for AEDC scores between the control and treatment groups. Robust standard errors in parentheses.

AEDC Domain	Average score for the control group	Average score for the treatment group	Effect[x]
Physical health and wellbeing	8.89	8.95	0.06 (0.07)
Emotional maturity	7.88	7.96	0.08 (0.09)
Social competence	8.14	8.24	0.10 (0.08)
Language and cognitive skills	8.79	8.95	0.16** (0.08)
Communication and general knowledge	8.2	8.34	0.14 (0.11)

Significance levels: * 10%, ** 5%, *** 1%.

Source: Deloitte Access Economics (2023).

[x] These results are based on the AEDC scale of 0-10 and are not expressed in terms of standard deviations so cannot be compared to the literature review.

These results indicate that a child who attended three-year-old preschool as well as four-year-old preschool scored 0.16 points higher on average in the AEDC language and cognitive skills domain than a child with the same contextual factors who only attended four-year-old preschool.

While there is evidence of improved school readiness in terms of cognitive skills, the AEDC scores filled out by teachers can vary in measurement between different schools across the same or different geographies. As such, NAPLAN test scores, being a standardised test, can be used to test the effects across the national survey with more consistency in scores and effect sizes, as well as tracking the persistence of the treatment effect of three-year-old preschool throughout schooling from Year 3 to Year 9.

The NAPLAN tests score students across five domains being grammar, numeracy, reading, spelling and writing. The scores are on the scale of 0 to 1000, with all observed scores in the sample ranging from 0 to 889. The scores are standardised to be comparable across years, and as such it is expected that students score higher in later years when they know more.

Regression estimates of the treatment effect, being the difference in NAPLAN scores between the *four-year-old preschool only* and the *three- and four-year-old preschool* groups indicate positive effects, whereby attending three-year-old preschool was associated with students achieving higher test scores, suggesting improved education outcomes. Across the different domains, there are varying effect sizes and patterns. In grammar, for example, the treatment group performs significantly better in the Year 3 test, however the effect size dwindles throughout later years, and by the Year 7 and Year 9 tests is not statistically different from 0 at a 5% significance level. On the other hand, scores in numeracy and reading are significantly higher for the treatment group in the Year 3 test, and this effect size persists throughout later schooling years, with the treatment group also performing better in the Year 7 and 9 numeracy and reading tests. Effect sizes and robust standard errors are reported in Table 3.5 with the pattern over time illustrated in Chart 3.3.

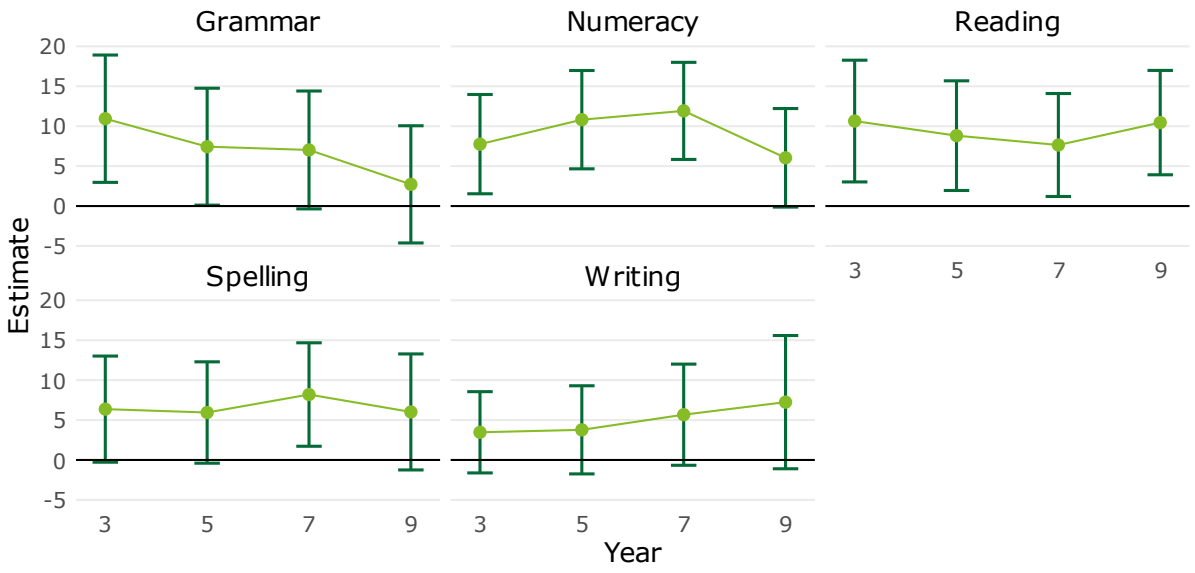
Table 3.5: NAPLAN test score effect sizes with robust standard errors in parentheses.

NAPLAN Domain	Year 3	Year 5	Year 7	Year 9
Grammar	10.94*** (3.82)	7.43** (3.58)	7.02* (3.81)	2.71 (3.62)
Numeracy	7.75** (3.14)	10.82*** (3.14)	11.92*** (2.98)	6.04* (3.28)
Reading	10.64*** (3.94)	8.81** (3.56)	7.64** (3.24)	10.45*** (3.54)
Spelling	6.37* (3.39)	5.94* (3.29)	8.19** (3.29)	6.02 (3.87)
Writing	3.47 (2.55)	3.77 (2.72)	5.67* (3.31)	7.24* (4.35)

Significance levels: * 10%, ** 5%, *** 1%.

Source: Deloitte Access Economics (2023).

Chart 3.3: estimated effect sizes over time for the five NAPLAN domains. Point estimates displayed with 95% confidence intervals.



Source: Deloitte Access Economics (2023).

While some effect sizes are still large in Year 9, most notably in the reading domain, these score increases should be considered in the context of control and treatment group students scoring higher overall and with a lower standard deviation across scores in later years. For example, the Year 3 reading effect estimates that children attending three- and four-year-old preschool scored 10.64 points higher on average than comparable children who only attended four-year-old preschool. This average effect size was estimated to be 10.45 points in Year 9. However, in relation to the actual dispersion of scores attained in Year 3, 10.64 points represents a 2.6 per cent score increase or 0.12 standard deviations. On the other hand, 10.54 points in the Year 9 reading test represents 0.16 standard deviations or a 1.8 per cent score increase due to a higher and more concentrated distribution of NAPLAN scores.

Of course, a 1 point or 1 per cent increase in the NAPLAN standardised scores, whilst indicative of better academic performance, is not a clearly interpretable metric. To assist interpretation of NAPLAN score differences, research conducted by the Grattan institute translated NAPLAN scores into equivalent months of learning, communicating the non-linear relationship between increases in NAPLAN scores and how many months of learning it is expected to take to achieve that increase in each of the test domains (Goss et al. (2016); Goss et al. (2018)).

In general, there tends to be decreasing returns on a month of learning in terms of NAPLAN scores such that a given score increase from a higher base score requires more months of learning. That is, to go from a score of 420 points in reading to 438 points requires around 9 months of learning on average. However, to go from 540 points in reading to 558 requires around 12 months of learning on average. Table 3.6 reports the effect of three-year-old preschool on NAPLAN scores in terms of the equivalent months of learning, noting that statistical significance of the estimates will be the same as the significance of the measured points effect.

Table 3.6: Average effect on NAPLAN scores in terms of equivalent months of learning.

NAPLAN Domain	Year 3	Year 5	Year 7	Year 9
Grammar	4.65***	4.11*	4.77*	2.44

Numeracy	1.89**	4.56***	6.19***	3.98*
Reading	5.20***	4.92**	5.30**	6.50***
Spelling	2.30*	2.10*	4.49**	3.89
Writing	2.11	1.77	4.43*	3.88*

Significance levels: * 10%, ** 5%, *** 1%.

Source: Deloitte Access Economics (2023) using LSAC data and a conversion based on the Equivalent Years of Learning measure developed by the Grattan Institute (Goss et al. (2016)).

In terms of equivalent months of learning, the fading of effect sizes is less evident as given score improvements in Year 9 correspond to more months of learning than the same score improvement in Year 3. Across the domains, there is also some variation in the rate at which point increases translate to months of learning. For example, the average Year 3 numeracy score increase of 7.75 points observed for the treatment group relative to the control group only corresponds to 1.89 equivalent months of learning at that level. On the other hand, the statistically insignificant estimate for writing of 3.47 points on average corresponds to 2.11 equivalent months of learning on average. This occurs because the sample of study children who attended preschool tended to be ahead of track in the numeracy domain relative to writing in Year 3, and therefore a given point increase in numeracy requires more months of learning than it does for writing. In general, statistically significant effect sizes indicate that three-year-old preschool corresponds to approximately an additional 4-6 equivalent months of learning for later educational outcomes.

Looking across the distribution of NAPLAN scores, the LSAC data were also used to test the likelihood in each group of meeting national minimum expectations, which means scoring in or above NAPLAN Band 2 in Year 3, Band 4 in Year 5, Band 5 in Year 7, and Band 6 in Year 9.[xi] Both the *four-year-old preschool only* and *three- and four-year-old preschool* groups were already very likely to attain above the minimum national expectation level, with no statistically significant differences in the likelihood of being above the minimum national expectations, except for a difference of 9.7 percentage points (70.6% – 80.3 %) in the Year 9 Writing test. At the other end of the distribution, however, there were statistically significant effects measured, particularly in the domains of numeracy and reading. The *three- and four-year-old preschool* group were estimated to be on average 4.5 – 6.5 percentage points, or around 1.3 times, more likely to attain scores in the top two reported performance bands, relative to the *four-year-old preschool only* group.

Overall, for education outcomes, the LSAC data provide evidence for some significant improvements in education outcomes for children who attend three- as well as four-year-old preschool, with main benefits observed for cognitive skills, and in particular numeracy, reading and grammar scores. Full regression tables displaying the effects of control variables for AEDC and NAPLAN outcomes are provided in Appendix C. It is noted that, whilst AEDC and NAPLAN together provide short- and medium-term perspectives on the benefits of three-year-old preschool to a student's education, the quality of the outcome variable needs to be kept in perspective. Often, later NAPLAN tests in Years 7 and 9 may be perceived by some students as not important to their school results and therefore may not be taken very seriously. As such, results for Year 9 test scores, whilst still indicative on average of the performance of students in each group, may be scrutinised for potential estimation bias more than the Year 3 and 5 results, where it is expected that students are more likely to have a genuine attempt at the test.

[xi] NAPLAN results are standardised each year and the range of scores for each domain is split into 10 performance bands. Different year levels only report a subset of the 10 bands, with Bands 1-6 reported in Year 3, Bands 3-8 in Year 5, Bands 4-9 in Year 7, and Bands 5-10 in Year 9 (ACARA, 2023).

As a further educational benefit of three-year-old preschool, it was tested whether the study children attending three-year-old preschool required less support services in the classroom than those children who had only attended four-year-old preschool. Although additional classroom support was a question surveyed in the LSAC data, the question had very low response rates meaning regression analysis was only able to be conducted on a sample one tenth the size of the full sample. Consequently, results for this outcome are omitted as the reduced sample size substantially lowered the statistical power of hypothesis tests to identify significant effects, and further raised concerns around the representativeness of the reduced sample relative to all LSAC children and South Australian children as the population of interest.

Health outcomes

As well as education outcomes, the LSAC data was used to investigate whether there were any differences in health measures of the study children associated with attending three-year-old preschool as well as four-year-old preschool. Health outcomes available in LSAC and measured in relation to attending three-year-old preschool focused on mental health, self-esteem and the child's self-assessment of their own health. Three measures were used to assess health outcomes at the time when the study children were in Years 9 or 10, aged 14 or 15.

The first measure is the child's score on the Kessler 10+ Psychological distress scale which scores the study child between 10 and 50 based on a series of targeted questions with a higher score indicating more psychological distress and likelihood of a mental disorder or requiring psychological assistance. Scores 10-19 suggest the subject is likely to be well, whilst scores above 20 and 30 indicate likelihood of mild or severe mental disorders respectively (Andrews and Slade (2001)). Secondly, is the study child's self-assessment of their health. Responses could take one of five outcomes: Poor, Fair, Good, Very good or Excellent. These responses were coded from 1-5 and regression analysis tested both this as a numeric outcome, but also a binary outcome in terms of how likely the child was to report that they perceived themselves to be in Very good or Excellent health. Thirdly, the child was asked whether if they applied themselves, did they think that they could achieve anything. The response to this question was used to estimate the child's self-esteem level in terms of how likely they were to say yes to this question. Average outcome scores and effect sizes are reported in Table 3.7, noting that the binary health outcome and self-esteem outcomes are reported in terms of the estimated probability of good health or high self-esteem, and standard errors are not reported as they are not directly comparable to the effect in terms of probability. Statistical significance of the effect is still indicated.

Table 3.7: Effect sizes for health outcomes. Standard errors given in parentheses. Asterisk indicates statistical significance at a 5% level. Binary outcomes are given in terms of probability of the outcome.

Health outcome	Average score for the control group	Average score for the treatment group	Effect
Kessler 10+ psychological distress scale	20.43	19.25	-1.18** (0.53)
Self-reported health 1-5	4.20	4.29	0.10** (0.04)
Self-reported in good health (binary)	0.83	0.87	0.04**
Reported high self-esteem (binary)	0.76	0.78	0.02

Significance levels: * 10%, ** 5%, *** 1%.

Source: Deloitte Access Economics (2023).

Results indicate that those in the *three- and four-year-old preschool* group tended to report better health outcomes in the LSAC data. In particular, they scored 1.22 points lower on average on the

Kessler 10+ psychological distress scale, suggesting a better state of mental health and lower likelihood of a mental disorder or need for psychological assistance. In terms of key threshold effects on the Kessler 10+ scale not reported in Table 3.7, the treatment group were found to be 7.4 percentage points less likely on average to score over 20 than the control group (35.3% probability instead of 42.7%), and 4 percentage points less likely to score over 30 (9.7% probability instead of 13.7%) on average. The treatment group were also 3.9 percentage points more likely to report themselves in very good or excellent health. These differences in mental and self-reported health were statistically significant benefits for the *three-year-old preschool* group, even when accounting for a range of contextual factors.

In terms of self-esteem, the data indicated that the treatment group were fractionally more likely to report high self-esteem, however the evidence was not strong enough to conclude that there is a statistically significant difference in terms of self-esteem between the two groups.

Social outcomes

As well as education and health outcomes, further social and developmental outcomes were tested using the LSAC data. Some key social outcomes tested were crime and police interaction, emotional problems, bad behaviour and general social development of the study children. Propensity for crime was estimated through the likelihood of a child in each group to have been cautioned or arrested by police during the ages of 13-15. Emotional problems, bad behaviour and social development are all composite score variables developed in the LSAC data from targeted questions on the child's feelings, behaviours and peer interactions, with higher scores corresponding to a worse outcome. Results are reported in Table 3.8 below and whilst effect estimates are often consistent with better outcomes for the treatment group, the estimated effects are only as large as, or smaller than, their standard errors meaning there is not enough evidence to conclude these effects are statistically different from 0 at a 5% significance level. A different dataset may provide further insight into social outcomes related to three-year-old preschool, however the LSAC data provides limited evidence for any clear social benefits that an additional preschool year provides.

Table 3.8: Estimated effect sizes for social outcomes. Robust standard errors in parentheses.

Social outcome	Average score for the control group	Average score for the treatment group	Effect
Police interaction (binary)	0.14	0.15	0.01
Emotional problems	2.21	2.15	-0.06 (0.13)
Bad behaviour	1.60	1.51	-0.09 (0.08)
Social development	9.60	9.24	-0.36 (0.30)

Significance levels: * 10%, ** 5%, *** 1%.

Source: Deloitte Access Economics (2023).

Full regression model outputs for health and social outcomes are included in Appendix C.

3.1.4 Modelling limitations

Linear regression estimates above indicate that there is empirical evidence in support of benefits of three-year-old preschool, particularly in terms of academic performance and health outcomes. However, as with any linear model, a measured correlation does not necessarily mean a causal

relationship. The control variables in the model aim to remove the effects of other driving factors that may also be correlated with the outcome or the treatment effect, such as how the *three- and four-year-old preschool* group tends to be more advantaged in terms of higher parent income and level of education. In this context, where the treatment group is more advantaged and more advantage often correlates to better education and health outcomes, omitted confounding factors would bias the estimated effects upwards, overestimating the true causal effect of three-year-old preschool on outcomes as it is conflated with an omitted or unobserved characteristic.

Although the LSAC dataset is not a perfect experimental setup with identical children randomly allocated to the treatment and control groups, the LSAC data contain a rich set of control variables which account for key drivers of the study children's outcomes and disentangles these effects from the treatment effect of interest. In addition, results for placebo outcomes not expected to be significantly influenced by the treatment effect, for example the physical AEDC scores, did not identify any statistically significant treatment effects, despite control variables driving a significant difference in these outcomes between the treatment and control groups. This suggests that the set of controls used has accounted for the majority of confounding factors, and any omitted variables that could bias the estimates would likely only have a small impact on the measured and reported effects.

Consideration should also be given to the sample and population of the LSAC data used, and the intended target population of the benefits of three-year-old preschool. Although relative advantage and Indigenous status was controlled for in the regressions, both the treatment and control groups were of children who attended preschool – which at the time was often quite costly – and tended to have higher socioeconomic advantage, more highly educated parents and lower representation of Indigenous children than the overall sample, and especially the *no preschool or LDC* group. This means the reported effect sizes reflect a difference in outcome between the average child from two relatively advantaged groups. Considering then the effect of three-year-old preschool on a child from a less advantaged or educated background, it may be that the reported effects underestimate the true relationship, where the marginal effect of an additional year of preschool is higher for a child whose upbringing in the home was not augmented by as much support as an advantaged child who already has many other factors contributing to better outcomes later in life on average.

Furthermore, due to the sample size limitations and that the survey predominantly consisting of study children in New South Wales, Victoria and Queensland, there is limited evidence to indicate how the effects found at a national level may translate into a South Australian context. Analysis of the South Australian Department for Education data in the next section complements the evidence found in the LSAC data, with a more contemporary view on the South Australian context.

3.2 Estimating three-year-old preschool effects from South Australian Department for Education data

As an alternative empirical approach to the LSAC analysis, further analysis was conducted using data from the South Australian Department for Education.

While the data provided by the South Australian Department for Education is a more contemporary dataset focusing on South Australian children, in some ways it is more limited than LSAC in examining the returns from three-year-old preschool. Most importantly the sample of children attending a government preschool as a three-year-old is not a representative sample, with eligibility limited to those children with an Aboriginal and Torres Strait Islander background, children in care, some children with additional needs or who are classified as gifted.

A further important limitation of this datasets is that it is not possible to definitively determine that children who did not attend three-year-old government preschool did not attend a non-government preschool program (including a long day care preschool program) at age three. This means that it is not possible to identify the impact of a three-year-old preschool with certainty as some in the control group are likely to have been treated (i.e. also attended three-year-old preschool). This means that any findings from this analysis need to be treated with care. Notwithstanding these important limitations, the results of this analysis do yield some pertinent findings on the role of preschool generally and the importance of attendance and as such are included here for completeness.

3.2.1 Overview of the data

The Department for Education (DfE) data originates from various sources (see Table 3.9) and encompasses diverse assessments pertaining to children's developmental abilities and early academic accomplishments.

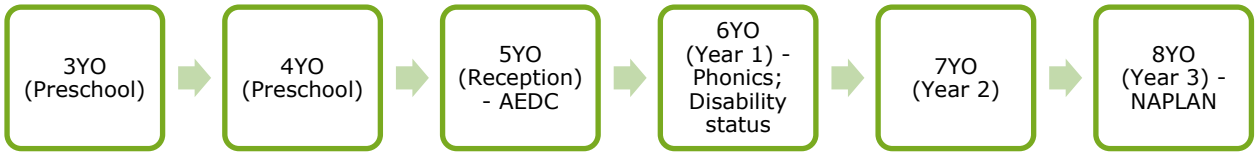
Table 3.9: Summary of Department for Education data

Dataset	Description/Purpose	Years	Limitations
1.a Preschool extract 2016-2022 All Terms – All enrolments	Provides the necessary enrolment data for both government and non-government preschools (under the Preschool Reform Agreement) to assess whether a child enrolled in government preschool at age 3 and/or a government preschool or government funded non-government preschool at age 4. Provides supplementary information on child attributes that are utilised as control variables.	2016 - 2022	Although the data includes certain details regarding attendance at non-government preschools, it was mandatory for non-government preschools to report child enrolments only if they were funded under the PRA, which is applicable to 4-year-old children only. As a result, the data concerning non-government preschool attendance at age 3 is not available.
1.b AEDC 2018	Supplies the Australian Early Development Census (AEDC) data to offer valuable insights into children's development and abilities upon entering school. This data assesses their physical health and well-being, social competence, emotional maturity, language and cognitive skills, as well as communication skills and general knowledge. These variables serve as outcomes in the analyses.	2018	
1.c NAPLAN Year 3 2021	Supplies the scores of children on their Year 3 NAPLAN assessment, encompassing their achievements in numeracy, reading, writing, spelling, and grammar and punctuation. These scores serve as outcome variables in the analyses.	2021	
1.d Phonics screening check	Supplies data regarding children's performances on the Phonics screening check, a brief assessment conducted in Year 1 to evaluate their sound-letter correspondence. This information serves as an outcome variable in the analyses.	2018 - 2022	The assessment consists of 40 items that a child can either respond to correctly or incorrectly. The scoring system for this evaluation is non-standardized, meaning that children's scores cannot be directly compared. As a result, the analysis focuses on a benchmark indicating whether a child meets the expected level rather than examining score comparisons across children.
2 Student background data	Provides supporting information regarding a child's parental background, including their parents' educational and occupational backgrounds, which are utilised as control variables.	2018 - 2022	Typically, this information is gathered during the child's entry into school or when transitioning between schools. As a result, the data is most dependable when collected around these specific timepoints.
3 NCCD	Supplies information regarding the presence of disabilities among children throughout their educational journey, including whether they receive additional support due to physical, social/emotional, cognitive, or sensory impairments. This data serves as both control variables and is evaluated as a potential outcome.	2018 - 2022	A significant number of children are not initially diagnosed with disabilities upon entering school but rather at a later stage. As a result, a child's disability status during early life may not accurately reflect their actual condition.

