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ORIGINAL CONTRIBUTION

Mental health of adolescents: variations by borderline intellectual functioning and disability

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Abstract

Adolescence is a period of elevated stress for many young people, and it is possible that the challenges of adolescence are different for vulnerable groups. We aimed to document the depressive and anxiety symptoms, emotional–behavioural difficulties and suicidal/self-harming behaviours among adolescents with borderline intellectual functioning (BIF) or a disability, compared to those with neither disability nor BIF. Data were drawn from the nationally representative Longitudinal Study of Australian Children. Participants were 2950 adolescents with complete data for waves 3–6 (years 2008–2014), aged 14–15 years in 2014. Anxiety and depression symptoms and self-harming/suicidal thought/behaviours were self-reported. Emotional–behavioural difficulties items came from the Strengths and Difficulties Questionnaire, and were parent-, and adolescent-reported. Results of logistic regression analyses indicate that the emotional–behavioural difficulties of adolescents with either a disability or BIF, were worse than for those with neither disability nor BIF. While adolescents with a disability reported more anxiety symptoms, no clear associations were observed for self-harming/suicidal thoughts/behaviours or depressive symptoms for those with either BIF or a disability. Adolescents with BIF or a disability are at higher risk of poor mental health than those with neither disability nor BIF, and it is vital that factors contributing to these differences are identified in order to reduce these mental health inequalities.

Keywords Adolescence · Emotional–behavioural difficulties · Mental health · Suicide · Self-harm · Borderline intellectual functioning · Disability

Introduction

The period of adolescence is critical in laying the foundations for adult health and wellbeing [1]. Mental health symptoms often first emerge in adolescence [2], with unipolar depression the largest single contributor to the global burden of disease for adolescents [3, 4]. Furthermore, it is known that poor mental health in adolescence is a risk factor for adult mental health conditions [5]. The period of adolescence therefore, represents a vital opportunity to intervene to prevent the detrimental effects of poor mental health being carried through to adulthood [4, 6].

For many reasons, including stigmatisation, exclusion and discrimination [4], the challenges of adolescence may be different for those with a disability, including those with a developmental disability. Certainly there is growing recognition that disability does not stem purely from a health condition or impairment, but arises as a consequence of an interaction between the impairment or condition, and societal forces and barriers [7]. These barriers include

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discrimination, biased attitudes, inaccessible environments and services that lead to the subversion of people with disabilities, as well as their exclusion from many domains of everyday living [8]. For young people with a disability, navigating this complex period while simultaneously experiencing, and or coming to terms with an environment and social milieu that marks them as non-normative, adolescence is likely to be particularly challenging.

While prevalence estimates of disability are difficult to ascertain due to variations in definitions and a dearth of quality data [9], the World Health Organization estimates that internationally, about 15% of adolescents have a mild to severe disability or chronic condition [10]. In Australia, it is estimated that 9% of young people aged 15–24 years are living with a physical, intellectual, psychological, or sensory/speech disability, or a disability related to a head injury, stroke or brain damage [11]. A greater and largely under-researched proportion of the population can be classified as having ‘borderline intellectual functioning’ (BIF). Typically classified according to standardised IQ tests, BIF is defined as being between one and two standard deviations below the mean (typically an IQ of 71–85) [12].

While it is known that the incidence of mental health problems increases during adolescence [4], there is also evidence of an increased risk of emotional distress and poorer mental health for adolescents with a chronic illness or disability [9], or an intellectual disability [13]. It has been observed that children aged 6–7 years with BIF have poorer mental health than those without BIF [14], however less is known about the mental health of adolescents with BIF.

Self-harm is described as the deliberate act of self-injury, irrespective of suicidal intent or motive [15]. It is estimated that about 10% of adolescents have intentionally harmed themselves [15, 16], and self-harm represents one of the most significant contributors to the burden of disease among adolescents [16]. The onset of suicidal and self-harming behaviours often occurs in adolescence, with rates of self-harm consistently found to be higher among adolescents than among adults [17]. Depression is known to be an important risk factor for suicide [18], and it is also known that the onset of major depressive disorder in adolescence is associated with more suicidality than adult-onset depression [19].

There is some evidence that adolescents with chronic physical conditions have slightly higher odds of self-harm, suicidal thinking and suicide attempts [20], but overall there has been scant research in the area, and little is known about self-harming behaviours among adolescents with BIF.

Given the paucity of knowledge about the mental health and self-harming and suicidal behaviour of adolescents with either a disability or BIF, there is a patent need to examine and understand whether the developmental period of adolescence presents increased risks of psychopathology for adolescents with either a disability or BIF. This is particularly important, given the changing contexts in which adolescence is experienced [1]. These vast changes, together with the fact that adolescents with disability, and particularly adolescents with BIF are vastly under-researched, impel this research. Furthermore, it is argued that a multi-informant approach to the assessment of child and adolescent mental health is preferable to reliance on a single informant [21, 22], however this is rarely done, particularly among adolescents with a disability or BIF. This risks failing to identify vulnerable adolescents.

