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Prevalence of language and pre-literacy difficulties in an Australian cohort of five-year-old children experiencing adversity.

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Abstract

Background: Early reading success is predicated on language and pre-literacy skills. Children who are behind their peers in language and pre-literacy development prior to formal schooling are less likely to be proficient beginner readers, and difficulties may persist throughout primary school and beyond. We know children experiencing adversity are at greater risk of early language and pre-

literacy difficulties; we do not know the prevalence of these difficulties in an Australian adversity context.

Aims: To investigate the prevalence and co-occurrence of language and pre-literacy difficulties in a cohort of Australian five-year-old children experiencing social adversity.

Methods & Procedures: Data were drawn from a large Australian community-based trial of nurse home visiting (right@home), which aimed to support women experiencing social adversity, from pregnancy until their child turned 2 years. Social adversity was determined by ≥2 risk factors: young pregnancy, not living with another adult, no support, poorer health, current smoker, long-term illness, anxious mood, not finishing high school, no household income and no previous employment. Children whose mothers were enrolled in the control group (receiving usual maternal and child health care) were included in the current study (*n*=359). Language and pre-literacy skills were measured at age five using the Clinical Evaluation of Language Fundamental Preschool Second Edition (CELF-P2) and the School Entry Alphabetic and Phonological Awareness Readiness Test (SEAPART). Language difficulties were defined as ≥1.25 standard deviations (SD) below the Australian normative mean on CELF-P2 Core Language scores. Pre-literacy difficulties were defined as children scoring in the Beginner (versus Developing or Competent) criterion-referenced level on the SEAPART First Sound Identification and/or Alphabet Letter Identification subtests. Co-occurrence of language and pre-literacy difficulties was also determined.

Outcomes & Results: At the five-year follow-up, 201/359 (56%) children were assessed (M_{age} 5.1 years, SD=0.1). Mean Core Language score for this cohort (91.8, SD=15.9) was 0.54 SD below the normative mean (100, SD=15). The proportion of children presenting with language difficulties was 24.9%. Regarding pre-literacy skills, 43.8% of children were 'Beginner' for identifying first sounds and 58.6% for identifying alphabet letters/sounds. There was also considerable overlap whereby 76.7% of children with language difficulties also exhibited pre-literacy difficulties.

Conclusions & Implications: This is the first empirical Australian-based study highlighting the high prevalence and co-occurrence of language and pre-literacy difficulties in preschool children

experiencing social adversity. Clinicians should be aware of co-morbid language and pre-literacy difficulties in disadvantaged populations and consider both areas during assessment and intervention planning.

What this paper adds

What is already known on the subject

- The prevalance of language and literacy difficulties is substantially higher in cohorts experiencing social adversity when compared to more advantaged families. There is some evidence that adversity also contributes to pre-literacy difficulties, but less is known here.

What this study adds

- This study presents new prevalence data, showing high rates of language and pre-literacy difficulties for five-year-old children experiencing adversity within an Australian context. This study is the first to explore these skills in a large cohort of preschoolers recruited from community settings in Australia.

Clinical implications of the study

- In this cohort experiencing adversity, most children who presented with language difficulties likewise exhibited pre-literacy difficulties. This concordance reflects how early oral language and pre-literacy skills develop together. Clinicians should assess *both* skills in preschool populations - especially those working with children experiencing adversity - to ensure all children have strong foundations to become proficient beginner readers.

Introduction

Language and literacy skills are integral to later academic success. As oral language underlies written language, literacy achievement is strongly associated with earlier language abilities (Law, Rush, Schoon, & Parsons, 2009; Spira, Bracken, & Fischel, 2005). In addition, pre-literacy skills – which include phonological awareness and alphabet knowledge - are also essential precursors of literacy achievement (Hogan, Catts, & Little, 2005; Lonigan, Burgess, & Anthony, 2000). Children who are behind their peers in oral language and pre-literacy development in the years prior to formal schooling are less likely to be proficient beginner readers, with reading difficulties sometimes persisting throughout the primary school years and beyond (Spira et al., 2005). We know that children experiencing adversity are more likely to present with language and literacy difficulties (Law, McBean, & Rush, 2011; Law et al., 2009), but we do not know the prevalence of these difficulties amongst children experiencing adversity in Australia. In the context of the current study, adversity is defined more broadly than in the extant literature to include mothers of lower socioeconomic status (SES) (i.e. those with less education and reduced household income), in addition to mothers presenting with additional risk factors for social adversity (i.e. young maternal age, lone parenthood, and those with poorer mental or physical health) (Goldfeld et al., 2018; Price et al., 2018).

Early language and pre-literacy skills

Oral language includes the ability to understand what is being said (receptive language) and to use language to communicate (expressive language), with development of both skills essential for becoming a successful early communicator. Pre-literacy skills comprise, amongst other things, phonological awareness and alphabet knowledge (Lonigan et al., 2000; Muter, Hulme, Snowling, & Stevenson, 2004). An important component of phonological awareness at the preschool level involves young children's ability to attend to the sound structure of the speech stream, as opposed to just attending to the meaning of what is being said. The most useful indicator of this ability is the

task of segmenting and identifying phonemes at the beginning of words (Muter et al., 2004), although measures of the ability to identify rhymes and syllables are often assessed at the preschool level too (Lonigan, 2006). Alphabet knowledge at the point of school entry is also a powerful predictor of early reading success and is usually assessed by asking children to identify the names of letters and/or the sounds typically associated with those letters (Lonigan, 2006; Lonigan et al., 2000; Muter et al., 2004; Piasta, Petscher, & Justice, 2012).