Source: Deloitte Access Economics (2023).

Through the combination of these data sources, the interrelationships between preschool attendance, child characteristics, and outcomes can be examined (see Figure 3.1). This approach offers the opportunity to gain valuable insights into the effectiveness of preschool, with a particular focus on the advantages associated with an additional year of preschool at age 3.

Figure 3.1: Linkage of Department for Education data



Source: Deloitte Access Economics (2023).

3.2.2 Overview of the cohorts of interest

To seek to explore any child-level benefits from three-year-old preschool attendance, the primary cohorts of interest in this analysis consist of children who attend government preschool both at age three and four (treatment group) relative to those who solely attend government preschool at age four (the counterfactual or control group).

A second cohort of interest are those who can be observed to attend a non-government preschool at age four. Importantly, it is unclear whether these children attended a non-government preschool at age 3due to the reporting of enrolments being only compulsory for children funded under the Preschool Reform Agreement (PRA), which is applicable to four-year-olds only. To supplement this, survey data collected during previous work with the Royal Commission was used to estimate the likelihood of non-government preschools offering a three-year-old preschool program which acts as an admittedly imperfect proxy for whether a child was likely to have attended preschool as a three-year-old as well.

Based on this, two additional treatment/control groups have been added, namely those who attended a four-year-old non-government preschool program (without a three-year-old preschool program) and those attending a four-year-old non-government preschool program at a long day care which was assessed as having a three-year-old preschool program in 2022. Importantly, there is no way of determining for certain that those attending a program as a four-year-old attended the same long day care as a three-year-old or that a preschool program was in place if they attended prior to 2022.

As a final control group for this analysis, data has been triangulated to identify those children that have not attended any form of preschool program based on the available data.[xii] This allows for the estimation of the impact of different types of preschools to be compared to the impact of attending no preschool at all.

Cohorts excluded from this analysis are children who have attended government preschool only as a three-year-old (due to small sample sizes) or those children with no preschool record but a conflicting preschool indicator in the AEDC data (these could be children from interstate or who attended services not required to report on their enrolments to the Department).

The definition of included cohorts is shown in Table 3.10.

[xii] This group has been defined based on the absence of a preschool enrolment as a four-year-old or a government preschool enrolment as a three-year-old and no indication of having attended preschool in the year before school as part of the AEDC.

Table 3.10: Definition of cohorts of interest

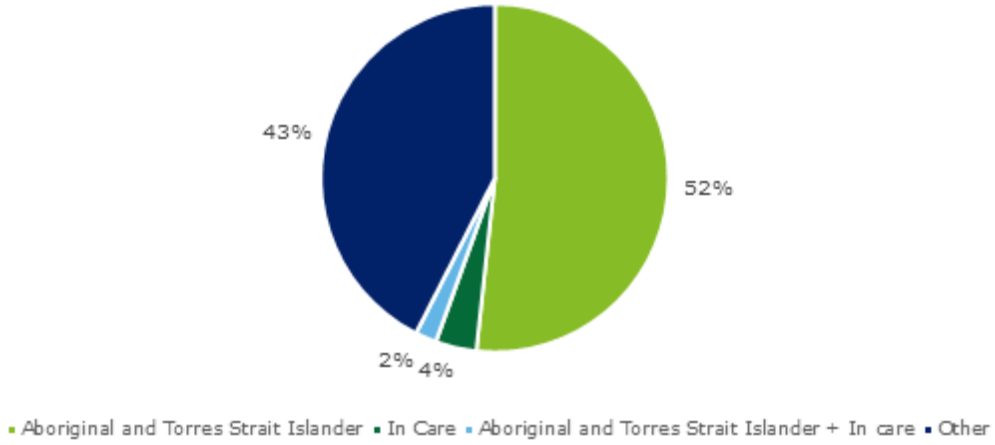
Cohorts	Definition
Attended preschool both as a 3- and 4-year-old	Includes children who have attended government preschool at age 3 and government or non-government preschool at age 4
Attended government preschool as a 4-year-old only	Includes children who have only attended government preschool at age 4 (i.e., they have not attended government preschool at age 3 and no non-government service at age 4)
Attended government preschool as a 3-year-old only	Includes children who have only attended government preschool at age 3 (i.e., they have not attended any form of preschool at age 4)
Attended non-government preschool as a 4-year-old only with a potential 3-year-old preschool program	Includes all children who have not attended government preschool at age 3 and who attended a non-government preschool at the age 4 with a potential 3-year-old preschool program
Attended non-government preschool as a 4-year-old only without a 3-year-old preschool program	Includes all children who have not attended a government preschool at age 3 and who attended a non-government preschool at the age 4 without a 3-year-old preschool program
Attended no preschool program	Includes children without a preschool enrolment record and who have been identified as having not attended preschool in the year before school based on AEDC data

Source: Deloitte Access Economics (2023).

As part of this analysis, the determination of the enrolment age of children was done in the following way: the date of birth cut-off for enrolments for four-year-old children was the 1st of May of each year. So, if a child turned four before this cut-off day, they are recorded as a four-year-old enrolment for that calendar year. In contrast, if a child turns four on or after this cut-off date, they are recorded as a three-year-old enrolment for that calendar year.

It is important to note that children in South Australia are eligible for three-year-old preschool if they are from an Aboriginal and/or Torres Strait Islander background or if they are, or have ever been, in care (formerly known as under the guardianship of the Minister). Consequently, it is expected that children within the data who have attended three-year-old preschool have at least one of these characteristics (see Chart 3.4). Some additional children may also be eligible for an early preschool start if they have additional needs, a disability or, in some rarer cases, are considered gifted. Based on these differences in characteristics between the treatment and control groups, two analytical approaches can be taken: analysis can be conducted on (1) all children, trying to control for potential disadvantage characteristics between the treatment and control groups, or (2), on the children who were eligible for three-year-old preschool only. The sample sizes for the first approach can be found in Table 3.11. The eligibility sample sizes are in Appendix D.

Chart 3.4: Eligibility profile of children that have attended government preschool as a three-year-old between 2016 and 2022



Note: Children in the 'Other' cohort are assumed to be children with additional needs, or in rarer cases, gifted children.
Source: Deloitte Access Economics (2023).

Table 3.11 : Number of children by years of government and non-government preschool attendance and outcome dataset

	AEDC 2018	NAPLAN 2021	Phonics 2018 - 2022	NCCD 2018 - 2022
Attended preschool both as a 3- and 4-year-old	1,057	1,083	4,489	6,159
Attended government preschool as a 4-year-old only	9,520	9,091	38,109	54,211
Attended government preschool as a 3-year-old only	13	13	92	328
Attended non-government preschool as a 4-year-old only with a potential 3-year-old preschool program	379	385	1,630	2,080
Attended non-government preschool as a 4-year-old only without a 3-year-old preschool program	679	670	2,888	3,755
Attended no preschool program	147	107	131*	-
Total	11,795	11,349	47,339	66,533

Note: *Sample size reduced as we can extract this information for 2019 only where AEDC information is available.
Source: Deloitte Access Economics (2023).

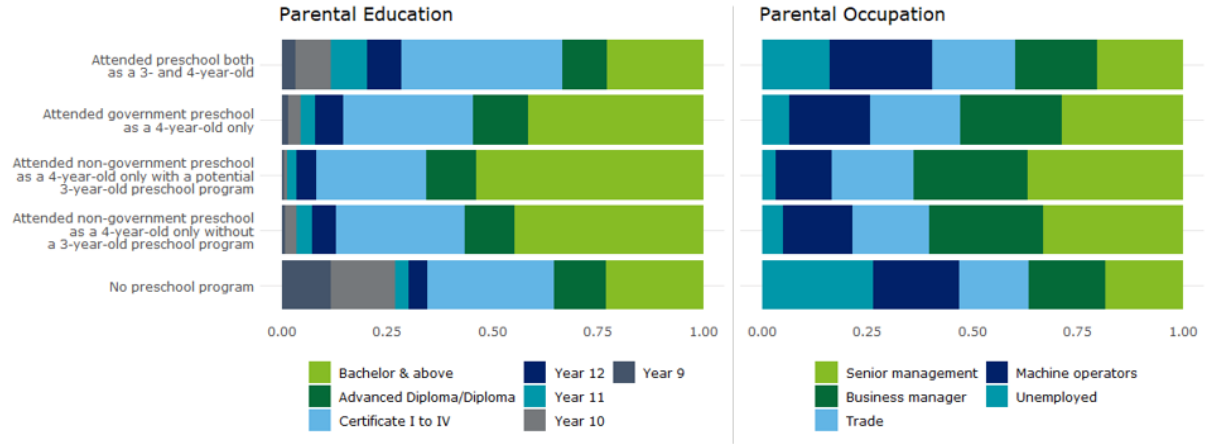
The absence of a *no preschool* cohort in the additional needs analysis is due to the limitation that the NCCD dataset only includes data on children with disabilities. As a result, all children without disabilities are not represented in the data. Introducing a *no preschool* cohort would therefore only include children with disabilities, leading to potential confounding factors in the analysis and has therefore been avoided.

To better understand differences in characteristics between the cohorts, some descriptive statistics on the demographic characteristics of both groups is considered to reveal any potential cohort effects. The *three-year-old preschool only* group is omitted from these summaries because of small sample sizes.

In alignment with enrolment regulations, the *government preschool at age 3 and 4* group have a greater share of Aboriginal and/or Torres Strait Islander and in care children compared to the other groups. They also represent the most disadvantaged group in terms of parental education, parental occupation, disability status, and SEIFA relative to other children who attended some form of preschool, as shown in Chart 3.5 and Table 3.12. Consequently, the outcomes for this treatment group are expected to be inferior to those of the remaining preschool groups, primarily due to factors unrelated to their preschool attendance. This motivates the use of regression modelling to control for these differences in demographic factors and their impact on outcomes.

Additionally, it is important to highlight that the *no preschool* cohort faces comparable disadvantages concerning parental education, occupation, and SEIFA when compared to the *government preschool at age 3 and 4* group. Children without a preschool record are also more likely to have a disability than any other group.

Chart 3.5: Parental education and occupation characteristics broken down by preschool attendance



Source: Deloitte Access Economics (2023).

Table 3.12: Sample characteristics breakdown by preschool attendance

Variable	Value	Government preschool both at age 3 and 4	Government preschool at age 4 only	Non-government preschool with a potential 3-year-old program	Non-government preschool without a 3-year-old program	No preschool program
Gender	Female	47.10%	48.80%	50.40%	49.30%	42.90%
Aboriginal and/or Torres Strait Islander	Yes	50.70%	1.90%	1.00%	2.40%	11.60%

Under the care of the minister	Yes	5.50%	0.30%	0.50%	0.50%	2.30%
English as a second language (ESL)	Yes	11.00%	13.80%	10.00%	5.30%	-
Disability (physical, social, cognitive, or sensory)	Yes	24.70%	13.70%	13.20%	15.40%	31.30%
SEIFA Quintiles	1	42.60%	24.80%	22.20%	26.00%	38.80%
	2	26.80%	27.50%	26.90%	25.40%	26.50%
	3	16.60%	21.50%	19.30%	21.30%	18.40%
	4	9.90%	17.50%	20.70%	18.60%	10.90%
	5	4.20%	8.70%	10.90%	8.70%	5.40%

Note: The data for the no preschool group has been taken from data sources other than the enrolment data. Source: Deloitte Access Economics (2023).

3.2.3 Model specification

This section provides further details on the outcome variables and control variables used in the modelling.

Outcome variables

The outcome variables are set out in Table 3.13 below across the AEDC, NAPLAN, phonics, and NCCD outcomes datasets.

Table 3.13: Outcome variables from Department for Education data

	Outcome variable	Description	Type	Statistical method
AEDC	Multiple strength indicator (MSI)	Measures a child's strengths from all five development domains of the AEDC. Ranges from 0 to 100.	Continuous	Linear regression
	Domain-specific scores	Measures a child's performance on the five developmental domains of the AEDC (physical health and wellbeing, social competence, emotional maturity, language, and cognitive skills, and communication skills and general knowledge). Scores range from 0 to 10.	Continuous	Linear regression
	Developmentally vulnerable	If a child is off-track on two domains of the AEDC, it is categorised as being developmentally vulnerable.	Categorical	Logistic regression

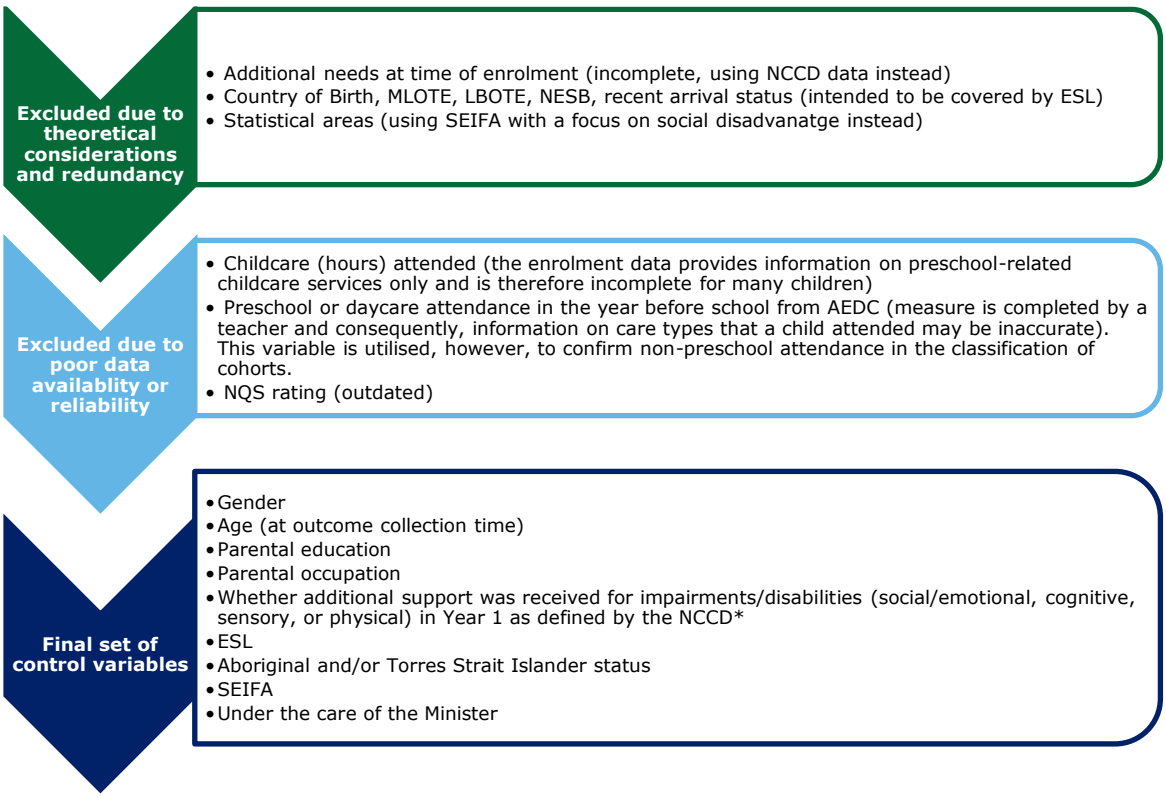
NAPLAN	Domain-specific standard scale scores	National academic assessment that measures a child's performances on numeracy, reading, writing, spelling, grammar & punctuation.	Continuous	Linear regression
Phonics	Above or below expectations	A child is classified as meeting expectations in phonics when they answer 28 or more out of 40 items correctly.	Categorical	Logistic regression
NCCD	Disability status	Determines whether a child has a physical, sensory, cognitive, or social/emotional impairment. Disability status at Year 1 is evaluated as no considerable alteration in the number of children with disabilities is observed after that.	Categorical	Logistic regression

Source: Deloitte Access Economics (2023).

Control variables

A range of child characteristics is available through the multiple data sources. While it is important to control for all relevant factors to isolate the impact of preschool on specific outcomes (and reduce the risk of omitted variable bias), as noted in section 3.1 it is important to strike a balance with model parsimony. Including too many controls can result in an overly complex model with a range of variables that add little explanatory power relative to other control variables. Similar to the approach for LSAC, control variables were selected due to their theoretical validity, data availability and quality, and their statistical importance in the models. The selection process is outlined in Figure 3.2. For children without a preschool record, control variables have been supplemented with available data from the outcomes datasets, e.g. AEDC.

Figure 3.2: Control variable selection process



Note: Disability status is also considered as an outcome variable in one stream of the analysis. Source: Deloitte Access Economics (2023).

3.2.4 Results

This section provides an overview of results from the AEDC, NAPLAN and phonics datasets. All analyses are structured so that a positive regression coefficient corresponds to a more positive outcome. For example, it may indicate higher scores for continuous outcomes or a higher probability of achieving a more favourable categorical outcome, such as meeting expectations.

Model performance in linear regressions is assessed using adjusted R-squared, which considers the number of variables included in the analysis. A higher value indicates better prediction performance. In logistic regressions, the Akaike Information Criterion (AIC) is reported, considering both model performance and complexity. Here, a lower value suggests improved model performance.

The analyses for each outcome test in the AEDC and NAPLAN were conducted based on the considerations outlined in the previous sub-chapters. The following samples were used in the analysis.

1) Open sample: This analysis includes all children and all groups of interest, as well as the *no preschool* group.
2) Eligible sample: This analysis only includes children from an Aboriginal and/or Torres Strait Islander background or children that are under the care of the Minister. It focuses on the two main cohorts of interest (government preschool attendance at age three and four compared to government preschool attendance at age four only). Children who did not attend government preschool were not included in this analysis due to small sample sizes and more limited information on their characteristics which made it more difficult to ascertain if they are eligible for three-year-old preschool.

In the phonics analysis, the *no preschool* group was omitted from the open sample due to relatively small sample sizes and limited data availability for relevant control variables. Consequently, the results of the phonics analysis have been reported without a *no preschool* group.

The primary purpose of undertaking analysison the eligible cohort only is to address the possibility that an ordinary least squares approach – which assumes a consistent linear effect of a given characteristic on outcomes – may not be appropriate for the eligible cohort who, by definition, have characteristics that differ from the rest of the sample. Overall, the findings of the analysis of the eligible sample does not lead to materially different conclusions being reached from the analysis of the open sample. In the open sample, the effect of attending preschool on outcomes was broadly similar for those attending two years of government preschool relative to those attending one year of government preschool. For the eligible sample, the effect sizes comparing two years of government preschool to one were generally slightly more positive than for the open sample but any differences were not found to be statistically significant. Nonetheless the analysis of the eligible cohort provides a useful sensitivity check on the findings by focusing on a similar cohort of children.

3.2.4.1 AEDC results

Results of the AEDC analysis from the open sample are shown in Analysis 1 in Table 3.14. In this case, comparisons are relative to children who did not attend any form of preschool (as can be ascertained from the data). Positive associations were observed between all forms of preschool attendance and scores across various subdomains of the AEDC. The exceptions were the emotional and social domains. Notably, the strongest associations can be observed for the language and cognitive domain which is consistent with the findings of the literature review in Section 2.

However, although there were significant benefits associated with attending preschool, the effect sizes were generally similar across the different preschool cohorts. This could suggest that there were limited additional benefits to AEDC outcomes from a second year of preschool. However, as noted above it is not possible to rule out the possibility that some cohorts identified as only attending preschool as a four-year-old may have in practice attended a non-government preschool program as a three-year-old.

The eligible cohort analysis (see Analysis 2 in Table 3.14) compares the AEDC results of the eligible cohort who completed two years of government preschool relative to those who completed one year of government preschool.

While the effect sizes for children who have attended government preschool both as a three- and four-year-old generally exceed those of children who have attended government preschool at age four only, the difference is small and not statistically significant.

Table 3.14: AEDC results from Department for Education data

	Analysis 1: Open sample (all groups of interest relative to children who did not attend any form of preschool)						**Analysis 2: Eligibility sample (children who attended government preschool at age 3 and 4 relative to those only attending at age 4)**		
Continuous outcomes	Sample size	Government preschool both at age 3 and 4	Government preschool at age 4 only	Non-government preschool with a potential 3-year-old program	Non-government preschool without a 3-year-old program	Adjusted R2	Sample size	Government preschool both at age 3 and 4	Adjusted R2
MSI	11,779	7.123 **	7.795 ***	6.531 **	7.278 **	0.255	671	2.024	0.263
Physical	11,779	0.417 ***	0.457 ***	0.414 **	0.488 ***	0.183	671	0.185	0.207
Social	11,779	0.400 *	0.358 *	0.192	0.265	0.231	671	0.243	0.272
Emotional	11,748	0.225	0.278	0.095	0.178	0.240	670	0.116	0.345
Language & Cognitive	11,744	0.598 ***	0.632 ***	0.673 ***	0.597 ***	0.288	667	0.218	0.275
Communication & General Knowledge	11,778	1.195 ***	1.228 ***	1.372 ***	1.328 ***	0.250	671	0.320	0.232
Categorical outcomes						**AIC**			**AIC**
Not developmentally vulnerable	11,779	0.122 ***	0.129 ***	0.119 ***	0.125 ***	5,826	671	0.024	715

Significance levels: * 10%, ** 5%, *** 1%.

