Socioeconomic disadvantage and onset of childhood chronic disabling conditions: a cohort study

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Keywords: Socioeconomic disadvantage; childhood chronic disabling conditions; cohort study

Word count: 2500

Abstract

Objective: To study the temporal relationship between socioeconomic disadvantage and onset of chronic disabling conditions in childhood.

Method: Using parent reported data from the Longitudinal Study of Australian Children, we compared children who developed a chronic disabling condition between the ages of 6/7 and 10/11 years with children without a chronic disabling condition at either age. Logistic regression models assessed association between onset of chronic disabling condition and household income quintiles at 6/7 years, adjusting for confounders. To study the consequences of chronic disabling condition onset for family finances, a linear regression model was fitted on change in household income adjusted for income at 6/7. We compared prevalence of family material hardship in the two groups between 6/7 and 10/11.

Results: Of 4010 children present in both waves, complete data were available for 3629 of which 233 (6.4%) developed a chronic disabling condition between 6/7 and 10/11. After adjustment for confounding, the children from the lowest income quintile were more than twice as likely to develop a chronic disabling condition as those from the highest income quintile. Onset of a chronic disabling condition was associated with a relatively smaller increase in household income over time, but no change in hardship prevalence.

Conclusion: Family socioeconomic disadvantage when children are aged 6/7 is associated with their development of a chronic disabling condition over the next four years, and with adverse effects on household income.

Word count 232

INTRODUCTION

Globally, an estimated 200 million children aged 0-17 experience a disability.[1] In high income countries, chronic disabling conditions (CDCs) affect up to 10 percent of children . [2] CDCs are a heterogenous group of conditions with diverse aetiologies and life-time courses combining genetic, biological and social-environmental factors. All conditions share some degree of functional disablement, leading to their grouping in the overall classification of childhood disability in the International Classification of Functioning – Children and Young People (ICF-CY) [3] and in definitions of disability used in the USA [4] and UK [5]. CDCs include mental health problems which are recognised as leading causes of disability. [6]

Although the association between family socioeconomic disadvantage and childhood CDCs is well documented, most research is cross-sectional. [7;8;9] It is not yet established whether socioeconomic disadvantage is on the causal pathway to childhood CDCs, or if socioeconomic disadvantage is a consequence of caring for a child with a CDC. Possibly, socioeconomic disadvantage is both a driver and a consequence of childhood CDC, leading to reciprocal, potentially compounding, relationships. Longitudinal studies exploring the temporal relationship of social disadvantage with disability are rare[10]. Blackburn et al's [11] study is an exception, finding increased odds of CDC onset in later childhood among children socioeconomically disavantaged in early childhood. However, they did not examine socioeconomic disadvantage arising as a consequence of CDC.

Socioeconomic disadvantage can be measured using low household income, absolute or relative poverty, or with proxies for low income such as unemployment, occupational class, educational level, or residence in disadvantaged areas . [12] More than 80% of empirical

studies on the relationship of socioeconomic status (SES) with childhood disability [13] used household income, poverty and maternal education (or some combination) to measure family socioeconomic disadvantage. Household income, in contrast to poverty, allows a social gradient to be identified and is useful forexamining change over time. By contrast, parental education is less subject to change, largely reflecting parents' own childhood social circumstances.

The present study, based on the *Growing Up in Australia*: Longitudinal Study of Australian Children (LSAC), aims to replicate and extend Blackburn et al's findings [11] in a different country setting. We first test if socioeconomic disadvantage, assessed by household income, precedes childhood CDC. A second analysis considers if socioeconomic disadvantage also occurs as a consequence. We compare families where a child develops a CDC, considering associations between risk for developing CDC and household income at age 6/7, as well as the associations between CDC onset and family income and material hardship four years later.

METHODS

This study uses data from the LSAC, a representative cohort study of 10,000 children and families, funded and managed by the Australian Department of Social Services (DSS) [14]. A two-stage clustered design was employed with Medicare enrolment and activity databases held by the Health Insurance Commission as sampling frames.

