

The intersection of developmental vulnerability and socioeconomic disadvantage on access to health care for preschool aged children: evidence for the inverse-care law

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Abstract

Aim. Children who are developmentally vulnerable have greater health needs. Socioeconomic disadvantage not only increases this risk of developmental vulnerability but can be associated with less access to health services. Our aim was to compare health services use in children aged 4-5 years in Australia with and without developmental vulnerability and consider the intersection of socioeconomic disadvantage on this relationship. **Method.** Cross sectional data were collected from Wave 3 of the Longitudinal Study of Australian Children birth cohort when the children were aged 4-5 years. A composite variable for developmental vulnerability was designed by combining those children who were in the lowest 15% in the physical, socioemotional and/or learning outcome indices. Children were then subgrouped according to developmental vulnerability and disadvantage based on socioeconomic position (SEP) quintile (derived from parental education, occupation, household income). We defined SEP 1 the lowest quintile as 'disadvantaged' and SEP quintiles 2-5 as 'not disadvantaged'. Multivariate regression was used to examine the intersection between health service use and developmental vulnerability and disadvantage using these composite variables. **Results** The total number of children with information on developmental vulnerability in Wave 3 was 3967 (90% of the sample). A total of 1292 (32.6%) children were classified as developmentally vulnerable. 30.6% of children who were developmentally vulnerable came from families who were disadvantaged. Overall children who were developmentally vulnerable were reported to use more specialist/hospital health services than those who were not developmentally vulnerable (10-25 % vs 5-16%). Children who were developmentally vulnerable and not disadvantaged were 1.4-2.0 times more likely to have reported using a GP, paediatrician, other specialist, and Emergency Department compared with children who were developmentally vulnerable and disadvantaged. **Conclusion** Preschool children who are developmentally vulnerable have a higher reported use of specialist and hospital services compared with those who are not developmentally vulnerable. There is evidence of an inverse care law; those who were not disadvantaged with and without developmental vulnerability are more likely to use health services compared with their counterparts who were disadvantaged.

Background

Developmental vulnerability includes a spectrum ranging from children who are less equipped for school compared with their peers through to children with significant neurodevelopmental disabilities. For example, between a fifth to a quarter of Australian preschool children have physical, socioemotional and learning difficulties that require additional support for school success.(1-4) These children are more likely to have poor educational outcomes in primary school and early high school. (5) As adults, these inequities widen, presenting as higher levels of morbidity and mortality, lower levels of academic achievement, poorer employment opportunities and less participation in society.(6-8) Children who are developmentally vulnerable also have additional health service needs including support for their parents/carers, specialist services for diagnostic assessment, and therapy such as speech pathology. (9) It is important that children who are developmentally vulnerable have their needs identified and receive these services early, preferably in the preschool years, in order to ameliorate, and in some cases prevent, adverse physical health, socio-emotional and learning outcomes(8). International research has found that children who are developmentally vulnerable across the spectrum of severity, despite their higher health care needs, are at greater risk of missing out on health services.(9, 10) Australian research would suggest that only a small proportion of children entering school with additional needs have accessed health care with parents citing a number of clear barriers such as waiting times and cost of services across the health care system.(1, 11, 12)

Socioeconomic disadvantage is both a risk factor for a child to be developmentally vulnerable and for inequitable access to health services. (13, 14) Children who experience socioeconomic disadvantage are 1.5 - 2 times more likely to be developmentally vulnerable than their more advantaged peers.(2, 5, 13, 15) Greater socioeconomic disadvantage is associated with less use of medical specialist services by all children in Australia. (16) Thus, when socioeconomic disadvantage and developmental vulnerability co-exist, this can result in the "inverse care law" where despite having greater health needs compared to their more advantaged peers, children who are both disadvantaged and developmentally vulnerable are the least likely to access the services they need.(17)

To date the research on inequitable access to health services tends to be siloed to either examining the inequities in health experienced by children who are developmentally vulnerable or the inequities in health experienced by children who are socioeconomically disadvantaged. In order to address this inverse care law so that all preschool aged children in Australia are equitably receiving health services, it is necessary to capture both the health needs of the children who are developmentally vulnerable compared with those who are not classified as developmentally vulnerable and the impact of if they are socioeconomically disadvantaged. Using data from the Longitudinal Study of Australian Children (LSAC) the aim of this study was to compare health services use in children aged 4-5 years in Australia with and without developmental vulnerability and consider the intersection with socioeconomic disadvantage on this relationship. We hypothesised that: children who were developmentally vulnerable would have a greater use of all health services compared to those who were not; and that children who were developmentally vulnerable and who were socioeconomically disadvantaged would have less access to health services compared to their more advantaged peers.

