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The mental health of young children with intellectual disabilities or borderline intellectual functioning

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Abstract
Objective To determine within a nationally representative sample of young Australian children: (1) the association amongst intellectual disability, borderline intellectual functioning and the prevalence of possible mental health problems; (2) the association amongst intellectual disability, borderline intellectual functioning and exposure to social disadvantage; (3) the extent to which any between-group differences in the relative risk of possible mental health problems may be attributable to differences in exposure to disadvantageous social circumstances.
Methods The study included a secondary analysis of a population-based child cohort of 4,337 children, aged 4/5 years, followed up at age 6/7 years. The main outcome measure was the scoring within the 'abnormal' range at age 6/7 years on the parent-completed Strengths and Difficulties Questionnaire.
Results When compared to typically developing children, children identified at age 4/5 years as having intellectual disability or borderline intellectual functioning: (1) showed significantly higher rates of possible mental health problems for total difficulties and on all five SDQ subscales at age 6/7 years (OR 1.98–5.58); (2) were significantly more likely to be exposed to socio-economic disadvantage at age 4/5 and 6/7 years. Controlling for the possible confounding effects of exposure to socio-economic disadvantage (and child gender) significantly reduced, but did not eliminate, between-group differences in prevalence.
Conclusions Children with limited intellectual functioning make a disproportionate contribution to overall child psychiatric morbidity. Public health and child and adolescent mental health services need to ensure that services and interventions fit to the purpose and are effective for children with limited intellectual functioning, and especially those living in poverty, as they are for other children.

Keywords Children · Disability · Mental health · Intelligence

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Introduction

A high prevalence of mental health disorders amongst children (and possibly adults) with intellectual disabilities has now been documented in a number of studies [1–4]. However, little attention has been paid to the mental health of the much greater proportion of the population with 'borderline' intellectual functioning (commonly defined as scoring between 1 and 2 standard deviations below the mean on standardised tests of intelligence, typically equivalent to an IQ of less than 85) [5].

The available evidence, however, suggests some marked similarities between the situation of people with intellectual disabilities and those with borderline intellectual functioning. First, emerging evidence points to significantly higher rates of mental health needs amongst children and adults with borderline intellectual functioning when compared to 'typically developing' children [6–12]. Second, there is

evidence of similar patterns of service response to mental health disorders in both groups. For example, both groups appear more likely to be treated by psychopharmacological agents, more likely to suffer extrapyramidal side effects from these agents [13] and are less likely to be treated by talking therapies [7, 14]. Forensic mental health services and child protection services describe adverse consequences of failure to meet the similar communication and support needs of people with both intellectual disability and borderline intellectual functioning [15, 16]. Finally, both groups are at increased risk of exposure to socio-economic disadvantage as children and adults [6–8, 17, 18]. Given that exposure to socio-economic disadvantage is a recognised risk factor for child mental health problems [19–23], the latter observation raises the question of the extent to which the relative risk of psychiatric disorders amongst people with limited intellectual functioning may be attributable to their more disadvantageous social circumstances [2, 24].

Children with borderline intellectual functioning may be a particularly important group to study, given that they comprise a substantial minority of the child population (12–15%), will (as a result of higher rates of psychiatric morbidity) account for an even greater proportion of child and adolescent psychiatric morbidity, and may be poorly served by current services (see above).

The aims of the present study are, within a nationally representative sample of young Australian children, to: (1) determine the association amongst intellectual disability, borderline intellectual functioning and the prevalence of possible mental health problems; (2) determine the association amongst intellectual disability, borderline intellectual functioning and exposure to social disadvantage; (3) estimate the extent to which any between-group differences in the relative risk of possible mental health problems may be attributable to differences in exposure to disadvantageous social circumstances.

Methods

The present report is based on a secondary analysis of data collected in Waves 1 and 2 of the Longitudinal Study of Australian Children (LSAC). Full details of LSAC are available in a series of annual reports [25–27], a data user guide [28] and a series of technical reports addressing sample design [29], data weighting [30] and the development of the LSAC child outcome index [31]. Relevant details are briefly summarised below.