Source: Deloitte Access Economics (2023).

3.2.4.2 NAPLAN results

The results of the NAPLAN analysis shown in Analysis 1 in Table 3.15 for the open sample suggest that attendance at three- and four-year-old preschool is positively associated with academic outcomes in reading, writing, and grammar and punctuation. Interestingly, some of the largest

effect sizes (measured in NAPLAN points) are observed for the children who attend a non-government preschool at age four with a potential three-year-old preschool program, who may in practice have received two years of preschool.

Among the cohort of eligible children (Analysis 2 in Table 3.15), when the outcomes of those who attended preschool at ages three and four are compared to those attending government preschool only at age four, the group attending at age three and four have slightly better outcomes in some domains but none of the results are statistically significant.

Table 3.15: NAPLAN results from Department for Education data

	Analysis 1: Open sample (all groups of interest relative to children who did not attend any form of preschool)						**Analysis 2: Eligibility sample (children who attended government preschool at age 3 and 4 relative to those only attending at age 4)**		
Continuous outcomes	Sample size	Government preschool both at age 3 and 4	Government preschool at age 4 only	Non-government preschool with a potential 3-year-old program	Non-government preschool without a 3-year-old program	Adjusted R2	Sample size	Government preschool both at age 3 and 4	Adjusted R2
Numeracy	10,715	2.924	-1.189	-0.525	0.542	0.299	554	1.499	0.208
Reading	10,826	22.955 **	18.537 *	20.765 **	16.319	0.297	587	-0.630	0.226
Writing	10,684	17.953 **	17.952 **	23.559 ***	17.604 **	0.294	574	11.654	0.270
Spelling	10,754	12.640	15.427	20.784 **	8.403	0.291	565	3.926	0.237
Grammar & Punctuation	10,753	25.181 **	22.549 **	30.629 ***	18.364 *	0.313	565	3.872	0.284

Significance levels: * 10%, ** 5%, *** 1%.

Source: Deloitte Access Economics (2023).

3.2.4.3 Phonics results

The impact of preschool attendance on results for the phonics assessments across the different cohorts are shown in Analysis 1 in Table 3.16. In this case the impacts are expressed relative to children attending a non-government preschool as a four-year-old without a three-year-old preschool program. While other forms of preschool are associated with more positive outcomes on the phonic assessment, only significant effects are observed for those attending government preschool as a four-year-old. By comparison, among the eligible sample for three-year-old preschool, attending two years of government preschool did improve outcomes on the phonics assessment but this impact was not found to be statistically significant (see Analysis 2 in Table 3.16).

Table 3.16: Phonics results from Department for Education data

	Analysis 1: Open sample (all groups of interest relative to children who did attend non-government preschool without a 3-year-old program)					**Analysis 2: Eligibility sample (children who attended government preschool at age 3 and 4 relative to those only attending at age 4)**		
Continuous outcomes	Sample size	Government preschool both at age 3 and 4	Government preschool at age 4 only	Non-government preschool with a potential 3-year-old program	AIC	Sample size	Government preschool both at age 3 and 4	AIC
Meeting expectations	45,113	0.013	0.017 **	0.012	53,172	2,785	0.022	3,415

Significance levels: * 10%, ** 5%, *** 1%.

Source: Deloitte Access Economics (2023).

3.2.4.4 Disability (NCCD) results

Another outcome of potential interest is whether children are classified as requiring additional learning supports under the Nationally Consistent Collection of Data (NCCD). The results of this analysis are shown in Table 3.17. In the open sample, children who attended government preschool both as a three-year-old and four-year-old were significantly more likely to have physical and cognitive disabilities. Relative to other children in the eligible sample they were also more likely to have social and emotional disabilities.

These findings may nonetheless reflect the characteristics of children attending three- and four-year-old preschool given that some places in three-year-old preschool are allocated to children with special needs.

Table 3.17: NCCD results from Department for Education data

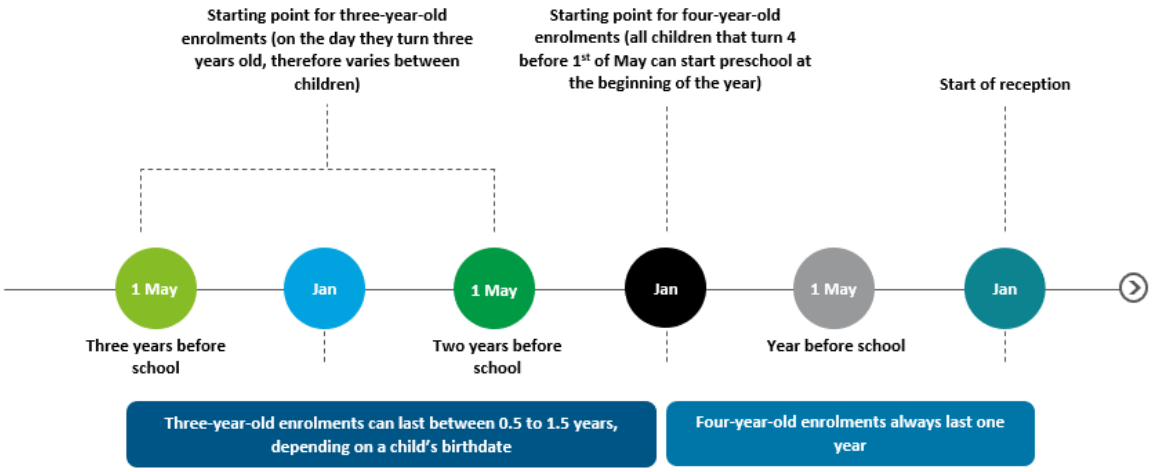
		Analysis 1: Open sample (all groups of interest relative to children who did attend non-government preschool without a 3-year-old program)				**Analysis 2: Eligibility sample (children who attended government preschool at age 3 and 4 relative to those only attending at age 4)**		
Continuous outcomes	Sample size	Government preschool both at age 3 and 4	Government preschool at age 4 only	Non-government preschool with a potential 3-year-old program	AIC	Sample size	Government preschool both at age 3 and 4	AIC
Physical	66,205	-0.007 **	-0.001	0.002	-94,700	4,110	-0.003	-6,499
Social/ Emotional	66,205	-0.004	0.007 *	0.003	-16,031	4,110	-0.025 **	2,755
Cognitive	66,205	-0.015 **	0.001	0.014	41,594	4,110	-0.016	4,722
Sensory	66,205	-0.002	0.001	0.001	-133,629	4,110	-0.005	-6,273

Significance levels: * 10%, ** 5%, *** 1%.
Source: Deloitte Access Economics (2023).

3.2.5 Preschool intensity

The analysis in the previous subsections does not explicitly consider the extent of preschool exposure. However, given the nature of when three-year-olds can enrol in government preschool, exposure can vary considerably across children. As eligible three-year-olds can enrol as soon as they turn three years old, the enrolment date is different for every child. Consequently, the enrolment duration for an eligible child can also vary between 1.5 to 2.5 years, and therefore up to 7 terms (assuming continuous enrolment until the start of reception, see Figure 3.3).In contrast, the majority of children attending four-year-old preschool attend for all four terms.

Figure 3.3: Timeline of enrolment for children who are eligible to enrol in government preschool at the age of three



Note: The chart outlines the preschool enrolment process in South Australia before the mid-year intake was introduced in 2023.
Source: Deloitte Access Economics (2023).

The Department for Education data also contains information on children's hours of attendance during the two-week reference weeks of each term. The preschool hours attended may differ between different weeks of the term. Three-year-old enrolled children are eligible to access 12 hours of preschool per week, while four-year-old enrolled children can access 15 hours per week. These figures do not have to be met every week, however. For example, children may attend 18 hours per week during one term in exchange for 12 hours per week in another term. Consequently, the preschool intensity during the reference weeks may not be entirely accurate reflections of the extent of attendance across the entire term. Nonetheless, averaging weeks across multiple terms is likely to minimise any measurement error due to non-standard arrangements.

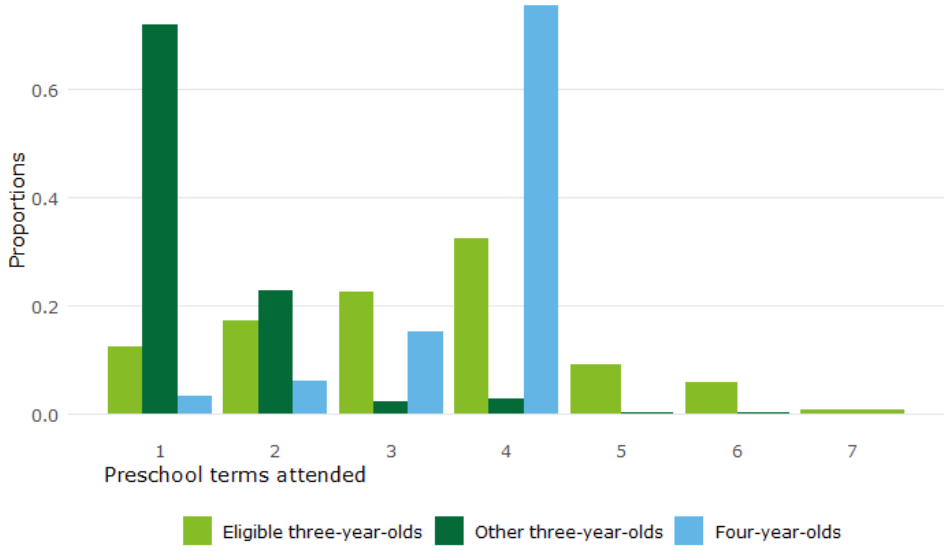
Keeping the above limitations in mind, preschool exposure has been examined for children at age three and age four. A further distinction was made within the three-year-old cohort, to distinguish between children that are eligible for preschool, i.e., those children from an Aboriginal and/or Torres Strait Islander background or those in care, and those who were only eligible for early entry into preschool. These include children who have additional needs or who are considered gifted. The difference between these two cohorts is that eligible children can access 12 hours of preschool per week, whereas for the latter cohort (referred to as other three-year olds in the charts below), they may start preschool early *only* if there are places available. Therefore, early entry to preschool is not guaranteed, and may not correspond with a 12-hour weekly dosage.

For all subsequent analysis, only children who have recorded above 0 hours at a government preschool at age three and/or four have been considered. Moreover, children with preschool hours that were more than three standard deviations above the mean have been treated as outliers and were omitted from the dataset. These high outliers included children with an average of more than 22 hours of preschool per week.

The data shows that attendance for four-year-olds is largely consistent, with 75.6 per cent of children attending all four terms as a four-year-old (Chart 3.6), with weekly hours peaking at around 15 hours (in line with the expected hours per week, Chart 3.7). In contrast, the other three-year-old cohort show significantly less preschool exposure both in terms of the number of terms attended (Chart 3.6) as well as in the average number of hours attended during those terms during which they were enrolled(Chart 3.7), which aligns with the non-guaranteed enrolment policy for those children. The eligible three-year-old cohort shows great variation in the number of

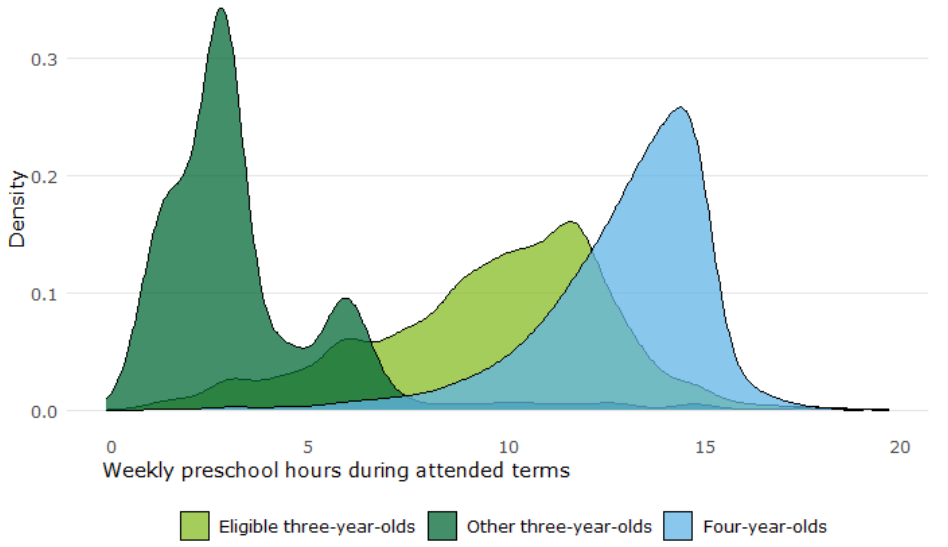
terms attended (Chart 3.6), which may largely be driven by the birthdates of those children (i.e., some children not being able to access a whole year of three-year-old preschool, refer back to Figure 3.3). However, their average hours during attended terms peaks at just below 12 hours, which is the prescribed dosage for this cohort.

Chart 3.6: Preschool terms attended at age three and four.



Note: Eligible three-year-olds include those that are from an Aboriginal and/or Torres Strait Islander background or children in care. Other three-year-olds include children with additional needs or who are considered gifted. The number of terms an eligible three-year-old child can attend is dependent on their birthdate and can range up to 7 terms. Source: Deloitte Access Economics (2023)

Chart 3.7: Average weekly preschool hours of children at age three and four during attended terms.



Note: Eligible three-year-olds include those that are from an Aboriginal and/or Torres Strait Islander background or children in care. Other three-year-olds include children with additional needs or who are considered gifted. Weekly preschool hours have been estimated by averaging the recorded hours during the reference weeks of each attended term.
Source: Deloitte Access Economics (2023).

The number of attended terms and hours have been combined into an overall weekly preschool intensity estimate by averaging the hours attended during the reference weeks of each term. Here, it was assumed that children with missing enrolment data during a term have attended 0 hours of preschool during that term.

Based on the different levels of preschool intensity among children, three preschool intensity groups have been derived (Table 3.18). The cut-off of hours for each group has been chosen to ensure that all groups contain large enough samples for both the three- and four-year-old cohort.

Table 3.18: Categorisation of children into preschool intensity groups

Preschool intensity groups (estimated weekly attended hours)	Three-year-old preschool attendance	Four-year-old preschool attendance	Three- and four-year-old preschool attendance (considering the average preschool hours across both years)
Low (0 – 8)	5,006 (70.5%)	10,614 (12.6%)	3,821 (53.8%)
Medium (8 – 12)	1,147 (16.1%)	20,631 (24.4%)	2,289 (32.2%)
High (12+)	950 (13.4%)	53,278 (63.0%)	993 (14.0%)

Source: Deloitte Access Economics (2023).

To test the effect of preschool intensity, two sets of analyses have been conducted. The first analysis tests for the effect of preschool intensity at age four and includes children who have attended government preschool at age four only with recorded hours greater than 0. Second, the effect of preschool intensity has been tested on the group of children who attended government preschool both at age three and four with recorded hours greater than 0 in both years.

NAPLAN

Analyses on four-year-olds shows that higher preschool intensity is associated with more favourable NAPLAN outcomes (see Analysis 1 in Table 3.19). Similarly, for children who attended government preschool at both ages 3 and 4, higher preschool intensity across both years is associated with more favourable outcomes on the majority of the NAPLAN domains (see Analysis 2 in Table 3.19). This may largely be driven by four-year-old attendance. Specifically, children who have consistently received 12 or more hours of preschool per week across both years tend to score better than their peers.

Table 3.19: NAPLAN results (preschool intensity)

	Analysis 1: Children who have attended government preschool as a 4-year-old only				**Analysis 2: Children who have attended government preschool both at age 3 and 4**			
	Sample size	Medium: Government preschool hours as a 4YO (8 - 12)	High: Government preschool hours as a 4YO (12+)	Adjusted R2	Sample size	Medium: Government preschool hours combined (8 - 12)	High: Government preschool hours combined (12+)	Adjusted R2
Numeracy	8,650	8.980 **	13.986 ***	0.283	810	7.134	18.073 **	0.366
Reading	8,732	6.081	7.448 *	0.279	824	5.989	17.000 *	0.338
Writing	8,625	6.226 *	11.989 ***	0.274	811	7.072	19.340 **	0.380
Spelling	8,683	8.987 **	10.138 **	0.280	811	9.111	17.317	0.312
Grammar & Punctuation	8,682	5.691	11.035 ***	0.295	811	5.850	27.150 ***	0.373

Note: The reference group for both analyses are children who have attended preschool for less than 8 hours a week on average. Source: Deloitte Access Economics (2023).

AEDC

Greater preschool intensity is associated with more favourable outcomes on all AEDC domains for children who have attended government preschool at age four only as well as for children who have attended both years (see Table 3.20).

Table 3.20: AEDC results (preschool intensity)

	Analysis 1: Children who have attended government preschool as a 4-year-old only				**Analysis 2: Children who have attended government preschool both at age 3 and 4**			
Continuous outcomes	Sample size	Medium: Government preschool hours as a 4YO (8 - 12)	High: Government preschool hours as a 4YO (12+)	Adjusted R2	Sample size	Medium: Government preschool hours combined (8 - 12)	High: Government preschool hours combined (12+)	Adjusted R2
MSI	9,519	7.714 ***	9.584 ***	0.248	900	7.269 ***	14.232 ***	0.255
Physical	9,519	0.363 ***	0.511 ***	0.179	900	0.365 ***	0.827 ***	0.214
Social	9,519	0.509 ***	0.577 ***	0.223	900	0.413 ***	0.763 ***	0.239
Emotional	9,496	0.342 ***	0.409 ***	0.232	899	0.351 ***	0.474 **	0.266
Language & Cognitive	9,490	0.564 ***	0.745 ***	0.277	898	0.608 ***	1.028 ***	0.307

Communication	9,518	0.698 ***	0.889 ***	0.246	900	0.590 ***	1.050 ***	0.234
Categorical outcomes				AIC				AIC
Not developmentally vulnerable	9,519	0.125 ***	0.144 ***	4,077	900	0.111 ***	0.128 ***	806

Note: The reference group for both analyses are children who have attended preschool for less than 8 hours a week on average. Source: Deloitte Access Economics (2023).

Given the data points to a positive impact of greater hours of attendance on outcomes, supplementary analysis was undertaken to compare the outcomes of those who (i) attended at least 12 hours of preschool a week and attended government preschool as a three year and four-year-old and (ii) those who attended at least 12 hours of preschool on average only as a four-year-old. The former group will have on average attended roughly double the hours of government preschool.

The results of this analysis are set out in Appendix D. Overall, there was evidence of more positive outcomes on most outcome measures in NAPLAN and AEDC for those who received an additional year of government preschool (with an average intensity of at least 12 hours per week) but almost all of these effects were not statistically significant. Thus while we see an improvement in outcomes for those who attend for greater hours per week within the cohort attending government preschools only as a four year old, and a similar effect within the cohort attending government preschools as both a three year and a four year old, the evidence does not establish a significant improvement for those attending at least 12 hours per week over two years relative to one.

How much can be drawn from the findings of this section on the incremental benefits of an additional year of preschool is unclear. However, a few important observations can be made:

1. It is possible that many children who attended government preschool as a four-year-old as well as those who attended a non-government preschool as a four-year-old may have attended a non-government preschool, or at least an ECEC program, as a three-year-old. Thus, many children in other groups may have also received two years of preschool. This makes it difficult to draw definitive conclusions from this dataset on the incremental benefits of three-year-old preschool.
2. The cohort attending two years of government preschool were, on average, relatively disadvantaged compared to other cohorts. While a large set of demographic controls were used to account for differences between these groups, it is possible that the range of controls available may not have fully accounted for differences in the characteristics of these children.

While acknowledging that these observations limit the definitiveness of conclusions that can be drawn from this analysis on the incremental benefits of three-year-old preschool, the analysis does support the view that attendance at preschool (in any form) is associated with improved outcomes on a range of measures. It also points to the potential role that hours of attendance may play in securing improved learning outcomes.

4 Methodology for estimating the costs and benefits

This section presents the methodology employed to undertake the cost-benefit analysis. As outlined in Section 1, the costs modelled for the Royal Commission's Interim Report, and the benefits calculated for this additional analysis, draw upon a common set of assumptions regarding the eligible population, the uptake of preschool, the period of transition, and the attributes of the program delivered under the universal three-year-old preschool model.[xiii]

For the costs and benefits, the analysis provides a calculation relative to the counterfactual, or base case. In this work, this is a continuation of the current policy parameters in which some cohorts of South Australian children are eligible for three-year-old government preschool (including Aboriginal and Torres Strait Islander children and children in care, and where places are available, early entry children with a disability or children identified as academically gifted may be eligible). Otherwise for a majority of South Australian three-year-olds, they continue to participate in another form of early childhood education and care, predominantly long day care (which may or may not involve a preschool program), and the remaining three-year-olds do not participate in any form of ECEC.

As outlined in the following methodology, the costs modelled for the Royal Commission are restricted to the costs borne by the South Australian Government for the universal three-year-old preschool program. While the South Australian Government is expected to bear the majority of the costs of the reform, there may be additional costs borne by other parties that are not captured in the modelling. For example, increasing participation in ECEC programs across the three-year-old population may lead to higher demand for long day care services, and ultimately, Australian Government contributions through the Child Care Subsidy (CCS) as well as additional parental contributions. In contrast, the benefits modelling outlined herein considers the benefits to all parties resulting from universal three-year-old preschool. This comparison of costs and benefits is consistent with the purpose of considering the return from South Australian Government's investment in the policy reform. Nonetheless, it is worth noting that over the course of the period from 2026-2045 an estimated 19.5 per cent of additional enrolments relative to the base case occur in LDCs and thus some costs will be incurred by both the Australian government and South Australian parents.

