

RESTACKING THE ODDS



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COMMUNICATION BRIEF

Early childhood education and care: An evidence based review of indicators to assess quality, quantity, and participation

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RESTACKING THE ODDS: PROJECT BACKGROUND

Inequities emerging in early childhood often continue into adulthood, contributing to unequal rates of low educational attainment, poor mental and physical health and low income. In some cases, this experience is part of a persistent cycle of intergenerational disadvantage. Inequities constitute a significant and ongoing social problem and – along with the substantial economic costs – have major implications for public policy.

To redress inequities, research tells us that efforts should be delivered during early childhood (pregnancy to eight years of age) to deliver the greatest benefits. Restacking the Odds focuses on five key evidence-based interventions/platforms in early childhood: antenatal care; sustained nurse home visiting; early childhood education and care; parenting programs; and the early years of school (see *Figure 1: Five Fundamental Strategies*).

These five strategies are only a subset of the possible interventions, but we have selected them carefully. They are notably *longitudinal* (across early childhood), *ecological* (targeting child and parent), *evidence-based*, *already available* in almost all communities, and able to be *targeted* to benefit the ‘bottom 25 per cent’. Our premise is that by ‘stacking’ these fundamental interventions (i.e., ensuring they are all applied for a given individual) there will be a cumulative effect - amplifying the impact and sustaining the benefit.

Our intent is to use a combination of data-driven, evidence-based and expert informed approaches to develop measurable best practice indicators of quality, quantity and participation for each of the five strategies:

Quality: Are the *strategies delivered effectively*, relative to evidence-based performance standards? A strategy with ‘quality’ is one for which there is robust evidence showing it delivers the desired outcomes. A large number of research studies have explored aspects of this question (i.e., “What works?”). Therefore, we pay particular attention to the quality dimension in this report.

Participation: Do the *appropriately targeted* children and families *participate* at the right dosage levels? ‘Participation’ shows us what portion of the relevant groups are exposed to the strategy at the level required to trigger the desired benefit. (For example, attending the required number of antenatal visits during pregnancy). Participation levels can be calculated whether the strategy is universal (for everyone), or targeted (intended to benefit a certain part of the population).

Quantity: Are the strategies *available locally* in sufficient quantity for the target population? ‘Quantity’ helps us determine the quantum of effort and infrastructure needed to deliver the strategy adequately for a given population.

These indicators will help identify gaps and priorities in Australian communities. We will test preliminary indicators in 10 communities over the next three years to determine which are pragmatic to collect, resonate with communities, and provide robust measures to stimulate community and government action.

The findings summarised in this report provide essential inputs to guide our subsequent work. There is a similar report for each of the five strategies.

FIVE FUNDAMENTAL STRATEGIES				
Antenatal	Early childhood		School years	
	Birth to 2 years	2-5 years		
<p>1 Antenatal care</p> <ul style="list-style-type: none"> Targeted at parents Centre-based <i>Outcomes:</i> healthy birth weight, good brain health, appropriate care, “adequate parenting” 	<p>3 Early childhood education and care</p> <ul style="list-style-type: none"> Targeted at all children (in groups) High quality for all children Delivered out of home in a “pseudo-home-learning environment” <i>Outcomes:</i> children on optimal developmental pathway (cognitive and social-emotional), school readiness 		<p>5 Early years of school</p> <ul style="list-style-type: none"> Targeted at all children School-based <i>Outcomes:</i> children on optimal learning pathway by Year 3 	
<p>2 Sustained nurse home visiting</p> <ul style="list-style-type: none"> Targeted at disadvantaged parents Health and development support Home-based <i>Outcomes:</i> parents develop parenting skills 		<p>4 Parenting programs</p> <ul style="list-style-type: none"> Targeted at parents whose children have behavioural issues (higher prevalence in disadvantaged families) Centre-based, delivered in groups or 1:1 <i>Outcomes:</i> remedy of specific emerging behavioural issues 		

Figure 1: Five fundamental strategies

EARLY CHILDHOOD EDUCATION AND CARE: RESEARCH SUMMARY

OVERVIEW

Early childhood education and care (ECEC) is defined as any arrangement providing education and care for children aged 0 to the first year of formal schooling regardless of the setting, funding, opening hours, or program content [1]. In Australia the sector is large and complex, with a range of services offered by a mix of non-profit and for-profit providers.

In 2016, 43% of all Australian children aged 0-5 years were enrolled in ECEC services, and 92% of children were enrolled in a preschool program in the year before school [2]¹. The enrolment rate for four year-olds is high relative to other Organisation for Economic Co-operation and Development (OECD) nations (which average 84%) [3], but some large subgroups of Australian children are substantially less likely to participate in ECEC programs – including children from low socioeconomic backgrounds, remote communities, Indigenous backgrounds, non-English speaking backgrounds, and those with a disability or special health care needs [4, 5]. Further, nationally-reported enrolment figures do not elucidate the ECEC dosage children actually receive (i.e. the number of hours children attend ECEC per week).

Significant policy reforms have been delivered over the last decade targeting service access and quality. This includes the introduction of universal access (providing access to 15 hours of preschool education for all 4 year-olds), the introduction of a National Quality Framework (NQF) (providing a national approach to regulation to drive service quality improvements) and introduction of the means-tested Child Care Subsidy Package (designed to support access to affordable ECEC). International research has demonstrated the link between quality frameworks and associated indicators of service performance to maintain, restore, or improve performance [6-9]. Establishing a National Quality Framework for ECEC is consistent with international best practice, and provides an excellent mechanism to drive improvements in ECEC service quality.

