Australian Journal of Educational & Developmental Psychology

newcastle.edu.au/ajedp

Early childhood development over time for a cohort of Australian Aboriginal children living in an urban environment

Rebekah Grace, Emma Elcombe, Jennifer Knight, Catherine McMahon, Jenny McDonald & Elizabeth Comino

Australian Journal of Educational & Developmental Psychology, 2017, Vol. 15, pp. 35-52

Editor for this article: Jennifer Archer, PhD
Published by the UON School of Education
ISSN 1446-5442

Original Research AJEDP

Early childhood development over time for a cohort of Australian Aboriginal children living in an urban environment

Rebekah Grace[1]
Macquarie University, Australia

Emma Elcombe
University of New South Wales, Australia

Jennifer Knight
University of New South Wales, Australia

Catherine McMahon
Macquarie University, Australia

Jenny McDonald
South West Sydney Local Health District, Australia

Elizabeth Comino
University of New South Wales, Australia

Abstract

Child development for a cohort of urban Aboriginal children was assessed at three time points: 12 months, 3 years and 4.5 years. This paper reports developmental findings and explores the impact of child, family, home and community variables over time. Overall, child development at 4.5 years was significantly below the standardised mean. Female gender, preschool attendance, and having 10+ child-appropriate books in the home were significantly related to better performance. Over time the children demonstrated strengths in the locomotor and personal-social domains. Maternal factors were most predictive of performance at 3 years. These results are discussed in relation to their meaning within the Aboriginal community.

Keywords: early childhood, development, Aboriginal Australians, urban environments

---

[1] Corresponding author
Dr Rebekah Grace
Children and Families Research Centre, X5B 232
Faculty of Human Sciences
Macquarie University NSW 2109
Email: Rebekah.grace@mq.edu.au

Background and introduction

This paper presents longitudinal developmental findings from the Gudaga study, a birth cohort study of Australian Aboriginal children. This research was conducted in partnership with an urban Aboriginal community in Sydney, Australia. Gudaga means 'healthy baby' in the local language (Comino, Craig, Harris, & Knight, 2010; Knight, Comino, Harris, Jackson Pulver, Anderson, & Craig, 2007). In this paper the word Aboriginal will be used to describe the descendants of the first people of mainland Australia. This is the preferred word of our community partners. The word Indigenous will be used to collectively describe Australian Aboriginal and Torres Strait Islander people.

There has been a growing body of Australian research describing significant inequalities in the health and development of Australia's Indigenous children compared with non-Indigenous children. For example, the most recent Australian Early Development Index (AEDI) findings suggest that, as a group, Indigenous children are more likely to be developmentally vulnerable on all five of the domains assessed (physical health and wellbeing, social competence, emotional maturity, language and cognitive skills, and communication skills and general knowledge) (Australian Government, 2013; Brinkman et al., 2012). Other large studies also point to developmental vulnerabilities, including the Western Australia Aboriginal Child Health Study (De Maio et al., 2005) which found that almost a quarter (24%) of Indigenous children were at risk of clinically significant emotional or behavioural difficulties compared with 15% of non-Indigenous children.

The national 'Close the Gap' strategy (COAG, 2008) constituted a major Australian government response to the growing and consistent body of evidence demonstrating inequality for Indigenous people across a wide range of variables from birth and continuing on through the lifespan (ARACY, 2013). Three of the six 'Close the Gap' strategies relate to early childhood health and development, built on the understanding that investment in the early years may be most effective in reducing inequities and social disadvantage in the long term (James, 2008; Robinson, Tyler, Jones, Silburn,& Zubrick, 2011), and that increased support for early learning provides a foundation for later learning and school achievement (Cunha, Heckman, Lochner & Masterov, 2006; Bowes, Harrison, Sweller, Taylor & Neilsen-Hewett, 2009).

The research described in this paper is one of a small number of longitudinal studies in Australia that responded to a call for rigorous research on the health and development of Indigenous children over time to inform the 'Close the Gap' agenda (Freemantle, Officer, McAullay & Anderson, 2007; National Health and Medical Research Council, 2008). The Gudaga study is unique for three reasons: it was initiated by and developed in partnership with an Aboriginal community; it enumerated a birth cohort; and it gives exclusive focus to urban Aboriginal children, an often invisible group because of the more common research focus on the challenges for Indigenous people in rural and remote areas of Australia (Eades et al., 2010).

Any discussion of the inequities that exist between Indigenous and non-Indigenous Australians must be understood in the context of a difficult national history, marked by conflict and government policies of separation and assimilation that worked to fragment Indigenous cultures (Attwood 2005), leaving a legacy of inter-generational trauma and mistrust of government service systems for many Indigenous Australians (Burns, Burns, Menzies & Grace, 2013). Consistent with developmental theorists who stress the importance of understanding development within its cultural and political context (Bronfenbrenner, 1979; Girishwar & Babu, 2013; Super and Harkness, 1986), it is clear that the context in which many Australian Indigenous children are growing up leaves them potentially vulnerable to life circumstances that constitute developmental risk factors. For example, level of education is low for mothers of Indigenous children (Craig et al. 2011). This reflects an ongoing challenge in Australia to engage Indigenous people in an education system that they may not experience as culturally meaningful to them (Dockett, Perry & Kearney, 2010; Harrison & Greenfield, 2010; Hayes,

Johnston, Morris, Power & Roberts, 2009). Australian Indigenous children, as a group, also experience very high levels of family disruption as the result of past assimilation policies (Human Rights and Equal Opportunity Commission, 1997) which left a legacy of disconnections between extended family members and the loss of parenting knowledge. Indigenous children today continue to be significantly over-represented in the out-of-home care system (Australian Institute of Health and Welfare, 2013; Avan & Kirkwood, 2010; Zubrick et al., 2005), and experience more stressful life events in general (Askew, Schluter, Spurling, Bond & Brown, 2013).

In recent years there has been a significant increase in the number of Indigenous children enrolling in early childhood education services. This is an encouraging trend because quality early childhood education is known to be a potential protective factor for child development (Sylva, Melhuish, Sammons, Siraj-Blatchford & Taggart, 2008) and important to addressing issues of equity and social inclusion (National Health and Hospital Reform Commission, 2008; Vinson, 2007; Yuksel & Turner, 2008). Baxter and Hand (2013) found that 69 -79% of Australian Indigenous children attend early childhood education settings compared to 82.4 – 93.9% of non-Indigenous children.

This paper presents the longitudinal early childhood development findings of the Gudaga study. Cross-sectional data for the Gudaga cohort children at 12 months and 3 years of age have been published elsewhere (McDonald, Comino, Knight, & Webster, 2012; McDonald, Webster, Knight, & Comino, 2014). This paper is guided by three main objectives: (1) to describe participating children's developmental progress at 4.5 years of age, prior to the commencement of formal schooling; (2) to examine development over the three early childhood time points (12 months, 3 years and 4.5 years); and (3) to assess the impact of child, family and home and community variables on child development over time.

Methods

Design

The Gudaga study is a descriptive longitudinal birth cohort study of the health, development and service use of urban Aboriginal children and their families in Sydney, Australia. The data presented in this paper are focused on the developmental findings only of the larger study.

The research took a partnership approach. It was developed with an Aboriginal community organisation in response to their request for high quality data to guide the provision of better support for local Aboriginal mothers and children. Survey questions and methods were developed in collaboration with representatives from the community. Study findings were reported to the Organisational Board of directors regularly and disseminated to the community in presentations at community events and in brochures and booklets.