4.1 Costs of three-year-old preschool

In calculating the costs of three-year-old preschool, two streams of costs were considered:

1. Initial capital costs, and
2. Recurrent costs of delivery

The methodology for estimating these cost streams is outlined in the sections below.

4.1.1 Capital costs of three-year-old preschool

In the cost modelling of three-year-old preschool, a set of rules and assumptions is applied to reconcile the assumed demand for three-year-old preschool with the supply of capacity available for the policy. In many regions, the supply of preschool is insufficient to meet the demand for a universal three-year-old program. In these cases, additional demand is met through either the physical expansion of existing services, or through the establishment of new services. For Scenario

[xiii] For a comprehensive set of data and assumptions used for the cost modelling, see the published Model specification document.

3B, the establishment of new services also includes the creation of the commissioned services for equity targeting.

To determine which existing services could physically expand, the model uses survey data from the *South Australian Early Childhood Education and Care Sector Survey*, which asked responding LDC and non-government preschool services to indicate their potential to physically expand.[76] Services were asked if they would be able to expand physically to enable more three-year-old children to participate in three-year-old preschool, if they were at capacity. 19 per cent of long day care services, and 16 per cent of non-government preschools reported that they would be able to make physical modifications to their site to enable more three-year-old children to attend.[77] These represented 15 per cent and 27 per cent of approved places among the survey respondents, respectively. It is assumed that all of these places would be available for three-year-old preschool.

Capital expansion is also assumed to include further demand for workforce, including both capital and workforce assumptions.

Similar data do not exist for government services. The model assumes that government capital expansions would take the form of new standalone services (i.e., zero provider capacity to expand). Under Scenario 3B, these standalone services would take the form of specifically commissioned new integrated hubs, where they are opened in areas of high disadvantage.

As agreed with the Royal Commission, the model allows user selections to implement quality thresholds for services eligible to expand using government funding. This option is included to reflect that the South Australian Government may choose to only provide funding for expansion to services meeting a certain quality threshold. Three user options for quality thresholds are incorporated into the model, with the central scenario used for this cost-benefit analysis reflecting a scenario in which services that are 'working towards the NQS' would not be eligible for support.

In the modelling, after existing capacity and new places of service expansion are filled, any remaining demand for three-year-old preschool would be met by new places in LDC and government services. The modelling determines the excess demand, service type, and where services are required, based on the patterns of mobility of South Australian children accessing services.

Where the modelling indicates a requirement to construct new services, the capacity of these new services is based on median provider size by service type based on data from ACECQA and South Australian Department for Education (Table 4.1). Commissioned preschool is assumed to have the same average size as government preschools, noting that the estimated cost of commissioned preschool is doubled to account for the intent to ensure physical capacity is available for these children at four years old.

Table 4.1: Median provider size by service type

Service type	Median size (approved places)
Government (standalone)	44
Long day care	75
Non-government preschool	41

Source: ACECQA, South Australian Department for Education.

The capital costs for expansions and new services have been derived from Rawlinsons Australia Constructions Guide (2021) and data from the Department for Education, based on the parameters set out in Table 4.2 below. All capital costs were applied an annual 2.5 per cent inflation rate.[78][xiv]

[xiv] Based on the Commonwealth Budget October 2022 Economic outlook.

This inflation factor was removed in the cost-benefit analysis so that capital and recurrent costs were expressed in 2023 dollars.

These parameters are combined with the following assumptions about (1) the minimum indoor and outdoor space requirements per child and (2) estimates of the additional children supported through physically expanded and newly constructed services by service type, to estimate a total cost. Capital costs are limited to construction costs, and do not consider the costs of land acquisition and demolitions.

Table 4.2: Capital cost inputs (2023 dollars)

	Expanded service (cost per 15-hour place)	**New service (cost per 15-hour place)**	**Place in commissioned service (cost per 15-hour place, with a child enrolled for two years)**
Capital costs included	New room, 7.15m^2 per child, space for 10 children per room, airconditioned, unfurnished	New build, 7.15m^2 per child, space for 10 children per room, airconditioned, landscaping with 9.3 m^2 outdoor space per child, unfurnished	New build of ECEC Centre, 7.15m^2 per child with smaller collocated children's centre with 3.58m^2 per child, airconditioned, landscaping with 9.3 m^2 outdoor space per child, unfurnished
Metro	$8,500 - $9,400	$8,800 - $9,700	$23,700 - $26,000*
Non-Metro	$10,300 - $11,400	$10,600 - $11,700	$28,500 - $31,200*

Source: Rawlinsons Australian Construction Guide (2021) - Edition 39, DfE data. Note: Figures rounded to nearest $100. *The average cost per three-year-old place in commissioned service is higher than for other sectors as it accounts for children remaining in the service when they are four years old.

4.1.2 Recurrent costs of three-year-old preschool

The ongoing, recurrent costs of three-year-old preschool represent the costs of delivering a preschool program, considering costs such as workforce costs, building/rental and site costs, utilities, equipment and consumables.

Estimates of the aggregate recurrent cost to the South Australian Government are derived from the per-child figures presented in Table 4.3. These figures take an estimated base cost with additional layers to recognise costs associated with regional delivery, additional wraparound supports to families and children, and costs of case management and outreach. The parameters have been derived based on bottom-up modelling conducted by Deloitte Access Economics, using data on current funding for the South Australian four-year-old preschool program as a point of reference. Table 4.3 provides an overview of the breakdown of recurrent cost estimates for the South Australian Government.

The estimated 'base cost' to the South Australian Government covers the incremental cost of delivering a preschool program.

In LDC, this is the differential cost of employing a teacher relative to an educator and recognising additional adjustments to working conditions. Wage rates are estimated with reference to relevant awards and Australian Bureau of Statistics (ABS) data.

The modelled adjustments to working conditions include:
- an additional two hours of non-contact time per week for teachers;
- an additional two days of paid leave for professional development; and
- an additional $400 spent towards professional development per 15-hour enrolment.

In government preschool, the estimated base cost to the South Australian Government is developed to cover the cost of delivering each place in a standard setting. Estimates were drawn from wage data provided by the Department for Education and the assumption that non-wage costs represented 15 per cent of the total estimated cost of delivery.

An adjustment is applied to account for variation in delivery costs in non-metropolitan areas. This adjustment reflects differences in observed wages between metropolitan and non-metropolitan settings as well as differences arising from the diseconomies of scale that services in regional, rural and especially remote locations commonly face.

Additional to this estimated base cost is the costs of supporting children with additional needs. This cost varies by SEIFA and is applied on a per 15-hour enrolment basis based on the current Inclusive Education Support Program (IESP) payments. In addition to this, costs associated with case management are estimated, reflecting the outreach function associated with inclusion support, based on wages for Community Development Coordinators. Case management costs are applied on a per 15-hour enrolment basis in SEIFA 1 and 2 regions.

The cost of Student Support Services provided to children and young people with specific educational needs is considered at a state-wide level and is applied to all children based on their applicable SEIFA. The variation of Student Support Services costs by SEIFA is based on data provided by the Department for Education.

An annual wage inflation rate of 3 per cent is applied to all the recurrent costs over time,[xv] although for the purposes of the cost-benefit analysis costs were expressed in terms of 2023 dollars.

Table 4.3: Estimates of cost to South Australian Government, per child by service type (2022 terms)

Components of cost:	**LDC *preschool program***	**LDC *preschool program, additional non-teaching time***	**Non-Government Preschool**	**Government Preschool**	**Commissioned preschool[xvi]**
Base costs to South Australian Government (Metro)	$1,574	$2,307	$10,550	$10,550	$10,550
Base costs to South Australian Government (Non-metro)	$1,716	$2,499	$12,687	$12,687	$12,687[xvii]
+ Cost of additional supports (varies by SEIFA 1-5)	$248 - $1,159	$248 - $1,159	$248 - $1,159	$248 - $1,159	$248 - $1,159
+ Case management costs (applied SEIFA 1 -2)	$391 - $782	$391 - $782	$391 - $782	$391 - $782	$391 - $782
+ Student Support Services	$220 - $605	$220 - $605	$220 - $605	$220 - $605	$220 - $605

Source: Deloitte Access Economics (2023).

4.2 Benefits of three-year-old preschool

Conceptually, based on the literature, and with reference to the earlier 2018 *Three year old preschool cost benefit analysis,* there are five key groups of beneficiaries anticipated from a universal three-year-old preschool program. These are the benefits to children as individuals (both

[xv] Based on 2020-2024 growth rates in the Victorian Enterprise Agreement.
[xvi] Funding for commissioned places includes the base funding for Government Preschool, plus a loading of $1,367. The loading has been developed based on current funding for the IESP and student support services.
[xvii] This per-15-hour dose funding rate is equal to the rate in a 'standard' government preschool rate, noting that the 30-hour dosage assumed for this cohort results in a doubling of the recurrent cost of delivery per child.

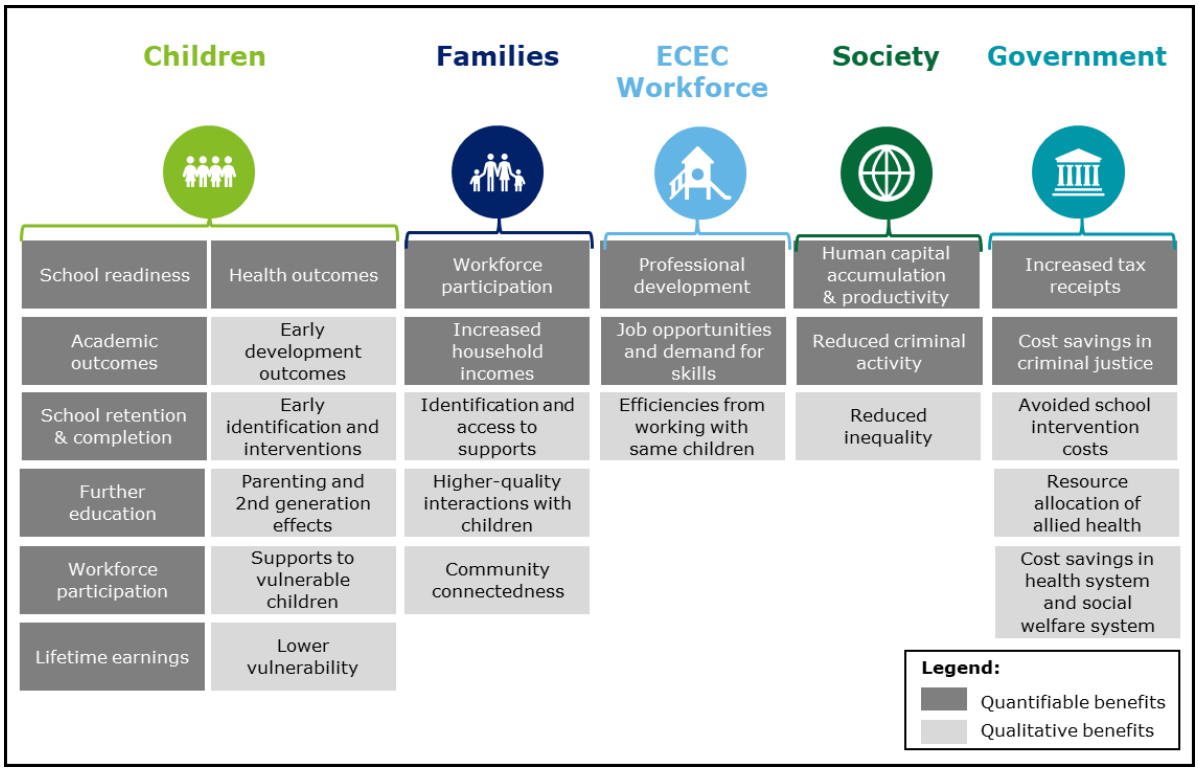
in their childhood and in later life), the families of children attending three-year-old preschool, the ECEC workforce, benefits to broader society, and benefits flowing to the government (Figure 4.1).

Figure 4.1: Beneficiaries of universal three-year-old preschool in South Australia

Source: Deloitte Access Economics (2023).

Considering the literature discussed in Chapter 2, along with previous estimates for the cost-benefit analysis of three-year-old preschool, there is a wide array of benefits which may be expected to accrue due to the proposed universal three-year-old preschool program with equity targeting. Figure 4.2 outlines these benefits, including those which have been quantified in this analysis.

Figure 4.2: Beneficiaries and benefits of universal three-year-old preschool in South Australia



Source: Deloitte Access Economics (2023).

For children, benefits start while participating in a three-year-old program and can be expected to flow through to development outcomes, school readiness and academic success, and later life experiences, such as further study, workforce participation, and health. Some evidence, such as from Garcia, Heckman & Ronda (2021), indicates participation in preschool programs can result in better life outcomes for the children of preschool participants, due to differences in parenting. Some potential child benefits, such as early development outcomes, early identification and

intervention, and second-generation effects have not been quantified for this analysis, due to limitations in the available evidence base.

For families, the provision of a universal three-year-old preschool program may induce additional hours of labour force participation for primary carers. This increased workforce participation may in turn increase household incomes (depending on the costs of preschool relative to family income). Additionally, participating in a formal preschool program earlier in a child's life has been found to support parenting and lead to higher quality interactions with children. These interactions may also support families to connect with other families in their area, and the community more broadly, which can be particularly important for vulnerable or newly arrived families. Finally, families can benefit from earlier identification of any additional needs experienced by their child and subsequent support to connect with relevant services. The *Mapping long day care and non-government preschool in South Australia* report published by the Royal Commission identified that ECEC services commonly acted as this community facilitator, in which services provided additional activities directly or supported families to access these supports.

For the ECEC workforce, the recommendations proposed by the Royal Commission could have multiple possible benefits for workers in the sector. Specifically, the recommendations of professional development can benefit the human capital accumulation of ECEC workers, while the uplift in demand for preschool would increase the demand for qualified early childhood teachers. For workers and services more broadly, working with the same children and families for multiple years may present opportunities for administrative efficiencies, with less administration required for the same child over two years than for two children for one year each. Moreover, it may present opportunities to build greater rapport with children and their families, benefitting the child's outcomes and ECEC workers' professional satisfaction.

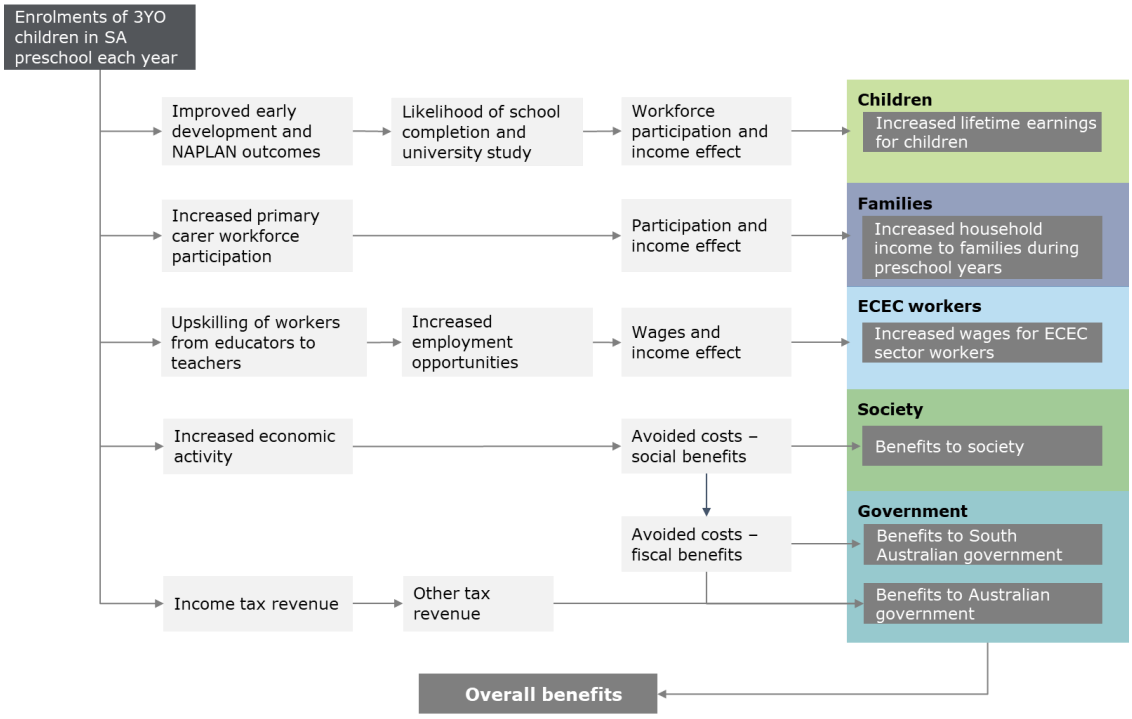
As outlined in Chapter 2, many studies find particular benefits to disadvantaged cohorts from participating in preschool programs. By intervening early, and with additional dosage and support for equity cohorts, these children are anticipated to particularly benefit and catch up on their peers. This may ultimately support a reduction in inequality. While the benefits from reduced inequality have not been quantified for this study, they represent a significant opportunity for South Australia from universal three-year-old preschool and an outcome to continue monitoring into the future. This study has quantified the benefits of human capital accumulation and productivity associated with the policy, which has spillover benefits for society.

Finally, the government (considering the South Australian Government and the Australian Government) can benefit from outcomes associated with universal three-year-old preschool. First, the policy may reduce costs borne by governments, such as criminal justice costs and costs of school interventions. It may also flow through as increased income, which can increase tax receipts.

4.2.2 Quantified benefits of three-year-old preschool

Figure 4.3 depicts the streams of *quantifiable* benefits for each group as they flow through the benefits modelling. The estimated benefits of three-year old preschool to these five distinct categories are discussed in turn.

Figure 4.3: Benefits modelling to each beneficiary group of universal three-year-old preschool in South Australia



Source: Deloitte Access Economics (2023).

In modelling the benefits of the three-year-old preschool policy, benefits have been estimated for cohorts undertaking three-year-old preschool between 2026 and 2045. This is consistent with the cost modelling, considering total costs to 2045. However, the benefits for each child are based on the benefits of preschool to lifetime earnings. The analysis in section 3.1 established that three-year-old preschool is likely to lead to significant improvements in a range of learning outcomes. The dividends of this are likely to continue to accrue over a child's working life and thus should be captured across the lifecycle. However, consistent with the typical approach in a cost-benefit analysis, future benefits are expressed in net present value terms. (More detail on the net present value calculations and discount rates used is included in Chapter 5).

4.2.2.1 Benefits to children

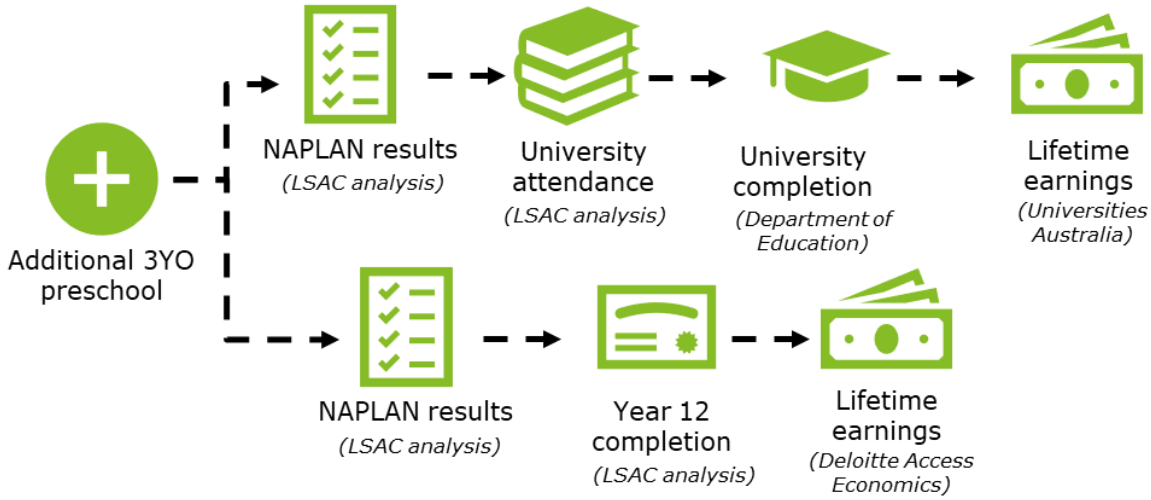
For the cost-benefit analysis, the benefits to children of participating in three-year-old preschool are considered in terms of the flow from preschool educational outcomes through to later lifetime earnings and contributions to the economy in gross domestic product (GDP) terms. These benefits to children are estimated through the method outlined in Figure 4.4.

From the LSAC analysis of student outcomes, children who participate in three-year-old preschool have higher NAPLAN outcomes, on average. LSAC data was then used to estimate the impact of higher NAPLAN outcomes (associated with three-year-old preschool) on (i) the likelihood of children completing Year 12 and (ii) the likelihood of attending university. The analysis found no substantial difference in the likelihood of undertaking VET qualifications associated with the changes in NAPLAN scores due to participation in three-year-old preschool.