Despite these changes, there are enduring challenges to ensure that high quality services are available and accessible to all children and families. These include issues of affordability, cultural inclusion, service quality and viability.

ECEC and developmental outcomes for children

The Australian Early Development Census (AEDC) is a national, teacher-reported population measure of the development of all children starting school. The AEDC is undertaken every three years, and assesses development across five domains: physical health and wellbeing; social competence; emotional maturity; language and cognitive skills; and communication skills and general knowledge.

Every year, about 18.5% of children from Australia's lowest socioeconomic quintile enter school developmentally vulnerable on two or more domains, almost three times the rate for children in the highest socioeconomic quintile (6.5%) [10]. Furthermore, while overall levels of developmental vulnerability in Australia have not shifted significantly in recent years, the gap between the poorest and wealthiest communities, and between remote/rural and metropolitan areas, has increased [10].

Extensive research indicates that the education and care of young children (from birth to eight years of age) has an immense influence on long-term outcomes related to their cognition, resilience, health and wellbeing (e.g. [11]) suggesting that children from the lowest socioeconomic quintile would benefit from good quality early education opportunities prior to starting school.

Notably, evaluations of model programs in the US dating back to the 1960-70s, targeted toward children living in adversity, have well established the benefit of ECEC in the areas of academic, cognitive and social-emotional domains (e.g. [12]). However, more recent research from Australia [13] and the UK [14, 15] for example, suggests that participation in high quality ECEC has the potential to provide all preschool-aged children (usually defined as the year or two before full time schooling) with an opportunity to develop lifelong skills for learning and wellbeing. This research has supported policy shifts in Australia to make ECEC programs available for all children.

In Australia, national studies show that ECEC is associated with better outcomes for children. For example, AEDC data shows that children who attend preschool are less likely to be developmentally vulnerable even when considering their level of relative disadvantage [16, 17]. Similarly, research from the Longitudinal Study of Australian Children (LSAC) demonstrates that children who attend preschool in the year before school score higher on Year 3 National Assessment Program for Literacy and Numeracy (NAPLAN) tests, with lower probability of being rated by their carer as having poor social and emotional development [18].

Not all ECEC is the same: quality matters

The research clearly shows that the *quality* of ECEC programs has a significant influence on developmental outcomes for children. Rating scales assessing quality include aspects of *structural quality* (i.e. the design and organisation of the ECEC system, including the number of professionally trained staff) and *process quality* (i.e. the practices within an ECEC setting, such as relationships and interactions between staff and children).

¹ To be considered "enrolled" the child must have attended the ECEC program at least one hour during the reference period, or be absent due to illness or extended holiday leave and expected to return.

International research has shown that ECEC programs for children aged 3 to 5 years with an emphasis on literacy, maths, science, environment and using a diversity of cultural and theoretical approaches result in better academic and social-behavioural outcomes [19]. Children also make more progress in preschools where staff have higher qualifications (e.g. [18]). It has also been found that preschools that score well on standardised, objective measures of quality such as the Classroom Assessment Scoring System (CLASS) and Early Childhood Environment Rating Scale (ECERS) have better outcomes for children, and the association is strongest for children from disadvantaged backgrounds (e.g. [14, 19-21]).

More broadly, several studies have reported that the relationship between ECEC quality and benefits to child development are stronger for children from disadvantaged backgrounds (e.g. [22-24]). However, others have found no support for this 'compensatory hypothesis' suggesting that even high-quality ECEC is insufficient to totally compensate for environmental disadvantage (e.g. [25, 26]). It nevertheless remains important to increase ECEC participation for disadvantaged children.

AIM

Our targeted rapid review of the existing research base for ECEC sought to answer four key questions:

1. Within an existing national quality system for ECEC, which quality areas and/or standards have the most significant effect on child developmental outcomes (i.e., cognition, language, academic, and social and emotional development)?
2. What does the evidence indicate is the most effective universal *starting age*, *dosage* (i.e. number of hours per week) and *attendance duration* (i.e. number of months or years) as it relates to improving child developmental outcomes?
3. Given the evidence determined from Question 2, in what quantity should a given community be delivering ECEC?
4. Do the answers to these questions differ for targeted provision to disadvantaged populations?

METHOD

Our literature review utilised a targeted restricted evidence assessment (REA) research methodology. REA uses similar methods and principles to a systematic review but makes concessions to the breadth and depth of the process to enable faster completion. Rigorous methods for locating, appraising and synthesising the evidence related to a specific topic are utilised, but the methodology places some limitations on the search criteria and on how the evidence is assessed. For this review, we sought data primarily from large, longitudinal, national or international cohort studies.

Quality

To determine the indicators of quality, we used Australia's existing quality rating system - the National Quality Standard (NQS) implemented by the Australian Children's Education and Care Quality Authority (ACECQA). We undertook an initial mapping exercise to determine how closely Australia's Quality Areas (as utilised by ACECQA) matched the key principles identified from the European Commission Quality Framework and, on domains from standardised, objective measures of ECEC quality (Classroom Assessment Scoring System PreK [CLASS PreK] and Early Childhood Environment Rating Scale – Revised [ECERS-R]). This initial scoping work provided confidence that we were not missing any important areas when using the seven Quality Areas from the ACECQA NQF to direct our targeted literature search. We then utilised a combination of literature reviews (peer-reviewed and web-based reports) and expert interviews to determine which Quality Areas had the most robust evidence related to child development outcomes. This determined the Quality Areas used for our recommended indicators for assessing ECEC quality. A full description of the search strategy is provided in the *Technical Report* [43].