Community discussions were essential to data interpretation, and no findings have been published before they were discussed with community members. The researchers actively engaged in research translation, partnering with organisations and people from the Aboriginal community to translate research into practice. The research team included Aboriginal academics and health service providers. The data surveys were administered by Aboriginal project officers who also lived within the local area and had strong networks within the region. Every effort was made to conduct this research in line with the research principles and values outlined by the Australian National Health and Medical Research Council (NHMRC, 2003; NHMRC, 2010).

Participants

The Gudaga study took a whole of population approach, inviting the participation of all mothers who gave birth to an Aboriginal child at a large public hospital within an 18 month period. To be eligible, the mother of the baby needed to have identified herself and/or the father of the baby as Aboriginal. A total of 178 potentially eligible infants and their mothers were identified, and 149 (83.7%) consented

to join the Gudaga study. This cohort of children and their primary carers were visited regularly (6-monthly) by members of the research team to assess their health, development and service engagement (Comino et al., 2010). The term primary carer refers to the adult who identified themselves as being primarily responsible for the care of the child. This group was largely made up of mothers, but also included five extended family members who were the legal guardians of children who had been removed from the care of their mother (two grandparents, one aunt, one cousin and one father).

It was necessary for the study to adopt a flexible approach to participation. Many of the families would spend extended periods of time away from their homes to participate in cultural and/or family events or to spend time on ancestral lands. Families who missed data collection points because of extended absences were welcomed back into the study on their return to the community. Of the 149 children recruited to the study, 137 (91.9%) completed a full developmental assessment at twelve months of age, 128 (85.9%) at three years of age, and 114 (76.5%) prior to starting formal schooling at, on average, four and a half years of age.

In total 43 families withdrew from the study: 22 because the family moved from the area altogether; 7 because the family felt unable to commit to the long term nature of the study; 11 because children were removed from the care of their parents by child protection authorities and it was not possible to remain in contact with the child; and 3 because of the death of the child.

All of the participating children and families spoke English as their first language.

Measures

The Griffiths Mental Development Scales – Extended Revised (GMDS-ER) (Luiz, Barnard, & Knoesen, 2006) was the primary outcome measure employed to assess child development. The GMDS-ER is a developmental assessment tool, standardised in the UK and widely used in Australia by paediatricians (Beggs, Sewell, Efron & Orkin, 2005). The GMDS-ER provides a general quotient (GQ) of overall development. It also provides six sub-domain scores including locomotor development (gross motor skills, balance, coordination, control of movement), personal-social development (activities of daily living, independence, social interaction), hearing and language (receptive and expressive language), eye-hand co-ordination (fine motor skills, manual dexterity, visual monitoring), performance (visuo-spatial, speed of working, precision), and practical reasoning (from 3 years of age onward) (solving problems, basic mathematical concepts, understanding moral issues). Raw scores for each developmental domain in the GMDS-ER were combined to produce a measure of overall child development. Early in the Gudaga research a pilot study was conducted with the first 55 of the current sample which demonstrated that this was an appropriate instrument for use with Aboriginal children (Bennett, McDonald, Knight, Comino & Henry, 2010).

Child and family data were collected in a survey completed by the child's primary carer during home visits at six monthly intervals commencing at birth. Survey data included demographic information, child and family early childhood service engagement (e.g., preschool attendance), parent reports of child health, child nutrition, and other home environment factors (e.g., number of books available to the child). In relation to child health, ear health was a particular focus because of the high levels of otitis media reported for this population (Jervis-Bardy et al. 2014). Child nutrition scores were obtained by asking the primary caregiver to record everything the child had eaten in the last 24 hours. Food items were then given a score of 1 if they fell within a healthy food group (e.g., fruit and vegetables, healthy protein source, healthy milk-based product, etc.), and -1 if they fell into an unhealthy food group (e.g. fast food, sugary snacks, etc.). Results were summed then categorised into 3 nutritional quality groups: poor (scores -2 to 2); average (scores 2 to 4); and good (scores 4 to 8).

Child birth outcome data (gestational age, birth weight) were collected through data linkage to hospital records. Maternal smoking, history of domestic violence and

maternal psychosocial vulnerability data in pregnancy (based on the Edinburgh Postnatal Depression Scale, Murray & Cox, 1990) were also collected through data linkage to hospital antenatal records.

Data for home variables were primarily gathered in the family survey mentioned above. Information about whether or not drug and/or alcohol use was a problem in the home was based on the self-report of the primary caregiver. Parent perception of support available to them was based on the Kessler Psychological Distress Scale (Kessler, Andrews & Colpe, 2002) administered during the home visits. Information relating to family socio-economic status was not collected directly from families at the request of our research partners within the local Aboriginal community. Instead we relied on the SEIFA score (Socio-Economic Indexes for Areas) for the suburb in which families lived. SEIFA is a measure developed by the Australian Bureau of Statistics (ABS, 2011) to rank suburbs and geographic areas according to level of relative disadvantage and advantage.

Procedure

Before commencing the study, approval was obtained from the Human Ethics Committees of the Aboriginal Health and Medical Research Council, the University of NSW Australia, and the South West Sydney Area Health Service. Developmental assessments took place as close as possible to the child's first birthday, third birthday, and shortly before they commenced formal schooling (average age 4.5 years). The assessments were conducted by a paediatrician who is part of the research team, or by a senior paediatric registrar working under their supervision. The majority of the assessments took place in the children's outpatient department of the local hospital, however a small number were conducted in the family home.

Analysis

Data analysis was conducted using SPSS v19 for Windows. Gudaga raw scores on the GMDS-ER were standardised according to previously published normative data (Luiz et al., 2006). Analysis of variance and Student's t-test analyses were used to test the associations between risk and/or protective factors and developmental outcomes (GMDS-ER GQ z-score) at the prior to school assessment. Continuous variables (e.g. maternal age at parturition) were categorised prior to data analysis. A further analysis used linear mixed modelling to test the association between child development trajectories and each of the risk and/or protective factors. This analysis was completed using the MIXED procedure in SPSS where assessment was included as the repeated measure, and Schwarz's Bayesian Criterion (BIC) was used to determine that an autoregressive one (AR1) covariance matrix using maximum likelihood estimation provided the best fit. Each analysis used the maximum number of records possible, typically including a total of 379 records (137 + 128 + 114). Children with diagnosed developmental delays (n = 5) were included in these analyses.

Results

Development of the Gudaga Cohort at 4.5 years Prior to School Commencement

GMDS developmental assessments were administered prior to starting school to 114 Gudaga children (mean age = 56.1 months, range 50 - 69 months, SD = 2.66).
Of the children assessed, 55% were female (n = 63), 18% were born to a mother under 20 years of age, 58% lived in the lowest SEIFA quintile, 10% were born under-weight (less than 2500 grams) and 15% reported recent ear or hearing issues (Table 1).

In total, 13% of children scored <= 2 SD's below the GMDS-ER GQ mean, 31% scored between 1 and 2 SD's below this mean, 2% scored between 1 and 2 SD's above this mean and 1% scored over >= 2 SD's above this mean (Figure 1).

Child and family factors were assessed in relation to overall child developmental outcome (GMDS-ER - GQ). Child gender, preschool attendance and the number of books the child has in the home were shown to be significantly related to child development. Other factors including the child having a primary carer who was not their biological mother, maternal age under 20 years at parturition, mother previously being

in foster care and reported drug use in the household whilst not significant, did show a trend towards poorer developmental outcomes. Please see Table 1.