Methods

Subjects

Data were drawn from the LSAC B-cohort. The LSAC is broadly representative of Australian children, except for those living in remote areas. (18) The LSAC design, weighting and sampling methodology is well documented.(18, 19) In short, data were collected on children's development as well as family and community characteristics. The methodology for data collection included a complex survey design with multiple information sources (including parent interview, direct child assessments and observational measures, parent and teacher self-report questionnaires, and linkage to administrative datasets).

The birth cohort (B-cohort) commenced in May 2004 and consisted of 5107 infants (51.2% male).(19) Data were collected when children were aged 4-5 years (Wave 3; n=4386). At Wave 3, the B-cohort consisted of n=4386 children (88% Wave 1). The children more likely to be lost to follow up include those whose parents have less than a high school education, were born overseas or from more disadvantaged households and neighbourhoods.(20)

Exposure group

Developmental vulnerability

Developmental vulnerability was defined as children in LSAC at age 4-5 years in Wave 3 who were either in the bottom 15% of the LSAC Physical Outcomes Index, Socioemotional Outcomes Index and/or Learning Outcomes Index. These outcome indices, derived from validated tools (21), were developed and validated within LSAC for Waves 1–3, as a means of summarizing progress within the three developmental domains of health and physical development, social and emotional functioning and learning competencies. (21). Each index is a composite of direct measures of child and parent surveys and teacher rated standardised assessments. The Physical Outcomes Index in Wave 3 is an overall rating of physical health, special health care needs, weight and quality of life. The Socioemotional Outcomes Index is an overall rating of internalising and externalising behaviour and social competence. The Learning Outcomes Index is an overall rating of literacy, language and numeracy skills. The tools used have been well described in the LSAC protocol (21) A composite variable developmental vulnerability was designed by combining those children who were in the lowest 15% in the physical, socioemotional and learning outcomes indices. Any child in the bottom 15% for any of these outcome indices was deemed “developmentally vulnerable”.

Outcome measure

Health service use and need

Parent reported use of health services at 4-5 years of age was established for their child in the question “*In the last 12 months, have there been any of the services listed that the child has used?(yes/no)*”. These included primary health care services -maternal and child health nurse (MCHN) visits; General Practitioners (GPs); specialist services - speech therapy; paediatrician; other specialists; and hospital services – the Emergency Department (ED); hospital outpatient department (OPD); other medical services. These measures were combined as a composite for any health service use.

Risk Factors

Socioeconomic disadvantage

We examined socioeconomic position (SEP) when the child was 4-5 years of age (Wave 3) by using the composite variable provided in the LSAC datasets.(22) SEP was based on household income, parental education and occupation. In summary: parental income from all sources, was summed and log transformed; parental education level was based on numbers of years of education from 0 to a maximum of 20 years. Parents' occupations was based on current/most recent occupation based on a standardised tool developed by the Australian National University (ANU4) that groups occupations by skill and type from the Australian Standard Classification of Occupations.(22) The individual measures were standardised (mean of 0, SD of 1), summed, divided by the number of parents in the home; this score was re-standardised to produce a final continuous measure of SEP.(22) Past LSAC analysis have converted SEP into quintiles which were computed based on the distribution of SEP scores with cut-points applied(14). These groups were further categorised with SEP 1 being the lowest 20% and SEP2-5 being the other 80% of the sample. We define SEP 1 the lowest quintile as 'disadvantaged' and SEP quintiles 2-5 as 'not disadvantaged'.