Critically, whilst literacy attainment is initially predicated on oral language and pre-literacy skills, as children move through their first years of schooling the relationship between written language and oral language becomes reciprocal (Hogan et al., 2005; Storch & Whitehurst, 2002). It is therefore essential that we optimise early language *and* pre-literacy abilities during the preschool period, in order to maximise later literacy and language development as children progress through formal education.

Prevalence of language and pre-literacy difficulties

Most young children acquire language along a typical trajectory, but some fail to meet their early language milestones. Many children presenting with poorer early communication catch up with peers; others exhibit typical early language development that slows and becomes a clinical concern later in childhood. The ability to predict which children will end up in which group remains problematic, particularly for children under three years of age (Bishop, Snowling, Thompson, Greenhalgh, & CATALISE consortium, 2017; Reilly et al., 2010). By around four to five years, prediction improves and children presenting with language difficulties at this age are less likely to resolve (Everitt, Hannaford, & Conti-Ramsden, 2013). A similar pattern can be seen for pre-literacy abilities. Although it is difficult to obtain robust measures of phonological awareness in young preschoolers - largely due to floor effects in most measures used (see PIPA; Dodd, Crosbie, McIntosh, Teitzel, & Ozanne, 2000) - phonological awareness does emerge reliably at the point of school entry. From the end of preschool onwards, stability of phonological awareness skills can be

observed (Lonigan, 2006; Storch & Whitehurst, 2002). This pattern is particularly true for those with the poorest abilities, such that children with low early skills often continue along a flatter trajectory of language acquisition (Cabell, Justice, Logan, & Konold, 2013).

Population-level prevalence of language and pre-literacy difficulties has been explored in empirical studies with four- and five-year-olds (i.e. when skills are more stable). These studies allow us to understand the number of children at risk of persistent problems and their associated comorbidities. As an illustration, Norbury et al. (2016) screened 12,398 children aged four to five years across schools in the UK. A comprehensive assessment of language, non-verbal intelligence quotient (IQ), social, emotional and behavioural problems and academic achievement was administered to a stratified sample of these children the following school year (*n* = 529). Criteria for developmental language disorder (DLD) in their study was defined as ≥1.5 standard deviations (SD) below the normative mean on two of five language composites, in the absence of other diagnoses. The authors found that one in ten children presented with language difficulties (9.9%). The Early Language in Victoria Study (ELVS) reported a higher prevalence of language difficulties, at 20.6% amongst four-year-olds, defining language difficulties as presenting with receptive and/or expressive scores ≥1.25 SDs below normative means on a standardised language measure (Reilly et al., 2010). Prevalence estimates may vary depending on the cut points used and whether non-verbal ability is used as an exclusion criterion. Norbury et al. (2016) defined DLD using a more stringent cut point than used in ELVS to define language difficulties and their definition of DLD excluded those with an intellectual disability and/or existing medical diagnosis. The ELVS definition did not exclude children with an intellectual disability and/or existing medical diagnosis, although exclusions were made at the initiation of the cohort including children with developmental delay, hearing loss, Down syndrome, cerebral palsy or other serious intellectual or physical disability, and children whose parents did not speak and understand English (S. Reilly et al., 2009). Other studies have reported different prevalence figures (i.e. 12-13% and 7% respectively; McLeod & McKinnon, 2007; Tomblin et

al., 1997), but studies consistently indicate that language difficulties are a common developmental concern.

When considering the prevalence of pre-literacy difficulties, findings are less clear-cut. As mentioned, pre-literacy includes myriad different skills from rhyme awareness to letter identification. Consequently, performance varies across tasks and so it is challenging to delineate children with difficulties versus those without. This is compounded by floor and ceiling effects being more pronounced for tasks evaluating pre-literacy skills compared to language abilities. For example, many pre-literacy tasks require children to demonstrate relatively discrete skills (i.e. naming the 26 letters of the English alphabet), as compared to language tasks which typically require ongoing learning (i.e. understanding and using increasingly complex vocabulary). As a consequence of the determinate nature of pre-literacy skills, children's performance on pre-literacy tasks can quickly transition from incompetent to proficient. For example, Lonigan et al. (2000) reported on data involving young children's ability to perform blending tasks (i.e. joining separate sounds together to make words) and elision tasks (i.e. omitting a sound from a spoken word to make a new word). The authors reported a positively skewed distribution (that is, more children performing poorly) when children were three years of age (M_{age} = 41 months), and a negatively skewed distribution (more children performing well) when children were five years of age (M_{age} = 60 months).

Despite the challenges with evaluating pre-literacy skills, some studies have investigated these skills at the point of school entry. For example, a large sample of kindergarten students (i.e. first year of formal US schooling; average age five years) from Virginia US were assessed using the Phonological Awareness and Literacy Screening – Kindergarten (PALS-K; Invernizzi, Justice, Landrum, & Booker, 2004). Of the >80,000 kindergarten children who were screened, around a fifth (21.4%) were identified as requiring support to enhance their pre-literacy abilities. In the ELVS, approximately 21% of four-year-old children could not name any of alphabet letters (Castles et al., 2013). As US guidance suggests that effective transition into formal school literacy instruction requires knowledge of at least 10 letter names by the end of preschool (i.e. children <5 years; see

Piasta et al., 2012 for details), both studies indicate one fifth of children may have benefited from additional pre-literacy support.