Figure 1

The distribution of z-scores for the Gudaga cohort at 4.5 years compared with a normal distribution (n = 114)

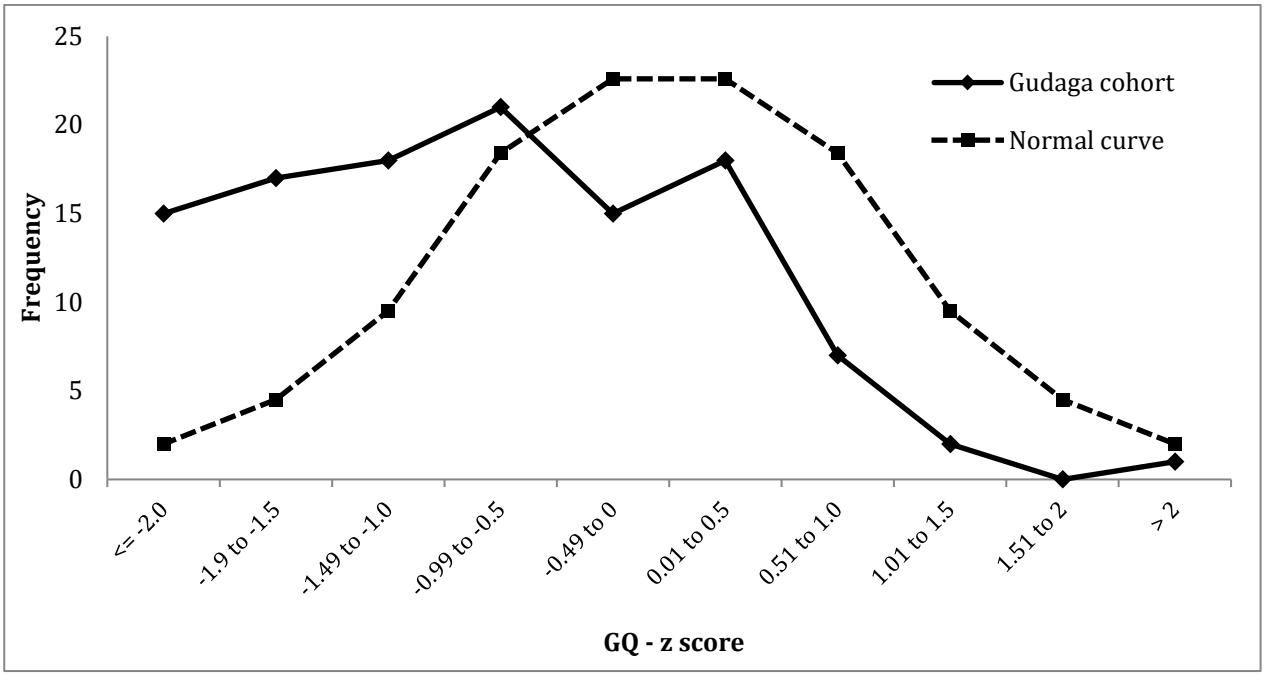


Table 1

Characteristics of the study group and relationship of these with child development General Quotient z-score (n=114)

Characteristics of the study group	**n (%)**	**t (or F) statistic**	**p value**	**n included analysis**
Child factors				
Gender, female	63 (55.3%)	**2.74**	**0.007**	114
Gestational Age (<37 weeks)	10 (9.2 %)	-0.03	0.977	109
Low Birth weight (<2500 grams)	11 (10.1%)	-0.75	0.457	109
Eldest child	30 (26.5%)	-0.74	0.464	113
Removed from care of mother	7 (6.4%)	-1.72	0.089	110
Child development factors (non-static)				
Ear problems (in previous 6 months)	16 (14.5%)	-0.10	0.321	110
Attendance at preschool (4 yrs of age)	80 (70.2%)	**3.44**	**0.001**	114
Healthy food choices (mean, SD)	2.62 (3.0)	0.06	0.578	101
Maternal factors				
Mother under 20 (at parturition)	21 (18.6%)	-1.46	0.147	113
Mother did not complete year 10	26 (24.1%)	0.13	0.899	108
Single/un-partnered (at parturition)	46 (42.6%)	-0.32	0.753	108
Smoking during pregnancy	43 (39.8%)	0.09	0.930	108
History of domestic violence	15 (15.3%)	-1.11	0.270	98
Mother was in foster care / state ward	7 (6.9%)	-1.69	0.094	101
Any psychosocial vulnerability	72 (66.7%)	-0.21	0.836	108
Home and Family factors				
Alcohol a problem in the household	9 (8.0%)	0.165	0.869	111
Drugs used in the household	17 (15.3%)	-1.48	0.141	111
Perception of support				
K-5 (Score >= 12)	5 (5.0%)	-0.52	0.607	101
Number of books (> 10 at 30 mths of age)	83 (75.5%)	**2.12**	**0.037**	110
Community factors				
SEIFA lowest quintile	63 (58.3%)	-0.48	0.633	108

Early Childhood Development of the Gudaga Children at Three Time Points

One hundred and thirty seven children completed the GMDS-ER assessment at 12 months of age, 126 at 3 years and 114 at 4.5 years of age. For full details on the cohorts at 12 months and 3 years of age please see McDonald et al. (2012) and McDonald et al. (2014). In brief, at 12 months of age, the mean GQ score achieved was 0.42 SD's below the GQ standardised mean. This represents a significantly lower performance compared to the standardised values ($t = -5.71$, $p < 0.001$) (Figure 2). At 3 years, the overall performance decreased further to -0.54 SD's below the standardised mean.

When assessed prior to school commencement at approximately 4.5 years, overall development (GQ) again showed a decline in performance compared to the standardized scores ($t = -8.62$, $p < 0.001$). However, the children were above average on the Personal-social ($t = 2.28$, $p = 0.025$) sub-scale (Figure 2). This strength had also been observed at the 3 year time point ($t = 3.54$, $p = 0.001$). Table 2 provides a summary of subscale and GQ scores across the three time points. Figure 2 depicts these scores in relation to the standardized mean at each time point.

