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Child Abuse & Neglect

journal homepage: www.elsevier.com/locate/chiabuneg

Infants entering out-of-home care: Health, developmental needs and service provision

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ARTICLE INFO

Keywords:

Child maltreatment
Out-of-home care
Developmental delay
Standardise assessments
Health outcomes
Linked data

ABSTRACT

Background: There are rising numbers of infants entering out-of-home care due to child protection concerns. Research has found that infants entering care are at higher risk of developmental vulnerability and poor health problems.

Objectives: To determine the prevalence of developmental vulnerability for children who entered care as infants, and the extent and likelihood of service provision in relation to their developmental vulnerability.

Participants and setting: This study includes children who entered care before the age of 1 year for the first time between May 2010 and October 2011 in New South Wales, Australia, and who received final Children's Court care and protection orders by 30 April 2013.

Methods: This is a prospective cohort study using interview data from the Pathways of Care Longitudinal Study (POCLS) as well as linked administrative child protection and health data. This study used standardised assessments (Age and Stages Questionnaire and the Brief Infant Toddler Social Emotional Assessment) included in the POCLS. Simple and multiple logistic regression analysis was conducted to investigate the likelihood of infants receiving professional services for developmental delays since placement.

Findings: A high proportion of children who entered care as infants were identified as developmentally vulnerable through health indicators (36 %) and standardised assessments (70 %). Only 17 % of infants in care received services for developmental delay, with 20 % and 15 % of those identified as developmentally vulnerable through standardised assessments and health-related variables receiving services, respectively.

Conclusions: The findings point to the importance of developmental assessment of infants in care and the identification of developmental vulnerability and delays. The provision of early intervention services is essential for this group of high-risk infants and will be important in optimising their health, as well as social and emotional outcomes.

1. Introduction

Rising numbers of infants (defined as under 1 year of age) in Australia are entering out-of-home care during the first year of life due to child protection concerns ([Australian Institute of Health and Welfare, 2023](#)). This trend is also being reported internationally in New Zealand, England and the United States ([Pearson et al., 2020](#)). Across Australia, infants are over-represented in the child protection

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<https://doi.org/10.1016/j.chiabu.2023.106577>

Received 8 June 2022; Received in revised form 17 November 2023; Accepted 22 November 2023

Available online 2 December 2023

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data: (i) Infants are the age group with the highest rate of child protection service involvement (37.5 per 1000 children), a rate which has risen by 14 % since 2013–14 (Australian Institute of Health and Welfare, 2023); (ii) Infants have the highest rates of substantiated notifications of maltreatment (14.7 per 1000 children), and (iii) the highest admission rates into care (6.7 per 1000 children) (Australian Institute of Health and Welfare, 2023). Within this infant group, the over-representation of Aboriginal infants involved in child protection processes has been widely reported, with Aboriginal infants being removed from their families at ten times the rate of non-Aboriginal infants (Australian Institute of Health and Welfare, 2023; O'Donnell et al., 2019).

Infants and toddlers entering care are reported to be at much higher risk of developmental vulnerability, poor health and attachment problems (Needell & Barth, 1998; Zhou & Chilvers, 2010). Previous research has also identified that infants involved in child protection have an increased risk of neonatal withdrawal syndrome (NWS) due to exposure to substances during pregnancy or have a birth defect or disability (O'Donnell et al., 2009). In a US study, infants entering foster care were 2.7 times more likely to be low birth weight and twice as likely to have a birth abnormality (Needell & Barth, 1998). A recent study in the UK similarly found that babies involved in care proceedings were more likely to be born pre-term and for those born full-term to have low birth weight (Griffiths et al., 2020). Developmental vulnerability has previously been measured through birth indicators (such as low birth weight and prematurity), the use of standardised assessments, or diagnosed disability or delay (Australian Institute of Health and Welfare, 2011; Bedford et al., 2013; Woolfenden et al., 2015). Developmental vulnerability can lead to long term impacts on children's school readiness, educational achievement, social-behavioural issues, and mental health conditions (Woolfenden et al., 2015). It can also signify the need for additional services and supports for these infants and their carers. However, little empirical research has been undertaken concerning infants entering care in Australia. The need for evidence and a knowledge base to support Australian child welfare policy and service development is therefore critically important to ensure that we are optimising outcomes for this vulnerable group through meeting their developmental needs.

The Pathways of Care Longitudinal Study (POCLS) is the first Australian large-scale longitudinal study to collect information on the wellbeing trajectories for children who entered care (NSW Department of Communities and Justice, 2020c). POCLS provides a unique opportunity to investigate the health and developmental needs of infants entering care and answer critical research questions. This study uses a combination of POCLS interview data and standardised developmental assessments, linked to administrative longitudinal data from two New South Wales (NSW) government agencies, to:

- (i) determine the prevalence of developmental vulnerability in a sample of Aboriginal and non-Aboriginal children entering care as infants, and
- (ii) the extent and likelihood of service provision to these children in relation to developmental vulnerability.

2. Methods

2.1. Study design and data sources

This is a prospective cohort study using the first wave of interview data from the NSW POCLS study together with longitudinal linked administrative data from the NSW Department of Communities and Justice (DCJ) and NSW Health Departments.

POCLS collected information on all children from birth to 17 years of age who entered care in NSW for the first time in the 18 months between May 2010 and October 2011, and who received final Children's Court care and protection orders by 30 April 2013 ($n = 2828$). A final care and protection order refers to a Children's Court order altering the allocation of parental responsibility to the statutory department, to ensure the safety and wellbeing of a child (NSW Department of Communities and Justice, 2020c; Paxman et al., 2014). The carers of 1285 children in this cohort agreed to participate in the study and the first wave interview and provided consent for the children to participate in standardised tests and in face-to-face interviews for children aged 7 and over. The POCLS data collection includes five waves of data collection to date, starting in 2011 with wave 1; wave 6 data collection now underway (NSW Department of Communities and Justice, 2020c). POCLS data were collected from multiple sources including children, parents, caregivers, caseworkers and teachers (depending on the child's age), and linked to a variety of governmental administrative datasets. Through the five waves of data collection POCLS has followed children regardless of whether they changed placement, were reunified or aged out of care, enabling a longitudinal follow-up. The POCLS study collects information on a wide range of child characteristics, care experiences and development, including physical health, socio-emotional wellbeing and cognitive ability. Further details in the POCLS study design and data collection are described in Paxman et al. (2014), the POCLS technical report (NSW Department of Communities and Justice, 2020c) and outlined in the introductory article to this special issue (Cashmore, Wulczyn and POCLS Team, 2023).