Sampling

Longitudinal Study of Australian Children employed a stratified cluster design to recruit two samples of children: a birth cohort of infants (data not used in the present study) and a cohort of children aged 4–5 years (born March 1999–February 2000). The sample was stratified and clustered by postcode to ensure proportional geographic representation. Postcodes were selected with probability proportional to size with equal probability for small population postcodes. Within the selected 311 postcodes, children were selected at random from the Medicare enrolment database. The overall response rate was 59% for the cohort used in the present study, giving a final Wave 1 sample of 4,983 children aged 4–5 years. In Wave 2, undertaken when the children were 6–7 years old, information was collected on 4,464 of these children (90% retention rate).

Procedure

Data were collected by: (1) face-to-face interview with the child's 'primary' parent (the parent who provided most of the care, the child's biological mother in 97% of cases for the K-cohort children); (2) written questionnaire completed by the child's primary parent and, for couple families, separately by the additional parent; (3) postal questionnaire from the child's teacher (if attending a school, preschool, kindergarten or long-day care centre); (4) direct assessment of the child.

Measures

Longitudinal Study of Australian Children collects a range of information pertaining to: household composition; housing conditions; finances; parent education, employment, health and well-being; parents' relationship history, including relationships with non-resident partners; parenting practices; child health, well-being and development; social support and social capital [27, 28]. Key measures for the analyses presented in the present paper are described below.

Child intellectual functioning at age 4/5 years

LSAC contains a scaled measure of child learning and cognition derived from a series of specific items and scales related to this domain [31]. In Wave 1, the scaled score was based on the results of child testing on the Peabody Picture Vocabulary Test (PPVT) [32, 33] the Who Am I? (WAI) test of school readiness [34] and teacher and parent ratings of child numeracy and literacy. The PPVT is a commonly used proxy measure for cognitive functioning that shows strong correlations with the Wechsler Intelligence Scale for children ($r > 0.8$) [33]. The WAI is a test of school readiness that includes five copying tasks (circle, cross, square, triangle, diamond), four writing tasks (numbers, letters, words, sentence) and a drawing task (of self). It has been

shown to correlate moderately strongly with a range of measures of child development and educational attainment [35–37]. We operationally defined intellectual disability as scoring below 2 standard deviations below the mean on the child learning and cognition outcome domain, and borderline intellectual functioning as scoring below 1 standard deviation below the mean on the child learning and cognition outcome domain (but excluding children identified as having intellectual disability). This led to the identification of 139 (2.8%) children with intellectual disability, 598 (12.1%) children with borderline intellectual functioning, and 4,195 (85.1%) children as 'typically developing' (child learning and cognition outcome domain scores were missing for 51 children).

Child mental health at age 6/7 years

The parental form of the Strengths and Difficulties Questionnaire was used to evaluate the mental health of children at age 6/7 years (Wave 2) [38]. The SDQ has been shown to possess a clear factorial structure and acceptable levels of reliability. It could predict a substantially raised probability of independently diagnosed psychiatric disorders [38–40], including in samples of Australian children [41, 42], and acceptable psychometric characteristics when used for children with intellectual disabilities [43]. We used the recommended cutoffs for 'abnormal' scores (http://www.sdqinfo.com/ScoreSheets/e1.pdf) to determine caseness for the total scale score and each of the five subscales (conduct difficulties, emotional difficulties, hyperactivity, peer problems, pro-social behaviour). SDQ scores were available for 4,337 children (97% of children participating in Wave 2).

Socio-economic position at age 4/5 and 6/7 years

We extracted from LSAC a number of variables related to family socio-economic position (SEP). *Income poverty* was defined as living in a household whose equivalised income was less that 60% of the sample median [44]. *Material hardship* was defined as the number of events that the informant reported happening over the preceding 12 months due to shortage of money from a predetermined list of six (e.g. not being able to pay gas, electricity or telephone bills on time). *Subjective poverty* was defined as the primary informant rating the financial position as being 'poor' or 'very poor'. *Living in a workless household* was defined as living in a household where the parental figure is not employed. *Household crowding* was defined as living in a household with an average of more than 1.5 persons per bedroom. *Low parental education* was defined as not completing year 12 of education. *Area deprivation* was defined as living in an area scoring in the bottom quintile on the SEIFA indices of advantage/disadvantage, disadvantage, education and occupation and economic resources [45]. For each of these indicators, we extracted data separately from Waves 1 and 2 and, to address issues related to persistent disadvantage, created indicators of repeated disadvantage (e.g. income poverty in Wave 1 and Wave 2).