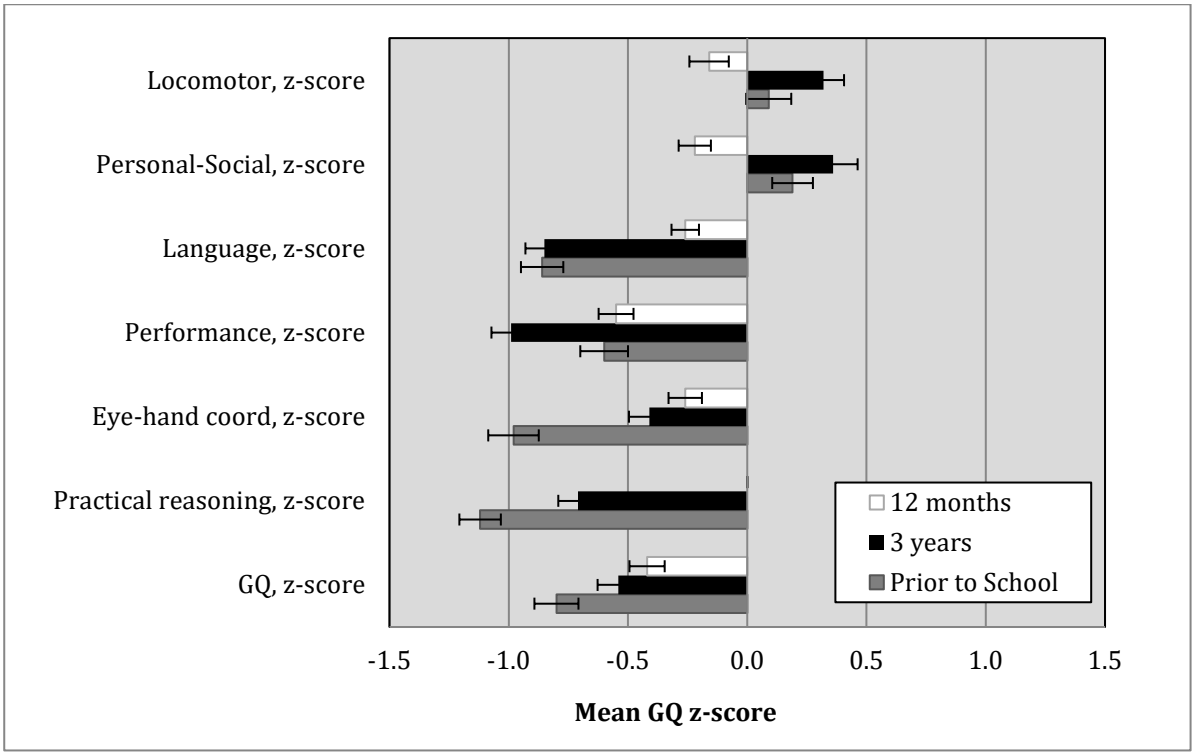
Table 2

Griffith's developmental standardised z-scores at 12 months, 3 years and 4.5 years of age

	12 months		3 years		4.5 years (prior to school)	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Locomotor, z-score	-0.16	0.97	0.32	0.97	0.09	1.01
Personal-Social, z-score	-0.22	0.79	0.36	1.16	0.19	0.91
Language, z-score	-0.26	0.67	-0.85	0.90	-0.86	0.95
Eye-hand coordination, z-score	-0.26	0.86	-0.41	0.93	-0.98	1.07
Performance, z-score	-0.55	0.82	-0.99	0.97	-0.60	1.31
Practical reasoning, z-score	-	-	-0.71	0.93	-1.12	0.93
GQ, z-score	-0.42	0.86	-0.54	1.00	-0.80	0.99

Participants: At 12 months, n = 137; at 3 years, n = 127; and at 4.5 years, n = 114.
SD = Standard Deviation

Figure 2
Griffith's data across three time points for the Gudaga cohort



The Impact of Child and Family Variables on Development over Time

Maternal, child, and home and community factors that were identified as having a relationship ($p < 0.15$) with child development at age 4.5 years were examined across all three time points. This analysis was completed using mixed modelling to allow for assessment of child developmental trajectories, over time, and in relation to selected study factors. Each model fits three factors simultaneously and provides the impact, and significance, of each factor in relation to the outcome measure (GQ – z-score) after accounting for the other factors included. The factors fitted in each model are the effect of time, the effect of the study factor, and the effect of the time*study factor interaction.

Maternal factors. Maternal age, education, marital status at parturition, and mother's history of foster care were examined across the three time points in relation to GMDS-ER GQ. The last factor is of particular interest to this participant group because of the long history of Aboriginal child removal, as mentioned earlier.

Overall, the effect of having a mother under 20 years at parturition was predictive of poorer performance ($F_{(1,156.22)} = 6.71$, $p = 0.010$). This association was seen most strongly at the 3 year assessment ($t = -2.47$, $p = 0.014$), decreasing by the 4.5 year assessments ($t = -1.81$, $p = 0.071$). There was no significant interaction effect of time by maternal age ($p = 0.594$).

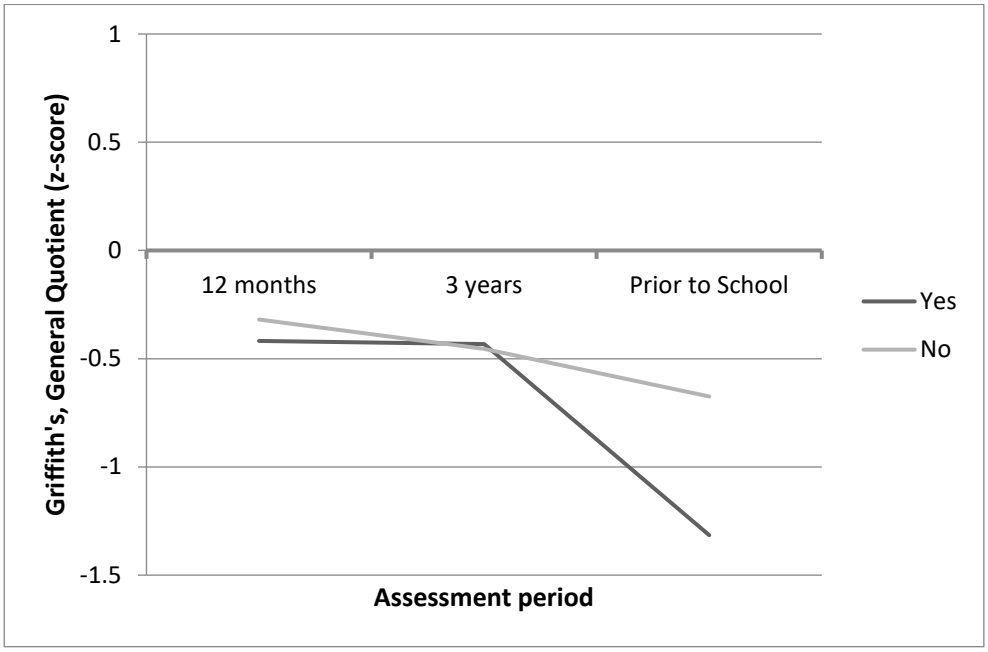
Similar to maternal age, there was a strong negative correlation between child development at 3 years of age and a low level of maternal education (not completing year 10) ($t = -2.53$, $p = 0.012$). This effect was not seen at 12 months or 4.5 years of age.

Overall, there was a non-significant negative effect of having a single mother at birth ($F_{(1,145.0)} = 3.60$, $p = 0.060$). Like maternal age and maternal education, there was a significant relationship seen at the 3 year assessment ($t = -2.46$, $p = 0.014$) but not at either the 12 month or 4.5 years assessments.

Overall, there was no significant relationship between child development and maternal experience of removal from the care of their own parents into foster care. However results at the 4.5 year assessment showed that children of mothers who had been in foster care were performing slightly below their peers (t = -1.81, p = 0.071). These results are depicted in Figure 3.

In summary, maternal age, maternal education and maternal relationship status had the largest impacts on child development at 3 years of age, with the effect of these factors diminishing as the child moved towards school age. In contrast, the effect of maternal experience of foster care or being raised as a state ward appears to be increasing with child age (see Figure 3).