Participation

To determine participation indicators, we focused on national and international longitudinal studies and utilised systematic reviews and meta-analyses, where available, with good quality and low bias. Study quality includes an assessment of *internal validity* (the degree to which the design and conduct of the study avoid bias, e.g. through randomisation, allocation concealment and blinding), and *external validity* (the extent to which the results of the study can be generalised to the population outside the study).

We examined the evidence to determine any differential effect related to universal or targeted program participation in children from 0 to 5 years (e.g. targeted according to housing vulnerability or poverty, culturally and linguistically diversity, or low IQ). We used the evidence to develop indicators for the key dimensions of participation that relate to improved child outcomes, including optimal starting age, duration and dosage.

Quantity

Quantity indicators require agreed indicators for both numerator (participation data) and denominator (population data). We developed quantity indicators using the best indicators of participation level (for universal and targeted provision), and community-level population data.

Ranking the evidence

We assessed individual studies for demonstration of ECEC effectiveness across the three domains of functioning (cognitive/language, academic, and social-emotional), and classified them into the following categories:

- *Supported.* Clear evidence of sustained benefits of at least one year, and without evidence of harm or risk to participants. Populations examined are similar to the Australian context, and results are sensible to apply to that context.
- *Promising.* Evidence suggestive of benefit of at least six months, and without evidence of harm or risk to participants. Populations examined may be somewhat different to the Australian population, affecting generalisability to the Australian context. Meta-analyses and systematic reviews of moderate quality are ranked as 'Promising' due to increased risk of bias.
- *Not supported.* There is evidence of harm or risk to participants.
- *Null.* No difference found between comparison groups.

Once each individual study was evaluated, we determined an overall ranking of the evidence using the classifications below, adapted from [27]. See Appendix A for full details.

- *Supported.* Clear, consistent evidence of benefit
- *Promising.* Evidence suggestive of benefit but more evidence needed.
- *Mixed.* Data is mixed and could show evidence of harm or risk.
- *Not adequately addressed.* Insufficient data in the target evidence-base.
- *Not supported.* There is evidence of harm or risk to participants.

Expert opinion

We vetted our set of indicators with three senior international ECEC experts:

- *Professor Iram Siraj* PhD OBE. Professor of Child Development and Education, University of Oxford.
- *Professor Edward Melhuish* CSci, CPsychol, FBPsS, FAcSS, OBE. Professor of Human Development, Birkbeck, University of London & Professor of Human Development, & Academic Research Leader, University of Oxford

These experts agree that the dose and duration of quality ECEC should be proportionately greater for vulnerable children. Although this is consistent with our own research, we have recommended only part time provision for both universal and targeted groups. Our rationale behind part time provision for targeted groups is based on the evidence that both part time and full time are effective at improving outcomes. Further research about the cost-benefit ratio for part and full time would help elucidate the correct dose for targeted groups.

FINDINGS FOR EARLY CHILDHOOD EDUCATION AND CARE

Overall, our review found a growing body of research examining the association between universal and targeted access to ECEC on children's developmental outcomes. This research generally provides evidence of the benefits of ECEC for child developmental outcomes. However, data predominantly comes from observational studies (rather than intervention studies) and shows variability in terms of what ECEC programs work best.

Since the bulk of research is from international studies there is a question of applicability of the findings to the Australian context. The Australian research base itself has limitations, as it often uses data collected prior to the introduction of the NQF, and so does not incorporate beneficial outcomes that may have occurred post-NQF, due to an increased focus on service quality.

To date there have been no published Australian comparison trials. Notably, the research is limited in its ability to consider the comparability of different ECEC programs that vary substantially, particularly in terms of dose and other resources such as student-teacher ratios. For example, the Abecedarian Project has a much higher participation intensity compared with other lower-resourced programs such as those typically offered in Australia.

Quality indicators

Australia has an established National Quality Framework, which provides a national approach to regulation and assessment of associated quality indicators (the NQS). The overarching objective of the NQF is to improve educational and developmental outcomes for children attending ECEC services, through driving improved quality in service delivery [28].

The NQS defines seven Quality Areas (see Appendix B for full detail of related elements), which we have divided into two categories, as shown below.

TEACHING-RELATED FACTORS

- QA1 – Educational program and practice
- QA4 – Staffing arrangements
- QA5 – Relationships with children

ENVIRONMENT-RELATED FACTORS

- QA2 - Children's health and safety
- QA3 - Physical environment
- QA6 – Collaborative partnerships with families and communities
- QA7 - Leadership and service management

We found clear evidence that the teaching-related factors are associated with improved child developmental outcomes (cognitive/academic and social-emotional). Conversely, we did not find clear evidence that the environment-related factors directly improve child developmental outcomes. However, this does not mean they aren't important enablers for effective ECEC. For example, the provision of the right physical environment is a prerequisite for the delivery of a safe and stimulating education program. Details are summarised in Table 1, and described below.

Quality Area 1 – Educational program and practice. There is strong evidence that educational programs and practice affect cognitive and social-emotional child outcomes. We identified two systematic reviews (of moderate to high quality) [29, 30], which provide evidence that educational program and practice is related to positive child outcomes (cognitive/academic and social emotional). These findings were further supported by a meta-analysis of low-moderate quality [31] and three major international studies:

- Effective Provision of Pre-School Education (EPPE) Study (e.g. [19]),
- The National Institute of Child Health and Human Development Study of Early Child Care Youth Development (NICHD SECCYD) Studies (e.g. [20, 32, 33]), and
- The International Association for Evaluation of Educational Achievement (IEA) Pre-Primary project [34].