Our analyses utilised information about children who entered care as infants with data collected from their carers by the POCLS carers Wave 1 interview. This information was also linked with longitudinal administrative data from:

- the NSW Perinatal Data Collection, which contains information on births outcomes, and maternal and newborn characteristics;
- the NSW Admitted Patient Data Collection (APDC), which collects information on hospitalisations in public hospitals, public psychiatric hospitals, multi-purpose services, private hospitals and private day procedures; and
- the NSW DCJ child protection and out-of-home care datasets, containing information related to allegations of maltreatment, substantiated maltreatment and care placements for all children in the POCLS.

The use of these linked administrative datasets allows extra analysis, enabling us to investigate, for instance, the association

between children's birth outcomes, health and child protection pathways including care placements (Paxman et al., 2014).

It is important to note that the term 'developmental vulnerability' is used to refer to children who are identified as having developmental needs or are at higher risk of developmental delay. The term 'developmental delay' is used to refer to those with a diagnosis of developmental delay.

2.2. Study population

This study aims to better understand the health and development needs of children who entered care as infants (defined as under 1 year of age), as well as service provision for those considered at-risk for developmental delay. The analysis focused on children who entered care as infants and their developmental measures and service needs at wave 1 (unweighted data) of the POCLS study.

The children who were included in wave 1 of the POCLS study ($n = 1285$) ranged in age at first entry from newborn to 15 years of age. Of these, 474 children who entered care before the age of 1 year, whose carer completed the POCLS interview, were selected and included in the analysis for this study. Wave 1 of the POCLS study occurred sometime after these children entered into care (between 2011 and 2013): carers of almost 40 % of children in this study were interviewed (wave 1) within the 12 months after placement and 92 % before 24 months after placement; at the time of interview 99 % of these children were aged 2 years old or less, and 1 % were 3 years old.

Infants were the age group with the highest rate of POCLS interview completion compared to any other age group (Wulczyn et al., 2017). Of the 1007 children who entered care as infants between May 2010 and October 2011, 47 % ($n = 474$) were included in POCLS wave 1 interview and in this study. There were not significant differences found between the 533 infants not in POCLS and those included in this study in terms of their demographic characteristics (as sex, Aboriginality, or maternal age at birth), health outcomes (as being preterm or identified as having a neonatal withdrawal syndrome hospitalisation) or child protection characteristics (Appendix Table 5). More than half of both groups of infants, in POCLS and not in POCLS, entered care before the age of 13 weeks, however a higher proportion of infants in POCLS entered care between 1 and 3 weeks of age. For both groups foster care was the predominant placement type, of note is that a smaller percentage of infants in POCLS were placed with their parents compared to infants not in POCLS. Mixed type of abuse (highest percentage was tied or the percentage was <50 %) was the predominant reason for entry for both groups. The average number of placements in their first period of care was similar in both groups, however, the average duration was double for those in POCLS (Appendix Table 5).

2.3. Variables including covariates

This study used data on child socio-demographic characteristics, parent/carer characteristics, placement factors and child health and developmental assessment measures to investigate developmental vulnerability in the children entering care.

Child and demographic characteristics included sex, ethnicity, maternal age at birth, gestational age and birth weight which were obtained from the NSW Perinatal Data Collection. Children were identified from the Perinatal Data Collection as low birth weight (<2500 g) and preterm birth (<37 weeks) (Cutland et al., 2017). The Socio-Economic Index for Area (SEIFA), more specifically the Index of Relative Socio-economic Advantage and Disadvantage, from the Australian Bureau of Statistics was used to describe, in quintiles, socio-economic status of birth parents at the time of birth (Australian Bureau of Statistics, 2018). SEIFA 2011 was used as this was the closest in time to wave 1 data. Preterm birth and infants born with Neonatal Withdrawal Syndrome were identified from the APDC. Children with any hospital admission under the age of 1 year diagnosed with "Disorders of newborn related to short gestation and low birth weight" (ICD-10 code P07) were flagged as preterm. Similarly, infants with any hospitalisation diagnosis for "Neonatal withdrawal symptoms from maternal use of drugs of addiction" (ICD-10 code P96.1) were flagged as having Neonatal Withdrawal Syndrome.

Child protection and out-of-home care information including reason for removal/report issue prior to entry into care, placement characteristics (number, reason, type and purpose of placement), number of periods of care, and age of entry were obtained from the DCJ child protection and out-of-home care dataset. Type of maltreatment at first entry to care refers to the predominant issue that the children were reported with prior to their first entry into care (considers the child maltreatment issues- physical, sexual, neglect, psychological and child risk- and determines the issue with the highest percentage). Type of maltreatment was considered as 'mixed maltreatment' if the predominant issue with highest percentage was tied or the percentage was <50 %. Child Disability (Disability) was also retrieved from the DCJ out-of-home care data, recorded from the latest updated data available from the DCJ's client information system (June 2019). Disability could have been recorded at any point of children's interaction with DCJ up to June 2019; however, it is included in the study as it is considered relevant to developmental vulnerability for children during the period of their care involvement. The disability indicator included identified disability of mental (Intellectual, developmental delay, autism and attention deficit disorders) and body functions (speech, neurological, acquired brain injury, vision, hearing and physical). Carers' characteristics and information at wave 1 on contacts with birth family were available in the POCLS interviews to carers and young people.

Two standardised measures were used from the POCLS assessments at wave 1 as baseline measures for children's cognitive and socio-emotional development: (i) the Ages and Stages Questionnaire (ASQ) and (ii) the Brief Infant Toddler Social Emotional Assessment (BITSEA) (NSW Department of Communities and Justice, 2020b). The ASQ is an internationally used and validated screening tool to assess children's developmental delays which is completed by carers. It collects information in five domains to assess physical health and non-verbal ability (personal-social skills, problem solving skills, communication skills, gross and fine motor skills) for children aged from 9 to 66 months old. For each domain, the suggested cut offs for ASQ scores are: 'typical' if the score is within 1

standard deviation (SD) below the mean; and ‘at-risk’ if >1 (which includes ‘needing monitoring’ if between 1 and 1.5 SD below the mean; ‘clinical’ if between 1.5 and 2 SD below the mean; and ‘needing intensive services’ if the score is >2 SD below the mean). The BITSEA is a screening tool for socio-emotional/behavioural problems (Problem scale) and delayed competence development (Competence scale), which is also completed by carers and records information for children between 9 and 35 months old. The BITSEA is standardised in a percentile rank, if the child scores at the 75th percentile or above in the problem scale and/or below the 15th percentile in the Competence scale their score is considered in the possible delay range. To ensure consistency across the standardised measures, BITSEA scores cut offs were also defined as ‘typical’ (1SD below the mean) and ‘at risk’ (more than 1SD below the mean).