Figure 3
Relationship between Griffiths GQ and the child's mother being a state ward or foster child

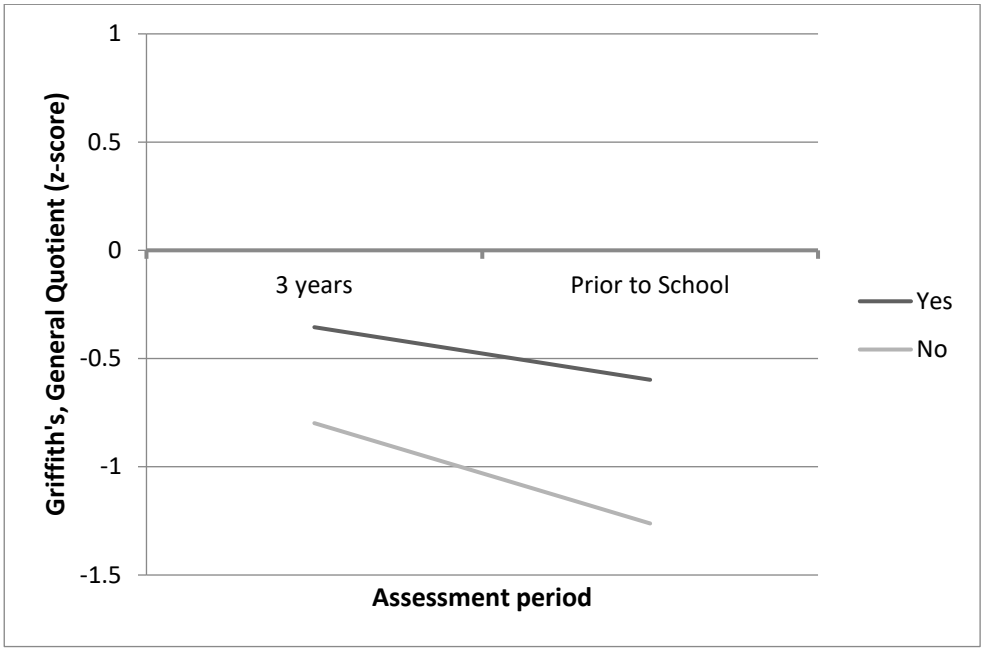


Child Factors. Gender and preschool attendance were examined across the three time points in relation to GMDS-ER GQ.

Overall there was a significant effect of gender on child development ($F_{(1,\ 152.08)}$ = 4.57, p = 0.034). This effect was most clearly seen at the 4.5 year old assessment with female children scoring 0.48 SD's higher than male children (t = -2.81, p = 0.005). In response to clinician rating of child co-operation during the assessments, the association between gender, child cooperation and overall development was assessed at 3 and 4.5 years. In this model, the gender by co-operation interaction effect was not significant, however there was a significant main effect for child co-operation during testing by GMDS-ER GQ ($F_{(2,\ 184.29)}$ = 15.95, p < 0.001). Inclusion of child cooperation in the model had the effect of lowering the significance of gender to p = 0.083.

Attendance at preschool was recorded at 3 and 4.5 years of age. Overall there was a strong positive association with child development ($F_{(1,241.9)}$ = 10.09, p = 0.002). This influence was similar at both 3 years and 4.5 years of age (3 years: t = 2.60, p = 0.010, 4.5 years: t = 2.38, p = 0.018). These findings are depicted in Figure 4.

Figure 4
Relationship between Griffiths GQ and child preschool attendance



At 12 months of age there was a significant positive correlation between healthy food choices and developmental performance (r = 0.20, p = 0.012). This relationship was not seen at 3 years or 4.5 years. However, the overall analysis showed that making healthier food choices marginally increased child performance ($F_{(1, 333.19)} = 3.84$, p = 0.051).

Home and community factors. Parent alcohol and drug use, family socio-economic status (SEIFA score), whether the child was removed from the care of their mother (e.g., in foster or into the care of extended family members) and the number of books available to the child were examined across the three time points in relation to GMDS-ER GQ.

Alcohol and drug use was measured by parental report at 6 and 42 months of age. While children in the households where alcohol and drug use was perceived by parents as problematic scored lower on average, this difference was not statistically significant. There was no overall effect of time on the impact of problem alcohol or drug use in the home, meaning that reports of problem alcohol or drug use did not significantly differ from one data collection time point to the next.

Family socio-economic status was determined by the SEIFA score assigned to the suburb in which the family lived when their child was 12 months, 3 years and 4.5 years of age. The impact of SEIFA on child development outcomes did not significantly vary from one time point to the next ($F_{(2, 242.51)} = 1.49$, p = 0.227).

In total, 11 children were removed from maternal care by state child protection authorities. Overall there was not a significant effect of being removed from maternal care on child development ($F_{(1,144.80)} = 1.34$, p = 0.249). However, as children age, the effect appears to be increasing (4.5 years: t = -1.88, p = 0.062). Please see Figure 5. A strong positive correlation was seen between overall development and there being 10 or more child appropriate books within the home ($F_{(1,139.02)} = 9.70$, p = 0.002). This influence was seen at all three time points (i.e., was consistent with time) (12 months: t = 2.50, p = 0.013, 3 years: t = 2.31, p = 0.022, 4.5 years: t = 2.15, p = 0.033). These findings are presented in Figure 6.

Figure 5
Relationship between Griffiths GQ and the child being removed from care of mother

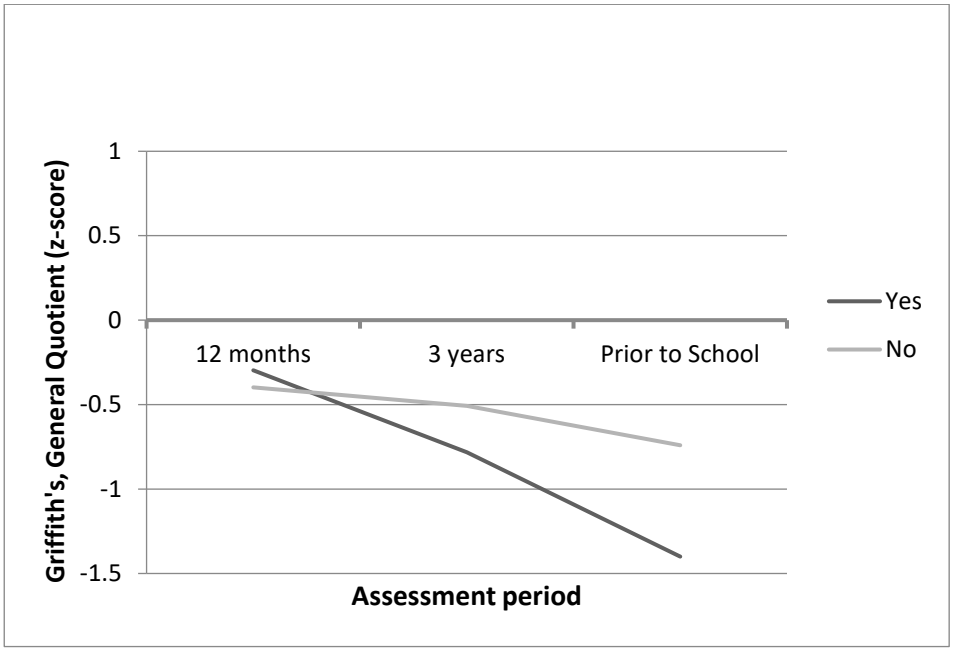
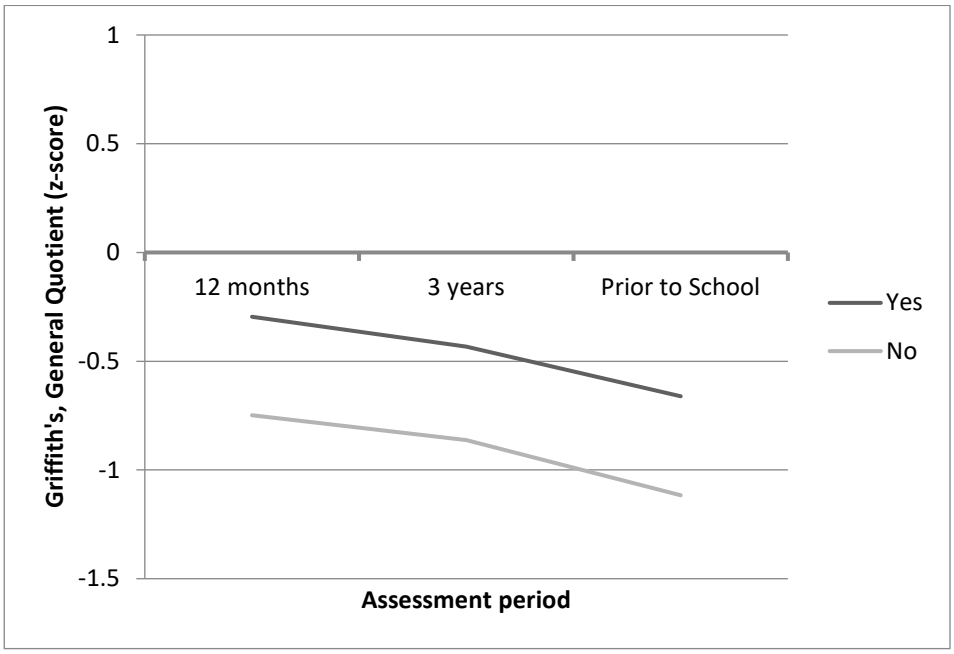