Multiplying this uplift in the likelihood of attending university by data from the Commonwealth Department of Education on university completion rates provides an estimate of the incremental number of university-qualified individuals associated with three-year-old preschool participation.[79] Modelling conducted by Deloitte Access Economics for Universities Australia (2020) on the return to an undergraduate degree allows this university completion to be translated to an uplift in lifetime earnings.[80]

This method also incorporates a small increase in Year 12 completion rates based on the findings of the LSAC analysis on the relationship between three-year-old preschool, NAPLAN scores and Year 12 completion. The impact of Year 12 completion on lifetime earnings relative to those whose highest level of educational attainment is below Year 12 is estimated for this study using Australian Bureau of Statistics 2021 census data and econometric estimates of the return to completing Year 12 from Wilkins and Lass (2018).[81]

Figure 4.4: Derivation of benefits to children



Source: Deloitte Access Economics (2023).

In addition to this core flow of benefits to children, several additional lenses of benefits accruing to children are explored in the modelling. These are outlined in turn.

4.2.2.1.2 Health benefits

As outlined in 3.1, the LSAC analysis additionally identified some statistically significant benefits to a child's health associated with participation in a three-year-old preschool program. From the LSAC modelling, the impact of three-year-old preschool on mental health is determined, assessed using the Kessler scale described in Section 3.1.3. On the Kessler scale, improved results translate to a lower risk of major depressive disorder, characterised by a score greater than 30 on the scale.

To translate these benefits of lowered risk of a major depressive disorder to quantified results for the cost-benefit analysis, these individual health outcomes are translated into the costs to the individual and to society that can be forgone by lowering the incidence of major depressive disorders.

For individuals, the analysis estimated the annual cost of depression using disability-adjusted life years (DALY) of the burden of disease from Australian institute of Health and Welfare (AIHW) data, and multiplied this by the value of a statistical life year (VSLY) recommended by the Office of Impact Analysis.[82]

The total cost of the disease was divided across all Australians with major depressive disorder as recorded by the Global Burden of Disease study in 2019, to calculate the cost on an individual basis. The benefits of reduced incidence of depression were calculated across a five year time horizon, given uncertainty around how long the impacts estimated in LSAC are likely to be sustained.

In addition to these individual avoided health costs, the analysis estimates indirect costs of major depressive disorders to society, using estimates from Schofield et al (2019).[83] This provides the basis for avoided costs to the government due to indirect costs foregone.

4.2.2.1.3 Quality preschool outcomes

While LSAC analysis provides a robust basis for estimating the uplift from three-year-old preschool on children's schooling results and later life outcomes, these estimates may not capture the full extent of benefits from three-year-old preschool which may be realised from reforms in South Australia. Namely:

1. As outlined in 3.1.1, the LSAC cohort children took part in a preschool program prior to the National Partnership Agreement on Early Childhood Education and the introduction of the National Quality Framework. These efforts to standardise preschool practices and lift the quality of preschools mean that the expected quality of a preschool program in 2026, in line with the specifications of the Royal Commission, is likely to significantly exceed that of a preschool program in 2007 and 2008.
2. The cohort of children in the LSAC data participating in three-year-old preschool is more advantaged than the rest of the LSAC cohort, Australian children generally, and particularly more advantaged than South Australian children (as outlined in 3.1.1). As identified in the literature, there may be higher outcomes from preschool for children who are more disadvantaged.

As a result of these features of the LSAC data, these estimates may be a conservative estimate of the impact of three-year-old preschool on children's outcomes.

To demonstrate the range of benefits that could result from universal three-year-old preschool in South Australia, the cost-benefit analysis modelling also includes a scenario in which the effect of three-year-old preschool is twice as strong as those found in the LSAC analysis. This reflects finding of studies that examine the impact of ECEC quality on outcomes such as Blanden et al. (2022) and Australian studies such as Tayler et al (2016) which showed improvement in verbal ability for children resulting from increased quality of instructional support.

4.2.2.1.4 Outcomes for children in commissioned services

In addition to a higher quality uplift being explored across all children, there is also evidence to suggest that children in equity cohorts who attend preschool at a specifically commissioned service (as outlined in 1.2.1) may achieve strengthened outcomes from the preschool reform, relative to other three-year-old children. In the Scenario 3B model, children identified as living in one of 27 highly disadvantaged SA2 regions would have access to a specifically commissioned, purpose-built integrated hub that provides preschool, health, and family support services, with a doubling of the entitled hours to 30 hours per week.

Considering both the differences in the dosage and quality of the program offered to these equity cohorts, and the evidence from the literature that more disadvantage children may have higher outcomes, these children may experience improved outcomes from the reform that exceed those observed in the LSAC analysis. To model this, an alternative scenario assumes that children in commissioned preschools achieve outcomes that are three times stronger than found in the LSAC analysis. This is based on evidence from a study of the benefits of preschool to disadvantaged children in the United States by Domitrovich et al (2014).

While the benefits of an overall uplift in quality for all children and heightened outcomes for children in commissioned services may be possible to achieve concurrently, the quality and equity modifiers were not applied simultaneously here.

4.2.2.2 Benefits to families

The increased proportion of children attending preschool modelled for this analysis provides an opportunity for greater workforce participation among primary carers. That is, families may have greater earnings as the expansion of three-year-old preschool allows them to either enter the workforce or increase their hours of work as a consequence of their children attending preschool. This constitutes a **benefit to families** in the form of increased income for households for the year the child is attending preschool.

Families will experience different benefits based on their behaviours in the absence of the universal three-year-old preschool policy. For households where children did not attend any preschool or related care during the week in the absence of three-year-old preschool, the benefits are larger.

For children who already accessed a similar number of hours of long day care, there will be limited gains to family workforce participation.

In addition to these benefits to household income in the year of three-year-old preschool participation, primary carers who enter the workforce as a result of the reform also benefit through a slight increase in wages as a result of a shorter period out of the workforce. As a result, they receive a relative wage premium which is assumed to apply for the next twenty years based on evidence of these effects in the literature.[84]

In the modelling, the income benefit to families was based on the assumed labour force response of primary carers. The number of children per family was calculated using the Childcare Subsidy data report, and allows the number of primary carers to be estimated while hourly wages were estimated from ABS labour force data.[85] A wage effect was also introduced, incorporating a lifetime wage increase for carers returning to the workforce as a result of reform over the rest of their working life (Beblo et al, 2009).[86] The labour supply response of primary carers was informed based on the percentage change in hours of early childhood education and care, multiplied by the implied elasticity of labour force hours in response to childcare hours estimated by Bruenig, Gong and King (2012).[87]

4.2.2.3 Benefits to the ECEC workforce

For the ECEC workforce, a universal three-year-old preschool policy will create additional demand for early childhood education and care workers, creating **benefits for the ECEC workforce**.

Preschools will need more employees, and specifically, more qualified early childhood teachers. These workers will be sourced from within the sector, from across the broader workforce, and from those who are currently unemployed or not in the labour force, by creating opportunities for upskilling, incentivising employees in other sectors to shift into the sector, and creating job opportunities for those currently unemployed or not in the labour force.

Demand for LDC programs without a preschool component is expected to decrease, and LDC educators retraining to become preschool teachers will receive an increase in their wages, though this will come at the cost of the forgone income while training (which has been incorporated in the analysis).

Greater demand for workers will also create an incentive for employees in other areas of the economy to transfer, provided they will be earning more as either a preschool teacher, director or other administrative staff member or will receive other employment benefits that make it attractive to shift to working in the ECEC sector. However, there is also expected to be a retraining cost associated with this transition, since workers entering the sector are assumed not to have a pre-existing teaching qualification. The remaining additional supply of employees for the sector will be found in the currently unemployed and marginally attached population. This group will benefit from additional wages once they enter the ECEC sector. While entering employment will result in the loss of some social welfare payments these represent a transfer for the purposes of the cost benefit analysis as a transfer from the government to individuals does not change the overall welfare of society.

The methodology was based on estimates of the additional workforce required from the cost modelling. It was assumed that 10 per cent of new employment was sourced from those who were either currently unemployed or not in the labour force. To fill the remaining positions required, it was assumed that existing early childhood teachers were able to upskill to directors and early childhood educators were able to upskill to work as teachers. The difference in average wages across these categories was offset by the cost of lost wages for educators who would have to study for four years to obtain a degree. During the period of study, it was assumed that educators were able to earn 40 per cent of their prior income (i.e., work two days per week).

4.2.2.4 Benefits to society

As discussed in Chapters 2 and 3, there is a range of evidence that preschool is likely to yield broader social benefits as a result of better developmental outcomes for children. Associated health and social benefits include better physical health, a reduced likelihood of psychological distress and improved self-esteem, and potentially fewer interactions with the criminal justice

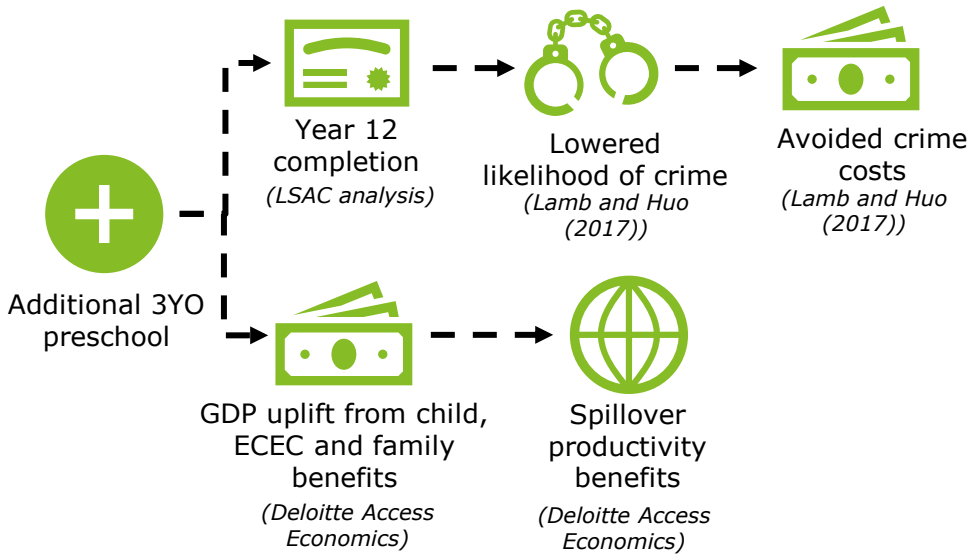
system. Moreover, benefits to GDP and productivity can have spillover benefits to the broader economy.

While some of the benefits to society have been calculated through their benefits to children (see 4.2.2.1), further benefits have been estimated specifically as social benefits. These benefits to society are outlined in Figure 4.5.

Estimates of avoided crime costs were based on the work of Lamb and Huo (2017) who estimate the impact of school completion on avoided social costs.[88] These estimates were combined with estimates of the increase in high school completion, as outlined in Figure 4.3.

In addition to these benefits, better cognitive outcomes are likely to lead to higher educational attainment. While some of the benefits of this will flow to children themselves in the form of higher wages over their lifetime, they will also create productivity spillovers for others, including improved returns for the firms that employ these children. Economic activity benefits were calculated as the proportion of based on the estimated uplift in GDP from the increased labour supply (and productivity) of children, families and the ECEC sector after netting out increases in wages and income tax.

Figure 4.5: Derivation of benefits to society



Source: Deloitte Access Economics (2023).

4.2.2.5 Benefits to government

While society benefits from the improvements in quality of life for children, there are also **benefits to government** through decreased public expenditure and increased tax receipts. These benefits are varied, and may come in the form of a reduced load for public health systems, lower costs of crime and rehabilitation, and reduced stress on the courts and judicial system.

The benefits to government in terms of avoided social costs, principally in the form of reduced crime and the marginal excess burden of taxation was estimated using the findings of a study by Lamb and Huo (2017) and the estimated impact of three-year-old preschool on high school completion rates. Health benefits from the avoided cost of depression were calculated using the methodology outlined in Section 4.2.2.1.

Additionally, there are benefits to government revenue from taxes associated with the higher lifetime productivity of those who attend preschool. Higher wages and participation for children, families and the ECEC workforce translate into more income tax revenue for the government. Similarly, by determining the contribution of workers to the gross operating surplus component of GDP, it is possible to estimate the potential contribution of preschool to corporate income taxes.

Income tax was calculated separately for all income in children, families and ECEC sector benefits. A marginal tax rate from the Australian Taxation Office (ATO) was applied to ECEC upskilling benefits since the workers were already previously earning, while children and families modelled income and participation effects and so used an average tax rate based on OECD data.[89] Increases in company taxes were calculated based on the non-employee compensation component of GDP contribution for children and families. Company tax was not applied to the ECEC sector since preschools are assumed to be primarily not-for-profit entities.

5 Results

This section provides an overview of the results of the cost-benefit analysis. As established in Section 5, the methodology used is able to provide quantitative estimates of the costs of three-year-old preschool, relative to the base case, in terms of upfront capital and recurrent costs to the South Australian Government.

The benefits modelling takes a broader approach, examining the benefits accruing to children, families, the ECEC workforce, broader society and government.

While the cost of providing universal three-year-old preschool in South Australia under Scenario 3B can be determined with a reasonable degree of accuracy, there is greater uncertainty regarding the benefits.

While the most relevant and contemporary evidence has been used to inform estimates of the benefits of three-year-old preschool in this study, no analysis will be perfectly applicable to the South Australian context and to the vision established by the Royal Commission.

The academic literature has consistently pointed to the degree to which benefits are likely to vary based on the:

- quality of preschool delivery; and
- characteristics of children who enter three-year-old preschool under the reform (and, relatedly, the quality of learning they would receive in alternative environments), with preschool being generally found to be more beneficial for disadvantaged cohorts.

Relatedly, relatively little is known about the impact of large scale expansions of three-year-old preschool programs on health and social outcomes into adulthood. The empirical evidence on health benefits presented in this report – drawing on the LSAC analysis – relies on measures that are constructed in a specific way and reliant on self-reporting (and, as such, bring additional levels of uncertainty).

Recognising that these factors will impact the ultimate benefits arising from the three-year-old preschool proposal being explored here, a range of results is presented. This range is presented with reference to four scenarios (in increasing order of the benefits realised):

1. Returns to children are based on the findings of LSAC with no benefits to improved mental health included.
2. Returns to children are based on the findings of LSAC with mental health benefits included based on the LSAC analysis.
3. This scenario assumes that, in addition to the mental health benefits, children in commissioned preschools achieve outcomes that are three times stronger than found in the LSAC analysis. This is based on evidence from a study of the benefits of preschool to disadvantaged children in the US by Domitrovich et al (2014).
4. This scenario explores the benefits where the quality of delivery results in outcomes that are twice as strong as that found in the LSAC analysis, reflecting the findings of studies such as Blanden et al. (2022) and Australian studies such as Tayler et al (2014).

Given the time period over which benefits from preschool are realised, the magnitude of benefits is sensitive to the discount rate used to present results in net present value terms. Herein, in line with the South Australian *Treasurer's Instructions 17* and advice from the Royal Commission for the purposes of this study, a central discount rate of 3.5 per cent has been used (consistent with a social rate of time preference approach and advice in the United Kingdom guidelines, *The Green*

Book)[90].[xviii] Further sensitivities at 3 per cent and 7 per cent are included in Appendix E of this report. Further information on discounting is presented in the box below.

Net present value (NPV) and discounting future costs and benefits

In cost-benefit analyses, future costs and benefits are considered differently to costs and benefits borne in the present. This reflects the phenomenon that individuals care more about their current consumption than they do about their future consumption, while for investors, investing in one opportunity comes at the cost of investing elsewhere. To this end, future costs and benefits are discounted to bring them into present terms (NPV).

While the practice of discounting is standard for cost-benefit analyses, the choice of discount rate used for government expenditure is controversial among economists and policymakers. There are two main approaches for calculating these rates, reflecting the theoretical underpinnings for consumers or for investors, which can lead to different discount rates.

The first of these is the social opportunity cost of capital (SOC) approach, which is set to reflect the rate of return that the government investment would achieve if the funds were invested by the private sector. The SOC is generally recognised to be around 7.0 per cent (Moore et al 2013), which is the rate advocated by the Office of Best Practice Regulation in Australia, although it further recommends conducting sensitivity analysis at 3.0 per cent and 10.0 per cent.[91]

An alternative approach involves using the social rate of time preference (STP), which estimates the rate at which society is willing to trade present for future consumption. The STP is typically estimated to be between 3.0 per cent and 4.0 per cent. Lower rates can apply to projects with extremely long-term time horizon where it is judged that outcomes for individuals further in the future should still be valued (to some degree) in the present – for example, investments related to climate change. The United Kingdom's guidance on cost benefit analysis (referred to as the Green Book) advocates applying an STP of 3.5 per cent, consistent with the range in Freeman et al (2018).[92]

As noted in Moore et al (2013), the decision about whether to use the SOC or STP depends on how government spending is assumed to be financed.[93] If it is assumed to be financed through changes to taxation, this essentially reflects a reallocation of consumption from the present to the future, in which case the STP is more appropriate. If government spending is seen as being debt financed and government debt is assumed to crowd out private investment, then the SOC will be more appropriate. In the context of universal three-year-old preschool, and as a typical starting position, Deloitte Access Economics advocates for a STP approach.

Aligning with this preference, and in line with the South Australian Treasurer's Guidelines, a central discount rate of 3.5 per cent has been adopted. This is used alongside sensitivity discount rates of 3 per cent and 7 per cent, which corresponds to advice received from the South Australian Government for the purposes of this analysis.

5.1 Outputs from CBA modelling

Outputs from the CBA model included an assessment of the benefits in each category of the model as well as the costs estimated in earlier modelling. The results of the cost-benefit analysis are shown in Table 5.1. Four different scenarios for benefit results are presented, which have been chosen to reflect both uncertainty in the underlying evidence but also the degree to which the benefits are likely to vary depending on the quality of three-year-old preschool that is delivered.

The first column of Table 5.1 sets out the results based on the improvement in NAPLAN scores observed in LSAC and excluding any impacts on improved mental health outcomes. The second

[xviii] Note: the Department of Treasury and Finance has noted a preference of a 7 per cent discount rate to be used for a central case for this analysis. This has been tested as a sensitivity.

column provides results which incorporate an improvement in mental health outcomes, consistent with what was found in the LSAC analysis which is assumed to be sustained for five years.

The third column examines how the benefits may differ in a scenario where the outcomes for children in commissioned preschools are three times better than those found in the LSAC analysis. This was based on the evidence found in the study of Head Start in the US by Domitrovich et al. (2014) outlined in the literature review which found effect sizes at least three times larger than what has been typically found, with that study focused on a relatively disadvantaged cohort. This scenario explicitly seeks to recognise that the cohort attending three-year-old preschool in LSAC was relatively advantaged, whereas those attending commissioned preschool are relatively disadvantaged. It also recognises the vision for commissioned preschools to provide a high quality learning environment.

The final column considered how the benefits are likely to compare where a high quality of preschool delivery is achieved for all children. The parameterisation of this quality uplift is based on some of the findings of the E4Kids study in Australia (Tayler et al 2016) which found that a one standard deviation improvement in instructional support improved verbal ability by 5 months (roughly a doubling of the impacts observed in LSAC) and the findings of Blanden et al. (2022) in the United Kingdom that those attending ECEC with the highest quality ratings had outcomes that were around three times greater than their peers at lower rated services. Accordingly, this scenario assumes that in high quality environments, learning improvements are twice as large for children, which in turn flow in outcomes that are twice as strong in terms of educational attainment and employment relative to those implied by the LSAC analysis.

Across the four scenarios, total benefits range from $2.9 billion to $5.4 billion in net present value terms (using a discount rate of 3.5 per cent in line with South Australian Treasury guidelines). The benefits to children range from $665 million to $2.065 billion as mental health benefits and improved quality is included in the analysis. Families and the ECEC workforce experience benefits of $490 million in net present value terms while the benefits to government and society range from $1.7 billion to $2.8 billion across the scenarios. On a per child basis, total benefits range from $10,939 to $20,577 in net present value terms.

The costs of the reform in net present value terms is estimated at $3.7 billion or $13,964 per child. This results in a benefit-to-cost ratio (BCR) that ranges between 0.78 to 1.47 across the scenarios.

Table 5.1: Benefit and costs under alternative scenarios (Net Present Value, 3.5% discount rate)

	Benefits without mental health effects	**Benefits with mental health effects**	**Benefits with mental health effects and stronger impacts for equity cohorts**	**Benefits with mental health effects and higher quality delivery**
Benefits	Total ($ million)	Total ($ million)	Total ($ million)	Total ($ million)
Children	665	1,399	1,504	2,065
Families	343	343	343	343
ECEC workforce	147	147	147	147
Government	838	937	1,026	1,493
Society	895	895	973	1,387
Total	2,889	3,722	3,993	5,435
Costs				
Recurrent costs	1,170	1,170	1,170	1,170
Capital costs	1,105	1,105	1,105	1,105
IESP	1,121	1,121	1,121	1,121
SSS	181	181	181	181
Case management	109	109	109	109
Total	3,688	3,688	3,688	3,688
Net results	- 799	34	305	1,747
Benefit-cost ratio	0.78	1.01	1.08	1.47

Source: Deloitte Access Economics (2023).

Finally, the results are sensitive to the choice of discount rate, which is unsurprising given the long period before children who attend preschool enter the workforce. Results for these scenarios based on alternative discount rates of 3 per cent and 7 per cent are set out in Appendix E.

The range of results demonstrates that whether the benefits outweigh the costs (and the degree to which they do so) depends to some extent on whether preschool leads to better longer term health outcomes but also to a large degree on the extent to which the reform is able to provide a quality learning environment. To the extent that the reform is able to achieve high quality of delivery such that learning outcomes exceed those that have occurred prior to the national quality reforms, the benefits of the reform are likely to exceed the costs.

It is important to note that this exercise has sought to calculate a return on investment for expenditure by the South Australian government. With 19.5% of additional enrolments in the long day care sector, some costs are likely to be borne by the Australian government and parents which would need to be considered if determining costs and benefits for Australia as a whole.