Information on services received by the study child since they were placed in care (child health and development services “Attendance by study child since placement”) was retrieved from the POCLS carer interview. Services considered in this study are detailed in the section below. Additionally, information on carers identifying whether the child was diagnosed by health professional for any developmental delay (“condition lasted or expected to last 6 months or more and have been diagnosed by a health professional”) in the domains of cognitive/language development, emotional/social/behavioural/nervous difficulties; and physical development was also included in the analysis.

To investigate the likelihood of infants receiving professional services for developmental delay, a group of POCLS variables identifying children in our cohort receiving professional services were used. Given that we were interested in analysing, more broadly, service provision for those with developmental needs, all services received that address developmental needs (behavioural management services, early intervention, neurologist, occupational therapist, physiotherapist, counselling or psychologist, and speech pathology service) since placement were aggregated in a single variable, coded 1 if any service was received and 0 otherwise. Unfortunately, we could not examine whether Aboriginal children were accessing Aboriginal specific services as this was not collected in the data; however, 40 % of Aboriginal children did attend the Aboriginal Medical Service (which provide holistic and culturally appropriate medical services for Aboriginal and Torres Strait Islander people).

2.4. Analysis

The vast information available from the POCLS interview at wave 1 and linked data allowed for a thorough descriptive analysis of children who entered care as infants (overall and by Aboriginality). Descriptive statistics of children’s health outcomes and their results in the BITSEA and ASQ standardised measures were investigated. This information enabled us to identify children who were potentially developmentally vulnerable by the standardised measures and criteria in Table 1. Additionally, children born preterm, low birth weight and with neonatal withdrawal syndrome are shown to be at greater risk of developmental vulnerability (Fill et al., 2018; Schieve et al., 2016). Therefore, children were also identified as developmental vulnerable using health-related variables in Table 1.

As a result, two indicator variables identifying infants with developmental vulnerability were derived using the variables described above. First, a developmental vulnerability indicator was created grouping only children who were identified by the standardised measures as developmentally vulnerable (numbered points 1 and 2, Table 1). Second, an additional measure was created grouping children who were identified by the health-related variables as being preterm, low birth weight, and/or hospitalised as preterm and/or with neonatal withdrawal syndrome (numbered points 3 to 6, Table 1).

Simple and multiple logistic regression analyses were conducted to investigate the likelihood of infants receiving professional services for developmental delays since placement. Both developmental vulnerability indicators, grouping a number of risk factors and/or measures of children’s developmental needs, enabled us to conduct an aggregated risk assessment of the likelihood of receiving services by children who were identified as potentially vulnerable; however, each component was also analysed separately. A number of child, care and placement related variables were tested in the bivariate analysis (carers’ age at interview; contact with birth family; placement type at interview; predominant placement type in first period of care; carer’s Aboriginal status; carer reports on caseworker explaining care plan, health plan and cultural plan; duration of first period of care; predominant type of maltreatment in first period of care; etc), however no significant results were found, and these variables were excluded from the analysis. The multiple regression models included sex, Aboriginality, socio-economic status (Table 3, M1) and child disability indicator (Table 3, M2) as covariates in the

Table 1
Indicators of developmental vulnerability.

Developmental vulnerability indicators	
Standardised measures	Criteria
1. Ages and stages questionnaire	Identified as ‘at risk’ (1SD below the mean), requiring ‘monitoring’, ‘clinical’ and/or ‘intensive services’ in any of the ASQ domains (Problem-solving, Communication, Personal Social, Fine and Gross motor skills).
2. Brief infant toddler social-emotional assessment	Identified as ‘at risk’ (1SD below the mean), having problems/delay in the BITSEA (Competence scale and/or Problem scale).
Health-related variables	
3. Gestational age < 37 weeks (preterm)	
4. Birth weight < 2500 g.	
5. Identified as preterm in the hospitalisation data.	
6. Identified as having neonatal withdrawal syndrome in the hospitalisation data.	

models.

3. Results

There were 474 children who entered out-of-home care as infants (aged <1 year) who participated in wave 1 of the POCLS study and were linked to hospital and perinatal data. There was a fairly even distribution of females to males (49 % to 51 %) and a higher proportion of non-Aboriginal (60 %) children compared to Aboriginal children (40 %). However, there was an over-representation of Aboriginal children compared to the NSW population, where Aboriginal children aged 0–4 years in 2011 comprise 6.6 % of all NSW 0–4 years old children (Australian Bureau of Statistics, 2011). There was overall a high proportion (40 %) of children living in highly socio-economic disadvantaged areas, and this percentage was higher (46 %) for Aboriginal children (Appendix Table 1).

Close to 70 % of infants entered care before 13 weeks of age, with 5 % entering as newborns (under 1 week) and 42 % within 4 weeks of birth. The most common maltreatment type prior to first entry to care was mixed maltreatment (45 %), physical abuse (28 %) and neglect (22 %); this was similar for both Aboriginal and non-Aboriginal infants. Approximately 60 % of all infants were placed in foster care (predominant placement at first period of care), with 32 % of non-Aboriginal and 28 % of Aboriginal infants placed in kinship care. For 85 % of infants, the purpose of the first placement at the time of the interview was for permanent care (Appendix Table 2).

In terms of birth outcomes, almost one in four were preterm (20 % low gestational age and 24 % preterm in APDC), one in five were low birth weight and 9 % had a diagnosis of neonatal withdrawal syndrome. One-sixth of all infants in the study cohort were identified as having a disability ($n = 77$), with the most prevalent type being developmental disability (49 %), autism (8 %) and intellectual disability (8 %).

The standardised measure on which the children were assessed, the Ages and Stages Questionnaire (ASQ), identified 66 % of children as ‘at risk’ in at least one ASQ domain. The proportion identified as ‘at risk’ for each specific domain included: 35 % for problem-solving domain; 28 % for communication domain; 30 % for personal-social; 35 % for fine motor skills; and 29 % for gross

Table 2
Children identified as potentially developmentally vulnerable in the POCLS.