Cohorts experiencing adversity

At a population level, language and pre-literacy difficulties are clearly common developmental concerns; yet, the prevalence of these difficulties increases markedly when considering cohorts of children experiencing adversity. For instance, one UK study measured the language skills of 240 preschool children recruited from four nurseries (i.e. providers of early years education, typically attached to primary schools) in areas of social and economic deprivation (Locke, Ginsborg, & Peers, 2002). Deprivation was gauged by the proportion of children receiving free school meals (reflecting lower income families) and language was assessed using the Clinical Evaluation of Language Fundamentals Preschool (CELF-P). Mean expressive and receptive language scores for these children were around 1 SD below the population mean. Furthermore, half the children (55.6%) were classified as having language difficulties (≥1 SD below the normative mean) in one or both domains. Another UK study recruited 138 children from a primary school located within one of Scotland's highest deprivation areas (Law et al., 2011). They found nearly 40% of children presented with language skills below the average range on the Clinical Evaluation of Language Fundamentals Fourth Edition (CELF-4).

Less research has been conducted on the pre-literacy (as opposed to literacy) skills of children experiencing adversity. Nevertheless, Chaney (1994) found that family literacy, maternal education and social class were associated with print awareness (i.e. the child identifying their own name), alphabet concepts (i.e. sorting and naming letters) and book concepts (i.e. knowledge of reading from left to right). Two more recent studies with low-income Head Start families also found that children performed 0.4-0.5 SDs below the national mean on letter-word identification tasks (Administration on Children Youth and Families, 2003; Bracken & Fischel, 2008).

Australian studies

Commencing in 2003, the Early Language in Victoria Study (ELVS) has assessed the language development of Australian children over the period of early childhood to adolescence (Reilly et al., 2010). Yet, the ELVS sample was relatively advantaged; for example, 38.1% of parents at the ELVS four-year assessment were graduates/postgraduates as compared to 24% nationally, with mean Socioeconomic Index for Areas (SEIFA) scores (M = 1039) above the normative mean (M = 1000). Consequently, aside from governmental data reported in the Australian Early Development Census (AEDC; Department of Education and Training, 2019), there is no empirical research on the prevalence of language and pre-literacy difficulties *in an Australian population of preschoolers experiencing adversity*. Published studies focusing explicitly on disadvantaged cohorts have largely comprised US and UK populations (Administration on Children Youth and Families, 2003; Bracken & Fischel, 2008; Law et al., 2011; Locke et al., 2002). Yet, as supports (i.e. social, health and childcare provision) contribute to child outcomes - and also vary widely across countries (Kuo et al., 2006; Mahon, Anttonen, Bergqvist, Brennan, & Hobson, 2012) - generalising international findings to Australian populations experiencing adversity is problematic; more local Australian data is needed.

Moreover, international studies largely explore the prevalence of these difficulties specifically within lower SES cohorts (Bracken & Fischel, 2008; Law et al., 2011; Locke et al., 2002). But it is not only lower SES factors that have been inversely related to child language and literacy - other measures of social adversity have likewise been unfavourably associated. As an illustration, poorer parental mental health (Pan, Rowe, Singer, & Snow, 2005), young and lone parenthood (Scottish Executive Education Department, 2008) and even smoking during pregnancy (Key et al., 2007) have all been negatively related to early speech, language and literacy outcomes. We must therefore measure language and pre-literacy skills in groups of children experiencing *broader indicators of adversity* to fully understand the potential magnitude of language and pre-literacy difficulties in this often over-looked population of young children.

Current Study

We know that children with poorer language *and* pre-literacy development in the years prior to formal schooling are less likely to be proficient beginner readers, and we also know that adversity impacts these skills. What we do not know is the prevalence and co-occurrence of these difficulties in young children experiencing social adversity in Australia. Without this empirical data we can neither understand, nor begin to address, this issue effectively. As the long-term costs of low language and pre-literacy skills do not just include poor literacy, but disengagement with education, under employment and antisocial behaviours (Law et al., 2009), the societal and economic costs of these difficulties are not to be understated. To enable local policy-makers, service providers and practitioners to plan appropriate funding and provisions to optimise child outcomes, information about the current prevalence of language and pre-literacy difficulties at the point of school entry, amongst children experiencing adversity, is essential.

This study aimed to identify the prevalence of language and pre-literacy difficulties in a large cohort of five-year-old children experiencing social adversity in Australia. We hypothesised that the prevalence of language difficulties would be greater in this population than in an Australian norming sample, and that the co-occurrence between language and pre-literacy difficulties would likewise be high.

Methods

Design and Setting

This cross-sectional study drew on data from the right@home randomised controlled trial (RCT) of nurse home visiting (Authors et al., 2017). The right@home RCT comprises a large cohort of women who were recruited from a community setting for their experience of adversity during pregnancy. Cross-sectional data were drawn from home-based follow-up assessments completed when children turned five years of age.

Participants

The current study focusses on children whose mothers were enrolled and allocated to the control group of the right@home RCT with completed five-year follow-up assessment data (*n* = 201). The right@home treatment group received 25 home visits from pregnancy to child age two years which focused on caregiving, parent responsivity and provision of a high-quality home learning environment. The control group was therefore chosen to represent the community population of interest in the absence of any intervention effects (above receiving usual antenatal and maternal and child health care).