Figure 6
Relationship between Griffiths GQ and there being more than ten children's books in the home



Discussion

This research explored development over three time points (12 months, 3 years and 4.5 years) for a cohort of 149 urban Aboriginal Australian children. The mean child development GQ score for the children of the Gudaga study was shown to be significantly lower than the standardised mean, and the distance from the mean increased with each data collection time point. An examination of the GMDS-ER development subscales points to areas of strength for this cohort of children, particularly on the personal-social domain.

This domain measured the child's ability to participate independently in the tasks of daily living and interact appropriately with their peers. This finding provides an opportunity for early childhood professionals to explore how these strengths can be utilised to address some of the areas of development that are not as strong. The subscales on which this cohort scored significantly below the standardised mean were those that are generally associated with the development of pre-academic skills (language, hand-eye coordination, practical reasoning and performance). The key predictors of performance on the GMDS-ER were maternal factors such as age and education, preschool attendance and number of books within the home environment.

The impact of maternal factors such as education, age and partner status at parturition were most evident at the 3 year time point. Data from this study support the argument that attendance at an early childhood education setting is a protective factor, compensating to some extent for other developmental risks within a child's life and serving as a form of early intervention for vulnerable children (e.g. Sylva et al., 2008). This is most apparent on the performance subscale (see Figure 2), on which the cohort children demonstrated notable improvement between the 3 year assessment and the 4.5 year assessment, when the majority (70%) were attending preschool. In addition to the importance of preschool engagement, the presence of child-appropriate books within the home was also strongly predictive of performance on this measure of development. Consistent with other child development research (e.g., Brinkman et al., 2012), child gender was also found to be significant, although this appears to be explained to some extent in this study by level of cooperation within the testing context. Female children in the Gudaga study were reported to be more likely to comply with the requests of the paediatrician administering the assessment.

It was important in this research that we considered variables that may reflect the intergenerational trauma experienced by Aboriginal people, as described briefly in the introduction to this paper. It is for this reason that we included variables such as problem alcohol and/or drug use within the household, socioeconomic disadvantage, and whether or not the mother had been removed by child protection authorities from the care of her own birth parents. These were not variables that demonstrated statistical significance in our analysis of child development in the early years, however they were variables that seemed to be emerging as important at the 4.5 year time point. Limitations in measurement need to be acknowledged. Drug and alcohol use was based on parent perception of whether or not this was at problematic levels within the household. There was, of course, considerable subjectivity in this assessment, however this method was felt to be the most appropriate and respectful way to approach this sensitive issue with our research participants. As mentioned earlier, socioeconomic status was based on suburb rather than individual family measures. This broad approach was encouraged by our Aboriginal community partners who did not feel it was respectful to ask participants direct questions about family finances.

Another important issue to consider in the interpretation of these results is the extent to which a standardised measure such as the GMDS-ER is appropriate for use with Australian Aboriginal children. A sample of children from the UK was used to validate this measure, and caution should be applied in the interpretation of findings in the absence of Australian standardised norms. In addition, it is important to consider whether standardised developmental instruments like this measure what is valued and encouraged within Aboriginal communities. As Ktunaxa (2011) points out in relation to First Nation children in Canada, results from developmental assessments are only meaningful if they can be understood according to local cultural norms and values. Byers and Kulitja (2012) and Armstrong and colleagues (2012) argue that Australian Aboriginal communities do not value the same developmental skills as those valued for children in non-Aboriginal communities. Taylor (2011) notes that Australian Aboriginal families most value autonomy, sibling and peer solidarity, motor skills, visual-spatial skills and the capacity to assess risk. If this is true for the Gudaga

families, then their children are certainly reflecting strength in what is most valued within their community because the skills described by Taylor are a close fit with the locomotor and personal-social developmental domains.

Dockett and colleagues (2010) warn that assessment measures that are developed based on non-Indigenous populations may reinforce a deficit approach and give emphasis to the performance gaps between Indigenous and non-Indigenous children. Standardised assessments potentially place Indigenous children at a disadvantage not only because they may not fully capture what is valued within Indigenous communities, but also because of the ways in which they measure development. For example, it is possible that performance on standardised measures like the GMDS-ER is affected by the requirement to use formal English rather than dialects of Aboriginal English (Australian Government 2013; McLeod, Verdon, & Bennetts Kneebone, 2014). An earlier language study on a sub-sample of the Gudaga cohort suggests that this may be the case for at least some of the Gudaga children (Miller, Webster, Knight, & Comino, 2014).

While these culturally relevant interpretations are important, it should also be acknowledged that the skills required to perform well on many standardized developmental assessment tools are the same skills that are valued in the formal school system. A balance between the valuing of skills that support success within the school system and the need for change within schools to support the strengths of a culturally diverse range of children is long overdue. A more comprehensive discussion of this issue is beyond the scope of this paper, except to acknowledge that the findings presented here should be interpreted with an understanding that different stakeholders (parents, cultural community leaders, educators, etc.) may attach different meanings to them. If we are to develop programs or interventions to support early development and school readiness for Indigenous children, it is important that a multi-faceted approach is taken and that any actions or strategies are developed through a process of community involvement to ensure that they are meaningful within the local context (Evans, Dongping & Sepanski, 2013; Wise, 2013).

Strengths, Limitations and Future Research

A significant strength of this research is the high participant recruitment rates (83.7%) and the high retention rates over 4.5 years of the study (76.5%). This success is due to the commitment and engagement of the local Aboriginal community, and the relationships between researchers and community members that have been nurtured throughout the life of this project. High retention rates are also the result of flexibility in data collection, not only in terms of where and when data are collected, but also in welcoming families back to the study after periods of time away. Flexibility and understanding of the transience of families is essential to the success of longitudinal studies with Aboriginal families.

Another limitation is the absence of a comparison group of non-Aboriginal children in similar socio-economic circumstances. The absence of a comparison group makes it difficult to examine the extent to which the findings reflect issues within the Aboriginal community or reflect issues present more broadly within socio-economically disadvantaged communities. A matched comparison group was included in the original design of the study, however funding was not secured for this part of the research. It should also be noted that the GMDS-ER provides standardised means based on a community sample and not specifically on a low-SES sample, which would have provided more appropriate comparative data. The use of a standard test is important to positioning the findings within the broader context, however findings must be interpreted carefully with an understanding of test limitations and community values.