Data analysis

In the first stage of the analysis, we employed simple bivariate tests to determine: (1) the association amongst intellectual disability, borderline intellectual functioning and the prevalence of possible mental health problems; (2) the association among intellectual disability, borderline intellectual functioning and exposure to social disadvantage. These analyses were undertaken on data weighted to compensate for unit non-response [46]. Weights were derived by using a technique of calibration on known marginal totals [47]. Variables used to calculate weights were mother's level of schooling and whether the mother spoke a language other than English at home, the two variables that made unique contributions in multivariate predictions of non-response [46].

In the second stage of the analysis, we used propensity score matching to estimate the impact on risk of possible mental health problems of controlling for between-group differences in SEP and other potentially relevant confounding factors. Propensity score matching is increasingly used in social epidemiological research to estimate 'treatment' effects (or between-group differences) whilst controlling for the effects of potentially confounding variables [48–50]. The procedure first determines the risk (propensity) that each child in the sample will show intellectual disability or borderline intellectual function (ID/BIF) based on a set of predictor variables. The predictor variables in the present analyses were the SEP variables, child gender and child and parental age in Wave 2. Technically, the propensity score of a case was the logit of the predictor variables regressed against the ID/BIF status. Propensity score matching then matches each child with ID/BIF with children having the same propensity (risk) for having ID/BIF, but who were not so categorised. Matching can be undertaken in a number of ways. To test the robustness of analysis, we used two different matching procedures (nearest neighbour and radius), each with varying degrees of precision. In the nearest neighbour matching, each child with ID/BIF was matched with n children not so categorised with the closest propensity score (using $n = 5$ and $n = 10$). In radius matching, each child with ID/BIF was matched with all children not so categorised, whose propensity score lay within a specified range (radius) of the

target child's score (using ranges or 'caliper widths' of 0.005, 0.01 and 0.02).

A number of reviews have suggested that propensity score matching often gives similar results to more traditional methods of adjusting for the effects of potentially confounding covariates (e.g. logistic regression) [50, 51]. Recent research, however, has shown that propensity score matching gives more accurate estimates of marginal treatment effects than traditional methods and that, in certain circumstances, the differences between the two approaches can be substantial [52]. One major advantage of propensity score matching is that, unlike traditional regression methods, cases are only included in the analyses if satisfactory matching can be achieved. All analyses were undertaken using the PSMATCH2 programme written for Stata [53].

Results

Prevalence of possible mental health problems

Information on the prevalence of possible mental health problems amongst 6–7-year-old Australian children with intellectual disabilities, borderline intellectual functioning and those who are 'typically developing' is presented in Table 1. For all indicators of possible mental health problems, children with intellectual disabilities or borderline intellectual functioning showed significantly increased prevalence rates. As a result, this group of children, 14.9% of the study population, accounted for disproportionate amounts of total morbidity: 40% for total difficulties; 31% for conduct difficulties; 30% for emotional difficulties; 28% for hyperactivity; 30% for peer problems; 37% for pro-social behaviour.

Table 1 Prevalence and odds ratios of 'abnormal' scores on the SDQ for intellectual status amongst 6–7-year-old Australian children

	Intellectual disabilities	BD	TD
Percentages			
Total difficulties (%)	24	17	5
Conduct difficulties (%)	24	19	8
Emotional difficulties (%)	13	15	6
Hyperactivity (%)	26	15	8
Peer problems (%)	35	21	11
Pro-social behaviour (%)	14	8	3
Odds ratios			
Total difficulties	5.58***	3.36***	1.00
Conduct difficulties	3.39***	2.29***	1.00
Emotional difficulties	2.23**	2.53***	1.00
Hyperactivity	3.71***	1.98***	1.00
Peer problems	4.38***	2.25***	1.00
Pro-social behaviour	5.33***	2.86***	1.00

ID intellectual disability; *BD* borderline intellectual functioning; *TD* typically developing

** $p < 0.01$

*** $p < 0.001$

Within-group comparison indicated that children with intellectual disabilities showed higher rates of possible mental health problems than children with borderline intellectual functioning on three of the six indicators: hyperactivity ($\chi^2 = 7.82(1)$, $p < 0.01$); peer problems ($\chi^2 = 10.42(1)$, $p < 0.01$); prosocial behaviour ($\chi^2 = 4.87(1)$, $p < 0.05$).