		Overall		Non-aboriginal		Aboriginal	
		N	%	N	%	N	%
N		474	100.0	285	60.1	189	39.9
BITSEA - at risk							
	Yes	97	20.5	58	20.3	39	20.6
	No	377	79.5	227	79.6	150	79.4
ASQ - at risk							
	Yes	311	65.6	194	68.1	117	61.9
	No	163	34.4	91	31.9	72	38.1
Preterm in HMDS (ICD10-P07)							
	Yes	112	23.6	65	22.8	47	24.9
	No	362	76.4	220	77.2	142	75.1
NWS in HMDS (ICD10-P96.1)							
	Yes	43	9.1	29	10.2	14	7.4
	No	431	90.9	256	89.8	175	92.6
Gestational age < 37 weeks							
	Yes	97	20.5	57	20.0	40	21.2
	No	377	79.5	228	80.0	149	78.8
Birth weight < 2500 g							
	Yes	100	21.1	59	20.7	41	21.7
	No	340	71.7	208	73.0	132	69.8
Developmentally vulnerable - derived variables							
Developmentally Vulnerable - Health variables							
	Yes	173	36.5	105	36.8	68	36.0
	No	301	63.5	180	63.2	121	64.0
Developmentally Vulnerable - Standardised measures							
	Yes	331	69.8	206	72.3	125	66.1
	No	143	30.2	79	27.7	64	33.9
Developmental delay – POCLS							
Developmental delay identified by carer and diagnosed by a health professional							
	Yes	57	12.0	35	12.3	22	11.6
	No	417	88.0	250	87.7	167	88.4
Receiving professional services related to developmental delay*							
	Yes	83	17.5	48	16.8	35	18.5
	No	391	82.5	237	83.2	154	81.5

* Includes: Behavioural management services, Early intervention, Occupational Therapist, Counselling or a psychologist, Physiotherapist, Speech pathology service.

motor skills. For the Brief Infant Toddler Socio Emotional Assessment (BITSEA), 20 % of children were identified as ‘at risk’, with 13 % considered as at risk of having delays in the competence scale and 13 % as ‘at risk’ in the socio-emotional or behavioural problems scale.

Interestingly, 79 % of those identified as vulnerable by the BITSEA were also flagged as ‘at risk’ by the ASQ, but only a quarter of those at risk on the ASQ were also at risk on the BITSEA (Appendix Table 3). Within the health-related variables, 94 % of those identified as of low gestational age and 81 % of those of low birth weight were also flagged as preterm in the APDC. Finally, 90 % of children with a disability were identified as at risk by the standardised measures. The full cross-tabulation of each component of the developmental vulnerability indicators is shown in Appendix Table 3.

As shown in Table 2, 70 % of children who entered care as infants were identified as developmentally vulnerable at wave 1 interview as per the standardised measures, 36 % were ‘at risk’ using the health related indicator, and only 12 % were identified by carers as having a diagnosis by a health professional for developmental delay. Fig. 1 displays a Venn diagram of the interaction of the four main indicators identifying children’s developmental vulnerability. Over 32 % of children in the study were only identified as developmentally vulnerable by standardised measures, 11 % only by the health-related variables, and a small proportion were only identified by carers report or by the child disability indicator only. Almost one in five (19 %) were identified by both the standardised and health measures only, and 2 % of infants were identified by the four indicators. As evident in Fig. 1, most children identified by the health measures were also identified as ‘at risk’ by the standardised measures; however, the opposite wasn’t true. This was a similar proportion for both Aboriginal and non-Aboriginal infants.

In regards to service provision since placement for those who entered care as infants, 17.5 % of children in care were receiving services related to developmental delays as reported in the Wave 1 interview. The service provision predominantly reported was Speech Pathology and Physiotherapy (Appendix, Table 4). Service provision was higher for those identified as developmentally vulnerable by the standardised measures than by the health measures (20 % cf. 15 %) (Fig. 2) (this was similar across both Aboriginal and non-Aboriginal children). Half (53 %) of children identified as having a disability received professional services for developmental delay, as well as 60 % of those identified by carers as having a diagnosis of developmental delay. However, only 12 % of children not identified by carers were receiving services. Carers who were not receiving services for infants who were diagnosed with developmental delay reported that the main barrier to receiving professional support was long waiting lists.

Single and multiple logistic regression models were used to investigate the odds of children who entered care as infants receiving professional services for developmental delay (Table 3). Multiple models were conducted including the two developmental vulnerability indicators with child sex, Aboriginality, socio-economic status and child disability as covariates. The developmental vulnerability indicators components were investigated separately to address potential collinearity between components. In the adjusted model including all covariates except child disability (Table 3, M1), being identified as ‘at risk’ by the ASQ was associated with a two times increased odds (OR: 2.09; 95%CI: 1.18–3.69) of receiving professional services for developmental delay compared to those identified as ‘typical’. Conversely, those identified as having neonatal withdrawal syndrome in the hospitalisation data were found to be less likely to receive services compared to other children. When including child disability in the multiple model (Table 3, M2) no risk factor for developmental vulnerability showed significant association with the likelihood of receiving services for developmental delay. It is worth noting that 90 % of children identified as having a disability were identified by the ASQ as developmentally vulnerable and were more likely to get services. However, not all children identified as developmentally vulnerable on the standardised measures were identified as having a disability; only 22 % of children identified as at risk by the ASQ were also identified as

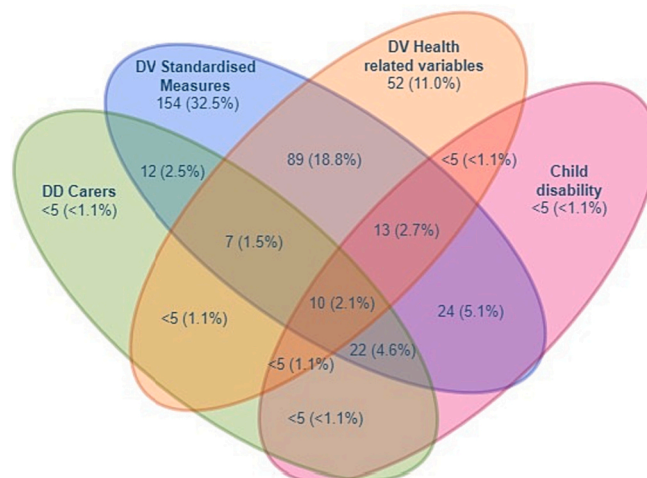


Fig. 1. Interaction between children identified as developmentally vulnerable by standardised measures, health related variables, child disability and/or identified by carers as diagnosed of developmental delay.