In future research we will follow the Gudaga cohort into the early years of school and examine the relationships between early child development and school performance. Ongoing formal assessment of development will take place at regular intervals. However, we will review our measures to allow for an in-depth understanding of language

development and particularly the impact of Aboriginal English dialects on test performance. We will also explore in more depth the locomotor and personal social strengths demonstrated by this cohort. In addition, future research should explore appropriate research translation in the communication of child development research findings to the community and the development of intervention strategies that are culturally appropriate and meaningful within the context of local values as well as the expectations of the school system. Also important for future research is an increased understanding of the relationships between inter-generational trauma and child development and emotional wellbeing.

Conclusion

For the cohort of Gudaga children, performance on a standardised measure of early childhood development was below the mean at three time points (12 months, 3 years and 4.5 years), and the distance from the mean increased at each assessment point. There were however, notable strengths across time in the locomotor and personal-social developmental domains. Strength within these domains reflects what we understand from other Australian research to be the most highly valued developmental skills within Aboriginal communities.

Maternal factors such as maternal age, education level and marital status at parturition were most predictive of poor performance at the 3 year time point. Preschool attendance and having more than 10 child appropriate books in the home were predictive of improved performance on the GMDS-ER. The impact of family disruption factors, including maternal history of being a state ward and/or cohort children being removed from their mother by child protection authorities, was beginning to emerge as important to child development at the 4.5 year time point. This trend needs to be confirmed and replicated in larger samples, and will be explored further in our ongoing longitudinal research with the Gudaga cohort. It is likely that child and family wellbeing variables become more impactful as the demands underpinning performance on child development measures rely on increasing sophistication in executive functioning and emotional regulation.

This research adds support to the importance of early childhood education for vulnerable children. It also points to the need for culturally appropriate parenting support in the first three years of a child's life to enhance parental understanding of child development and maximise child learning opportunities within home and community settings.

Acknowledgements

This work was supported by the Australian National Health and Medical Research Council. We would like to acknowledge and sincerely thank Darryl Wright and the members of the Tharawal Aboriginal Corporation Board and staff at the Tharawal Aboriginal Medical Centre for their ongoing support, insight, and guidance on the interpretation of study findings. We would also like to extend our sincere thanks to the participating Gudaga families. Jane Anderson and Natasha West must also be acknowledged for the importance of their contribution to this study as Aboriginal Project Officers, along with the rest of the Gudaga research team. We would also like to thank the Paediatric Registrars who completed the health and development assessments. Finally, we would like to thank Associate Professor Lynn Kemp, Professor Bin Jalaludin and Joseph Descallar who provided advice on the analysis of the data.

References

Armstrong, S., Buckley, S., Lonsdale, M., Milgate, G., Bennetts Kneeboone, L., Cook,L, & Skelton, F. (2012). Starting school: A strengths-based approach towards Aboriginal and Torres Strait Islander Children. Report by the Australian Council for Education Research for the Department of Families, Housing, Community Services and Indigenous Affairs. Canberra: Australian Government.

Askew, D., Schluter, P., Spurling, A., Bond, C. & Brown, A. (2013). Urban Aboriginal and Torres Strait Islander children's exposure to stressful events: A cross-sectional study. Medical Journal of Australia, 199(1), 42-45.

Attwood, B. (2005). Telling the truth about Aboriginal history. Melbourne: Windschuttle.

Australian Bureau of Statistics (ABS) (2011). Census of population and housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2011 (Report 2033.0.55.001). http://www.abs.gov.au/ausstats/abs@.nsf/DetailsPage/2033.0.55.0012011?OpenDocument

Australian Government (2013.) A snapshot of early childhood development in Australia: 2012 Australian Early Development Index (AEDI) national report. Canberra: Australian Government.

Australian Institute of Health and Welfare (AIHW) (2013). Child protection Australia 2011-12 (Child Welfare Series No. 55). Canberra: AIHW.

Australian Research Alliance for Children and Youth (ARACY) (2013). Report card: The wellbeing of young Australians. http://www.aracy.org.au/category/about_aria.html.

Avan, B & Kirkwood, B. (2010). Role of neighbourhoods in child growth and development: Does 'place' matter? Social Science and Medicine, 71(1), 102-109.

Baxter, J. & Hand, K. (2013). Access to early childhood education in Australia (Research Report No. 24). Melbourne: Australian Institute of Family Studies.

Beggs, S., Sewell, J., Efron, D. & Orkin, C. (2005). Developmental assessment of
children: a survey of Australian and New Zealand paediatricians. Journal of Paediatrics Child Health, 41, 444–8.

Bennett, B., McDonald, J., Knight, J., Comino, E., Henry, R. (2010). Assessing development of urban Aboriginal infants. Journal of Paediatrics and Child Health, 46, 384–91.

Bowes, J., Harrison, L., Sweller, N., Taylor, A. & Neilsen-Hewett, C. (2009). From childcare to school: Influences of children's adjustment and achievement in the year before school and the first year of school. Findings from the Childcare Choices Longitudinal Extension study. Research Report to NSW Department of Community Services. Sydney: NSW Department of Community Services.

Brinkman, S., Gialamas, A., Rahman, A., Mittinty, M., Gregory, T., Silburn, S. et al (2012). Jurisdictional, socioeconomic and gender inequalities in child health and development: Analysis of a national census of 5-year-olds in Australia. BMJ Open, 2, e001075. Doi:10.1136/bmjopen-2012-001075.

Bronfenbrenner, U. (1979). The ecology of human development: Experiments by nature and design. Cambridge, MA: Harvard University Press.

Burns, A., Burns, K., Menzies, K. & Grace, R. (2013). The stolen generations. In J. Bowes, R. Grace & K. Hodge (eds). Children, families and communities: Contexts and consequences, 4th edn. South Melbourne: Oxford University Press, pp.239-254.

Byers, L. & Kulitja, S. (2012). Hear our stories: Child-rearing practices of a remote Australian Aboriginal community. Australian Journal of Rural Health, 20(6), 293-297.

COAG (Council of Australian Governments) (2008). National Indigenous Reform Agreement (Closing the Gap). Canberra: COAG. Retrieved from http://www.coag.gov.au/node/145.

Comino, E.J., Craig, P., Harris, E., & Knight, J. (2010). The Gudaga study: Establishing an Aboriginal birth cohort in an urban community. Australian and New Zealand Journal of Public Health, 34, S9-S17.

Craig, P., Knight, J., Comino, E., Webster, V., Jackson Pulver, L. & Harris, E. (2011). Initiation and duration of breastfeeding in an Aboriginal community in South West Sydney. Journal of Human Lactation, 27(3), 250-261.

Cunha, F., Heckman, J., Lochner, L. & Masterov, D. (2006). Interpreting the evidence on life cycle formation. In E. Hanusket & F. Welch (eds). Handbook of the economics of education. Amsterdam: North Holland, pp.697-812.

De Maio, J.A., Zubrick, S.R., Silburn, S.R., Lawrence, D.M., Mitrou. F.G., Dalby, R.B. et al. (2005). The Western Australian Aboriginal child health survey: Measuring the social and emotional wellbeing of Aboriginal children and intergenerational effects of forced separation. Perth: Curtin University of Technology & Telethon Institute for Child Health Research. http://aboriginal.childhealthresearch.org.au/kulunga-research-network/waachs.aspx.

Dockett, S., Perry, B. & Kearney, E. (2010). School readiness: What does it mean for Indigenous children, families, schools and communities? Canberra: Closing the Gap Clearinghouse, Australian Institute of Health and Welfare.

Eades, S,J,, Taylor, B., Bailey, S., Williamson, A.B., Craig, J.C. & Redman, S. (2010).The health of urban Aboriginal people: Insufficient data to close the gap. Medical Journal of Australia, 193(9), 521–4.