Exposure to socio-economic disadvantage

Information on exposure to socio-economic disadvantage amongst 6–7-year-old Australian children with intellectual disabilities, borderline intellectual functioning and those who are 'typically developing' is presented in Table 2 for selected indicators. Indicators (income poverty, material hardship, area deprivation) were selected on the basis of their frequent usage in poverty research. Full data are available on request from the corresponding author. On all 29 indicators of exposure to socio-economic disadvantage, children with intellectual disabilities or borderline intellectual functioning showed significantly increased exposure rates ($p < 0.01$). As a result, they account for disproportionate proportion of young Australian children exposed to socio-economic disadvantage (e.g. 33% of all children exposed to repeated income poverty, 38% of all children living in repeatedly workless households; 29% of all children exposed to repeated material hardship).

Within-group comparison indicated that: (1) children with borderline intellectual functioning showed higher rates of exposure to socio-economic disadvantage than children with intellectual disabilities in 4 of the 29 indicators (SEIFA area economic resources at age 4/5 years, $\chi^2 = 6.28(1)$, $p < 0.05$; SEIFA area economic resources at ages 4/5 and 6/7 years, $\chi^2 = 4.13(1)$, $p < 0.05$; subjective poverty at age 6/7 years, $\chi^2 = 4.40(1)$, $p < 0.05$; living in workless household at age 6/7, $\chi^2 = 4.64(1)$, $p < 0.05$); (2) children with intellectual disabilities showed higher rates of exposure to socio-economic disadvantage than children with borderline intellectual functioning in 4 of the 29 indicators (SEIFA area education and occupation at age 4/5 years, $\chi^2 = 5.85(1)$, $p < 0.05$; SEIFA area education and occupation at age 6/7 years, $\chi^2 = 5.37(1)$, $p < 0.05$; living in workless household at age 6/7 years, $\chi^2 = 4.64(1)$, $p < 0.05$; living in workless household at ages 4/5 and 6/7 years, $\chi^2 = 10.72(1)$, $p < 0.01$).

Table 2 Percentage and odds ratios of exposure to selected indicators of socio-economic disadvantage for intellectual status amongst young Australian children

	ID	BD	TD
Percentages			
Income poverty at age 4/5 (%)	42	38	21
Income poverty at age 6/7 (%)	46	42	21
Repeated income poverty (age 4/5 and 6/7) (%)	34	29	12
Material hardship (2+ events) at age 4/5 (%)	21	25	13
Material hardship (2+ events) at age 6/7 (%)	34	32	19
Repeated material hardship (age 4/5 and 6/7) (%)	15	18	8
SEIFA area disadvantage at age 4/5 (%)	22	24	14
SEIFA area disadvantage at age 6/7 (%)	31	24	13
Repeated SEIFA area disadvantage (age 4/5 and 6/7) (%)	20	21	11
Odds ratios			
Income poverty at age 4/5	2.78***	2.38***	1.00
Income poverty at age 6/7	3.16***	2.67***	1.00
Repeated income poverty (age 4/5 and 6/7)	3.68***	3.00***	1.00
Material hardship at age 4/5	1.74***	2.14***	1.00
Material hardship at age 6/7	2.31***	2.07***	1.00
Repeated material hardship (age 4/5 and 6/7)	1.98**	2.51***	1.00
SEIFA area disadvantage at age 4/5	1.78**	1.99***	1.00
SEIFA area disadvantage at age 6/7	3.06***	2.20***	1.00
Repeated SEIFA area disadvantage (age 4/5 and 6/7)	1.98**	2.06***	1.00