The larger right@home trial recruited pregnant women attending antenatal clinics between 30 April 2013 and 29 August 2014, from 10 public maternity hospitals in metropolitan and regional areas of Victoria and Tasmania, Australia. Inclusion criteria were women who: 1) had expected due dates before October 1, 2014; 2) were <37 weeks into their pregnancy at the time of recruitment; 3) had sufficient English proficiency to complete assessments; 4) had home addresses within study travel boundaries; and 5) self-reported two or more of 10 antenatal adversity risk factors. Risk factors included: young pregnancy (≤23 years), not living with another adult, no support during pregnancy, poor/fair/good health (versus very good/excellent general health), current smoker, long-term illness, anxious mood or difficulty coping, not finishing high school, no household income, and never having had a job (Authors et al., 2017). Exclusion criteria included women who: 1) were enrolled in an existing Tasmanian nurse home visiting program; 2) were unable to provide informed consent (i.e. had an intellectual disability or had insufficient English); 3) had no means of contact; and, 4) experienced a critical event that excluded their participation (i.e. termination of pregnancy or stillbirth).

Procedure

After informed consent was provided, comprehensive baseline home-based assessments of maternal socioeconomic and psychosocial characteristics were completed by trained researchers.

The initial RCT included follow-up to child age two years, at which time women were invited to re-enroll in the extended follow-up to five years and informed consent was obtained. At child age five years, child language and pre-literacy measures were collected at another home-based assessment.

Ethics approval

This study was approved by the Human Research Ethics Committee of [details removed] (HREC xxxxx), Australia.

Measures

Language

The Clinical Evaluation of Language Fundamentals Preschool Second Edition, Australian and New Zealand Standardised Edition (CELF-P2; Wiig, Secord, & Semel, 2006) was used to measure child language skills. The Sentence Structure (SS), Word Structure (WS) and Expressive Vocabulary (EV) subscales were each administered (normative mean = 10, SD = 3). The SS subtest evaluates the child's ability to interpret spoken sentences of increasing length and complexity and to match them to a picture which correctly illustrates the meaning. The WS subtest evaluates the child's ability to apply grammatical rules and to select and use appropriate pronouns to refer to people, objects and possessive relationships. The EV subtest evaluates the child's ability to label illustrations of people, objects and actions. The three individual subtest scores were combined to generate a Core Language (CL) score (normative mean = 100, SD = 15). The CL score is reported to be the most representative measure of a child's language abilities (Wiig et al., 2006).

Pre-literacy

The School Entry Alphabetic and Phonological Awareness Readiness Test (SEAPART; Neilson, 2014) was used to measure child pre-literacy skills. The SEAPART is regarded as a screening test aimed at identifying children who are likely to require extra support when they are first exposed to formal

literacy instruction in school. Pre-literacy skills sampled in the SEAPART reflect 'readiness to learn' – that is, they tap into conceptual prerequisites that children who make typical progress in school have mastered at the point of school entry (Muter et al., 2004; Piasta et al., 2012). Children who have not mastered these concepts when they are first exposed to formal literacy instruction are likely to require extra support (Neilson, 2014).

Five SEAPART subtests were administered: Syllable Clapping, Syllable Isolation, First Sound Identification, Alphabet Letter Identification and Name Writing. The SEAPART provides a total score, individual subtest scores, as well as criterion-referenced mastery scores categorised as 'Beginner', 'Developing' and 'Competent' for each subtest. For each of the subtests, the 'Beginner' category indicates that the child demonstrates no awareness of the target skill. The 'Developing' category indicates that the child's skills in the target area are emerging, but not yet consistent. 'Competent' indicates that the child has mastered the target skill.

To describe the pre-literacy skills of this cohort, all SEAPART subtest scores are included in the results. Our analysis of pre-literacy difficulties then focuses only on the First Sound Identification and Alphabet Letter Identification subtests since these have the strongest empirical support as robust predictors of early literacy development (Muter et al., 2004; Piasta et al., 2012). For First Sound Identification, children were shown a picture, helped to name it and then asked to identify the first sound of the word. For Alphabet Letter Identification, children were shown lowercase printed letters and asked if they knew what each letter was. Since families and preschools vary as to whether they expose children to letter names or sounds, both were accepted as correct. First Sound Identification and Alphabet Letter Identification subtests both have total scores of 0-10 with mastery classifications scores of 0-3 = Beginner, 4-8 = Developing and 9-10 = Competent.

Non-verbal skills

In order to characterise the non-verbal abilities of this cohort of children, two subtests of the NIH Toolbox Early Childhood Cognition Battery (ages 3-6 years; Slotkin, 2012) were administered during the five-year, home-based assessments. Attention and executive function were measured using the Flanker Inhibitory Control & Attention Test and Dimensional Change Card Sort respectively. Both subtests were administered to the child using the NIH Toolbox iPad application. Subtest scores are standardised age-corrected scores (normative mean = 100, SD = 15).

Statistical analysis

For all participants who were enrolled in the control group of the trial, maternal baseline (pregnancy) characteristics were compared between those with and without completed five-year follow-up assessments; chi-square tests (categorical measures) and t-tests (continuous measures) were used to assess differences arising due to participant attrition.