Covariates

Other covariates included as potential confounders were: the child's sex, maternal country of birth and language spoken to the child other than English (LOTE) as defined by the Australian Bureau of Statistics (23, 24);and maternal relationship status at 4-5 years(Australian Institute of Family Studies derived variable) (25).

Statistical Analysis

Data analysis was in keeping with the recommendations for handling of LSAC survey data with weighting of Wave 3 for the multi-wave longitudinal survey design, and likelihood of selection bias due to recruitment and non-response. (20)

Estimates of the prevalence of developmental vulnerability were calculated with corresponding 95% confidence intervals. Univariate logistic regression was used to test for associations between developmental vulnerability in Wave 3 and child, parent, and family factors and health service use overall and for primary, specialist and hospital health services.

To examine the intersection between socioeconomic disadvantage and developmental vulnerability participants were categorised into the following 4 groups: developmentally vulnerable/disadvantaged; developmentally vulnerable/not disadvantaged; not developmentally vulnerable/disadvantaged; not developmentally vulnerable/not disadvantaged. Univariate logistic regression was used to test for associations between health service use overall and for primary, specialist and hospital health services and developmental vulnerability and socioeconomic disadvantage.

Multivariate regression was used to model the association between health service use overall and for individual health services and developmental vulnerability/disadvantage with covariates of sex, country of maternal birth, LOTE and maternal relationship status.

The analysis sample included the N=3967 Wave 3 B cohort participants that had information on developmental vulnerability as defined by the composite variable (bottom 15% physical, socioemotional and/or learning outcome indices). There was missing data on developmental vulnerability in 9.5% of the Wave 3 B cohort (Supplementary Table 1). All analyses were performed using Stata SE14 (StataCorp. College Station, TX).

Results

Participants

There were a total of n=4386 children in Wave 3 aged 4-5 years. This represented 88% of the Wave 1 sample. Of the children aged 4-5 years in the sample, just over half were male and 8% had a chronic disability/medical condition that had lasted at least 12 months. Of the families in the sample, 35% of mothers were born in a country outside of Australia, 15% spoke a language other than English at home, 29% were headed by a single parent and there was an even distribution of the sample across the SEP quintiles.

Developmental vulnerability

Of the children with information on developmental vulnerability, a total of 1292 (32.6%) children were “developmentally vulnerable”- 538 (42%), 509 (39%) and 610 (47%) children in the bottom 15% of the Learning Outcomes Index, Socioemotional Outcomes Index and Physical Outcomes Index, respectively. Participant characteristics of the developmentally vulnerable group are outlined in Table 1. Children who were developmentally vulnerable at age 4-5 years were significantly more likely to be boys. Families of developmentally vulnerable children were more likely to have a mother who was born outside of Australia, speak a language other than English at home, be single parent families, and be disadvantaged (in the lowest SEP).

Health service use and need in the last 12 months

Parents of 3403 (86%) children of the whole Wave 3 sample reported using a health service in the last 12 months. In terms of primary health care services this included 3119 (79%) who saw a GP and 538 (14%) who saw a MCHN. In terms of specialist services 517 (13%) saw a speech pathologist, 324 (8%) saw a paediatrician, 190 (15%) saw an “other specialist”. A total of 749 (19%), went to the ED, 251 (6%) went to the OPD, and 84(6%) went to an “other medical” service.

Health service use in the last 12 months according to developmental vulnerability (Figure 1)

The use of health services overall and GP services reported in the last 12 months was similar regardless of developmental vulnerability. When compared with children who were not developmentally vulnerable, significantly fewer children who were developmentally vulnerable were reported to have seen a MCHN. When compared with children who were not developmentally vulnerable, significantly more children who were developmentally vulnerable were reported to have seen a speech pathologist, a paediatrician, another specialist, an ED, outpatient service and/or other medical service. (Figure 1)

Use of any health services by developmental vulnerability and socioeconomic disadvantage

On univariate analysis, a significantly greater proportion of children who were not disadvantaged regardless of developmental vulnerability had parental report of using any health service in the last 12 months compared to the children who were developmentally vulnerable and disadvantaged. (Table 2) When primary health care service use was examined, a significantly greater proportion of children who were not disadvantaged regardless of developmental vulnerability had parental report of using a GP in the last 12 months compared to the children who were developmentally vulnerable and disadvantaged. There was no significant difference in the proportion of children reported to have used a MCHN between the children who were developmentally vulnerable and level of disadvantage. (Table 2)