Quality Area 4 – Staffing arrangements. There is strong evidence that certain aspects of staffing arrangements in ECEC settings – including staff-child ratios, group size, staff experience and qualifications – affect cognitive and social-emotional child outcomes. The evidence base included:

- Three systematic reviews or meta-analyses (high quality/ low bias), examining outcomes across a range of study types (e.g. cross-sectional, longitudinal, correlational, experimental, and quasi-experimental studies) [35-37].

- Another systematic review/meta-analysis (moderate quality, some risk of bias) examining outcomes from experimental and quasi-experimental studies and several national and international trials [38].
- The Longitudinal Study of Australian Children (LSAC) [18].
- The EPPE study [39], NICHD SECCYD [20], National Center for Early Development and Learning's (NCELD) Multi-State Study of Pre-Kindergarten [40].

Quality Area 5 – Relationships with children. Our review did not yield any high quality systematic reviews or meta-analyses relevant to Quality Area 5. However, a substantive and frequently cited literature review was identified which reports that there is some support for an association between staff relationships with children and both behavioural and cognitive child development [41]. The findings of the review are also supported by several international studies, EPPE, NICHD SECCYD, IEA Pre-primary longitudinal, cross-national study, and the Dutch pre-COOL study. The generalisability and applicability of these findings are further strengthened by local Australian data from the Child Care Choices (CCC) Longitudinal Extension study [42].

In addition, the evidence base related to Quality Area 1 (specifically, educators and coordinators are focused, active and reflective in designing and delivering the program for each child) and Quality Area 4 (specifically, educators, co-ordinators and staff members are respectful and ethical) are relevant to Quality Area 5. Consequently, we rated the overall evidence as "supported".

We rated the other four Quality Areas of the NQS (QA2, QA3, QA6 and QA7) as 'Promising' or 'Not adequately addressed in the target evidence-base'. A summary of the relevant evidence can be found in our detailed technical report [43].

Table 1: Summary of the overall evidence base

QUALITY AREA	COGNITIVE & ACADEMIC	SOCIAL-EMOTIONAL
TEACHING-RELATED FACTORS		
Educational program and practice	• Supported	• Supported
Staffing arrangements	• Supported	• Supported
Relationships with children	• Supported	• Supported
ENVIRONMENT-RELATED FACTORS		
Children's health and safety	• Not adequately addressed in target evidence-base	• Not adequately addressed in target evidence base
Physical environment	• Promising	• Not adequately addressed in target evidence base
Collaborative partnerships with families and communities	• Promising	• Promising
Leadership and service management	• Promising	• Not adequately addressed in target evidence base

Restacking the Odds assessment of ECEC services

Under Australia's NQS², an ECEC service can receive an overall 'Exceeds' rating if it meets the quality standards in all seven Quality Areas, and exceeds the standard in at least four of the seven, including at least two of:

- QA1 - Educational program and practice
- QA5 - Relationships with children
- QA6 - Collaborative partnerships with families and communities
- QA7 - Leadership and service management

In Q1 2018, 38% of Australia's ECEC centres met this standard, and therefore achieved an 'Exceeds' rating. These centres are doing many things well. However, Restacking the Odds is especially interested in understanding how many centres exceed the standard on all three of the Quality Areas which our review of the evidence has shown to have a demonstrable benefit on children's development, i.e.:

- QA1 – Educational program and practice
- QA4 – Staffing arrangements
- QA5 – Relationships with children

As shown in Figure 2, only 25% of centres met this hurdle (while also at least meeting the standard on the other four quality areas). This scarcity is more pronounced in low SEIFA (Socioeconomic Indexes for Areas) areas. Figure 3 shows the portion of services meeting this standard, displayed against their SEIFA level. Only 19% of services in the lowest SEIFA decile (most disadvantaged) meet this standard, compared with 27% in the highest SEIFA decile (most advantaged).

This analysis suggests that Australia has a significant gap between current ECEC service delivery and the evidence-based drivers of quality that make the most difference for child development, and that this is especially true in more disadvantaged areas. ACEQAS's rating data also show that QA1 (Educational program and practice) is the element with the greatest room for improvement. We have provided the NQS in Appendix B. It includes a detailed set of practices associated with each Quality Area.

Quality indicator

The proportion of ECEC services rated 'exceeding' the standard in quality areas 1, 4 and 5 and at least 'meeting' the standard in all other quality areas according to the ACECQA assessment.

Participation indicators

We identified three main participation-related factors: starting age, attendance duration, and dosage (part time/full time). We detail the key findings below, providing an overview of the evidence ranking for both universal provision of ECEC (Table 2) and targeted provision (Table 3).

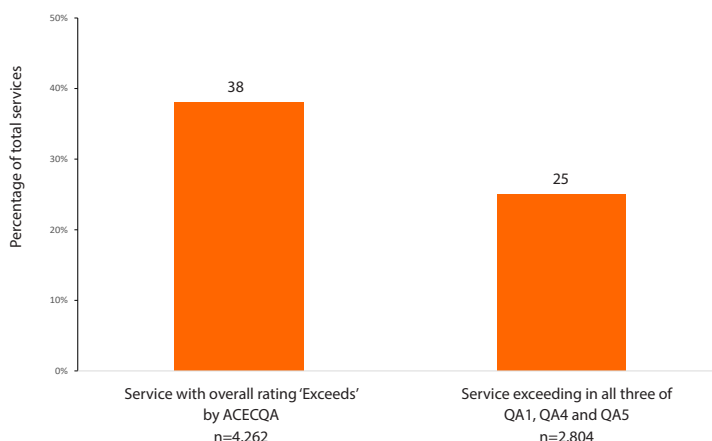


Figure 2: ECEC service ratings³



Figure 3: Centre ratings grouped by SEIFA decile

2. Note that modifications made to the NQF in February 2018 mean that all standards within a Quality Area now need to be rated Exceeding NQS, for that Quality Area to be rated Exceeding NQS. However, there were no changes made to the way in which an overall 'Exceeds' NQS rating is calculated across Quality Areas.