To describe the language and pre-literacy abilities of this cohort, CELF-P2 scores and SEAPART subtest scores were reported using means and SDs. CELF-P2 scores were then compared to Australian normative data (Wiig et al., 2006) using immediate t-tests, reported as mean differences and standardised effect sizes (Cohen's d). Normative data is not available for SEAPART measures and it was expected that scores would be negatively skewed (i.e. the majority of children would be performing well) in a population-based cohort of five-year-old children (Lonigan et al., 2000). Thus, we examined the proportion of children who fell into the criterion-referenced Beginner mastery category (versus Developing or Competent) for each subtest, as an indicator of those who had not mastered the conceptual prerequisites for formal literacy instruction.

The prevalence of language and/or pre-literacy difficulties was then examined as proportions (%). In line with existing Australian and international literature (Reilly et al., 2010; Tomblin et al., 1997), language difficulties were defined as scores of ≥1.25 SDs below CELF-P2 CL normative means (i.e. scores ≤81.25). Pre-literacy difficulties were defined as those in the 'Beginner'

mastery category on either or both of the First Sound Identification and Alphabet Letter Identification subtests. The proportion of children with language difficulties (CELF-P2 scores ≤81.25) who also presented with pre-literacy difficulties ('Beginner' category on one or both SEAPART subtests) was also examined to determine co-occurrence of difficulties.

Results

The RCT enrolled 722 pregnant women, with 359 allocated to the control arm of the trial. Of these, 201/359 (56%) completed five-year follow-up assessments (Figure 1). Table 1 shows maternal baseline (pregnancy) characteristics for the original enrolled control group and for those retained at the five-year follow-up. Characteristics were broadly similar between women who originally enrolled in the trial and those who completed five-year follow-up assessments, although statistical comparisons showed women who were younger and were unemployed during pregnancy were slightly less well represented at follow up. Of those retained at five years, baseline characteristics showed 25% reported not completing high school, 23% were single or not living with a partner, 62% were unemployed and 42% were living in the most disadvantaged areas (lowest quintile of an area-level measure of socioeconomic disadvantage; Australian Bureau of Statistics Census of Population and Housing (2011)). Table 2 shows the child characteristics for those who completed the five-year assessment; children's mean non-verbal scores were similar to standardised age-corrected scores.

CELF-P2 and SEAPART performance

Table 3 reports mean child language and pre-literacy assessment data for the current study with reference data for an Australian population normative sample (CELF-P2; Wiig et al., 2006) or criterion-referenced mastery categories (SEAPART; Neilson, 2014). CELF-P2 Core Language (CL) scores have a normative mean of 100, with SD of 15. The mean CELF-P2 CL score for this cohort was 91.8 (SD = 15.9), which was 0.54 SDs below the normative mean of 100. So, when compared to the CELF-P2 norming population, there was an overall propensity towards the lower scores for our

cohort. This difference was similarly observed across each of the CELF-P2 subtests; subtest means for this cohort were 0.42 to 0.53 SDs below the normative mean. Regarding the SEAPART, the proportion of children in the 'Beginner' category (compared to 'Developing' / 'Competent') ranged from 19.8% for Syllable Clapping, 43.8% for First Sound Identification, and 58.6% for Alphabet Letter Identification.

Table 4 presents the prevalence of language and pre-literacy difficulties and their co-occurrence. In this cohort, 24.9% of children were identified as having language difficulties using the definition of ≥1.25 SD below the CELF CL normative mean. Using the definition of being at the `Beginner' level on either the SEAPART First Sound Identification or Alphabet Letter Identification subtests, 63.3% of children were identified as having pre-literacy difficulties. With regard to co-occurrence, over three-quarters of children with language difficulties also presented with pre-literacy difficulties (76.7%) equating to 20.3% of the whole cohort.

Discussion

This novel study examined language and pre-literacy skills in a large cohort of Australian preschoolers experiencing social adversity. The prevalence of language difficulties in our study was around two to three times higher than has been reported in international population-based studies with children of a similar age (24.9% vs. 7-13%; McLeod & McKinnon, 2007; Norbury et al., 2016; Tomblin et al., 1997), and 4.3% higher than has been reported in a longitudinal population-based study of Australian four-year-old children (24.9% vs. 20.6%; Reilly et al., 2010). Also, as anticipated, most children who presented with language difficulties also displayed pre-literacy difficulties (76.7%). Our findings not only serve to demonstrate the impact of social adversity more generally on child outcomes but also the vulnerability of both early oral language and pre-literacy skills, as they develop together (Hipfner-Boucher et al., 2014). Given that children who begin school with poor language and pre-literacy skills are at greater risk of falling further behind as they progress through formal education (Nation, Cocksey, Taylor, & Bishop, 2010), our data highlights the substantial

proportion of Australian children who may require extra support to succeed in reading and writing at school.

Language difficulties

That the prevalence of language difficulties in the current study with children experiencing adversity was substantially higher than in many population-based studies was anticipated. It was surprising that the prevalence of language difficulties in our study was only 4.3% higher than reported in the ELVS - an Australian population-based study (Reilly et al., 2010); however, the difference may largely be explained by how language difficulties were classified across ELVS and the current study. The ELVS defined 'low language' as difficulties in receptive *and/or* expressive language. Here, we only reported on children's core language difficulties (the most representative measure of a child's language abilities; Wiig et al., 2006). When exploring individual CELF-P2 subtest data, the proportion of children in the current study struggling on individual subtests, especially expressive subtests, was high (i.e. 27.4% and 28.6% scoring ≤6.25 on the Word Structure and Expressive Vocabulary subtests respectively). This suggests that - had we classified difficulties according to low expressive and/or receptive scores - we would likely have had a greater prevalence of language difficulties.