The study commenced in 2004 with two cohorts - families with 4-5 year old children (the K cohort) and families with 0-1 year old infants (the B cohort). Interviews took place in the family home with the main respondent, usually the mother (98.6%). For this study, we used

data from waves 2 and 4 of the LSAC K cohort when the children were 6/7 and 10/11 years of age respectively. The initial response rate for the K Cohort was 59%, of whom 83.3% responded at age 10/11. [15]

Study 1: Association of prior socioeconomic disadvantage CDC onset

Dependent variable: Chronic disabling conditions

Child chronic disabling conditions (CDC) were reported conditions lasting or expected to last > 6 months and associated with restriction of normal functioning. As well as the physical health conditions listed (see Table 1), CDCs could include mental health conditions: Attention Deficit Hyperactivity Disorder (ADHD) diagnosed by a professional and/or; Strengths and Difficulties Questionnaire (SDQ) scores >95th centile for the cohort age group (>=18 at 6/7 years; >=17 at 10/11 years). We then derived a variable to represent *CDC onset* if a CDC was reported between age 6/7 and age 10/11 (Children who had a CDC at 6/7 were excluded from the analysis). '*No CDC'* was where no CDC was reported at either age.

Table 1: Chronic Disabling Conditions reported for children in the *CDC onset* group

Reported condition	Percentage reported*
Strengths & Difficulties Questionnaire >95th centile	44.1
Attention Deficit Hyperactivity Disorder – medically diagnosed	6.9
Conditions lasting >6 months & associated with functional restriction:	
Sight problems	8.8
Hearing problems	11.4
Fits, blackouts etc.	2.5
Difficulty learning	10.8
Limited use of arms and fingers	7.0
Difficulty gripping	5.5
Limited use of arms & feet	4.9
Other physical condition	28.2
Disfigurement	2.1

*Sum of percentages exceeds 100 as children may have more than one reported condition

Independent variable of interest

Household weekly income quintile (Australian dollars, AUD) at child age 6/7:

Quintile 1 = AUD 2124.80 through to highest; Quintile 2 = AUD 1590.65 to 2124.79; Quintile 3 = AUD 1200.01 to 1590.64; Quintile 4 = AUD 795.01 to 1200.00; Quintile 5 = lowest to AUD 765.00

Potential confounding variables

To replicate Blackburn et al's findings [11], we selected similar potential confounding variables: *child's sex and age in months at 6/7; Indigenous status; lone parenthood at child age 6/7*; with addition of maternal CDC at 6/7. Selected potential confounding variables have a known association with childhood CDC [16;7] and were significantly associated at 10% level with CDC onset in bivariate analysis (Table 2), a recognized statistical cut-off for inclusion in multivariate models. [17]

Analysis

Sample weighting between ages 6/7 and 10/11 was used to reduce bias associated with attrition between waves. [18] Logistic regression was undertaken in the SPSS Version 20 Complex Samples facility (IBM Inc). Models were fitted on the dependent variable with the independent variable of interested first followed by potential confounders in the same sequence as that used by Blackburn et al [11] with the addition of maternal CDC:

- Model 1 - household income quintile at 6/7 years only;
- Model 2 - child's sex and age added;
- Model 3 - indigenous status added;
- Model 4 – lone parenthood added;
- Model 5 – maternal CDC.

Sensitivity analyses also tested the extent paternal CDC confounded our analyses (not included in the main analyses due to missing data and loss of single parent families).

Study 2: Change in household financial situation as a consequence of CDC onset

To test the extent household social disadvantage is also a sequelae of caring for a child with CDC, we studied the change in household financial situation after CDC onset. We created a continuous variable, *income change*, derived by subtracting household income at 6/7 from income at 10/11, tested in a model with CDC onset as the independent variable, adjusted for income quintile at 6/7. We also compared scores on *material hardship*, a 7 item index ranging from 0-7, based on Yes=1, No=0 responses to the following questions:

- Difficulty raising $2000 in a week;
- Couldn't pay bills on time;
- Couldn't pay mortgage on time;
- Gone without meals;
- Been unable to heat or cool home;
- Pawned or sold something;
- Sought assistance from welfare/community organization

Analysis:

Income change was entered into a linear regression model with CDC onset adjusted for income quintile at age 6/7. To test if income quintile at 6/7 modified the effect of CDC onset on income change, we entered an interactive term CDC*income quintile at age 6/7 into the model. We undertook sensitivity analyses adding time variant variables (change in lone parenthood and maternal CDC) to the linear regression model as potential confounders. Changing prevalence of material hardship were estimated by calculating the ratio of different

levels of hardship in the CDC onset group compared with the no CDC group between 6/7 and 10/11.