When specialist health care service use was examined for children who were developmentally vulnerable, a significantly greater proportion of children who were not disadvantaged had parental report of using a paediatrician and /or other specialist compared to those who were disadvantaged. There was no significant difference in use of speech pathology services by children who were developmentally vulnerable with level of disadvantage. (Table 2) When hospital-based services were examined for children who were developmentally vulnerable, a significantly greater proportion of children who were not disadvantaged had parental report of using an ED compared to those who were disadvantaged. There was no significant difference in use of OPD and other medical services by level of disadvantage in children who were developmentally vulnerable. (Table 2)

On multivariate analysis children who were not disadvantaged, regardless of developmentally vulnerable had 1.6 to 1.8 times greater odds to have reported use of a GP than children who were developmentally vulnerable and who were not disadvantaged. Children who were developmentally vulnerable who were not disadvantaged had 1.4-2.0 times greater odds to have reported using a GP, paediatrician, other specialist, and ED compared with children who were developmentally vulnerable and were disadvantaged. (Table 3)

Discussion

In this study we set out to examine the intersection between developmental vulnerability and socioeconomic disadvantage on access to health services and to see if the inverse care law existed. We have demonstrated that consistent with their increased needs, preschool children who were developmentally vulnerable had a higher service use of specialist and hospital services compared to those who were not developmentally vulnerable. However, those children who were not disadvantaged were significantly more likely to have reported use of a paediatrician/other specialist and/or ED compared with those who were developmentally vulnerable and were disadvantaged. This is concerning given 30% of children who are developmentally vulnerable were in the disadvantaged group. Parents of children who were not disadvantaged, regardless of their child's developmental vulnerability, were more likely to report using a GP in the last 12 months. Thus, it appears that for Australian children there is an inverse care law in play, with those children with the greatest need having the least access to the health services they need.

In Australia at a federal level, there is a universal health coverage system where GPs, specialists and public hospital services for children are "bulk billed" to Medicare i.e. free of charge to the user. There is also a private health care system and GPs and specialists (e.g. speech pathologists, paediatricians) can charge an additional fee to the user on top of what is bulk billed on Medicare i.e. there it is an out of pocket expense for the user.(26) We found no difference in the use of GP services between preschool aged children in terms of developmental vulnerability with almost 80% of carers reporting their child using a GP in the last 12 months. Perhaps this is not surprising given the Australian Immunisation Schedule (27) has fully-funded 4 year old immunisations and the bulk of immunisation is done by GPs in Australia. However, given that children who are developmentally vulnerable have greater physical, socioemotional, and learning needs one would expect this group of children to have greater use of GPs compared to children who are not developmentally vulnerable. Australian GPs have reported that they are often bypassed in the care of children with chronic and complex conditions (28). Parents of children who have a disability report only using GPs for what they perceive to be simple problems (29).

Children who were not disadvantaged regardless of developmental vulnerability had 1.6 to 1.8 times greater odds of having reported use of a GP than children who were developmentally vulnerable and disadvantaged. This suggests that socioeconomic disadvantage plays a role in use of GPs in preschool aged children even when children have increased needs due to developmental vulnerability. This is in contrast to a recent paper examining GP attendance using Medicare linked data in children aged 0-11 years in the LSAC who found that there was no significant difference in GP use by socioeconomic position. (16) This paper examined household income as the measure of socioeconomic position whereas we used a composite measure that included education and occupation. One could argue that although the majority of Australian GPs do bulk bill using Medicare (30), socioeconomic disadvantage is a barrier to a child accessing a GP due to other out of pocket expenses, cultural barriers, and parental health literacy as reported by some service providers and parents (12, 31). If there was true equity we would expect that the highest proportion of children reporting use of a GP in the last 12 months would be children who were developmentally vulnerable and who were disadvantaged, because these children have the highest health and social needs.