DV: Developmentally vulnerable; DD Carer: Developmental delay identified by carers as diagnosed by a health professional.

* < used to de-identify <5 count.

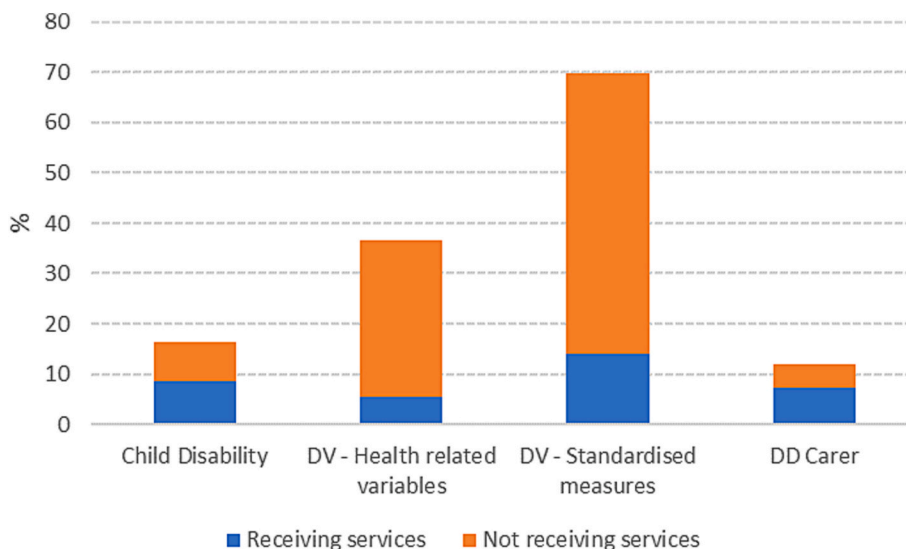


Fig. 2. Proportion of children identified as developmentally vulnerable by professional services provision for developmental delay. Children identified by standardised measures, health related variables, child disability and identified by carers as diagnosed of developmental delay. DV: Developmentally vulnerable; DD Carer: Developmental delay identified by carers as diagnosed by a health professional. Note: Services included: Behavioural management services, Early intervention, Occupational Therapist, Counselling or a psychologist, Physio-therapist, Speech pathology service.

Table 3
Odds of receiving professional services for developmental delay.

	Simple OR (95%CI)	Multiple 1 OR (95%CI)	Multiple 2 OR (95%CI)
BITSEA - at risk	1.91 (1.12–3.26)*	1.72 (0.99–2.99)	1.34 (0.72–2.47)
ASQ - at risk	2.13 (1.21–3.73)*	2.09 (1.18–3.69)*	1.27 (0.68–2.35)
Preterm in HMDS (ICD10-P07)	1.30 (0.76–2.22)	1.36 (0.79–2.35)	1.21 (0.66–2.21)
NWS in HMDS (ICD10-P96.1)	0.21 (0.05–0.89)*	0.22 (0.05–0.92)*	0.31 (0.07–1.35)
Gestational age < 37 weeks	1.29 (0.74–2.27)	1.36 (0.76–2.42)	1.16 (0.61–2.20)
Birth weight < 2500 g	1.38 (0.79–2.41)	1.43 (0.81–2.54)	1.34 (0.72–2.50)
Developmental vulnerability indicator - Standardised measures	2.01 (1.12–3.62)*	1.99 (1.10–3.60)*	1.26 (0.67–2.39)
Developmental vulnerability indicator - health related variables	0.76 (0.46–1.26)	0.78 (0.47–1.31)	0.80 (0.46–1.41)

M1: Includes Sex, socio-economic status and Aboriginality as covariates;

M2: Covariates in M1 and child disability

NWS: Neonatal Withdrawal Syndrome

Standardised Measures – BITSEA: Brief Infant Toddler Social Emotional Assessment, ASQ: Ages and Stages Questionnaire

Health related variables – pre-term birth, NWS, gestational age < 37 weeks, low birth weight.

* $p < 0.05$.

having a disability (Appendix, Table 3).

Additionally, two separate models were used to investigate the likelihood of receiving services for those identified as ‘developmentally vulnerable’ using the health and standardised measures indicators. We found that the odds of receiving services for children identified as ‘at risk’ by the standardised measures were not different for those identified as ‘typical’, when including all covariates in the model (Table 3, M2). Similarly, odds of receiving services for children identified as developmentally vulnerable only by the health variables was not significantly different compared to other children.

4. Discussion

Our study found that a high proportion (70 %) of POCLS children who entered care as infants were assessed as developmentally vulnerable at wave 1 of the interview and this was similar for both Aboriginal and non-Aboriginal infants. Those identified as developmentally vulnerable included children who were born pre-term or of low birth weight (21–29 %) which is double to triple the proportions found in the general population at 8.7 % preterm and 6.7 % low birth weight (Australian Institute of Health and Welfare, 2020). Almost 10 % of infants in our study had a diagnosis of neonatal withdrawal syndrome, which is much higher than the 0.32 % (3.2 per 1000 births) found in 2011 in the NSW population (Uebel et al., 2016). It is also higher than the proportion of infants in care

diagnosed with this syndrome found in a USA by Prindle et al. (Prindle et al., 2018), and comparable to the percentage found by Lynch et al. (Lynch et al., 2018). Note that children diagnosed with neonatal withdrawal syndrome are found to be more likely of entering care compared to other children (O'Donnell et al., 2009). There was also a large proportion of infants brought into care who were diagnosed with a disability, at 16 %, which was higher than the 7 % of children aged 0–14 with disability in the Australian population, reported in 2018 by the Australian Bureau of Statistics (Australian Bureau of Statistics, 2019).

Standardised assessments at wave 1 indicated high levels of developmental vulnerability. The Ages and Stages Questionnaire (ASQ) which is a globally recognised developmental screening tool found that 66 % of the children in the cohort were assessed as 'at risk' of developmental delay (Guevara et al., 2013). One in five infants were assessed as having social-emotional problems using the Brief Infant Toddler Social Emotional Assessment (BITSEA) which is an effective tool to detect early psychosocial problems (Kruizinga et al., 2015). Given the evidence that early intervention with children who exhibit developmental delays and social-emotional issues is critical for optimising outcomes, screening infants in this high risk group provides an important opportunity to address their needs during this important period of development (Smythe et al., 2020).