Ethics approval

LSAC was approved by the Australian Institute of Family Studies Ethics Committee. [19]

RESULTS

Of the 4010 children present in both waves, complete data were available on 3629 (90.5%) (Figure 1). Income data were missing for 381 children (9.5%); 1.8% missing in the highest quintile compared with 2.2% in the lowest income quintile. To study the precursors and consequences of CDC onset between ages 6/7 and 10/11 we included only children without a CDC at 6/7 and excluded 430 children reported to have a CDC at 6/7. Of children with complete data with no reported CDC at 6/7, 233 (6.4%) developed a CDC by 10/11 (*CDC onset* group) and 2966 (81.7%) did not (*no CDC* group).

Study 1.

Table 2 describes the socio-demographic characteristics of children in the two groups. CDC onset showed a significant linear trend as household income decreased. Children in lone parent households, those with a mother who had a CDC, and indigenous children were also significantly more likely to develop a CDC.

Table 2: Socio-demographic characteristics of children in the *onset* and *noCDC* groups

Characteristics at age 6/7	***CDC onset* – number (%) n = 233**	***No CDC* – number (%) n = 2966**	**X^2 & p value**
Mean age in months	82.35	81.98	F = 3.40 p = 0.065
% Male	128 (54.9%)	1450 (48.9%)	3.18

			p = 0.075
Indigenous status	13 (5.6%)	94 (3.2%)	3.88 p = 0.049
Lone parent	55 (23.6%)	416 (14%)	15.79 p <0.001
Mother had CDC	24 (10.3%)	105 (3.5%)	25.51 p <0.001
Household income quintile Q1 (richest) Q2 Q3 Q4 Q5 (poorest)	 32 (13.7%) 37 (15.9%) 42 (18%) 43 (18.5%) 79 (33.9%)	 626 (21.1%) 637 (21.5%) 584 (19.7%) 597 (20.1%) 522 (17.6%)	X^2 for linear trend 28.64 p <0.001

Model 1 in the logistic regression (Table 3) shows that although odds increased as income quintile decreased, the higher odds (3.01) for the lowest income quintile compared with odds of 1.42 in quintiles 3 and 4 suggest a threshold effect. Child's age, sex and indigenous status did not attenuate the effect of income on the odds of CDC onset. Lone parenthood and maternal CDC at child age 6/7 slightly attenuated the effect of income. When adjusted for all confounders, children in the lowest income quintile at 6/7 had two and half times the odds of CDC onset compared with children in the highest income quintile. Children whose mother reported a CDC at 6/7 were three times more likely to be in the CDC onset group.

Table 3: Logistic regression models fitted on children in *onset* and *no* CDC groups

Variables at age 6/7	**Model 1 OR (95% CI)**	**Model 2 OR (95% CI)**	**Model 3 OR (95% CI)**	**Model 4 OR (95% CI)**	**Model 5 OR (95% CI)**
Household income quintile Q1(richest) Q2 Q3 Q4 Q5(poorest)	 1.0 (ref) 1.15(0.71,1.86) 1.42(0.86,2.34) 1.42(0.85,2.37)	 1.00 (ref) 1.15(0.71,1.88) 1.40(0.85,2.31) 1.42(0.85,2.38)	 1.00 (ref) 1.14(0.70,1.86) 1.39(0.84,2.30) 1.40(0.83,2.36)	 1.0 (ref) 1.14(0.70,1.86) 1.38(0.83,2.28) 1.38(0.82,2.32)	 1.0 (ref) 1.11(0.68,1.82) 1.38(0.84,2.28) 1.37(0.81,2.31)

	3.01(1.86,4.86)	3.01(1.86,4.88)	2.93(1.82,4.73)	2.75(1.59,4.75)	2.65(1.53,4.60)
Child's age (months)	-	1.04(0.99,1.09)	1.04(0.99,1.09)	1.04(0.99,1.09)	1.04(0.99,1.09)
Child's sex	-	1.33(0.97,1.83)	1.34(0.97,1.84)	1.34(0.97,1.84)	1.35(0.98,1.86)
Indigenous status	-	-	1.43(0.63,3.24)	1.41(0.62,3.21)	1.37(0.60,3.12)
Lone parenthood	-	-	-	1.14(0.73,1.79)	1.15(0.73,1.81)
Mother had CDC	-	-	-	-	3.01(1.81,5.00)

Study 2.