Finally, there are a number of benefits which this exercise has not been able to quantify. Most important among these are the potential savings to the school system that will arise from the role of three-year-old preschool in preparing children for full time school. Given that significant resources are typically allocated by the school system to support students at risk of falling behind, as well as to support specific equity cohorts, this benefit is potentially significant and likely to accrue earlier than later life employment and social outcomes. There is also a range of social and emotional outcomes including resilience as adults which may be impacted by three-year-old preschool. The evidence of the impact of universal programs on these outcomes is limited at present but it is an important area of research particularly given the potential second generation effects.

This highlights the importance of ongoing longitudinal research into the long-term benefits of three-year-old preschool to help further extend this evidence base including through more detailed linkages of existing administrative datasets.

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Appendix A Equity regions

Table A.1 sets out the 27 SA2s which are flagged for additional preschool eligibility, under Scenario 3B: A mixed approach for delivery, with equity targeting. The proportion of children within SA2 classified as at 'high' risk[xix] has been converted to a population of three-year-old children using ABS Census data.

Table A.1: Inputs from BetterStart

SA2	% DV1 within each SA2[xx]	% DV1 across SA2[xxi]	Median probability	Mean probability	% of children within SA2 classified as at 'high' risk	Sensitivity	PPV	% CP and/or DV1 among those classified as at 'high' risk	SA2 3year-old population	Implied At-risk population
Quorn - Lake Gilles	20%	0.1%	0.24	0.27	32%	100%	62%	62%	18	6
Elizabeth	43%	1.6%	0.35	0.39	61%	75%	53%	75%	138	85
Smithfield - Elizabeth North	40%	2.0%	0.36	0.38	64%	74%	46%	72%	176	113
Wallaroo	26%	0.1%	0.27	0.32	43%	71%	43%	70%	40	18
Davoren Park	34%	2.5%	0.32	0.35	55%	71%	43%	67%	312	173
Coober Pedy	34%	0.1%	0.31	0.35	50%	69%	47%	74%	16	8
Port Pirie	31%	1.3%	0.28	0.31	45%	68%	46%	67%	156	71
Elizabeth East	35%	1.6%	0.30	0.33	50%	67%	47%	68%	212	106
Port Augusta	38%	1.9%	0.30	0.34	50%	66%	51%	67%	161	81
Salisbury	33%	1.6%	0.30	0.32	50%	66%	44%	64%	251	126
Murray Bridge	29%	1.4%	0.27	0.30	40%	63%	45%	66%	229	92
Whyalla	28%	1.9%	0.27	0.30	40%	63%	44%	70%	238	96
Christie Downs	30%	0.8%	0.27	0.31	40%	61%	45%	71%	104	42
Berri	26%	0.4%	0.25	0.28	33%	58%	45%	55%	37	13
Hackham West - Huntfield Heights	31%	0.9%	0.28	0.33	46%	57%	39%	71%	100	47
Goyder	25%	0.3%	0.21	0.23	23%	56%	61%	65%	37	9
Salisbury North	32%	2.0%	0.27	0.29	40%	56%	44%	63%	266	108
West Coast (SA)	24%	0.2%	0.21	0.24	21%	55%	61%	72%	47	10
Ceduna	36%	0.3%	0.25	0.29	30%	53%	65%	77%	40	12

[xix] Note that 'high' risk refers to a child who is identified by the BetterStart risk prediction model as being at risk of going on to be developmentally vulnerable on one of more domains of the AEDC. It does not refer to a child who is 'developmentally at risk', per the AEDC definition: *"Children who score between the 10th and 25th percentile (on a particular domain), determined using the cut-off points established in 2009, are classified as 'developmentally at risk'."*

[xx] Proportion on children in SA2 that were developmentally vulnerable on one or more domains of AEDC (row %). An example interpretation based on the results in row 1 is that the results indicate that there were 20% of children within Quorn - Lake Gilles who were developmentally vulnerable on 1+ domains.

[xxi] Proportion on children that were developmentally vulnerable on one or more domains of AEDC lived that SA2 (column %). An example interpretation based on the results in row 1 is that the results indicate that of *all* children who were developmentally vulnerable, 0.1% resided in Quorn - Lake Gilles at birth.

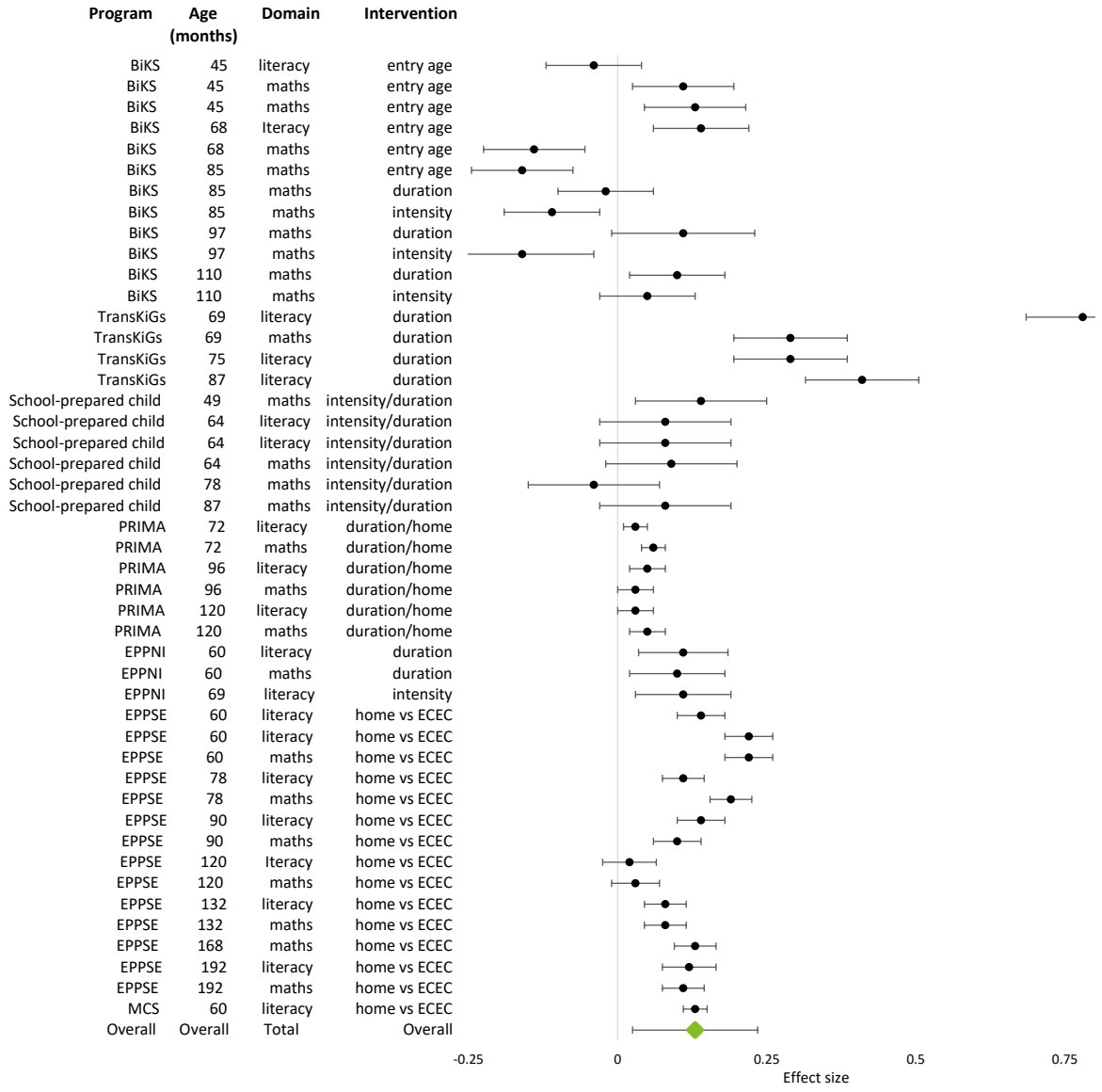
SA2	% DV1 within each SA2[xx]	% DV1 across SA2[xxi]	Median probability	Mean probability	% of children within SA2 classified as at 'high' risk	Sensitivity	PPV	% CP and/or DV1 among those classified as at 'high' risk	SA2 3year-old population	Implied At-risk population
Enfield - Blair Athol	24%	1.9%	0.24	0.27	33%	52%	38%	57%	340	113
Christies Beach	27%	0.7%	0.22	0.25	27%	51%	53%	74%	97	26
Woodville - Cheltenham	23%	1.0%	0.21	0.24	26%	51%	45%	58%	207	55
Port Lincoln	25%	1.0%	0.23	0.26	31%	50%	40%	66%	195	62
Goolwa - Port Elliot	17%	0.3%	0.21	0.22	18%	50%	45%	61%	65	12
Nailsworth - Broadview	14%	0.1%	0.12	0.16	9%	50%	78%	89%	71	7
Mount Gambier - West	14%	0.0%	0.20	0.18	7%	50%	100 %	100%	158	12
Loxton	21%	0.4%	0.21	0.22	21%	50%	51%	66%	53	11

Source: BetterStart Health and Development Research

Appendix B Forest plots from literature review

The literature review of three-year-old preschool impacts undertaken for this work surfaced the met-analysis of Holla et al. (2021). In their work, they compare 798 estimated effect sizes from 50 studies in 19 countries, across a variety of settings, interventions and outcome measures, with a focus on experimental or quasi-experimental studies. This means the observed effects are plausibly causal. The following figures are reconstructions of their 'forest plots', depicting the cross-study variation in findings within the literature. Relevant forest plots are replicated here.

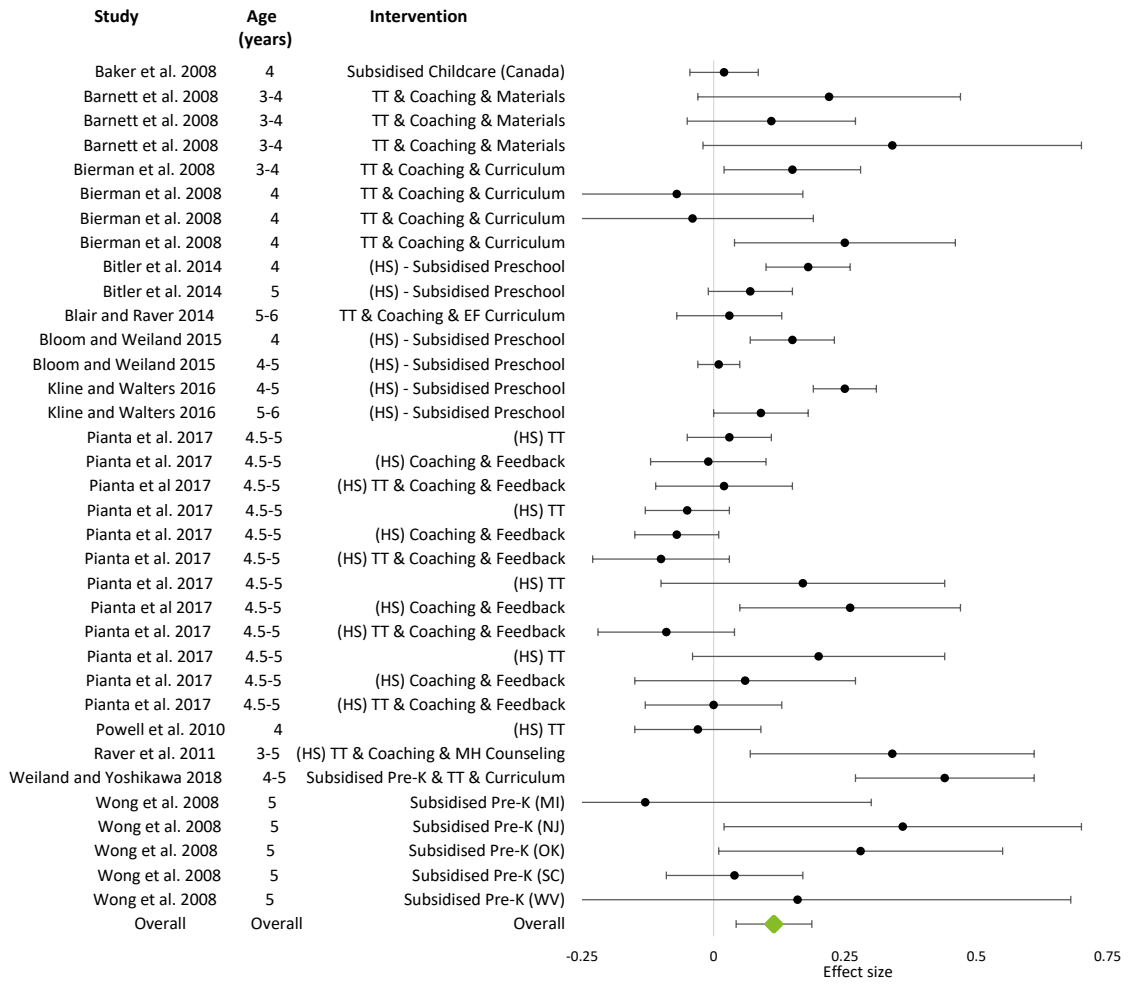
Figure B.1: Forest plot for the relationship of quantity to developmental outcome



Note: Each tick mark represents an individual effect size and the line its corresponding confidence interval. The diamond shape at the bottom shows the overall effect size (.12*) and the dotted line marks a null effect.

Source: Deloitte Access Economics (2023) reproduced from Holla et al. (2021).

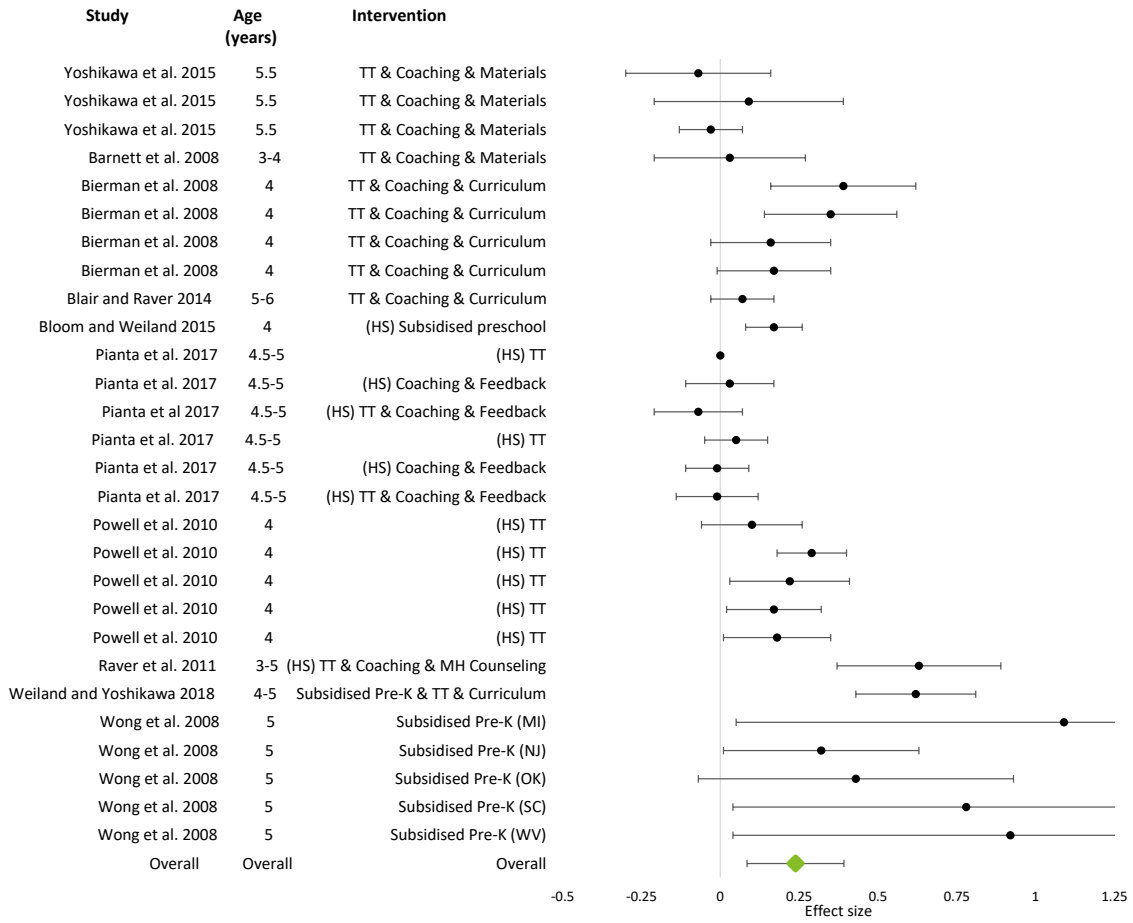
Figure B.2: Effect sizes on language skills in HICs (pre-primary)



Note: Each tick mark represents an individual effect size and the line its corresponding confidence interval. The diamond shape at the bottom shows the overall effect size and the dotted line marks a null effect.

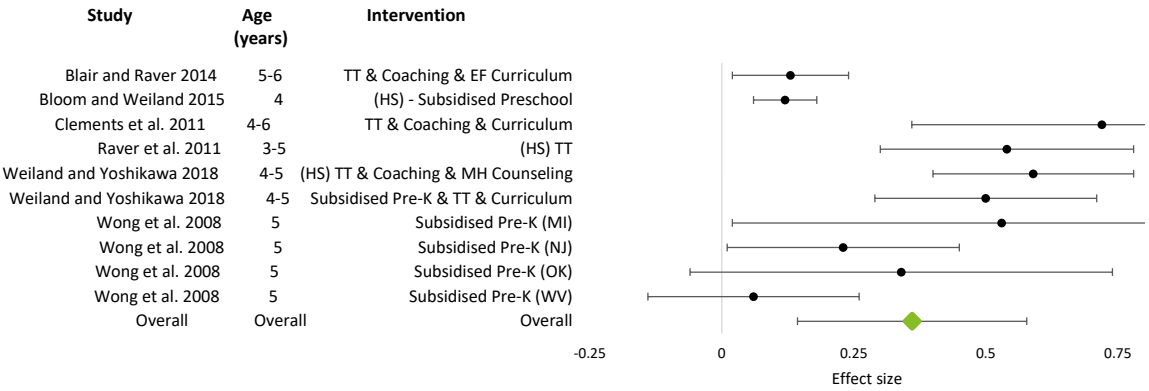
Source: Deloitte Access Economics (2023) reproduced from Holla et al. (2021).

Figure B.3: Effect sizes on cognitive literacy skills (pre-primary)



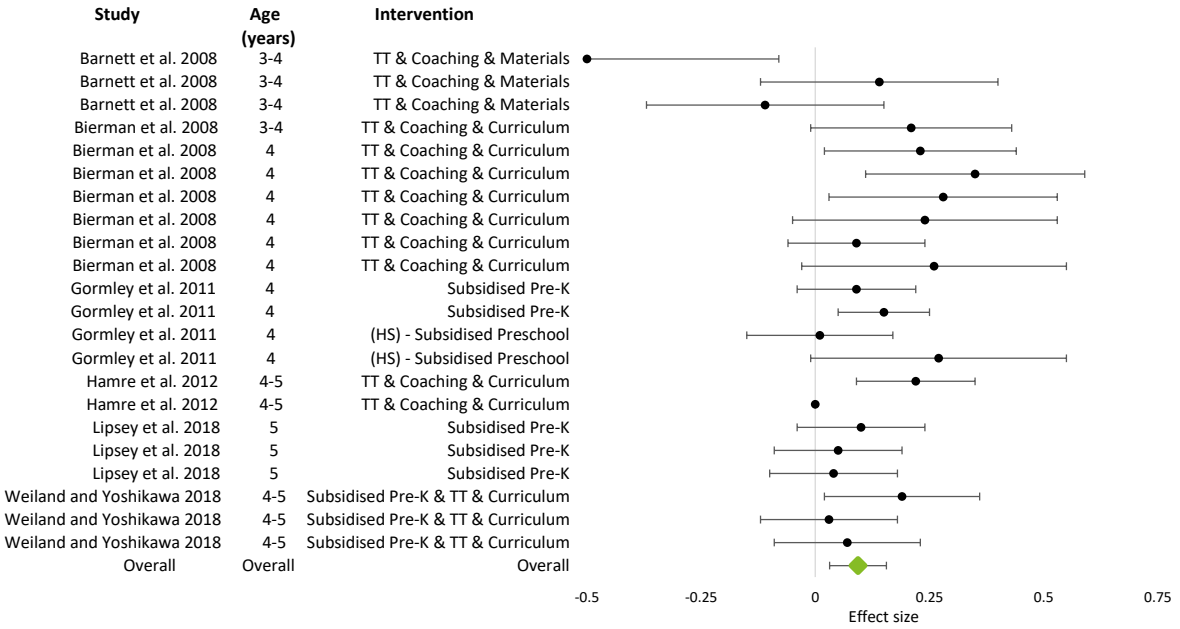
Note: Each tick mark represents an individual effect size and the line its corresponding confidence interval. The diamond shape at the bottom shows the overall effect size and the dotted line marks a null effect.
Source: Deloitte Access Economics (2023) reproduced from Holla et al. (2021).