ID intellectual disability; *BD* borderline intellectual functioning; *TD* typically developing

** $p < 0.01$

*** $p < 0.001$

Prevalence of possible mental health problems controlling for exposure to socio-economic disadvantage, child age and gender, and parental age

The adequacy of fit of the propensity score-matching procedures was evaluated by: (1) inspecting the extent to which each covariate in the model was balanced across the two matched groups; (2) calculating a pseudo r^2 from the propensity score across all variables before and after matching. In all analyses, all individual covariates were appropriately balanced ($p > 0.3$). The results of the propensity score-matching procedures are presented in Table 3, along with the summary statistics describing the adequacy of matching (reduction of matched pseudo r^2 to statistical insignificance). These analyses were restricted to cases for which complete data were available ($n = 3{,}370$, 78% of cases for whom Wave 2 SDQ data were available). The propensity score-matching procedures reduced between-group differences in the estimated prevalence of possible mental health problems by between 20 and 27% for total difficulties and by between 3 and 48% for specific subscales. In all but one instance, the residual between-group differences remained statistically significant ($p < 0.05$). That is, after between-group (combined intellectual disability and borderline groups vs. typically developing) differences in potentially confounding variables (socio-economic disadvantage, child age and gender, and parental age) were controlled statistically, significant group differences in prevalence of mental health problems remained for all but one comparison. In all cases, the group with limited intellectual functioning had higher prevalence.

Given that restricting the analyses to complete cases reduced the usable sample size (largely due to missing data on income and paternal education), we reran the analyses by imputing missing income and paternal education data from other indicators of SEP. In these analyses, the propensity score-matching procedures reduced between-group differences in the estimated prevalence of possible mental health problems by between 16 and 21% for total difficulties and by between 2 and 44% for specific subscales. In all instances, the residual between-group differences remained statistically significant ($p < 0.05$).

Discussion

When compared to typically developing children, children identified at age 4/5 years as having intellectual disability or borderline intellectual functioning showed significantly higher rates of possible mental health problems for total difficulties and on all five SDQ subscales at age 6/7 years and were significantly more likely to be exposed to socio-economic disadvantage. The use of propensity score-matching to control for the possible confounding effects of exposure to socio-economic disadvantage (and child gender) significantly reduced, but did not eliminate, between-group differences in prevalence.

Table 3 Change in prevalence of 'abnormal' scores on the SDQ for intellectual status amongst 6–7-year-old Australian children after propensity score matching ($n = 3,370$)

Type of matching	Pseudo r^2	% Reduction in between-group difference in prevalence rates following matching						*T* statistic for residual between-group difference in prevalence rates following matching					
		TD (%)	CD (%)	ED (%)	HY (%)	PP (%)	PS (%)	TD	CD	ED	HY	PP	PS
Nearest 5 neighbours	0.004	20	29	28	24	43	5	3.79***	2.47*	2.59**	3.02**	2.50*	4.77***
Nearest 10 neighbours	0.002	22	29	32	19	40	3	3.84***	2.52*	2.48*	3.35***	2.73**	4.66***
Radius (caliper 0.005)	0.002	27	43	33	40	41	17	3.61***	2.05*	2.47*	2.54*	2.71**	4.07***
Radius (caliper 0.01)	0.002	25	39	36	26	36	14	3.77***	2.24*	2.40*	3.12**	2.99**	4.24***
Radius (caliper 0.02)	0.004	24	31	48	18	40	11	3.74***	2.49*	1.91	3.38***	2.79**	4.40***
Unmatched	0.084***							7.42***	4.68***	5.01***	5.51***	6.08***	7.93***

TD total difficulties; *CD* conduct difficulties; *ED* emotional difficulties; *HY* hyperactivity; *PP* peer problems; *PS* pro-social behaviour

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

As noted above, whilst interest has grown in the mental health of people with intellectual disabilities, little attention has been paid to the mental health of the much greater proportion of the population with 'borderline' intellectual functioning [5]. The present study is the first, to our knowledge, to examine this issue in a nationally representative sample of younger children.