Evans, G., Dongping, W. & Sepanski, S. (2013), Cumulative risk and child development. Psychological Bulletin, 139(6), 1342-1396.

Freemantle, J., Officer, K., McAullay, D. & Anderson, I. (2007). Australian Indigenous health – Within an international context. Perth: Telethon Institute for Child Health. http://www.lowitja.org.au/sites/default/files/docs/AustIndigneousHealthReport.pdf

Girishwar, M. &Babu, N. (2013). Emerging perspectives on human development research. Psychological Studies, 58(4), 349-352.

Harrison, N. & Greenfield, M. (2010). Relationship to place: Positioning Aboriginal knowledge and perspectives in classroom pedagogy. Critical Studies in Education, 52(1), 65-76.

Hayes, D., Johnston, K., Morris, K., Power, K. & Roberts, D. (2009). Difficult dialogue: Conversations with Aboriginal parents and caregivers. The Australian Journal of Indigenous Education, 38, 55-64.

Human Rights and Equal Opportunity Commission (HEROC) (1997). Bringing them home. Report of the national inquiry into the separation of Aboriginal and Torres Strait Islander children from their families. Sydney: Commonwealth of Australia.

Jervis-Bardy, J., Sachez, L. & Carney, A.S. (2014). Otitis media in Indigenous Australian children: Review of epidemiology and risk factors. Journal of Laryngology and Otology, 128 (Suppl 1), 516-27.

James, A. (2008). Day care or early education? Perspectives on the institutional provision for young children in the UK. In G. Robinson, U. Eickelkamp, J. Goodnow & I. Katz (eds). Contexts of child development: Culture, policy and intervention. Darwin: Charles Darwin University Press, pp.100-110.

Kessler, R.C., Andrews, G. & Colpe, L.J. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychological Medicine, 32, 959–976.

Knight, J., Comino, E., Harris, E., Jackson Pulver, L., Anderson, C., & Craig, P. (2007). The Gudaga project: Researching with our local Aboriginal community. In A Williamson & R. DeSouva (Eds). Researching with communities: Grounded perspectives on engaging communities in research. Auckland: Muddycreek Press.

Ktunaxa, M. (2011). An Indigenous knowledges perspective on valid meaning making: A commentary on research with the EDI and Aboriginal communities. Social Indicators Research, 103(2), 315-325.

Lee, J., Grigg, W. & Donahue, P. (2007). The nation's report card: Reading 2007 (NCES 2007-496). Washington DC: National Center for Education Statistics, Institute of Education Sciences, US Department of Education. http://nces.edu.gov.nationsreportcard/pubs/mail2007/2007

Luiz, D., Barnard, A. & Knoesen, N. (2006). Griffiths Mental Development Scales – Extended Revised: 2 to 8 years. Oxford: Hogrefe.

McDonald, J., Comino, E.J., Knight, J. & Webster, V. (2012). Developmental progress in urban Aboriginal infants: A cohort study. Journal of Paediatrics and Child Health, 48(2), 114-21.

McDonald, J., Webster, V., Knight, J. & Comino, E.J. (2014). The Gudaga study: Development in 3 year old urban Aboriginal children. Journal of Paediatrics and Child Health, 50(2), 100-106.

McLeod, S., Verdon, S. & Bennetts Kneebone, L. (2014). Celebrating young Indigenous Australian children's speech and language competence. Early Childhood Research Quarterly, 29(2), 118-131.

Miller, E., Webster, V., Knight, J., & Comino, E. (2014). The use of a standardized language assessment tool to measure the language development of urban Aboriginal pre-schoolers. International Journal of Speech-Language Pathology, 16(2), 109-120.

Murray, D. & Cox, J. (1990). Screening for depression during pregnancy with the Edinburgh Postnatal Depression Scale (EPDS). Journal of Reproductive and Infant Psychology, 8(2), 99-107.

National Health and Hospitals Reform Commission (2008). A healthier future for all Australians: Interim Report December 2008. http://www.health.gov.au/internet/nhhrc/publishing.nsf/Content/interim-report-december-2008.

National Health and Medical Research Council (NHMRC) (2003). Values and ethics: Guidelines for ethical conduct in Aboriginal and Torres Strait Islander health research. https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e52.pdf

National Health and Medical Research Council (NHMRC) (2008). Review of the NHMRC Road Map: A strategic framework for improving Aboriginal and Torres Strait Islander health through research. http://www.nhmrc.gov.au/guidelines/consult/consultations/review_of_NHMRC_roadmap.htm

National Health and Medical Research Council (NHMRC) (2010). Road Map II: A strategic framework for improving the health of Aboriginal and Torres Strait Islander people through research. http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/r47.pdf

Robinson, G., Tyler, W., Jones, Y., Silburn, S. & Zubrick, S. (2011). Context, diversity and engagement: Early intervention with Australian Aboriginal families in urban and remote contexts. Children & Society, 26(5):343–55.

Super, C.M. & Harkness, S. (1986). The developmental niche: A conceptualization at

the interface of child and culture. International Journal of Behavioural Development, 9(4), 545-569.
Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I. & Taggart, B. (2008). Final report from the primary phase: Pre-school, school and family influences on children's development during key stage 2 (7-11). The Department for Children, Schools and Families (DCSF), Nottingham. http://eppe.ioe.ac.uk/eppe3-11/eppe3-11%20pdfs/eppepapers/Final%203-11%20report%20DCSF-RR061%2027nov08.pdf
Taylor, A. (2011). Coming ready or not: Aboriginal children's transition to school in urban Australia and the policy push. International Journal of Early Years Education, 19(2), 145-161.
Vinson, T. (2007). Dropping off the edge: The distribution of disadvantage in Australia. Melbourne. Jesuit Social Services/Catholic Social Services Australia.
Wise, S. (2013). Improving the early life outcomes of Indigenous children: Implementing early childhood development at the local level. Issues paper no. 6. Canberra: Closing the Gap Clearinghouse, Australian Institute of Family Studies.
Yuksel, C. & Turner, C. (2008). Building community connectedness in Broadmeadows. The Australian Community Psychologist, 20(1): 8-21.
Zubrick, S.R., Silburn, S.R., Lawrence, D.M., Mitrou, F.G., Dalby, R.B., Blair, E.M. et al. (2005). The Western Australian Aboriginal child health survey: Measuring the social and emotional wellbeing of Aboriginal children and young people. Perth, Western Australia: Curtin University of Technology and Telethon Institute for Child Health Research.

AJEDP is published by the University of Newcastle, Australia

About the authors

Dr Rebekah Grace is a Chief Investigator for the Gudaga program of research and was, at the time of the research described in this paper, the Manager for Research with Children and Young People in the Centre for Health Equity Training Research and Evaluation, UNSW.

Dr Jennifer Knight is a Senior Researcher at the Centre for Health Equity Training Research and Evaluation, UNSW. She has been the Project Manager for the Gudaga project since its commencement in 2005.

Ms Emma Elcombe is project officer of the Gudaga project, playing a key role in data management and statistical analysis.

Associate Professor Catherine McMahon is a developmental psychologist. She is a Chief Investigator for the Gudaga Program of Research.

Dr Jenny McDonald is a Paediatrician in South West Sydney and an Associate Investigator for the Gudaga Project. Dr McDonald both conducted paediatric assessments for the study, and supervised paediatric registrars who also conducted the health and development assessments.

Associate Professor Elizabeth Comino is the lead Chief Investigator for the Gudaga project She has been responsible for leading the project from its commencement, beginning with the earliest discussions and development of ideas in partnership with the local Aboriginal community.