Most of the children identified on health indicators as developmentally vulnerable were found to be at risk on the developmental assessments. However, there was a greater number of children who were assessed as at-risk on the standardised measures who would not have been identified by the health indicators at birth. The small proportion of children identified as having a diagnosed developmental delay in the first wave compared to those identified as at-risk on the developmental assessments may indicate that many of the children may not have undergone health professional assessments for diagnosis or that their developmental concerns did not reach the threshold of a formal diagnosis. Similarly, the low proportion of children with neonatal withdrawal syndrome receiving services may suggest the lack of health professional assessment. Mothers with substance use issues are less likely to seek prenatal and postnatal care (Simmons & Austin, 2022), which may have contributed to difficulties of identification of these children and low proportion receiving services. In most states best practice is that children entering care undertake assessments to identify and plan for their health needs. Standardised assessments such as the ASQ may be included and are useful for identifying developmental concerns. In 2010 NSW implemented the Out-of-Home Care Health Pathway program, which ensures that all children who enter care receive a health assessment and management plan including information about their health needs and the services required to meet these needs (New South Wales Government, 2021; NSW Ministry of Health, 2014). It is important that a child's caseworker and carer obtain a copy of their Health Management Plan and implement it together.

Unfortunately, only 17.5 % of children were receiving developmental services at Wave 1 which is much lower than the 70 % who were identified as being developmental vulnerable according to the standardised assessments. However, a positive finding was that if the carer did identify that the child was diagnosed for any developmental delay there was a large proportion receiving services (60 %). The concern is that only 20 % of children identified on the standardised measure and 15 % of those identified by the health indicator as developmentally vulnerable were receiving services. Meeting the needs of these children is an issue that still needs to be addressed in casework practice. Not all carers would have sufficient knowledge and skill to identify infant developmental vulnerability, therefore the role of caseworkers is essential in working with carers to discuss developmental milestones. Caseworkers also play an important role in working with carers to implement the out-of-home care Health program. This includes ensuring children's health management plans are implemented and reviewed. For children with a diagnosis of developmental delay who were not receiving services, one of the main reasons noted by carers was waiting lists which is an indication of the challenges of service availability.

Given the overwhelming evidence of poor outcomes for children in out-of-home care and the understanding that there is a high level of developmental vulnerability in infants entering care, it is essential that the identification of developmental vulnerability and outcomes are optimised through service provision (Gypen et al., 2017). There is also a role in ensuring carers are well-supported to enable children's needs to be met. The early years is an important period which provides the foundation for an individual's mental and physical health, educational achievement, work participation, and overall wellbeing (Shonkoff et al., 2012). Given the adversity that children identified as requiring child protection intervention are exposed to, it is imperative that sustained effort is made to provide early intervention to address developmental vulnerabilities.

4.1. Study limitations

As the data utilised in this study are from an interview to carers of children who entered care there is a risk of bias from non-response in participants (Wulczyn et al., 2017). However, no significant differences in demographics and health outcomes at birth were found between infants included in this study and those who were placed in care in the same period but did not participate in POCLS. In addition, the majority of children in this study were on final orders through the NSW Children's Court and are therefore not representative of all children who are in care. As investigated by the NSW DCJ technical report, children on 'final orders' differed significantly from other children in care but 'not on final orders' in various aspects as demographics, child protection involvement and placement history (NSW Department of Communities and Justice, 2020a). This study also only investigated children in formal care placements, not including children in any other type of placement such as informal care arrangements, given that data on this type of placement was not available. In regards to our analysis of service provision for children, this was based on carers' reporting of services and not the service providers themselves, therefore there could be bias or inaccuracy in carer reporting. Developmental assessments used in this study (ASQ and BITSEA) are standardised screening tools for children, but unfortunately these assessments are not separately standardised for Aboriginal children which may impact on their cultural validity. Previous research has suggested that the disproportionate rate of Aboriginal children with developmental issues might be related to the multiple disadvantages faced by these children, but also due to the use of tools that have not been developed and validated in this population and may not be culturally appropriate (Chando et al., 2020; Cibralic et al., 2022; Simpson et al., 2016). While there are limitations, there are also strengths in that

the study uses a mixed methods design of linked administrative health and child protection data, as well as questionnaire and standardised assessments of the children. This allows us to report on both diagnoses that the children may receive as recorded in the administrative data, as well as views of carers and caseworkers and the objective standardised assessments. This enables an investigation of the different evidence that can inform both policy and practice within child protection.

The results include data collected from Aboriginal children and families. Interpretation of the data should consider the factors associated with the over-representation of Aboriginal children in child protection and out-of-home care including the legacy of past policies of forced removal and the intergenerational effects of previous forced separations from family and culture. This erosion of community and familial capacity over time needs to be considered in any reform efforts as it continues to have a profoundly adverse effect on child development. The implications for policy and practice should highlight strengths, develop Aboriginal-led solutions and ensure that better outcomes are achieved for Aboriginal people.

5. Conclusion

Future research should investigate the developmental pathways of these infants to determine the long-term trajectories and the impact of interventions if provided. This will provide further evidence as to the impact of early intervention for this group of high-risk infants and inform practice efforts in this area. The findings from this study point to the importance of developmental assessment of children who enter care as infants and the identification of developmental vulnerability and delays. The provision of early intervention services is essential for this group of high-risk infants and will be important in optimising their health, as well as social and emotional outcomes.

Funding

Funding was provided for this study by the NSW Department of Communities and Justice.

Ethical approvals

Ethical approval was obtained from the University of NSW Human Research Ethics Committee (approval number HC10335 & HC16542); Aboriginal Health and Medical Research Council of NSW Ethics Committee (approval number 766/10); and the NSW Population & Health Services Research Ethics Committee (Ref: HREC/14/CIPHS/74 Cancer Institute NSW: 2014/12/570).

Declaration of competing interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability

The data that has been used is confidential.

Acknowledgements

We would like to acknowledge the Pathways of Care Longitudinal Study working group who provided the data and technical support for the study as well as the children, young people and caregivers who participated in the study. We would like to acknowledge the NSW Department of Communities and Justice who provided funding to support this study.

Appendix A. Appendix

Appendix Table 1

Infants' socio-demographic characteristics.