Figure B.4: Effect sizes on cognitive math skills (pre-primary)



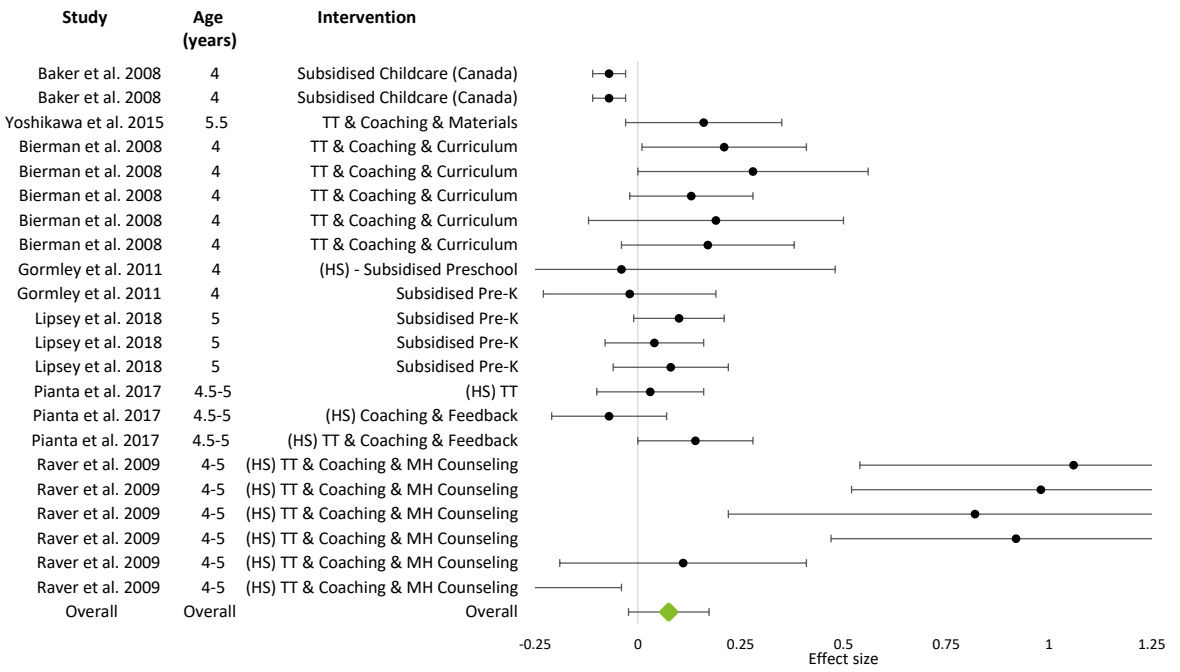
Note: Each tick mark represents an individual effect size and the line its corresponding confidence interval. The diamond shape at the bottom shows the overall effect size and the dotted line marks a null effect.
Source: Deloitte Access Economics (2023) reproduced from Holla et al. (2021).

Figure B.5: Effect sizes on social-emotional skills in HICs (pre-primary)



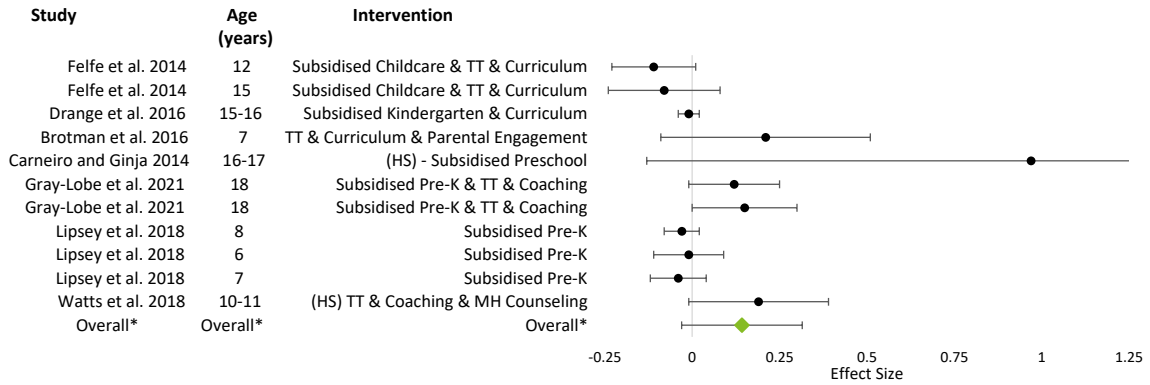
Note: Each tick mark represents an individual effect size and the line its corresponding confidence interval. The diamond shape at the bottom shows the overall effect size and the dotted line marks a null effect.
Source: Deloitte Access Economics (2023) reproduced from Holla et al. (2021).

Figure B.6: Effect sizes on behavioural skills (pre-primary)



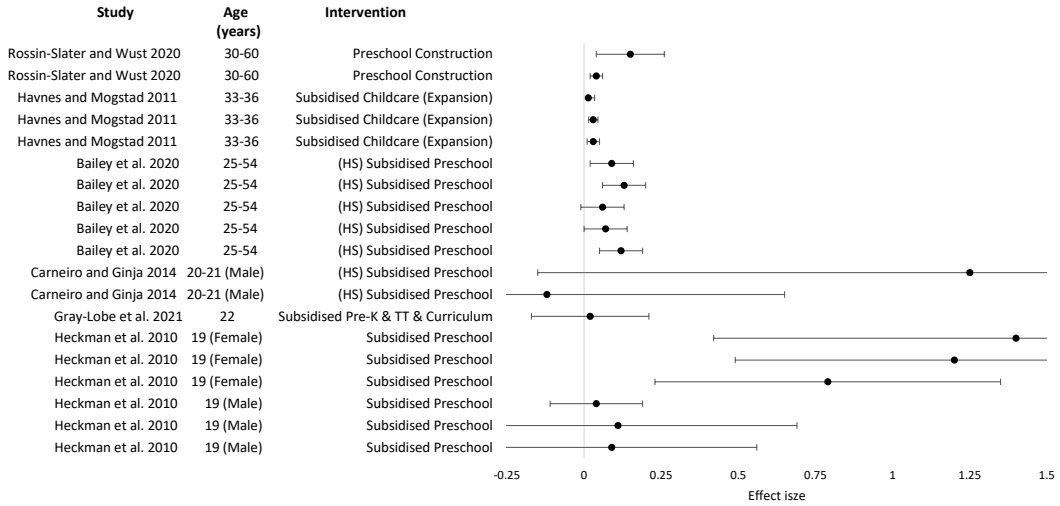
Note: Each tick mark represents an individual effect size and the line its corresponding confidence interval. The diamond shape at the bottom shows the overall effect size and the dotted line marks a null effect.
Source: Deloitte Access Economics (2023) reproduced from Holla et al. (2021).

Figure B.7: Effect sizes on school participation and progression (post-pre-primary)



Note: Each tick mark represents an individual effect size and the line its corresponding confidence interval. The diamond shape at the bottom shows the overall effect size and the dotted line marks a null effect.
Source: Deloitte Access Economics (2023) reproduced from Holla et al. (2021).

Figure B.8: Effect sizes on school participation and progression (adulthood)



Note: Each tick mark represents an individual effect size and the line its corresponding confidence interval. The dotted line marks a null effect.
Source: Deloitte Access Economics (2023) reproduced from Holla et al. (2021).

Appendix C LSAC regression outputs

C.1. Further model specifications and analyses tested

Alongside rigorous specification testing of potential controls, several other aspects of analysis were tested and their considerations are documented here. These include, consideration of sample weights, clustering standard errors by postcode and multiple hypothesis testing of effects.

C.1.1. Consideration of sample weights

It was considered whether the sample weights that are included in LSAC should be used to weight regression analyses. However, the use of weights did not change effect conclusions or significance. It can be debated on various grounds whether regression analyses with survey data should use the survey weights designed to generalise descriptive statistics to the population, accounting for the sample not being representative of the population. Weighted least squares regressions did not change the direction or statistical significance of effects, and effect sizes were relatively similar. Unweighted regression results have been reported, with descriptive sample summaries unweighted to accurately display the sample used in regressions, as descriptive statistics were not used here to make general statements around the population of Australian youth.

C.1.2. Clustering standard errors

Standard errors were clustered by postcode to correct for the sampling strategy employed during the LSAC data collection. This goes some way to address concerns around consistency which can be an argument for including or excluding weights in regressions. Heteroscedasticity-robust standard errors were also tested, with similar conclusions to the clustered errors, however due to the sampling strategy of the LSAC data collection, clustered standard errors are most appropriate.

C.1.3. Multiple hypothesis testing

Outcomes were grouped into composite scores to conduct grouped hypothesis testing for each education, health and social outcomes. The grouped testing effect sizes are not meaningfully interpretable and therefore not reported, however the conclusions in terms of statistical significance are consistent with the individually reported results below, reducing the risk of multiple hypothesis testing leading to spurious claims of statistical significance.

C.2. Full regression outputs for LSAC analysis

This section sets out the full regression outputs of the LSAC analysis.

C.2.1. Full AEDC regression outputs

	Dependent variable				
	Physical wellbeing	**Emotional maturity**	**Social competence**	**Language and cognitive skills**	**Communication and general knowledge**
Effect of three- and four-year old preschool	0.061 (0.069)	0.077 (0.084)	0.096 (0.090)	0.162** (0.079)	0.135 (0.113)
Sex Male	-0.297*** (0.056)	-0.915*** (0.075)	-0.777*** (0.076)	-0.341*** (0.062)	-0.567*** (0.093)
Aboriginal or Torres Strait Islander	0.041 (0.216)	0.129 (0.241)	-0.038 (0.308)	0.139 (0.226)	0.101 (0.365)
Has an ongoing medical condition	-0.546*** (0.148)	-0.251* (0.140)	-0.576*** (0.151)	-0.582*** (0.161)	-1.043*** (0.211)
Birth order	-0.025 (0.034)	0.060 (0.046)	0.012 (0.044)	-0.167*** (0.045)	-0.082 (0.060)
Number of younger siblings	-0.046 (0.062)	0.099 (0.082)	0.138* (0.079)	-0.053 (0.068)	-0.098 (0.103)
Language other than English spoken at home	-0.048 (0.092)	-0.090 (0.110)	-0.152 (0.122)	-0.093 (0.096)	-0.253 (0.157)
Home SEIFA	0.001*** (0.001)	0.0005 (0.001)	0.001* (0.001)	0.001** (0.001)	0.003*** (0.001)
Highest parent education: Year 10 or below	-0.614** (0.241)	-0.600** (0.247)	-0.756** (0.300)	-0.899*** (0.262)	-1.215*** (0.370)
Highest parent education: Year 12 or 11	-0.009 (0.116)	-0.046 (0.151)	-0.044 (0.150)	-0.158 (0.125)	-0.247 (0.190)
Highest parent education: Certificate	-0.267*** (0.081)	-0.229** (0.104)	-0.339*** (0.105)	-0.378*** (0.091)	-0.534*** (0.131)
Highest parent education: Advanced diploma/diploma	-0.028 (0.104)	-0.029 (0.133)	-0.066 (0.125)	-0.096 (0.104)	-0.215 (0.167)
Highest parent education: Graduate diploma/certificate	-0.245** (0.120)	-0.182 (0.132)	-0.210 (0.147)	-0.197 (0.122)	-0.407* (0.212)
Highest parent education: Postgraduate degree	-0.229** (0.096)	0.062 (0.124)	-0.022 (0.132)	0.064 (0.091)	-0.206 (0.148)
Highest parent education: Other	-0.783* (0.447)	-0.092 (0.314)	-0.703 (0.574)	-1.742** (0.820)	-1.583* (0.944)
Joint weekly parent income	0.00002 (0.00003)	0.0001** (0.00004)	0.00002 (0.00004)	0.00002 (0.00003)	0.00002 (0.00005)
Constant	8.013*** (0.626)	8.276*** (0.743)	7.723*** (0.811)	8.486*** (0.641)	6.809*** (0.935)
Observations	1,527	1,518	1,527	1,522	1,526
R^2	0.082	0.131	0.116	0.178	0.106
Adjusted R^2	0.064	0.114	0.098	0.162	0.088
F Statistic	4.604*** (DF = 29; 1497)	7.755*** (DF = 29; 1488)	6.744*** (DF = 29; 1497)	11.128*** (DF = 29; 1492)	6.092*** (DF = 29; 1496)

Significance levels: * 10%, ** 5%, *** 1%

Fixed effects omitted from the table but included in the model include State of residence, Remoteness of home, and whether there is a parent living elsewhere than the home.

Source: Deloitte Access Economics (2023) using LSAC data.

C.2.2. Full NAPLAN regression outputs

Year 3 Regressions

	Dependent variable				
	Year 3 Grammar	**Year 3 Numeracy**	**Year 3 Reading**	**Year 3 Spelling**	**Year 3 Writing**
Effect of three- and four-year old preschool	10.937*** (3.819)	7.751** (3.138)	10.642*** (3.938)	6.365* (3.390)	3.465 (2.545)
Sex Male	-23.023*** (3.823)	12.692*** (2.660)	-9.017*** (3.303)	-19.516*** (3.065)	-27.516*** (2.304)
Aboriginal or Torres Strait Islander	-47.940*** (14.888)	-12.891 (9.176)	-30.490** (13.237)	-17.927* (9.706)	-28.838** (13.387)
Has an ongoing medical condition	-27.461*** (7.653)	-20.550*** (5.798)	-30.376*** (6.726)	-21.508*** (5.961)	-21.495*** (4.660)
Birth order	-8.869*** (2.154)	-3.308** (1.457)	-9.033*** (2.039)	-7.446*** (1.889)	-4.058** (1.619)
Number of younger siblings	-2.273 (4.219)	-0.444 (3.310)	-0.931 (3.897)	2.197 (3.359)	-0.113 (2.758)
Language other than English spoken at home	6.881 (5.086)	6.829 (4.275)	-1.360 (5.064)	11.101** (5.012)	2.278 (3.654)
Home SEIFA	0.132*** (0.033)	0.112*** (0.026)	0.174*** (0.031)	0.097*** (0.027)	0.072*** (0.020)
Highest parent education: Year 10 or below	-61.821*** (13.299)	-40.689*** (9.599)	-53.994*** (10.447)	-34.654*** (10.312)	-39.360*** (8.579)
Highest parent education: Year 12 or 11	-26.354*** (7.717)	-25.857*** (5.554)	-31.536*** (7.151)	-11.959** (5.743)	-12.162** (4.755)
Highest parent education: Certificate	-40.525*** (5.133)	-29.976*** (4.000)	-39.796*** (4.872)	-25.156*** (4.236)	-19.150*** (3.246)
Highest parent education: Advanced diploma/diploma	-26.769*** (6.220)	-20.303*** (4.793)	-19.533*** (6.325)	-14.531** (5.737)	-11.026*** (4.022)
Highest parent education: Graduate diploma/certificate	-14.968** (7.247)	-19.687*** (6.277)	-15.928** (7.794)	-7.707 (6.650)	-1.617 (4.491)
Highest parent education: Postgraduate degree	7.585 (5.705)	8.678* (4.769)	8.182 (5.130)	8.252 (5.337)	6.557 (4.059)
Highest parent education: Other	-49.848*** (13.932)	-24.571* (13.963)	-41.411** (16.518)	-50.297*** (13.393)	-24.859*** (8.812)
Joint weekly parent income	0.003 (0.002)	0.005*** (0.002)	0.003* (0.002)	0.003** (0.002)	0.003** (0.001)
Age at time of test	0.625 (0.449)	1.038*** (0.361)	1.313*** (0.452)	0.623 (0.397)	0.352 (0.340)
Number of schools attended	-2.167 (3.074)	-6.005*** (2.244)	-1.305 (3.003)	-2.333 (2.334)	-1.519 (1.831)
School type: Catholic school	-1.482 (4.887)	-10.110*** (3.457)	-1.799 (4.498)	-3.389 (3.746)	3.547 (2.959)
School type: Independent or private school	14.106** (5.802)	10.762** (4.236)	7.781 (5.365)	11.501** (4.779)	8.655** (3.558)
Constant	295.052*** (57.991)	213.570*** (46.997)	166.962*** (55.489)	300.808*** (47.533)	352.058*** (40.379)
Observations	2,207	2,200	2,204	2,207	2,205
R^2	0.182	0.184	0.183	0.154	0.209
Adjusted R^2	0.169	0.172	0.170	0.141	0.197
F Statistic	14.631*** (DF = 33; 2173)	14.808*** (DF = 33; 2166)	14.704*** (DF = 33; 2170)	11.990*** (DF = 33; 2173)	17.359*** (DF = 33; 2171)

Significance levels: * 10%, ** 5%, *** 1%

Fixed effects omitted from the table but included in the model include State of residence, Remoteness of home, and whether there is a parent living elsewhere than the home.

Source: Deloitte Access Economics (2023) using LSAC data.

Year 5 Regressions

	Dependent variable				
	Year 5 Grammar	**Year 5 Numeracy**	**Year 5 Reading**	**Year 5 Spelling**	**Year 5 Writing**
Effect of three- and four-year old preschool	7.433** (3.579)	10.815*** (3.137)	8.814** (3.563)	5.942* (3.294)	3.771 (2.721)
Sex Male	-12.691*** (3.465)	17.257*** (3.048)	-2.486 (3.102)	-14.187*** (3.113)	-24.797*** (2.605)
Aboriginal or Torres Strait Islander	-32.648** (13.763)	-10.366 (9.427)	-31.250*** (11.332)	-21.164* (12.592)	-43.653*** (12.768)
Has an ongoing medical condition	-26.231*** (6.562)	-17.432*** (5.772)	-27.417*** (5.777)	-20.793*** (5.941)	-20.649*** (5.610)
Birth order	-5.464*** (1.908)	-1.269 (1.328)	-5.345*** (1.708)	-4.759*** (1.621)	-2.981** (1.403)
Number of younger siblings	1.616 (4.163)	0.441 (3.311)	-1.890 (3.650)	-1.653 (3.247)	-3.340 (2.899)
Language other than English spoken at home	-0.582 (4.948)	3.170 (4.942)	-6.551 (4.756)	10.541** (4.609)	2.419 (4.141)
Home SEIFA	0.103*** (0.031)	0.079*** (0.025)	0.127*** (0.028)	0.053** (0.026)	0.088*** (0.020)
Highest parent education: Year 10 or below	-42.815*** (11.449)	-40.730*** (10.524)	-43.993*** (10.040)	-21.580** (10.638)	-19.926** (9.200)
Highest parent education: Year 12 or 11	-33.922*** (7.042)	-28.441*** (5.729)	-38.440*** (6.242)	-21.630*** (5.828)	-24.644*** (5.704)
Highest parent education: Certificate	-37.846*** (4.994)	-31.082*** (4.002)	-34.718*** (4.276)	-29.075*** (4.121)	-19.423*** (3.788)
Highest parent education: Advanced diploma/diploma	-25.913*** (5.632)	-26.405*** (4.605)	-23.300*** (5.592)	-24.028*** (5.449)	-16.125*** (4.288)
Highest parent education: Graduate diploma/certificate	-10.092 (6.820)	-20.629*** (5.837)	-17.800*** (6.393)	-11.749* (6.227)	-8.188* (4.914)
Highest parent education: Postgraduate degree	14.667*** (5.471)	9.990** (4.977)	13.874** (5.543)	3.233 (5.020)	4.790 (4.581)
Highest parent education: Other	-52.166*** (18.776)	-31.750** (13.930)	-36.609** (15.070)	-42.853*** (14.426)	-18.202 (13.146)
Joint weekly parent income	0.003* (0.002)	0.004*** (0.001)	0.004** (0.002)	0.004** (0.002)	0.003** (0.001)
Age at time of test	-0.004 (0.447)	0.146 (0.373)	0.101 (0.410)	-0.144 (0.410)	-0.284 (0.385)
Number of schools attended	1.211 (2.130)	-1.332 (1.654)	2.313 (2.071)	0.946 (1.765)	-0.187 (1.477)
School type: Catholic school	-1.672 (4.297)	-3.592 (3.410)	-3.261 (3.845)	-1.485 (3.428)	5.105 (3.234)
School type: Independent or private school	4.147 (4.302)	1.592 (3.743)	-5.000 (4.363)	6.771* (3.872)	3.899 (3.526)
Constant	451.978*** (67.054)	414.827*** (55.450)	408.073*** (60.864)	503.315*** (57.886)	461.209*** (54.938)
Observations	2,069	2,068	2,070	2,069	2,061
R^2	0.163	0.168	0.168	0.125	0.163
Adjusted R^2	0.150	0.154	0.155	0.110	0.150
F Statistic	12.040*** (DF = 33; 2035)	12.446*** (DF = 33; 2034)	12.493*** (DF = 33; 2036)	8.776*** (DF = 33; 2035)	11.983*** (DF = 33; 2027)

Significance levels: * 10%, ** 5%, *** 1%

Fixed effects omitted from the table but included in the model include State of residence, Remoteness of home, and whether there is a parent living elsewhere than the home.

Source: Deloitte Access Economics (2023) using LSAC data.