The results are important on five counts. First, they suggest that children with borderline intellectual functioning are at significantly increased risk of possible mental health problems in early childhood when compared to their typically developing peers. This finding is consistent with and adds to the existing evidence that borderline intellectual functioning is associated with poorer mental health in later childhood and adult life [7–12]. Given the evidence of high rates of persistence of mental health problems across childhood and into the early adult years amongst people with intellectual disability [54], this finding also provides support for the development of preventative interventions for children with limited intellectual functioning in early childhood.

Second, the data presented above highlight the important contribution made by children with limited intellectual functioning to overall child psychiatric morbidity. Whilst this group of children only account for 15% of the total child population, we found that they account for up to 40% of total child psychiatric morbidity within their age group. This observation presents a clear challenge to public health and child and adolescent mental health services to ensure that services and interventions are as fit for the purpose and effective for children with limited intellectual functioning, as they are for other children. As noted above, however, the emerging evidence indicates the existence of significant inequities, with mental health disorders amongst people with limited intellectual functioning being more likely to be treated by psychopharmacological agents and less likely to be treated by talking therapies [7, 14]. It seems possible that: (a) more work needs to be done to adapt such therapies to the needs and abilities of people with limited intellectual functioning and low educational attainment, and (b) practitioners will need to be trained on how to use the full range of therapies with this population.

Third, our analyses showed modest differences between the intellectual disability group (2.8% of the sample) and the borderline intellectual functioning group (12.1% of the sample). Compared to children with borderline intellectual functioning, those with intellectual disabilities did not have significantly higher total SDQ scores (total difficulties), and only showed significantly higher prevalence than of mental health problems on three of six indicators. Whilst this is consistent with the failure to find consistent associations between severity of intellectual disability and prevalence of mental health problems [55], it is also possible that the SDQ, a measure not specifically developed for children with severe intellectual disability, may lack sensitivity in identifying specific manifestations of mental health problems amongst more severely disabled children [56].

It was also notable that there were no systematic differences in exposure to socio-economic disadvantage between the intellectual disability and borderline groups; the groups did not differ on most indicators, and where differences were evident they did not systematically favour either group. As has been previously reported, there are strong links between indicators of socio-economic deprivation and limited intellectual functioning for

children, in general, and amongst children with intellectual disability, with the possible exception of children with profound and multiple intellectual disability [57, 58]. These findings suggest that the mental health and socio-economic circumstances of these two groups are considerably more similar than different. In educational and disability services, important administrative and service eligibility distinctions are made between individuals with intellectual disability and those with borderline intellectual functioning. Our data suggest that such distinctions may not be useful in mental health services, and that members of this large group (14.9% of the sample) have important mental health needs in common that warrant sustained attention.

Fourth, our results add to the growing literature on the association between socio-economic disadvantage and mental health [19–23] and the wider literature on the social determinants of health [59–61]. Our analyses suggest that increased exposure amongst children with limited intellectual functioning to socio-economic disadvantage may account for a significant proportion of their increased risk of mental health problems. Similar results have been reported for the mental and physical health of children with intellectual disabilities [2, 62, 63]. Again, these findings present challenges to public health approaches to improving child and adolescent mental health and to psychiatric services. First, they suggest that poverty reduction should form a key component of any systemic approach to mental health promotion [64, 65]. Second, they suggest that services should be as fit for the purpose and effective for children with limited intellectual functioning living in poverty, as they are for other children.

Finally, our results suggest that the impact of increased exposure to socio-economic disadvantage on between-group differences varies across domains of functioning. In particular, difficulties with pro-social behaviour (and to a much lesser extent hyperactivity) amongst children with limited intellectual functioning appeared less influenced by exposure to socio-economic disadvantage than conduct difficulties, emotional difficulties and peer problems.

These findings do, of course, need to be treated with a degree of caution. In particular, whilst the SDQ is a well-validated screening measure for possible child mental health problems [38–42], future research should consider the use of more sophisticated procedures capable of generating ICD-10 diagnoses [66]. In addition, whilst the measures of child cognitive development used in the study appear relatively robust, future research should consider the use of more direct measures of intellectual ability. The main strengths of the present study lie in the use of a well-constructed, large nationally representative sample of children and the use of well-validated measures to identify children with limited intellectual functioning.

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