	Overall		Non-aboriginal		Aboriginal	
	N	%	N	%	N	%
Infants	474	100	285	60.1	189	39.9
Sex						
<i>Female</i>	234	49.4	136	47.7	98	51.8
<i>Male</i>	240	50.6	149	52.3	91	48.1
SES 2011						
1 (high disadvantage)	94	19.8	50	17.5	44	23.3
2	104	21.9	55	19.3	49	25.9
3	156	32.9	90	31.6	66	34.9

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Appendix Table 1 (continued)

	Overall		Non-aboriginal		Aboriginal	
	N	%	N	%	N	%
4	60	12.7	45	15.8	15	7.9
5 (low disadvantage)	44	9.3	37	13.0	7	3.7
missing	16	3.4	8	2.8	8	4.2
Child disability						
Yes ^a	77	16.2	41	14.4	36	19.1
No	397	83.8	244	85.6	153	80.9
Birth weight						
≥2500 g	100	21.1	59	20.7	41	21.7
≥ 2500 g	340	71.7	208	73.0	132	69.8
missing	34	7.2	18	6.3	16	8.5
Gestational age						
≥37 weeks	97	20.5	57	20.0	40	21.2
>37 weeks	377	79.5	228	80.0	149	78.8
Maternal age at birth						
<20	69	14.6	37	13.0	32	16.9
20–29	213	44.9	127	44.6	86	45.5
30–39	136	28.7	86	30.2	50	26.5
40+	22	4.6	17	6.0	5	2.6
missing	34	7.2	18	6.3	16	8.5

^a Includes mental and body functions.

Appendix Table 2

Infants' care placement characteristics.*

	Overall		Non-Aboriginal		Aboriginal	
	N	%	N	%	N	%
Infants	474	100	285	60.1	189	39.9
Age at entry to care						
Newborn	23	4.8	13	4.6	10	5.3
1 to 3 weeks	174	36.7	103	36.1	71	37.6
4 to 12 weeks	127	26.8	83	29.1	44	23.3
13 to 25 weeks	65	13.7	44	15.4	21	11.1
26 to 38 weeks	37	7.8	10	3.5	27	14.3
39 weeks and over	48	10.1	32	11.2	16	8.5
Reason for removal/report issue prior to entry into care						
Physical	133	28.1	81	28.4	52	27.5
Sexual	<10	<2.0	<5	<2.0	<5	<3.0
Neglect	105	22.1	61	21.4	44	23.3
Psychological	<10	<2.0	<10	<4.0	<5	<3.0
Child risk issues	<5	<1.0	<5	<2.0	<5	<3.0
Mixed	213	45.0	126	44.2	87	46.0
missing	<10	<2.0	<10	<4.0	<5	<3.0
Placement type						
Foster Care	293	61.8	172	60.3	121	64.0
Relative and Kinship Care – Aboriginal	29	6.1	<5	<2.0	<30	<16.0
Relative and Kinship Care – Non-Aboriginal	115	24.3	90	31.6	25	13.2
Parents	8	1.7	<10	<4.0	<5	<3.0
Others	29	6.1	17	6.0	12	6.3
N of distinct placements first period of care						
Mean (SD)	2.9 (1.9)		2.7 (1.8)		3.1 (2.0)	
Duration of first period of care (days)						
Mean (SD)	1123 (492)		1137 (487)		1096 (505)	
Had a second period of care						
Number	17	3.6	9	3.2	8	4.2
Mean age (years) at 2nd period of care (SD)	0.9 (1.6)		0.9 (1.5)		1.00 (1.8)	
Purpose at current placement at interview						
Adoption	<10	<2.0	8	2.8	<5	<3.0
Emergency care	22	4.6	15	5.3	7	3.7
Facilitate assessment	<5	<1.0	<5	<2.0	<5	<3.0
Pending court decision	<10	<2.0	<5	<2.0	5	2.6
Permanent care	403	85.0	236	82.8	167	88.4
Transition to adoption	<5	<1.0	<5	<2.0	<5	<3.0
Transition to permanent care	13	2.7	<10	<4.0	<5	<3.0
Transition to restoration	8	1.7	6	2.1	<5	<3.0
Other	<5	<1.0	<5	<2.0	<5	<3.0

(continued on next page)

Appendix Table 2 (continued)

	Overall		Non-Aboriginal		Aboriginal	
	N	%	N	%	N	%
POCLS carer interview						
Carer sex						
Female	439	92.6	267	93.7	172	91.0
Male	35	7.4	18	6.3	17	9.0
Carer's age at interview						
≤40 years	148	31.2	79	27.7	69	36.5
41–50 years	201.00	42.4	119.00	41.7	82	43.4
51–60 years	92.00	19.4	61.00	21.4	31	16.4
≥61 years	<20	<5.0	<20	<7.0	<10	<5
missing	<5	<1.0	<5	<2.0	<5	<3.0
Contact with mother						
Yes	379	80.0	242	84.9	137	72.5
No	95	20.0	43	15.1	52	27.5
Contact with father						
Yes	244	51.5	151	53.0	93	49.2
No	230	48.5	134	47.0	96	50.8
Placement type at interview						
Foster care	274	57.8	163	57.2	111	58.7
Relative/kinship care	200	42.2	122	42.8	78	41.3
Carer's Aboriginal status						
Aboriginal	96	20.2	<5	<2.0	>90	>45.0
non-Aboriginal	378	79.7	>250	>98.0	>90	>45.0
Caseworker explained to carer						
Care plan	216	45.6	124	43.5	92	48.7
Health plan	182	38.4	111	39.0	71	37.6
Cultural plan	57	12.0	–	–	57	30.2

* > and < used to de-identify <5 counts.