Although the proportion of children presenting with language difficulties in the current study was higher than in population-based studies, it was lower than data reported from other disadvantaged cohorts (40-56%; Law et al., 2011; Locke et al., 2002). It should be noted that we used a conservative criterion to determine language difficulties (≥1.25 SDs below the mean). Had we used the same benchmark as Law et al. (2011) and Locke et al. (2002), namely ≥1 SD below the mean, the prevalence of language difficulties would have been higher (32%), but still not as high as they reported (i.e. 40-56%). More importantly, in considering our findings, we must reflect upon the continuous and complex nature of adversity. Here, we included mothers with a broad range of social risk factors. Those studies that have reported a higher prevalence of child language difficulties have typically focused on families experiencing economic deprivation (Law et al., 2011; Locke et al., 2002).

Economic poverty is associated with myriad factors adversely related to child language (i.e. reduced child learning opportunities and experiences, poorer maternal mental health and parenting differences; Brooks-Gunn, Duncan, & Britto, 1999). As such, the impact of economic deprivation on child language (when compared to broader social adversity) may be especially pronounced. The discrepancy between our findings and past research findings with other disadvantaged cohorts is therefore likely explained, in part, by how we contextualised adversity.

Country-specific factors may have also played a role in the lower prevalence of language difficulties reported in our study compared to disadvantaged international cohorts. Stronger social and health supports available in Australia may have mitigated some of the impact of adversity on child language here. For example, in Australia, there is easy access to social supports, such as parental leave and childcare subsidies (Mahon et al., 2012). Similarly, Australian maternal and child health care services - especially Victorian services (where this study was partly based) - have been found to be particularly well-developed, comprehensive and accessible to families when considered alongside other developed countries (Kuo et al., 2006). Additionally, Australian average income inequality and long-term unemployment are lower, and levels of tertiary education higher than other Organisation for Economic Co-Operation and Development member nations, such as the US and UK (Australian Institute of Health and Welfare, 2019). Importantly though, we must reiterate that the prevalence of language difficulties in our samples was still *substantially higher* than in the normative Australian population.

Our research more broadly highlights the challenges around how we measure and define constructs such as language and adversity. In their population-based study, not only did Norbury et al. (2016) use a more stringent cut-off score than used in the ELVS or our own current study to define language difficulties (≥1.5 SDs below the normative mean compared to ≥1.25 SDs), but they also measured myriad language constructs (i.e. expressive/receptive vocabulary, receptive/expressive grammar and understanding and retelling of narrative). In their study of disadvantaged children, Law et al. (2011) also included explicit measures of vocabulary and

narrative, alongside overall expressive and receptive measures. Different measurement and definitions confound our understanding of the nature and extent of language difficulties in different populations. As such, the recent international move towards building a consensus around the definition of language disorder is a timely and welcome initiative (Bishop et al. 2017).

Pre-literacy difficulties

In their study of pre-literacy abilities of middle- to upper-income preschoolers, Lonigan et al. (2000) found that the vast majority of children performed poorly on pre-literacy tasks at three years of age (M_{age} = 40 months). But, in their group of older preschoolers (M_{age} = 60 months) most children performed well on word blending and word elision tasks, as well as letter knowledge. So, by five years of age, most children in Lonigan et al's (2000) study were able to manipulate phonemes and provide the typical sound associated with alphabet letters. Children in the current study were a similar age (M_{age} = 61 months) to the older preschoolers in Lonigan et al's (2000) study. In the current cohort, however, we did not observe that the majority of children were performing well (i.e. meeting the prerequisite skills expected at school entry). In our study, close to half of all children were identified as at 'Beginner' level for naming letters (58.6%) and identifying first sounds (43.8%). As children who have not mastered these concepts when they are first exposed to formal literacy instruction are likely to require extra support, our study indicates that over half the children in our study may benefit from support with their pre-literacy skills. This proportion is far higher than the fifth (21.4%) of US kindergarten students identified as requiring support to enhance their pre-literacy abilities in Invernizzi et al. (2004).

Letter naming is especially interesting to focus on here since there are clearer benchmarks around what is expected by school entry. Guidance indicates effective transition to formal school literacy instruction requires knowledge of at least 10 letter names by five years of age (Piasta et al., 2012 for details). Letter naming is also interesting to consider as it requires explicit adult instruction.

In the ELVS Australian sample, 21% of *four-year-olds* could not name any alphabet letters (Castles et al., 2013). Here, 58.6% of *five-year-olds* struggled to name alphabet letters. A US study of preschoolers from relatively low socioeconomic backgrounds (M_{age} = 52 months, SD = 4.48 months) similarly found a substantial proportion of children had difficulties with letter knowledge: 8% of children knew no lowercase letter names and 35% knew less than 10 lowercase letter names (Piasta et al., 2012).

Taken together, our data suggests that - as with language difficulties - this cohort of five-year-olds presented with pre-literacy difficulties at around three times the rate as reported in other population-based studies (i.e. 63.6% vs. 21%). And, as pre-literacy skills promote oral language development and oral language promotes pre-literacy abilities (Hogan et al., 2005; Storch & Whitehurst, 2002), it was unsurprising that most children in our study who exhibited language difficulties had co-occurring pre-literacy difficulties. It is noteworthy that children's non-verbal skills were similar to population normative data, indicating that language development may be disproportionately impacted by adversity (Brooks-Gunn et al., 1999; Noble, McCandliss, & Farah, 2007). Our findings serve to highlight the impact of broader social adversity on child language and pre-literacy outcomes, but also the mutual vulnerability of both skills since they develop in concert (Hipfner-Boucher et al., 2014). Moreover, our data suggests that knowledge of letter names is a vital pre-literacy skill which may be particularly vulnerable in young children experiencing adversity.