Only a small minority (14%) of carers of all children aged 4-5 years reportedly saw a MCHN in the previous year. This is consistent with the drop off in attendance after 18 months reported in Australia (3). This represents a missed opportunity in detection of this developmental vulnerability and referral for early intervention in the 12 months prior to school which may impact on school readiness particularly for children who are developmentally vulnerable and disadvantaged.

In the group of children who were developmentally vulnerable, those who were not disadvantaged had 1.5 to 2 times greater odds of reporting using a paediatrician, and other specialists compared to those who were disadvantaged. This finding regarding reduced access to specialists in Australia is consistent with Medicare data for older children in LSAC (16). It has been well documented that there are long waiting lists to see publicly funded paediatricians and wide variation in billing and out of pocket expenses for private paediatricians (32). This is a concerning finding in terms of the important role that paediatricians play in diagnostic evaluation, assessment of underlying causes and comorbidity and access to funding schemes including Carer's Allowance, the National Disability Insurance Scheme and Australia's funding model to provide early intervention to children who are developmentally vulnerable (33). Previous international literature has also shown that health insurance status is linked to developmental vulnerability and access to services (2, 34). Further Australian research is required to explore these barriers in greater detail.

Limitations

This paper relies on parental report of use of services where there may be recall bias in that parents of children who have increased developmental vulnerability are more focussed on their children and their needs and therefore more likely to report use of a service. There may be also issues with parental health literacy in terms of parent's understanding and recall of what service they attended depending on their level of disadvantage. However, it is also important to understand a parent's perspective on their service use to inform health literacy promotion approaches.

Another limitation was the available sample for this study – Wave 3 B cohort with developmental vulnerability data represented a sample with differential attrition as those children and families most likely to be lost to follow up from cohort inception to those with developmental vulnerability data in Wave 3 were families culturally and linguistically diverse and socioeconomically disadvantaged. While this impacts on the generalisability of our findings, one would expect this attrition to result in an underestimate of the impact of socioeconomic disadvantage, thus making our findings even starker. It is also worth noting that the Wave 3 B cohort aged 4-5 years may no longer be representative of Australian children currently aged 4-5 years however this is the most up to date and complete data set of Australian children available in terms of their developmental vulnerability and disadvantage.

Conclusions

Equity in access to health care is not about an equal distribution of health service use across groups of children who are developmentally vulnerable. Rather, for true equity, there needs to be enhanced services (more intense or delivered differently or financial barriers removed) for children in the most at risk group – those children who are developmentally vulnerable and who are disadvantaged. Further qualitative research is required to understand the potential pathways through which socioeconomic disadvantage results in reduced use of health services. In response to this, we need to develop and evaluate innovative models of care that address the service needs of all children who are developmentally vulnerable.

Abbreviations

ED – Emergency Department

GP – General Practitioner

LOTE- Language other than English

LSAC – Longitudinal Study of Australian Children

MCHN- Maternal and Child Health Nurse

OPD – Outpatient Department

SEP – Socioeconomic Position

Declarations

Ethics approval and consent to participate

Ethical approval was granted to conduct this study by the Human Research Ethics Committee, Royal Children's Hospital, approval number 24051

Consent to publish

Not applicable

Availability of data and materials

All data used in this manuscript are available from the Longitudinal Study of Australian Children (<https://growingupinaustralia.gov.au/>).

Competing interests

None of the authors have any competing interests.

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Author's contributions

SW, CG, MC, HB, SG contributed to study design and conduct and acquisition of data, data analysis, interpreted analyses and drafted the initial manuscript. All authors were involved in revising the manuscript critically for important intellectual content and have given final approval of the version to be published.