Appendix Table 3
 Crosstabulation of POCLS developmental vulnerability and delay measures analysed.*

	Total	BITSEA – at risk		ASQ – at risk		Preterm in APDC		NWS in APDC		Gestational age < 37 weeks		Birth weight < 2500 g		Child Disability		Developmentally vulnerable – Health indicator		Developmentally vulnerable – Standardised measures		Developmental delay Identified by carer as diagnosed		Receiving professional services for developmental delay	
	N	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
BITSEA – at risk	97	–	–	77	79.4	21	21.6	9	9.3	19	19.6	20	20.6	26	26.8	33	34.0	97	100.0	23	23.7	25	25.8
ASQ – at risk	311	77	24.8	–	–	76	24.4	30	9.6	66	21.2	67	21.5	69	22.2	114	36.7	311	100.0	51	16.4	65	20.9
Preterm in APDC (ICD10-P07)	112	21	18.7	76	67.9	–	–	<5	<5.0	91	81.2	81	72.3	22	19.6	112	100.0	81	72.3	15	13.4	23	20.5
NWS in APDC (ICD10-P96.1)	43	9	20.9	30	69.8	<5	<15.0	–	–	<5	<15.0	<5	<15.0	<5	<15.0	43	100.0	30	69.8	<5	<15.0	<5	<15.0
Gestational age < 37 weeks	97	19	19.6	66	68.0	91	93.8	<5	<5.0	–	–	75	77.3	20	20.6	97	100.0	70	72.2	12	12.4	20	20.6
Birth weight < 2500 g	100	20	20.0	67	67.0	81	81.0	<5	<5.0	75	75.0	–	–	19	19.0	100	100.0	71	71.0	14	14.0	21	21.0
Child Disability ^{a,c}	77	26	33.8	69	89.6	22	28.6	<5	<7.0	20	26.0	19	24.7	–	–	25	32.5	69	89.6	35	45.4	41	53.2
Developmentally vulnerable – Health indicator	173	33	19.1	114	65.9	112	64.7	43	24.9	97	56.1	100	57.8	25	14.4	–	–	119	68.8	17	9.8	26	15.0
Developmentally vulnerable – Standardised measures	331	97	29.3	311	94.0	81	24.5	30	9.1	70	21.1	71	21.4	69	20.8	119	35.9	–	–	51	15.4	67	20.2
Developmental delay Identified by Carer as diagnosed	57	23	40.3	51	89.5	15	26.3	<5	<10.0	12	21.0	14	24.6	35	61.4	17	29.8	51	89.5	–	–	34	59.6
Receiving professional services for Developmental delay ^b	83	25	30.1	65	78.3	23	27.7	<5	<7.0	20	24.1	21	25.3	41	49.4	26	31.3	67	80.7	34	41.0	–	–

* > and < used to de-identify <5 counts.

^a Includes mental and body functions.

^b Includes: Behavioural management services, Early intervention, Occupational Therapist, Counselling or a psychologist, Physiotherapist, Speech pathology service.

^c Interpretation example: The interaction between Child Disability (row) and ASQ-at risk (column) can be interpreted as: 69 children were identified as having a disability and at risk in the ASQ, which represents 89,6 % of children with disability. The interaction between ASQ-at risk (row) and Child Disability (column) also shows that 69 children were identified as having a disability and at risk in the ASQ, however, this represents 22.2 % of children identified as at risk in the ASQ.

Appendix Table 4

Socio-emotional, communication and motor skills standardised measures by professional services related to developmental needs.*

	ASQ/BITSEA socio-emotional						ASQ/BITSEA communication and motor					
	Total		Non-aboriginal		Aboriginal		Total		Non-aboriginal		Aboriginal	
	N	%	N	%	N	%	N	%	N	%	N	%
Children identified as vulnerable	230		136		94		357		211		146	
Behaviour management services												
Yes	<5	<3.0	<5	<4.0	<5	<5.0	7	2.0	<5	<3.0	<5	<3.0
No	>200	>97.0	>100	>96.0	>80	>95.0	350	98.0	<250	<97.0	>140	<97.0
Early intervention												
Yes	<5	<3.0	<5	<4.0	<5	<5.0	<5	<1.0	<5	<2.0	<5	<3.0
No	>200	>97.0	>100	>96.0	>80	>95.0	>350	>99.0	>200	>99.0	>140	<97.0
Occupational therapist												
Yes	5	2.2	<5	<4.0	<5	<5.0	9	2.5	>5	>3.0	<5	<3.0
No	225	97.8	>100	>96.0	>80	>95.0	348	97.5	<250	<97.0	>140	<97.0
Counselling or a psychologist												
Yes	7	3.0	<5	<4.0	<10	<7.0	11	3.1	5	2.4	6	4.1
No	223	97.0	>100	>96.0	<100	<95.0	346	96.9	206	97.6	140	95.9
Physiotherapist												
Yes	12	5.2	<10	<7.0	<5	<5.0	17	4.8	10	4.7	7	4.8
No	218	94.8	>100	>96.0	>80	>95.0	340	95.2	101	47.9	139	95.2
Speech pathology service												
Yes	22	9.6	13	9.6	9	9.6	36	10.1	20	9.5	16	11.0
No	208	90.4	123	90.4	85	90.4	321	89.9	191	90.5	130	89.0

Note: ASQ/BITSEA socio-emotional includes those at risk in the ASQ-personal social domain and BITSEA-Problem scale; and ASQ/BITSEA communication and motor includes those at risk in the ASQ-communication, problem solving, fine and gross motor, and BITSEA-competence scale.

* > and < used to de-identify <5 counts.

Appendix Table 5

Number and proportion of infants who entered care between May 2010 and October 2011 in POCLS (and our study) and those not in POCLS. Demographic, health and key child protection characteristics.

	POCLS infants		Infants not in POCLS		Test of proportions
	n = 474		n = 533		
	N	%	N	%	p-Value
<i>Demographic characteristics</i>					
Sex (males)	240	50.6	291	54.6	0.209
Aboriginality (Aboriginal)	189	39.9	192	36.0	0.209
Maternal age at birth (20–29 years)	213	44.9	225	42.2	0.384
<i>Health outcomes</i>					
Disability (Yes)	77	16.2	72	13.5	0.222
Low birth weight (<2500 g)	100	21.1	99	18.6	0.316
Gestational age (<37 weeks)	97	20.5	101	19.0	0.546
Preterm in HMDS (Yes)	112	23.6	111	20.8	0.285
NWS in HMDS (Yes)	43	9.1	58	10.9	0.340
<i>Child protection</i>					
Age at first entry					
Newborn	23	4.9	29	5.4	0.674
1–3 weeks	174	36.7	132	24.8	0.000
4–12 weeks	127	26.8	158	29.6	0.316
Reason for removal/ report issue prior entry into care					
Physical	133	28.1	150	28.1	0.977
Neglect	105	22.2	114	21.4	0.769
Mixed	213	44.9	212	39.8	0.098
Placement type					
Foster care	293	61.8	288	54.0	0.012
Relative or Kinship care	144	30.4	162	30.4	0.996
Parents	8	1.7	67	12.6	0.000

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