Income increased in all quintiles over the 4 year period studied; however, after adjustment for income quintile at 6/7, the increase in the *CDC onset* group was AUD 165 less than the *no CDC* group (p = 0.033) (Table 4). As shown in supplementary tables 4 and 5, the interaction term showed no significant modifying effect of income quintile at 6/7 on the estimate for income change by CDC group and sensitivity testing for the effect of change in lone parenthood and maternal CDC did not significantly affect the estimate.

Table 4: Linear regression model of weekly household income change (Australian $) by CDC onset

Parameter	**Estimate of income change (AUD)**	**95% Confidence Interval**		**t-statistic**	**Degrees of Freedom**	**Significance p value**
		Lower	**Upper**			
(Intercept = increase in income in	634.78	451.25	798.32	7.09	267	<0.001

whole sample)						
CDC onset*	-165.51	-317.78	-13.24	2.14	267	0.033
Income quintile at 6/7:						
Q1**	0.000	-	-	-	267	-
Q2	-232.74	-446.36	-19.17	-2.15		0.01
Q3	-286.80	-447.83	-125.77	-3.51		0.001
Q4	-273.76	-439.29	-108.23	-3.26		0.001
Q5	-261.27	-463.18	-59.37	-2.55		0.033

*Reference group = *no CDC* **Reference group = richest quintile

The ratio of overall hardship and at different levels of hardship in the CDC onset group compared with the no CDC group did not change between 6/7 and 10/11.

Table 5: Hardship at child age 6/7 and 10/11 for *CDC onset* and *no CDC* groups

Hardship scores	***CDC onset***	***No CDC***	**Ratio *CDC onset : No CDC***
Hardship scores at 6/7:			
0	151 (65.1%)	2426 (82.2%)	0.79:1
1	57 (24.6%)	313 (10.6%)	2.32:1
2	14 (6.0%)	132 (4.5%)	1.33:1
3	9 (3.9%)	47 (1.6%)	2.43:1
4	1 (0.4%)	23 (0.8%)	0.50:1
5	-	10 (0.3%)	-
6	-	-	-
7	-	-	-
Hardship scores at 10/11:			
0	152 (65.8%)	2395 (82.4%)	0.80:1
1	48 (20.8%)	297 (10.2%)	2.04:1
2	17 (7.4%)	142 (4.9%)	1.51:1
3	9 (4.1%)	47 (1.6%)	2.56:1
4	4 (1.7%)	17 (0.6%)	2.83:1
5	1 (0.2%)	8 (0.3%)	0.66:1
6	-	-	-
7	-	-	-

Sensitivity tests revealed the effect of social disadvantage was evident for both physical and mental health conditions in our measure. When ADHD and SDQ>95th centile were excluded from the dependent variable the odds of CDC onset by income quintile 5 increased suggesting stronger association of physical compared with mental problems with SES (see supplementary tables 2&3).

DISCUSSION

To our knowledge, this is the first paper to report empirical results from a longitudinal study considering socioeconomic disadvantage as both a precursor and consequence of CDCs in childhood. This paper extends the method used by Blackburn et al [11] by further considering if caring for a child with CDC subsequently eroded family finances.

Our findings suggest that socioeconomic disadvantage in early childhood is associated with later CDC onset in a developed, affluent nation - Australia. Although consistent with UK results, developed nations vary in terms of health services and social inequality: important caveats to the generalisability of our results. Although not providing conclusive proof of causation (only possible in experimental research), our study is consistent with experimental evidence that increased income is associated with positive child development outcomes. [20] In addition, there are biologically plausible pathways underlying our findings. [21] Children in socioeconomically disadvantaged households may encounter social and environmental risks in the prenatal and early childhood periods leading to activity limiting conditions as they mature. [22] Social adversity is associated with chronic stress [23] increasing the likelihood of chronic ill health. [21; 24; 25] Low household resources impair parental capacity for supportive, stimulating and consistent parenting leading to poorer mental health, intellectual

development and behavioural problems. [26] Reduced access, uptake or quality of services is a further possible pathway for socioeconomically disadvantaged children that may create vulnerability to CDCs. [27]

Over the four years of our study income increased across the whole sample, however income change in *CDC onset* households was 165 AUD/week lower than no CDC households. Despite this relatively lower increase in income, there was no overall change in prevalence of material hardship between the groups. Such relatively weak evidence of an adverse financial impact may be explained by the short period studied. Further, not all of the reported CDCs (see Table 1) may have been of sufficient severity to have a significant impact on family finances.