Strengths and limitations

The study has some clear strengths, including a large cohort of women prospectively recruited during pregnancy for their experience of adversity and comprehensive assessment of language and pre-literacy skills using blinded (in the context of the larger RCT), standardised assessment. Yet, there are some limitations which should also be noted. These include the proportion of families lost to follow-up over the 6-year period from recruitment in pregnancy to children's fifth birthday. However, this limitation is largely reflective of the challenges of engaging with families who are

experiencing adversity and sustaining their participation in longitudinal studies. In this context, retention of this cohort is relatively high (Authors et al., 2019) with re-enrolment of 75% of the cohort at 2-year follow-up and retention of 56% of the cohort 6 years after initial enrolment. Comparison of baseline characteristics, for those who enrolled in the trial and those who completed the five-year follow-up assessment, showed that the retained cohort was broadly representative of the original cohort recruited for their experience of adversity.

Another limitation is the proportion of children who were followed up at five years for whom we do not have complete child assessment data (12-20% missing data across all language and pre-literacy subtests). Data may have been missing because mothers did not have permanent care of their child, living circumstances did not permit a home-based assessment or the child was unable or refused to complete the assessment. Given that data may be missing for those in the most disadvantaged circumstances or for children who found the assessment too difficult or were non-compliant, our findings may underrepresent the proportion of children experiencing language difficulties in this cohort.

Conclusions

Children who begin school with poor language and pre-literacy skills are at greater risk of falling further behind as they progress through formal education (Nation et al., 2010). This is the first empirical Australian-based study to highlight the substantial proportion of Australian children who may require additional support to succeed in reading and writing at school, noting the inequitable distribution for those children living in adversity. Clinicians should be aware of co-morbid child language and pre-literacy difficulties in disadvantaged populations and ensure both areas are considered as part of assessment and intervention planning.

Figure 1. Participant flow.

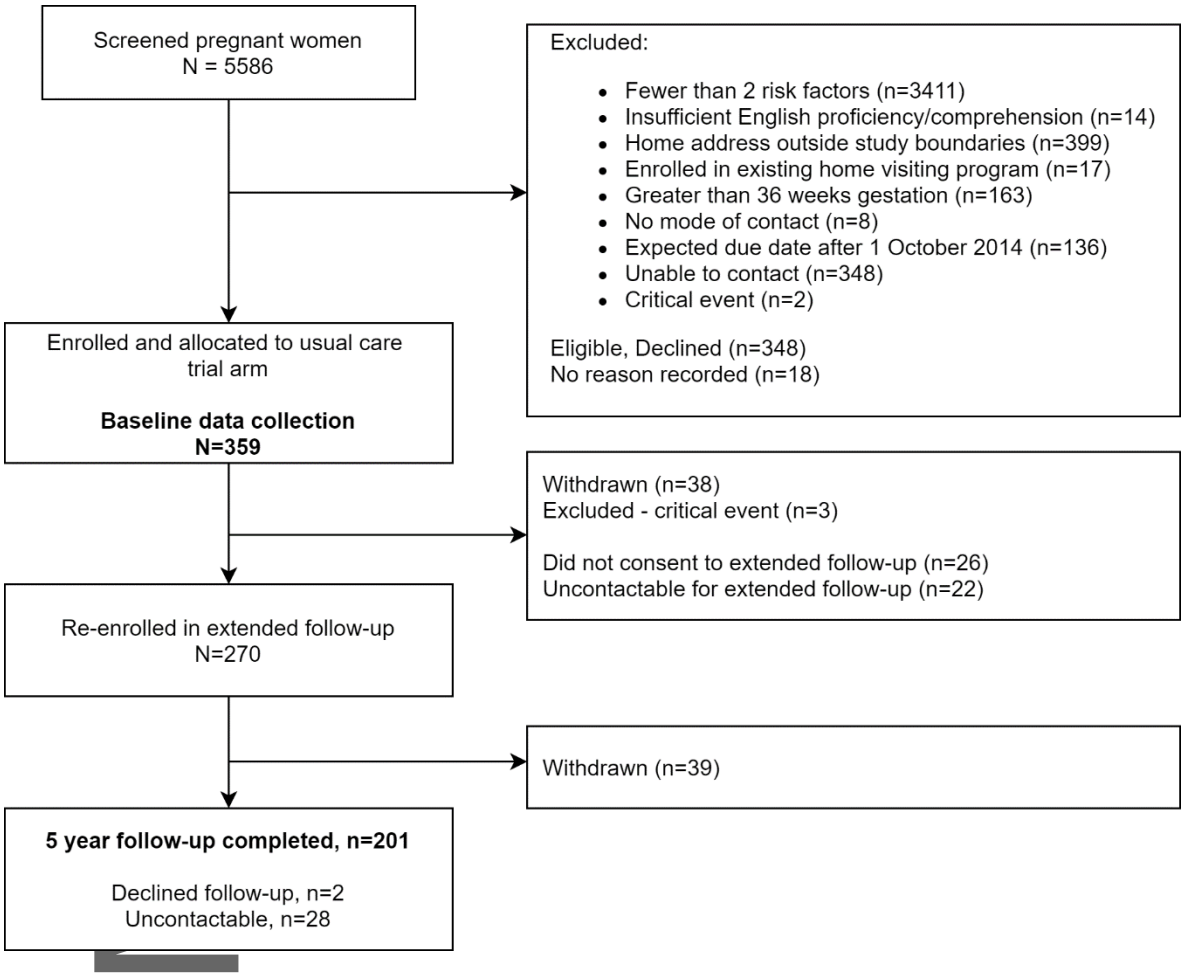

Table 1. Maternal baseline characteristics for all participants enrolled in the control group and those who completed the five-year follow-up assessment.