3. National Quality Framework Snapshot Q1 2018, Australian Children's Education & Care Quality Authority.

Table 2: Summary of the overall evidence base (for universal provision)

UNIVERSAL ECEC			
STARTING AGE	COGNITIVE & LANGUAGE	ACADEMIC	SOCIAL-EMOTIONAL
0-2 years	• Supported	• Promising	• Mixed
2-3 years	• Supported	• Promising	• Mixed
3-4 years	• Promising	• Promising	• Not adequately addressed in target evidence-base
4-5 years	• Not adequately addressed in target evidence-base	• Not adequately addressed in target evidence-base	• Not adequately addressed in target evidence-base
PROGRAM DURATION	COGNITIVE & LANGUAGE	ACADEMIC	SOCIAL-EMOTIONAL
Less than 1 year	• Not adequately addressed in target evidence-base	• Supported	• Not adequately addressed in target evidence-base
1-2 years	• Promising	• Supported	• Not adequately addressed in target evidence-base
2-3 years	• Supported	• Supported	• Not supported
More than 3 years	• Supported	• Supported	• Not supported
PROGRAM DOSE	COGNITIVE & LANGUAGE	ACADEMIC	SOCIAL-EMOTIONAL
Part time	• Supported	• Supported	• Not adequately addressed in target evidence-base
Full time (> 15 hours)	• Mixed	• Not adequately addressed in target evidence-base	• Not supported

Table 3: Summary of the overall evidence base (for targeted provision)

TARGETED ECEC			
STARTING AGE	COGNITIVE & LANGUAGE	ACADEMIC	SOCIAL-EMOTIONAL
0-2 years	• Supported	• Supported	• Supported
2-3 years	• Not adequately addressed in target evidence-base	• Supported	• Not supported
3-4 years	• Supported	• Supported	• Supported
4-5 years	• Not adequately addressed in target evidence-base	• Not adequately addressed in target evidence-base	• Not adequately addressed in target evidence-base
PROGRAM DURATION	COGNITIVE & LANGUAGE	ACADEMIC	SOCIAL-EMOTIONAL
Less than 1 year	• Not adequately addressed in target evidence-base	• Not adequately addressed in target evidence-base	• Not adequately addressed in target evidence-base
1-2 years	• Supported	• Supported	• Supported
2-3 years	• Not adequately addressed in target evidence-base	• Not adequately addressed in target evidence-base	• Not adequately addressed in target evidence-base
More than 3 years	• Supported	• Supported	• Supported
PROGRAM DOSE	COGNITIVE & LANGUAGE	ACADEMIC	SOCIAL-EMOTIONAL
Part time	• Supported	• Supported	• Supported
Full time (> 15 hours)	• Supported	• Supported	• Supported

Universal provision

Starting age

There was only one systematic review or meta-analysis of moderate quality and risk of bias that evaluated the effect sizes of starting age in relation to cognitive and academic achievement [44]. This work revealed that programs commencing before three years of age had larger effect sizes than programs that started later, so was rated as 'Promising'. The longitudinal EPPE study provided support for programs that start early (birth to three years old) across all domains of functioning, and another high quality study (the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development, or NICHD SECCYD) presented data that suggest earlier starting ages are 'Promising' for cognitive and academic achievement. The evidence-base related to starting age and social-emotional outcomes was more variable with at least three studies showing poorer [13, 45, 46] outcomes or both positive and negative outcomes [39, 47] with earlier starting ages.

The evidence is not clear-cut across domains of functioning (cognition and language, academic, and social-emotional), however a starting age between three and four years old provides the best balance of outcomes with none of the reviewed studies showing poorer outcomes.

Program duration

Two meta-analyses examined program duration in relation to cognitive and academic achievement. One was of moderate quality and risk of bias, and reported that programs longer than two years were associated with moderate increases in effect size for cognitive and academic outcomes [44]. We therefore rated this study as 'Promising' for programs lasting two years or longer. The other was low quality with several sources of bias identified [48]. However, it found a small advantage for child developmental outcomes for programs with durations of one and three years. We rated this study as 'Promising' for programs of three years or more.

The EPPE study was the only longitudinal international research to report on program duration, and found that high quality preschool coupled with longer duration (two to three years) had the strongest effect on cognition and academic achievement, and demonstrated sustained benefits of approximately two to four years [39]. This was supported by another EPPE follow up approximately four years later that showed preschool duration between 2 and 3 years had the largest positive effects on English scores at age 7 to 11 [49].

Data from the LSAC showed that program durations from two to more than three years resulted in cognitive and academic gains, but had detrimental effects on social-emotional outcomes [13]. Notably, the LSAC data were collected prior to the implementation of the NQF and so it is unclear what impact potential quality improvements may have had on outcomes. Data from Trends in International Mathematics and

Science Study (TIMSS) and Progress in International Reading Literacy Study (PIRLS) support programs of at least three years related to academic achievement [50, 51].

On balance, the evidence related to duration 'Supports' programs of two years. Although there was good evidence for programs between two and three years' duration for cognitive and academic achievement, there was also some evidence (local data) suggesting that programs longer than two years may have a negative impact on social-emotional outcomes. Importantly, this data does not take into account the quality of the program and it is likely that the relationship between duration and social skills is influenced by aspects of quality care and education.