Year 7 Regressions

	Dependent variable				
	Year 7 Grammar	**Year 7 Numeracy**	**Year 7 Reading**	**Year 7 Spelling**	**Year 7 Writing**
Effect of three- and four-year old preschool	7.024* (3.813)	11.915*** (2.982)	7.643** (3.243)	8.194** (3.289)	5.668* (3.308)
Sex Male	-15.684*** (3.259)	15.224*** (2.895)	-3.598 (2.793)	-10.733*** (2.995)	-29.534*** (3.000)
Aboriginal or Torres Strait Islander	-24.829** (12.478)	-10.001 (9.765)	-18.626 (12.756)	-20.083 (13.455)	-34.396*** (12.732)
Has an ongoing medical condition	-30.295*** (6.158)	-19.907*** (5.391)	-20.850*** (5.453)	-22.287*** (5.704)	-21.718*** (6.140)
Birth order	-4.196** (1.910)	-0.221 (1.436)	-4.864*** (1.592)	-3.811** (1.799)	-2.472 (1.706)
Number of younger siblings	1.578 (4.079)	1.067 (3.260)	-0.391 (3.047)	0.913 (3.449)	1.494 (3.532)
Language other than English spoken at home	2.716 (5.391)	7.125 (5.207)	-3.248 (4.290)	10.427** (4.904)	1.740 (4.131)
Home SEIFA	0.081*** (0.029)	0.082*** (0.026)	0.069*** (0.024)	0.039 (0.027)	0.046* (0.025)
Highest parent education: Year 10 or below	-33.299*** (11.641)	-28.744** (11.854)	-38.326*** (10.764)	-15.132 (13.609)	-22.382* (13.312)
Highest parent education: Year 12 or 11	-31.958*** (7.461)	-32.098*** (6.157)	-38.016*** (6.287)	-22.320*** (6.067)	-25.655*** (6.677)
Highest parent education: Certificate	-38.424*** (4.943)	-31.553*** (3.983)	-35.253*** (4.312)	-31.304*** (4.478)	-26.021*** (4.543)
Highest parent education: Advanced diploma/diploma	-26.038*** (6.167)	-26.439*** (4.781)	-26.421*** (5.114)	-21.943*** (4.973)	-18.205*** (5.292)
Highest parent education: Graduate diploma/certificate	-10.216 (7.201)	-17.249*** (6.248)	-14.265** (6.647)	-7.384 (6.289)	-6.019 (5.560)
Highest parent education: Postgraduate degree	6.230 (5.430)	11.025** (4.882)	11.951** (5.015)	1.252 (4.900)	-0.925 (4.686)
Highest parent education: Other	-31.925* (17.498)	-40.438** (18.780)	-37.345* (20.371)	-31.802** (14.897)	-35.038 (23.454)
Joint weekly parent income	0.004** (0.002)	0.004** (0.002)	0.005*** (0.002)	0.004** (0.002)	0.004*** (0.002)
Age at time of test	-0.690 (0.440)	0.080 (0.383)	-0.648* (0.372)	-0.588 (0.400)	0.017 (0.410)
Number of schools attended	0.847 (1.750)	-1.806 (1.308)	-1.237 (1.515)	1.705 (1.564)	-1.235 (1.502)
School type: Catholic school	-3.723 (4.603)	-5.225 (3.503)	-3.118 (3.627)	-1.243 (3.742)	4.817 (3.600)
School type: Independent or private school	4.246 (4.484)	1.143 (3.988)	1.173 (4.272)	2.791 (3.990)	1.983 (3.663)
Constant	608.755*** (73.870)	475.619*** (66.057)	613.168*** (63.242)	625.341*** (65.076)	506.042*** (69.170)
Observations	1,859	1,849	1,855	1,859	1,856
R^2	0.146	0.188	0.162	0.120	0.167
Adjusted R^2	0.131	0.173	0.147	0.104	0.152
F Statistic	9.490*** (DF = 33; 1825)	12.749*** (DF = 33; 1815)	10.682*** (DF = 33; 1821)	7.545*** (DF = 33; 1825)	11.096*** (DF = 33; 1822)

Significance levels: * 10%, ** 5%, *** 1%

Fixed effects omitted from the table but included in the model include State of residence, Remoteness of home, and whether there is a parent living elsewhere than the home.

Source: Deloitte Access Economics (2023) using LSAC data.

Year 9 Regressions

	Dependent variable				
	Year 9 Grammar	**Year 9 Numeracy**	**Year 9 Reading**	**Year 9 Spelling**	**Year 9 Writing**
Effect of three- and four-year old preschool	2.714 (3.618)	6.039* (3.280)	10.449*** (3.540)	6.015 (3.869)	7.240* (4.345)
Sex Male	-11.284*** (3.507)	16.211*** (2.965)	-5.411* (2.899)	-10.871*** (3.279)	-24.866*** (3.744)
Aboriginal or Torres Strait Islander	-11.501 (12.458)	-10.200 (12.018)	-14.237 (12.306)	-15.425 (13.361)	-21.685 (13.723)
Has an ongoing medical condition	-12.528** (5.887)	-7.907 (5.311)	-11.697** (5.114)	-18.621*** (7.087)	-16.610** (6.762)
Birth order	-4.266** (2.015)	-0.419 (1.591)	-1.882 (1.578)	-3.317* (1.974)	-5.085*** (1.912)
Number of younger siblings	2.882 (3.342)	4.749 (3.040)	5.750* (3.242)	2.012 (3.721)	-0.385 (4.598)
Language other than English spoken at home	6.790 (5.327)	3.883 (4.383)	-1.324 (4.200)	14.098*** (4.967)	5.821 (5.765)
Home SEIFA	0.066** (0.027)	0.077*** (0.023)	0.056** (0.024)	0.060** (0.028)	0.060** (0.028)
Highest parent education: Year 10 or below	-49.800*** (11.131)	-34.773*** (11.194)	-51.058*** (10.241)	-30.550** (14.859)	-62.303*** (20.414)
Highest parent education: Year 12 or 11	-27.962*** (7.532)	-25.784*** (6.541)	-26.294*** (6.303)	-20.286*** (6.849)	-33.152*** (8.673)
Highest parent education: Certificate	-30.430*** (5.181)	-31.489*** (4.254)	-30.220*** (4.619)	-29.238*** (4.754)	-31.670*** (5.657)
Highest parent education: Advanced diploma/diploma	-10.586* (6.323)	-19.000*** (4.658)	-14.252*** (5.013)	-17.125*** (5.737)	-15.750** (6.496)
Highest parent education: Graduate diploma/certificate	-12.152* (7.311)	-15.997*** (5.881)	-5.741 (6.269)	-4.408 (7.228)	-15.541* (8.656)
Highest parent education: Postgraduate degree	10.990** (5.218)	16.453*** (4.647)	10.802** (4.659)	7.390 (5.246)	4.470 (5.772)
Highest parent education: Other	-32.214** (14.365)	-14.546 (16.529)	-37.181 (26.052)	-35.218** (14.853)	-57.973* (33.827)
Joint weekly parent income	0.003 (0.002)	0.003** (0.002)	0.004*** (0.002)	0.004** (0.002)	0.005*** (0.002)
Age at time of test	-0.304 (0.452)	-0.194 (0.355)	-0.300 (0.355)	-1.010** (0.410)	-0.845* (0.481)
Number of schools attended	-2.848 (1.948)	-2.813** (1.159)	-1.065 (1.490)	-0.042 (1.522)	-3.000 (2.329)
School type: Catholic school	-1.317 (4.406)	-1.587 (3.665)	-2.739 (3.750)	-4.112 (4.151)	9.075* (5.495)
School type: Independent or private school	4.278 (4.812)	3.970 (3.944)	5.081 (4.222)	2.891 (4.398)	13.477** (5.276)
Constant	618.178*** (83.927)	576.904*** (69.319)	608.751*** (67.906)	730.092*** (75.472)	688.200*** (94.126)
Observations	1,677	1,649	1,674	1,677	1,669
R^2	0.146	0.203	0.150	0.133	0.151
Adjusted R^2	0.129	0.187	0.133	0.116	0.133
F Statistic	8.495*** (DF = 33; 1643)	12.494*** (DF = 33; 1615)	8.763*** (DF = 33; 1640)	7.645*** (DF = 33; 1643)	8.779*** (DF = 33; 1635)

Significance levels: * 10%, ** 5%, *** 1%

Fixed effects omitted from the table but included in the model include State of residence, Remoteness of home, and whether there is a parent living elsewhere than the home.

Source: Deloitte Access Economics (2023) using LSAC data.

C.2.3. Full health regression outputs

	Dependent variable			
	Kessler 10+ psychological distress scale	**Self-reported health (1-5)**	**Self-reported health (binary)**	**Self-esteem**
	OLS	*OLS*	*Logistic*	*Logistic*
Effect of three- and four-year old preschool	-1.182** (0.530)	0.097** (0.039)	0.311** (0.150)	0.117 (0.128)
Sex Male	-4.907*** (0.514)	0.039 (0.037)	-0.018 (0.141)	-0.066 (0.118)
Aboriginal or Torres Strait Islander	2.210 (1.718)	0.068 (0.135)	-0.014 (0.419)	-0.206 (0.452)
Has an ongoing medical condition	1.115 (0.869)	-0.254*** (0.072)	-0.516** (0.208)	-0.224 (0.210)
Birth order	0.029 (0.249)	0.012 (0.021)	0.015 (0.075)	-0.092 (0.067)
Number of younger siblings	0.136 (0.499)	0.030 (0.040)	0.108 (0.149)	0.007 (0.129)
Language other than English spoken at home	1.249* (0.715)	-0.067 (0.057)	-0.189 (0.198)	0.305 (0.211)
Home SEIFA at or before preschool	0.001 (0.005)	0.0002 (0.0004)	-0.001 (0.001)	-0.001 (0.001)
Home SEIFA at time of outcome	0.003 (0.005)	0.00002 (0.0004)	0.002 (0.001)	0.001 (0.001)
Highest parent education: Year 10 or below	2.483 (1.829)	-0.152 (0.130)	-0.426 (0.395)	-0.966*** (0.352)
Highest parent education: Year 12 or 11	-0.578 (1.105)	-0.108 (0.080)	-0.070 (0.286)	0.066 (0.268)
Highest parent education: Certificate	1.225* (0.686)	-0.142*** (0.051)	-0.284 (0.191)	-0.148 (0.168)
Highest parent education: Advanced diploma/diploma	-0.210 (0.816)	-0.107 (0.072)	-0.430* (0.247)	-0.097 (0.223)
Highest parent education: Graduate diploma/certificate	-0.072 (1.015)	-0.030 (0.068)	0.051 (0.300)	0.014 (0.243)
Highest parent education: Postgraduate degree	1.150 (0.735)	-0.076 (0.054)	-0.180 (0.220)	0.044 (0.212)
Highest parent education: Other	9.263** (3.645)	-0.450* (0.272)	-1.412*** (0.468)	-1.126** (0.549)
Joint weekly parent income at or before preschool	0.0004* (0.0002)	0.00003 (0.00002)	0.00003 (0.0001)	-0.00004 (0.0001)
Joint weekly parent income at time of outcome	-0.0003** (0.0001)	0.00002 (0.00001)	0.0001 (0.0001)	0.0001 (0.00004)
Age at time of outcome	0.317 (0.484)	-0.079* (0.042)	-0.161 (0.147)	0.020 (0.126)
Constant	14.666* (8.274)	5.078*** (0.687)	3.319 (2.322)	1.161 (2.088)
Observations	1,306	1,761	1,761	1,694
R^2	0.113	0.052		
Adjusted R^2	0.091	0.034		
F Statistic	5.082*** (DF = 32; 1273)	2.961*** (DF = 32; 1728)		

Significance levels: * 10%, ** 5%, *** 1%

Fixed effects omitted from the table but included in the model include State of residence, Remoteness of home, and whether there is a parent living elsewhere than the home.

Source: Deloitte Access Economics (2023) using LSAC data.

C.2.4. Full social regression outputs

	Dependent variable			
	Police interaction	**Emotional problems (0-10)**	**Bad behaviour (0-10)**	**Social development *(0-40)***
	Logistic	*OLS*	*OLS*	*OLS*
Effect of three- and four-year old preschool	0.072 (0.248)	-0.058 (0.126)	-0.094 (0.076)	-0.356 (0.299)
Sex Male	1.002*** (0.240)	-1.756*** (0.110)	0.229*** (0.074)	-1.642*** (0.264)
Aboriginal or Torres Strait Islander	-0.982 (1.167)	0.571 (0.554)	0.149 (0.258)	0.889 (1.311)
Has an ongoing medical condition	-0.376 (0.395)	0.162 (0.195)	0.321** (0.132)	1.039** (0.520)
Birth order	0.012 (0.118)	0.073 (0.063)	0.052 (0.041)	0.235 (0.148)
Number of younger siblings	-0.317 (0.254)	0.060 (0.117)	0.100 (0.078)	0.288 (0.281)
Language other than English spoken at home	-0.545 (0.423)	-0.126 (0.176)	-0.004 (0.099)	-0.377 (0.422)
Home SEIFA at or before preschool	0.0001 (0.003)	-0.001 (0.001)	-0.001 (0.001)	-0.003 (0.003)
Home SEIFA at time of outcome	-0.001 (0.002)	0.0002 (0.001)	-0.001 (0.001)	-0.002 (0.003)
Highest parent education: Year 10 or below	1.739*** (0.501)	0.463 (0.417)	0.404 (0.276)	1.894* (1.021)
Highest parent education: Year 12 or 11	-0.016 (0.485)	-0.072 (0.232)	0.007 (0.146)	-0.177 (0.561)
Highest parent education: Certificate	0.456 (0.278)	0.027 (0.163)	0.090 (0.102)	0.569 (0.398)
Highest parent education: Advanced diploma/diploma	-0.394 (0.527)	0.080 (0.205)	-0.024 (0.117)	-0.050 (0.461)
Highest parent education: Graduate diploma/certificate	-0.847 (0.593)	-0.114 (0.212)	-0.077 (0.128)	-0.108 (0.550)
Highest parent education: Postgraduate degree	-0.493 (0.467)	0.320 (0.198)	-0.064 (0.116)	0.331 (0.451)
Highest parent education: Other	0.193 (0.977)	0.747 (0.689)	1.341** (0.600)	4.148* (2.184)
Joint weekly parent income at or before preschool	-0.00002 (0.0001)	0.00004 (0.0001)	0.0001* (0.00004)	0.0002 (0.0001)
Joint weekly parent income at time of outcome	-0.0001 (0.0001)	-0.0001** (0.00003)	-0.0001*** (0.00002)	-0.0003*** (0.0001)
Age at time of outcome	0.277 (0.238)	0.326** (0.128)	0.107 (0.074)	0.640** (0.294)
Constant	-6.506* (3.796)	-0.185 (2.179)	1.339 (1.176)	7.056 (4.798)
Observations	1,692	1,694	1,694	1,694
R^2		0.149	0.052	0.072
Adjusted R^2		0.132	0.034	0.054
F Statistic		9.063*** (DF = 32; 1661)	2.866*** (DF = 32; 1661)	4.009*** (DF = 32; 1661)

Significance levels: * 10%, ** 5%, *** 1%

Fixed effects omitted from the table but included in the model include State of residence, Remoteness of home, and whether there is a parent living elsewhere than the home.

Source: Deloitte Access Economics (2023) using LSAC data.

Appendix D Department for Education data

The sample sizes for the second analytical approach utilised in the Department for Education analysis can be found in Table D.1. The sample included only children who were eligible for three-year-old preschool based on their Aboriginal and/or Torres Strait islander and out-of-care status.

Table D.1: Number of children eligible for three-year-old preschool (including children from an Aboriginal and/or Torres Strait Islander background or children under the care of the Minister) by years of government and non-government preschool attendance and outcome dataset:

	AEDC 2018	**NAPLAN 2021**	**Phonics 2018 - 2022**	**NCCD 2018 – 2022**
Attended preschool both as a 3- and 4-year-old	497	495	2,384	3,027
Attended government preschool as a 4-year-old only	175	169	758	1,083
Attended non-government preschool as a 4-year-old only with a potential 3-year-old preschool program	1	2	21	28
Attended non-government preschool as a 4-year-old only without a 3-year-old preschool program	13	15	75	101
Attended no preschool program	20	14	19*	-
Total	713	702	3,315	4,454

Note: *Sample size reduced as we can extract this information for 2019 only where AEDC information is available.
Source: Deloitte Access Economics (2023).

Based on the results of a positive impact of greater hours of preschool attendance outlined in chapter 3.2.5, additional analysis has been undertaken to compare the outcomes between children who have attended government preschool both at the age three and four against children who have attended government preschool at age 3 only. In contrast to previous analyses, however, the sample includes only children who have attended an average of 12 hours a week of preschool across two or one year, respectively. The purpose of this analysis is to reveal a potential benefit of an additional year of preschool among children who experienced high intensity preschool only, therefore attempting to reduce the confounding effect of preschool hours attended.

Overall, there was evidence of more positive outcomes on most outcome measures in NAPLAN (see Table D.2) and AEDC (see Table D.3) for those who received an additional year of government preschool (with an average intensity of at least 12 hours per week). Most of these effects were not statistically significant, however.

Table D.2: NAPLAN results (considering children with consistently high preschool exposure with more than 12 hours per week only)

Continuous outcomes	**Sample size**	**Attending government preschool both as a 3- and 4-year-old**	**Adjusted R2**
Numeracy	6,971	2.251	0.268
Reading	7,025	2.726	0.267
Writing	6,961	11.536	0.262
Spelling	6,993	-6.901	0.268
Grammar & Punctuation	6,992	5.672	0.279

Note: The reference group are children who have attended government preschool at age 4 only.

Source: Deloitte Access Economics (2023).

Table D.3: AEDC results (considering children with consistently high preschool exposure with more than 12 hours per week only)

Continuous outcomes	**Sample size**	**Attending government preschool both as a 3- and 4-year-old**	**Adjusted R2**
MSI	7,613	1.887	0.228
Physical	7,613	0.286 *	0.160
Social	7,613	0.160	0.213
Emotional	7,596	0.118	0.222
Language & Cognitive	7,591	0.001	0.242
Communication	7,612	0.228	0.224
Categorical outcomes			
Not developmentally vulnerable	7,613	-0.034	2,667

Note: The reference group are children who have attended government preschool at age 4 only.

Source: Deloitte Access Economics (2023).

Appendix E Discount rate sensitivity results

As outlined in Chapter 5, the benefits of a universal three-year-old preschool policy are highly sensitive to the chosen discount rate to convert future streams of benefits into net present value (NPV) terms. This is due to the lifetime nature of many of the largest streams of benefits: for example, children participating in three-year-old preschool in 2026 are unlikely to join the workforce much earlier than 2046, and so benefits are discounted approximately 20 years or more to convert them to current terms.

In the results presented in Chapter 5, a discount rate of 3.5 per cent is used, in line with the South Australian *Treasurer's Instructions 17* and advice from the Royal Commission for the purposes of this study, and consistent with a social rate of time preference approach and advice in the United Kingdom guidelines, *The Green Book*.[94]

Further sensitivities at three per cent and seven per cent are included in this appendix, aligning with the sensitivity and reporting preferences of the South Australian Department of Treasury and Finance and the Department for Education.

E.1.1. Results at a 3 per cent discount rate

At a three per cent discount rate, total benefits range from $3.5 billion to $6.7 billion in net present value terms. The benefits to children range from $862 million to $2.6 billion as mental health benefits and improved quality is included in the analysis. Families and the ECEC workforce collectively experience benefits of approximately $529 million in NPV terms, while the benefits to government and society range from $2.1 billion to $3.6 billion across the scenarios. On a per child basis, total benefits range from $13,237 to $25,221 in net present value terms.

The costs of the reform in net present value terms is estimated at $3.9 billion or $14,912 per child. This results in a benefit-to-cost ratio (BCR) that ranges between 0.89 to 1.69 across the scenarios.

Table E.1: Benefit and costs under alternative scenarios (Net Present Value, 3 per cent discount rate)

	Benefits without mental health effects	**Benefits with mental health effects**	**Benefits with mental health effects and stronger impacts for equity cohorts**	**Benefits with mental health effects and higher quality delivery**
Benefits	Total ($ million)	Total ($ million)	Total ($ million)	Total ($ million)
Children	862	1,691	1,827	2,553
Families	374	374	374	374
ECEC workforce	155	155	155	155
Government	1,030	1,142	1,257	1,866
Society	1,075	1,075	1,176	1,714
Total	3,496	4,437	4,789	6,661
Costs				
Recurrent costs	1,248	1,248	1,248	1,248
Capital costs	1,182	1,182	1,182	1,182
IESP	1,199	1,199	1,199	1,199
SSS	193	193	193	193
Case management	116	116	116	116
Total	3,938	3,938	3,938	3,938
Net results	-442	499	851	2,723
Benefit-cost ratio	0.89	1.13	1.22	1.69

Source: Deloitte Access Economics (2023).

E.1.2. Results at a 7 per cent discount rate

At a seven per cent discount rate, total benefits range from $1.0 billion to $1.7 billion in net present value terms. The benefits to children range from $120 million to $563 million as mental health benefits and improved quality is included in the analysis. Families and the ECEC workforce collectively experience benefits of approximately $301 million in NPV terms, while the benefits to government and society range from $602 million to $829 million across the scenarios. On a per child basis, total benefits range from $3,870 to $6,407 in net present value terms.

The costs of the reform in net present value terms is estimated at $2.4 billion or $9,036 per child. This results in a benefit-to-cost ratio (BCR) that ranges between 0.43 to 0.71 across the scenarios.

Table E.2: Benefit and costs under alternative scenarios (Net Present Value, 7 per cent discount rate)

	Benefits without mental health effects	**Benefits with mental health effects**	**Benefits with mental health effects and stronger impacts for equity cohorts**	**Benefits with mental health effects and higher quality delivery**
Benefits	Total ($ million)	Total ($ million)	Total ($ million)	Total ($ million)
Children	120	443	462	563
Families	201	201	201	201
ECEC workforce	100	100	100	100
Government	262	305	321	400
Society	340	340	354	429
Total	1,022	1,390	1,437	1,692
Costs				
Recurrent costs	765	765	765	765
Capital costs	709	709	709	709
IESP	721	721	721	721
SSS	119	119	119	119
Case management	72	72	72	72
Total	2,387	2,387	2,387	2,387
Net results	-1,364	-997	-949	-694
Benefit-cost ratio	0.43	0.58	0.60	0.71

Source: Deloitte Access Economics (2023).

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