Strengths and limitations

Longitudinal data on a representative child population allows a robust analysis of the temporal relationship between socioeconomic disadvantage and childhood CDC. However longitudinal data cannot unequivocally establish causality, and our findings must be interpreted cautiously, especially the relatively weak evidence that childhood CDC could generate household socio-economic disadvantage. Differential social attrition between the waves of the LSAC, which may have under-estimated the impact of social disadvantage on the outcome, was partially addressed by using sample weights. [18] Imputation rather than exclusion of missing household income data may have increased the precision of the estimates of the impact of CDC onset particularly for income quintiles 3 and 4; however, as income data were missing more frequently for lone parent households and those in the lowest income quintile, our apporach may under-estimate the effect of CDC onset. Although a gradient effect can be discerned, the lack of statistical significance raises the alternative

possibility that there may exist thresholds with only the most severe level of socioeconomic disadvantage associated with higher odds of CDC onset.

Our CDC measure was based on parental reports of conditions that had lasted more than 6 months and were associated with restriction of function. We also included children with medically diagnosed ADHD and/or a total score on the Strengths and Difficulties Questionnaire (SDQ) greater than the 95th centile for the cohort sample to reflect mental health disorders (predictive of chronic and reduced functioning in childhood). [28] Such a broad category of CDC is consistent with internationally accepted disability classifications [3;5;6] and the international literature. [13] It does not however, tease out possible differences for families based on specific CDCs. It is possible that households with children who became ill during the study period may have been more likely to drop out; however, we have no data on this and are not able to predict the direction of possible bias. Further, the CDC measure was parent reported, and should not be considered as precise as using clinician diagnoses. It is also posible that our study underestimates the assocation between CDC and socio-economic status as low SES families may be less likely to access services which would identify a CDC.

Conclusions

Our findings are consistent with those of Blackburn et al [11] indicating that socioeconomic disadvantage in early childhood is associated with later CDC onset. In addition, we show that, even over a short four year period, family finances are adversely affected by CDC onset, with consequences for the child and the family. A well established literature on health selection attests to the importance of good health for later life opportunities, especially securing high quality employment. [29] Later waves of the LSAC may allow us to track the

possible longer term influence of childhood CDC. In most high income countries financial benefits of varying generosity are available to families coping with the added burden of caring for a child with CDC. Additional social policy consideration should be given to preventative measures that are both child and family focussed.

Acknowledgments: This paper uses confidentialised unit record data from Growing Up in Australia, the Longitudinal Study of Australian Children. The study is conducted in partnership between the Department of Social Services (DSS, formerly Department of Families, Housing, Community Services and Indigenous Affairs), the Australian Institute of Family Studies (AIFS) and the Australian Bureau of Statistics (ABS). The findings and views reported in this paper are those of the authors and should not be attributed to DSS, AIFS, ABS and cannot be taken in any way as expressions of Government policy. Lyndall Strazdins is supported by an Australian Research Council Future Fellowship FT110100686.

Competing interests: None declared

Funding statement: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Contributorship statement: NS and LS jointly designed the study and NS undertook the analysis. Both authors contributed to preparation and revision of the manuscript. Both authors have approved, and given permission for, the final version submitted for publication. The authors are jointly accountable for the accuracy and integrity of the work.

What is already known on this topic

- The association of socioeconomic disadvantage with chronic disabling conditions in childhood in high income countries is well established

- Whether socioeconomic disadvantage is on the causal pathway to, or arises as a consequence of, childhood chronic disabling conditions remains unresolved
- Only one longitudinal study to date has been published, and it did not consider whether socioeconomic disadvantage precedes or follows onset of chronic disabling conditions in later childhood.

What this study adds

- Longitudinal evidence that socioeconomic disadvantage precedes the onset of childhood chronic disabling conditions in a high income country
- New evidence that onset of a chronic disabling condition in later childhood is associated with relative deterioration in family finances.
- Evidence that policies which alleviate social disadvantage now could help prevent the future health and social burdens linked with chronic health conditions.

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