Program dose (intensity)

The EPPE study provides support for part time universal provision of ECEC, which is consistent with local data from LSAC [13, 39, 52]. Several papers reporting on the US-based National Institute of Child Health and Human Development (NICHD) Study found evidence for a positive relationship between full time provision during toddlerhood and higher language scores, but also found that greater hours of ECEC in infancy was related to lower pre-academic scores [25, 53-55]. The NICHD studies also report that higher ECEC doses (average of 27 hours per week) relate to poorer social-emotional outcomes in grade one.

The evidence for part time provision of ECEC is supportive, but the evidence for full time provision is mixed. Therefore, our conclusion is that the evidence best supports part time provision for universal access.

Universal participation indicator

Proportion of all children attending ECEC for 15 hours or more per week, for the two years before starting formal school

Targeted provision

Starting age

For highly vulnerable children and families (with low socio-economic status or risk of low IQ), the developmental benefit of targeted provision of ECEC - and an early starting age of 0-2 years - is well supported by evidence from the Abecedarian Project (e.g. [12, 56, 57]). This was a well-designed randomised controlled trial, with multiple follow-up studies ranging from 18 months to adulthood. The evidence applies to all three domains of functioning (cognitive, academic, social-emotional). The Early Head Start program also supports early start ECEC across all domains [58]. Two other US-based programs (Milwaukee Project and Project Care), were rated as 'Promising' in relation to a starting age of 0-2 years for improved outcomes for cognition and language [59, 60] due to their small sample size and selective populations (i.e. low IQ;

African-American mothers) which affect their generalisability to the Australian context.

The EPPE study examined academic and social-emotional outcomes in a subset of disadvantaged children attending preschool at either 2 or 3 years and found a positive association for English attainment. However, there were some negative associations with prosocial behaviour [47].

The Perry Preschool Project found positive associations between starting age 3 to 4 years and cognition, academic achievement, and social-emotional functioning [61-63].

Most of the population samples are from the US and may differ in ways that affect the generalisability to the Australian context. For example, most of the targeted samples drew from predominantly African-America populations and from the 1960s and 1970s. On balance, children from at-risk backgrounds would likely benefit from an earlier start to ECEC compared with the general population. The evidence 'Supports' a starting age of 0 to 2 years.

Program duration

The Abecedarian Project demonstrated a positive association between ECEC attendance for over three years and improved cognitive, academic, and social-emotional outcomes [12, 57, 64, 65]. The Milwaukee Project and Project Care were consistent with these results [59, 60], but were rated as 'Promising' due to the small sample size and selective populations (i.e. low IQ; African-American mothers), which affect their generalisability to the Australian context.

The Early Head Start programs and the Perry Preschool Project support programs of two years across all three outcome dimensions (cognitive, academic, and social-emotional).

Unlike universal provision of ECEC, there was no evidence of an increased risk of social-emotional difficulties associated with programs of longer duration. Limitations regarding generalisability and applicability to the Australian context are relevant here, but given the quantity and relative strength of the Abecedarian findings the evidence 'Supports' programs of at least three years' duration.

Program dose (intensity)

There was limited data available to compare the relative benefit of higher levels of ECEC intensity. However, the results of the Abecedarian project are convincing - suggesting full time provision is related to better cognitive and language, academic, and social-emotional outcomes in both the short- and long-term [12, 57, 64, 65].

The Perry Preschool project (part time provision) reported significant social gains over a sustained period (into adulthood) as well as sustained (1-2 years) cognitive and language benefits.

The research regarding program dose for children from disadvantaged backgrounds 'Supports' full time and part-time provision. There are some potential issues with generalisability (US-based research, selective samples of low IQ, African-American people). Without a cost-benefit assessment of the relative effect of part time and full time provision for disadvantaged groups it is difficult to recommend full time provision when there is evidence that part time provision is also effective at improving child outcomes.

Targeted participation indicator

Proportion of children experiencing disadvantage who attend ECEC for 15 hours or more per week, for at least the three years before starting formal school

Current Australian participation indicators

Nationally, Australia collects some participation data for two subgroups of children:

- The proportion of children aged three to five years enrolled in a preschool program who are from targeted special needs groups (non-English speaking background, Aboriginal and Torres Strait Islander children, children with disability, and children from regional and remote areas);
- The proportion of children aged four to five years enrolled in a preschool program in the year before school who are disadvantaged (residing in an area with a SEIFA Index of Relative Socio-economic Disadvantage [IRSD] quintile of 1).

These national indicators are based on enrolment, and do not provide sufficient information about whether the dosage of participation in ECEC is at the level that research has identified is important to benefit child outcomes. Restacking the Odds aims to collect actual attendance data (not only enrolment data) for these two sub-groups in the communities we work with.

Quantity indicators

The required quantity of ECEC services in a given community is a function of the size of the population, the portion of the population participating, and the effort required to provide the right standard of care. This is largely a practical consideration, and the literature reviewed did not provide any specific data related to this driver. However, there are two relevant dimensions for quantity:

- Does the ECEC infrastructure provide places sufficient for the defined population to attend for fifteen hours or more?
- Is there a sufficient workforce of qualified ECEC workers and teachers?

Current Australian quantity indicators

Nationally, Australia collects data on two relevant workforce metrics:

- The proportion of paid primary contact staff employed at approved childcare services with a relevant formal qualification (at or above Certificate level III), or three or more years of relevant experience.
- The proportion of teachers delivering preschool programs (across all services) who are at least three-year university trained and early childhood qualified. Teachers are defined using the following worker roles: principal/director/coordinator/teacher in charge and group leader/teacher. At least three-year university trained includes: 'Bachelor degree (3 years or more equivalent); 'Bachelor Degree (4 years pass and honours); 'Graduate diploma/certificate and above.'