Using data from the Longitudinal Study of Australian Children (LSAC), this study aimed to document the prevalence of anxiety, depression, emotional–behavioural difficulties (EBD) and self-harming and suicidal behaviours among adolescents with BIF or a disability, compared to adolescents with neither disability nor BIF. We focused on a broader category of disability (which included a wide range of impairments), and also applied a specific focus on BIF. As reviewed above, those with BIF may be particularly vulnerable, even when compared against those with other disabilities. Use of multiple informants on some measures of mental health enabled us to triangulate associations. We hypothesised that greater odds of having abnormal emotional–behavioural difficulties, and higher levels of anxiety, depression and self-harming and suicidal behaviours would be observed among adolescents with a disability compared to adolescents without a disability, and among adolescents with BIF, compared to adolescents without BIF.

Methods

Participants and study design

Data were drawn from LSAC, a nationally representative longitudinal study of Australian children conducted biennially since 2003–2004 [23]. Data from Cohort K (children born in 2000–2001), waves 3–6 were used. This corresponds to the period from 2008 (wave 3) when children were 8/9 years of age, to the year 2014 (wave 6), when children were 14/15 years of age.

We examined two disability exposure variables. The first exposure variable ‘disability status’ was collected in wave 5, based on parent-report of a disability or medical condition that lasted, or was likely to last, 6 months or more. The second exposure variable, ‘borderline intellectual functioning’ (BIF) is an objective measure based on test scores obtained from each participant at 8/9 years of age (wave 3). While analysis for BIF and disability were conducted separately, of those in the analytic sample classified as having a disability, 25.0% ($n = 28$) were also classified as having BIF. Furthermore, while we recognise the overlap between BIF and disability, for the purposes of this paper, we refer to ‘disability’ as those classified according to the wave 5 parental report measure defined above, and 'BIF' as those categorised as such in wave 3.

Covariates included in models as confounding variables were measured in wave 4, and outcomes were measured in wave 6. The outcome variables (suicidal/self-harming thoughts and behaviours, anxiety, depression, EBD) were collected in wave 6, when adolescents were 14/15 years of age.

Exposure variables

Disability

Primary household informants (94% were the adolescent's mother) responded to the following question: "Does [the study child] have any medical conditions or disabilities that have lasted, or are likely to last, for 6 months or more?"

Prompt cards with a range of conditions were presented (see Supplementary Material A). If respondents answered 'yes' to any of these conditions, the adolescent was categorised as having a disability. To minimise measurement error due to conflation of the exposure and outcome, we used the LSAC measure of disability that did not include mental illness. One hundred and eleven participants with disability (4.2% of the survey-weighted sample) were retained in the analytic sample (see Supplementary Figure S1).

Borderline intellectual functioning

Following the precedent of other work in the area [13], we used the Learning Outcome Index (LOI) contained in LSAC to define BIF. The LOI measure is a composite of direct measures of children and teacher rated assessments [24], measured among cohort K participants in wave 3. Specifically, language and literacy skills were assessed directly with the Peabody Picture Vocabulary Test (PPVT) [25] and the Academic Rating Scale (ARS) Language and Literacy subscale [26]. The Numeracy and Cognition domain of the LOI was assessed directly using the Matrix Reasoning test, a subtest of the Wechsler Intelligence Scale for Children IV (WISC-IV) [27], and the ARS Mathematical Thinking subscale (completed by teachers) [28].

The results of these four subscales produce a continuous LOI score with a mean of 100, and a standard deviation of 10. Following standard operational definitions of BIF [12], we classified those between one and two standard deviations below the mean LOI score—anyone more than two standard deviations below the mean of the within cohort LOI was classified as having an intellectual disability, and was excluded from the analysis. There were 262 participants classified as being BIF—this equates to 10.9% of the survey-weighted sample.

Outcomes variables

Self-harming and suicide

In wave 6, two sets of questions asked respondents about suicidal and self-harming thoughts and behaviours over the past 12 months. We created two variables to distinguish between thoughts and behaviours. The self-harming/suicidal thoughts variable was derived from three questions that asked respondents whether, in the past 12 months, they had: (1) considered harming themselves; (2) seriously considered suicide; (3) made a plan about how they would attempt suicide. A binary variable was created: 'yes' (if yes to any of the three questions); 'no' (if no to all three items).

The self-harming/suicidal behaviours variable was created based on respondent answers to two questions about behaviours in the past 12 months: (1) whether they had self-harmed; (2) how many times they had attempted suicide. As above, a binary variable was created: 'no' (no self-harming/suicide attempt) or 'yes' (at least one self-harming/suicide attempt).

Emotional–behavioural difficulties

The Strengths and Difficulties Questionnaire (SDQ) was used to measure emotional–behavioural difficulties (EBD). The SDQ, a commonly applied tool that is used for screening behavioural and emotional problems in children and adolescents, has been shown to have good validity and strong correlations with other measures of psychopathology [29]. Furthermore, there is evidence that it is a robust measure of mental health among adolescents with intellectual disabilities [30].