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Tables

Table 1 Participant characteristics for the full sample and according to developmental vulnerability

Variable	Full sample in Wave 3 N (%)	Missing data n (%)	Developmental vulnerability n (%)	
TOTAL	4386	419 (9.5)	1292 (32.6)	2675 (76.4)
CHILD				
Sex	4386	419 (9.5)	1292	2675
male	2251 (51.3)		766 (59.3)	1284 (48.0)
female	2135 (48.7)		526 (40.7)	1391 (52.0)
PARENT				
COB	4375	417(9.5)	1289	2669
Not Australia	1545 (35.3)		488(37.9)	875(32.8)
Australia	2830 (64.7)		801 (62.1)	1794(67.2)
LOTE to child	4385	418 (9.5)	1292	2675
LOTE	672 (15.3)		238 (18.4)	330 (12.3)
No LOTE	3713 (84.7)		1054 (81.6)	2345 (87.7)
FAMILY				
Marital status	4346	415 (9.5)	1278	2653
single	1253 (28.8)		402 (31.5)	724 (27.3)
dual	3093 (71.2)		876 (68.5)	1929 (72.7)
SEP	4382	419 (9.5)	1290	2673
Q1 (lowest)	877 (20.0)		395 (30.6)	384 (14.4)
Q2	876(20.0)		272 (21.1)	517 (19.3)
Q3	877(20.0)		254 (19.7)	551 (20.6)
Q4	876 (20.0)		194 (15.0)	601 (22.5)
Q5	876 (20.0)		175 (13.6)	620 (23.2)

Table 2 - Use of health services by developmental vulnerability and socioeconomic disadvantage univariate analysis

Developmental vulnerability/ Disadvantage	Any health service n [% (95%CI)]	CFHN	GP	Speech Pathology	Paediatrician	Other specialist	OPD	ED	Other medical
Total N=3963	3400 [86(85-87)]	538 [14 (13- 15)]	3116 [79 (77- 80)]	517 [(13 (12-14)]	324 [8 (7-9)]	437 [11(10-12)]	251 [6 (6- 7)]	749 [19(18- 20)]	182 [5(4-5)]
Developmentally vulnerable/ disadvantaged N= 395	322 [81 (77-85)]	33 [9 (6-11)]	281 [71 (66- 75)]	78 [20 (16-24)]	42 [11(7-14)]	35 [9(6-12)]	37 [10(7- 13)]	81 [21(17- 25)]	18 [5(3-7)]
Developmentally vulnerable/ not disadvantaged N = 895	798 [89(87-91)]**	110 [12(10- 15)]	738 [82 (80- 85)]**	172 [19 (17-22)]	168 [(19(16- 21)]**	155 [17 (15- 20)]**	92 [10(8- 12)]	240 [27(24- 30)]	66 [7(6-9)]
Not Developmentally vulnerable/ disadvantaged N= 384	299 [78 (73-82)]	47 [13 (9-16)]	263 [68 (64- 73)]	34 [9 (6-12)]**	13 [4 (2-6)]**	24 [7 (4-9)]	25 [6(6- 7)]	68 [18(14- 22)]	14 [4(2-6)]
Not Developmentally vulnerable/ not disadvantaged N= 2289	1981 [86 (85-88)]*	348 [15 (14- 17)]**	1834 [80 (78- 82)]**	233 [10(9-11)]**	101 [4(4-5)]**	223 [10 (9-11)]	97 [4(3- 5)]**	360 [16(14- 17)]*	84 [4 (3-5)]

**p<0.001; * p<0.05

Figures

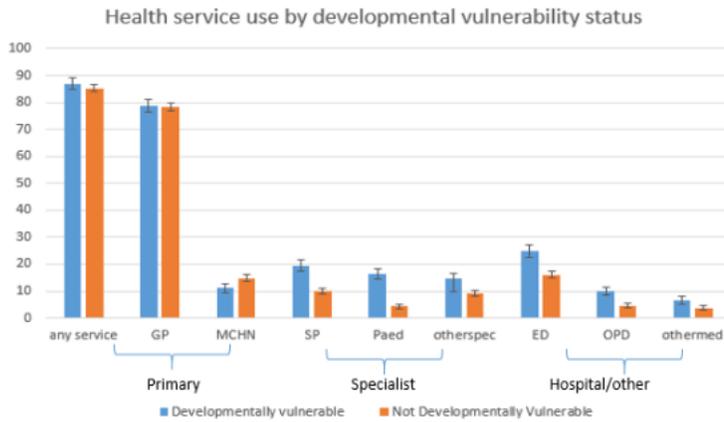


Figure 1

Health service use by developmental vulnerability status

Supplementary Files

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- [SupplementaryTable1WoofendevvulIndis.docx](#)