Note that Quality Area 4 sets the benchmark for teacher-to-child ratios and qualification requirements. There is no national indicator for service availability.

Quantity indicator

The number of ECEC places for 15 hours per week available to 2-5 year olds

CONCLUSION

We have established an evidence based set of indicators for best practice indicators of ECEC quality, participation and quantity.

Quality

We used Australia's existing quality rating system (ACECQA) to determine the indicators of quality with regard to positive impact on child development, and found that the available evidence supports three of ACECQA's seven Quality Areas well (i.e., QA1 - Educational program and practice; QA4 – Staffing arrangements; and QA5 – Relationships with children). We identified that while 38% of Australia's ECEC centres receive an 'Exceeds' rating from ACECQA, only 25% of centres exceed the NQS standard for performance on all three of these Quality Areas.

Quality indicator

The proportion of ECEC services rated 'exceeding' the standard in quality areas 1, 4 and 5 and at least 'meeting' the standard in all other quality areas according to the ACECQA assessment.

Participation

The literature supports the importance of ECEC for all children. However, the participation thresholds differ for universal versus targeted provision.

Universal participation indicator

Proportion of all children attending ECEC for 15 hours or more per week, for the two years before starting formal school

Targeted participation indicator

Proportion of children experiencing disadvantage who attend ECEC for 15 hours or more per week, for at least the three years before starting formal school

Quantity

When assessing quantity, the key considerations are whether there is sufficient ECEC infrastructure and a qualified ECEC workforce to support the relevant populations to attend for at least fifteen hours per week.

Quantity indicator

The number of ECEC places for 15 hours per week available to 2-5 year olds

The preliminary indicators and thresholds we have selected will help identify gaps and priorities for ECEC in Australian communities. We will test them in ten communities over the next three years to determine which are pragmatic to collect, resonate with communities, and provide robust measures to stimulate community and government action. We follow a similar path for the other four fundamental strategies that Restacking the Odds is exploring – antenatal care, sustained nurse home visiting, parenting programs, and the early years of school.

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APPENDICES

Appendix A: Overall ranking of the evidence

OVERALL RANKING OF THE EVIDENCE	
	Definition
Supported	Clear, consistent evidence of benefit. No evidence of harm or risk to participants. A well conducted systematic review or meta-analysis (++ or +) or at least two RCTs found the intervention to be more effective than a control group on at least one child or parent valid outcome measure. A positive effect was maintained for at least 6 months.
Promising	Evidence suggestive of benefit but more evidence needed. No evidence of harm or risk to participants. At least one RCT found the intervention to be more effective than a control group on at least one child or parent valid outcome measure.
Evidence fails to demonstrate effect	A well conducted systematic review or meta-analysis or at least one RCT found the intervention to be ineffective compared with a control group. The overall weight of the evidence does not support the benefit of the practice.
Unknown	The data reported across trials is inconsistent. One or more RCTs show a high level of bias. There are insufficient trials to provide an evaluation of the evidence-base.
Concerning practice	At least 1 RCT of low risk of bias where the practice has shown to have no effect or a negative effect sustained over at least 1 year.

Appendix B: ACECQA National Quality Standard

Elements	
Quality Area 1: Educational program and practice	
Standard 1.1	An approved learning framework informs the development of a curriculum that enhances each child's learning and development
1.1.1	Curriculum decision making contributes to each child's learning and development outcomes in relation to their identity, connection with community, wellbeing, confidence as learners and effectiveness as communicators
1.1.2	Each child's current knowledge, ideas, culture, abilities and interests are the foundation of the program
1.1.3	The program, including routines, is organised in ways that maximise opportunities for each child's learning
1.1.4	The documentation about each child's program and progress is available to families
1.1.5	Every child is supported to participate in the program
1.1.6	Each child's agency is promoted, enabling them to make choices and decisions and influence events and their world
Standard 1.2	Educators and co-ordinators are focused, active and reflective in designing and delivering the program for each child
1.2.1	Each child's learning and development is assessed as part of an ongoing cycle of planning, documenting and evaluation
1.2.2	Educators respond to children's ideas and play and use intentional teaching to scaffold and extend each child's learning
1.2.3	Critical reflection on children's learning and development, both as individuals and in groups, is regularly used to implement the program
Quality Area 2: Children's health and safety	
Standard 2.1	Each child's health is promoted
2.1.1	Each child's health needs are supported
2.1.2	Each child's comfort is provided for and there are appropriate opportunities to meet each child's need for sleep, rest and relaxation
2.1.3	Effective hygiene practices are promoted and implemented
2.1.4	Steps are taken to control the spread of infectious diseases and to manage injuries and illness, in accordance with recognised guidelines
Standard 2.2	Healthy eating and physical activity are embedded in the program for children
2.2.1	Healthy eating is promoted and food and drinks provided by the service are nutritious and appropriate for each child
2.2.2	Physical activity is promoted through planned and spontaneous experiences and is appropriate for each child
Standard 2.3	Each child is protected
2.3.1	Children are adequately supervised at all times
2.3.2	Every reasonable precaution is taken to protect children from harm and any hazard likely to cause injury
2.3.3	Plans to effectively manage incidents and emergencies are developed in consultation with relevant authorities, practised and implemented
2.3.4	Educators, co-ordinators and staff members are aware of their roles and responsibilities to respond to every child at risk of abuse or neglect
Quality Area 3: Physical environment	
Standard 3.1	The design and location of the premises is appropriate for the operation of a service

Appendix B: ACECQA National Quality Standard (cont.)