Baseline (pregnancy) characteristics	Enrolled control group (n = 359)	Completed 5-year follow-up (n = 201)	p-value*
	n (%)	n (%)	
Age, mean(SD) [range]	27.8 (6.4) [14.5-46.2]	28.7 (6.4) [15.7-46.2]	0.002
Education status			0.95
Did not complete high school	82 (25.3)	46 (25.0)	
Completed high school/vocational training	207 (63.9)	119 (64.7)	
Completed a university degree	35 (10.8)	19 (10.3)	
Marital status			0.40
Single / not living with partner	92 (25.6)	47 (23.4)	
Married / living with partner	260 (72.4)	151 (75.2)	
Separated / divorced	7 (2.0)	3 (1.5)	
Currently unemployed	239 (66.6)	125 (62.2)	0.05
Family income from benefit/pension	150 (41.8)	81 (40.3)	0.52
SEIFA Index of Social Disadvantage Quintile†			0.56
1 (most disadvantaged)	139 (40.2)	80 (41.5)	
2	30 (8.7)	18 (9.3)	
3	132 (38.2)	70 (36.3)	
4	32 (9.3)	20 (10.4)	
5 (least disadvantaged)	13 (3.8)	5 (2.6)	
Language other than English spoken at home	34 (9.7)	16 (8.1)	0.25

* p-value for chi-square tests (categorical measures) and t-tests (continuous measures) comparing those retained at 5 years and those lost to follow-up.

† Socioeconomic Index for Areas (SEIFA) is a national postcode level index with higher scores indicating greater advantage (Australian Bureau of Statistics Census of Population and Housing, 2011).

Table 2. Child characteristics at five-year follow-up.

	Completed 5-year follow-up (n = 201)
	Mean (SD) [range]
Age	5.1 (0.1) [5.0-5.5]
Child gender	
Male, n (%)	104 (51.7)
Female, n (%)	97 (48.3)
NIH Toolbox executive functioning	
Flanker Inhibitory Control & Attention Test	96.1 (13.3) [54-123]
Dimensional Change Card Sort	97.0 (12.4) [54-120]

Table 3. Descriptive language and pre-literacy scores at five years for right@home cohort compared to Australian population normative and criterion references.

	right@home cohort data		Population normative reference			
	n	Mean (SD) [range]	Mean (SD)	Mean difference* (95% CI)	ES	p
Language (CELF-P2)						
Sentence Structure	177	8.7 (3.3) [1-16]	10 (3)	-1.3 (-1.8; -0.7)	-0.42	<0.001
Word Structure	175	8.5 (3.4) [1-15]	10 (3)	-1.5 (-2.1; -1.0)	-0.51	<0.001
Expressive Vocabulary	175	8.4 (3.0) [1-18]	10 (3)	-1.6 (-2.1; -1.0)	-0.53	<0.001
Core Language	173	91.8 (15.9) [48-126]	100 (15)	-8.2 (-11.0; -5.4)	-0.54	<0.001
				Criterion reference †		
Pre-literacy (SEAPART)			Beginner, n (%)	Developing / competent, n (%)		
Syllable Clapping	167	7.7 (2.9) [0-10]	33 (19.8)	134 (80.2)		
Syllable Isolation	164	2.5 (2.6) [0-10]	94 (57.3)	70 (42.7)		
First Sound Identification	160	4.9 (4.2) [0-10]	70 (43.8)	90 (56.3)		
Alphabet Letter Identification	162	3.8 (3.6) [0-10]	95 (58.6)	67 (41.4)		
Name Writing	162	3.4 (2.2) [0-6]	70 (43.2)	92 (56.8)		
Total Score	149	23.2 (11.5) [0-45]				

Note: CI = 95% Confidence interval, ES=Effect size, SD = Standard deviation, CELF-P2 = Clinical Evaluation of Language Fundamentals Preschool Second Edition, Australian and New Zealand Standardised Edition (Wiig, Secord, & Semel, 2006); SEAPART = School Entry Alphabetic and Phonological Awareness Readiness Test (SEAPART; Neilson, 2014).

* Mean difference, ES and p-value from immediate t-test comparing right@home to population normative data.

† Children with mastery level of 'Beginner', compared to 'Developing' or 'Competent', according to criterion references.

Table 4. Proportions of children identified with language and/or pre-literacy difficulties at five years.

n = 163-173

	n	%
Language difficulties	43	24.9
Pre-literacy difficulties	105	63.6
Both language and pre-literacy difficulties	33	20.3

Language difficulties defined as ≥1.25 SD below the normative mean on CELF-P2 Core Language. Pre-literacy difficulties defined as 'Beginner' level mastery on either or both SEAPART First Sound Identification and/or Alphabet Letter Identification subtests

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