3.1.1	Outdoor and indoor spaces, buildings, furniture, equipment, facilities and resources are suitable for their purpose
3.1.2	Premises, furniture and equipment are safe, clean and well maintained
3.1.3	Facilities are designed or adapted to ensure access and participation by every child in the service and to allow flexible use, and interaction between indoor and outdoor space
Standard 3.2	The environment is inclusive, promotes competence, independent exploration and learning through play
3.2.1	Outdoor and indoor spaces are designed and organised to engage every child in quality experiences in both built and natural environments
3.2.2	Resources, materials and equipment are sufficient in number, organised in ways that ensure appropriate and effective implementation of the program and allow for multiple uses
Standard 3.3	The service takes an active role in caring for its environment and contributes to a sustainable future
3.3.1	Sustainable practices are embedded in service operations
3.3.2	Children are supported to become environmentally responsible and show respect for the environment
Quality Area 4: Staffing arrangements	
Standard 4.1	Staffing arrangements enhance children's learning and development and ensure their safety and wellbeing
4.1.1	Educator-to-child ratios and qualification requirements are maintained at all times
Standard 4.2	Educators, co-ordinators and staff members are respectful and ethical
4.2.1	Professional standards guide practice, interactions and relationships
4.2.2	Educators, co-ordinators and staff members work collaboratively and affirm, challenge, support and learn from each other to further develop their skills, to improve practice and relationships
4.2.3	Interactions convey mutual respect, equity and recognition of each other's strengths and skills
Quality Area 5: Relationships with children	
Standard 5.1	Respectful and equitable relationships are developed and maintained with each child
5.1.1	Interactions with each child are warm, responsive and build trusting relationships
5.1.2	Every child is able to engage with educators in meaningful, open interactions that support the acquisition of skills for life and learning
5.1.3	Each child is supported to feel secure, confident and included
Standard 5.2	Each child is supported to build and maintain sensitive and responsive relationships with other children and adults
5.2.1	Each child is supported to work with, learn from and help others through collaborative learning opportunities
5.2.2	Each child is supported to manage their own behaviour, respond appropriately to the behaviour of others and communicate effectively to resolve conflicts
5.2.3	The dignity and rights of every child are maintained at all times
Quality Area 6: Collaborative partnerships with families and communities	
Standard 6.1	Respectful supportive relationships with families are developed and maintained
6.1.1	There is an effective enrolment and orientation process for families
6.1.2	Families have opportunities to be involved in the service and contribute to service decisions
6.1.3	Current information about the service is available to families
Standard 6.2	Families are supported in their parenting role and their values and beliefs about child rearing are respected

Appendix B: ACECQA National Quality Standard (cont.)

6.2.1	The expertise of families is recognised and they share in decision making about their child's learning and wellbeing
6.2.2	Current information is available to families about community services and resources to support parenting and family wellbeing
Standard 6.3	The service collaborates with other organisations and service providers to enhance children's learning and wellbeing
6.3.1	Links with relevant community and support agencies are established and maintained
6.3.2	Continuity of learning and transitions for each child are supported by sharing relevant information and clarifying responsibilities
6.3.3	Access to inclusion and support assistance is facilitated
6.3.4	The service builds relationships and engages with their local community
Quality Area 7: Leadership and service management	
Standard 7.1	Effective leadership promotes a positive organisational culture and builds a professional learning community
7.1.1	Appropriate governance arrangements are in place to manage the service
7.1.2	The induction of educators, co-ordinators and staff members is comprehensive
7.1.3	Every effort is made to promote continuity of educators and co-ordinators at the service
7.1.4	Provision is made to ensure a suitably qualified and experienced educator or co-ordinator leads the development of the curriculum and ensures the establishment of clear goals and expectations for teaching and learning
7.1.5	Adults working with children and those engaged in management of the service or residing on the premises are fit and proper
Standard 7.2	There is a commitment to continuous improvement
7.2.1	A statement of philosophy is developed and guides all aspects of the service's operations
7.2.2	The performance of educators, co-ordinators and staff members is evaluated and individual development plans are in place to support performance improvement
7.2.3	An effective self-assessment and quality improvement process is in place
Standard 7.3	Administrative systems enable the effective management of a quality service
7.3.1	Records and information are stored appropriately to ensure confidentiality, are available from the service and are maintained in accordance with legislative requirements
7.3.2	Administrative systems are established and maintained to ensure the effective operation of the service
7.3.3	The Regulatory Authority is notified of any relevant changes to the operation of the service, of serious incidents and any complaints which allege a breach of legislation
7.3.4	Processes are in place to ensure that all grievances and complaints are addressed, investigated fairly and documented in a timely manner
7.3.5	Service practices are based on effectively documented policies and procedures that are available at the service and reviewed regularly

THE TEAM

Restacking the Odds is a collaboration between three organisations, each with relevant and distinctive skills and resources:

Murdoch Children's Research Institute (MCRI) is an independent medical research institute. MCRI's research covers the breadth of health and medical research from basic science through to clinical sciences and population health. MCRI is committed to giving all children the opportunity to have a happy and fulfilled life.

Prof Sharon Goldfeld – Deputy Director Centre for Community Child Health and Co-group leader Policy and Equity, Royal Children's Hospital and Murdoch Children's Research Institute

Dr Carly Molloy – Senior Research Officer and Project Manager, Murdoch Children's Research Institute

Social Ventures Australia (SVA) supports partners across sectors to increase their social impact. SVA helps business, government and philanthropists to be more effective funders and social purpose organisations to be more effective at delivering services.

Nicholas Perini – Principal, SVA Consulting

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Chris Harrop – Partner, and member of Bain's worldwide Board of Directors