SDQ ratings came from two sources: adolescents; and parents (primary household informant). From the SDQ items, we created three measures of EBD for each informant (parent, and adolescent): a 'Total Difficulties' score (range 0–40); an 'Emotional Symptoms' score (range 0–10); and a 'Conduct Problems' score (range 0–10), with higher scores indicating more problems on each measure [31]. We chose to use these three measures as they represent an overall score of EBD (total difficulties), as well as dimensions of EBD related to emotional regulation and behavioural control (emotional symptoms and conduct problems). EBD scores were dichotomised according to Australian SDQ norms [32]: 'abnormal/of concern'; 'not abnormal'.

Depressive and anxiety symptoms

Depressive symptoms were assessed with the Short Mood and Feelings Questionnaire (SMFQ) for children, a shortened version of the 34-item Mood and Feelings Questionnaire [33]. The SMFQ has demonstrated strong concordance with depressive diagnoses derived from other inventories such as the Diagnostic Interview Schedule for Children (DISC) and shows high internal consistency [33]. Scores were summed to produce a total score ranging from 0 to 26, with higher scores indicating more depressive symptoms. Following the precedent of other work using this variable [34], a binary variable was created by dichotomising scores at the 75th percentile.

The Children's Anxiety Scale 8-item (CAS-8) was used to measure symptoms of anxiety. The CAS-8 is a shortened version of the Spence Children's Anxiety Scale (SCAS) [35]. Scores were summed to yield a total score ranging from 0 to 24, with higher scores indicating higher levels of anxiety. Responses were highly positively skewed, thus justifying transformation. As this is not a standardised scale, there was no precedent for transforming scores. We therefore created a binary variable, dichotomising at the 75th percentile.

While to our knowledge neither of these measures have been validated among specific populations of adolescents with disability or borderline intellectual functioning, we note that previous psychometric testing of the SMFQ has not excluded those with either disability or BIF [36, 37].

Covariates

Other variables from wave 4 included in our models as confounders were: household composition (single parent household; two parents), parental education (at least one parent completed secondary school; no parent completed secondary school), sex, and area-level socio-economic disadvantage (categorised into quintiles based on the index of relative socio-economic disadvantage [38]). We also adjusted for ethnicity, following the precedent of previous research [39]: Australian-born parents; at least one Anglo/European (Caucasian/White) born parent; visible minority (a parent of non-Caucasian/non-White and not Indigenous); Indigenous (self- or parent-reported Aboriginal or Torres Strait Islander).

Dropout and non-response

Our eligible sample was defined as those attending waves 3–6, of which there were 3349 respondents (see Supplementary Table S1 for summary of missingness). Respondents were excluded if they were: missing data on exposures, confounding variables, outcomes; classified as having an intellectual disability; missing longitudinal weights. Our resultant analytic sample was 2950 participants (88% of eligible sample). See Supplementary Figure S1.

As for most longitudinal studies, the majority of missing data in the LSAC survey is due to participant drop out, which particularly affects the outcomes of interest (as these were measured in wave 6). Multiple imputation is one of the methods available to handle missing data, however it has been found that imputing dependent (outcome) variables does little to improve the efficiency of the analysis [40, 41]. Given this, we chose not to use multiple imputation to handle the missing data. However, we did incorporate survey weights into our models, which account for non-response bias [41].

Comparing the analytic sample with the eligible sample, those omitted from the analysis due to missing data did not differ in terms of the outcomes nor sex. Those omitted were, however, slightly more likely to have a disability or BIF, come from a single parent household, and not have a parent who had finished secondary school.

Survey weights

Longitudinal survey weights for LSAC were included to reduce non-response bias, and to accommodate sample design characteristics including stratification. The following variables were used to create the survey weights: age of parent-1, mothers highest level of high school completed, parent-2 self-completed questionnaire returned, teacher-reported reading ability, parent-1 renting home indicator, number of days each week that someone in the household helps study child with homework [42].

Statistical analysis

All analyses were conducted in Stata/SE version 13.1 [43] using the 'svy' commands.

We first describe the prevalence of the outcomes according to disability and BIF status. We used logistic regression to obtain odds ratios (OR) for all outcome variables. Results of the logistic regression analyses are presented, both excluding and including the potential confounding variables described above.

To examine selection bias and measurement error, we conducted different sets of sensitivity analyses. Firstly, we conducted sensitivity analyses in which we treated the outcomes of anxiety symptoms, depressive symptoms and EBD as continuous outcomes and fitted linear regression models.

Secondly, as the BIF measure was obtained in wave 3 (prior to collection of wave 4 covariates), we conducted sensitivity analyses in which we fitted the regression models described above with the exposure BIF, and adjusted for the confounding variables measured at wave 2 (i.e. prior to collection of BIF information) instead of wave 4.

Results

Descriptive statistics

Statistics showing the prevalence of BIF and disability by demographic and socio-economic characteristics are presented in Table 1. These are presented as survey-weighted statistics, however we also include non-survey weighted statistics in Supplementary Table S2. There was a higher prevalence of both disability and BIF among adolescents living in one-parent households, and among those whose parents had not completed secondary education. There was a higher prevalence of BIF among adolescent males, Indigenous adolescents and those adolescents living in more disadvantaged areas. Supplementary Table S3 also contains summary statistics for those outcomes derived from continuous measures, and Supplementary Table S4 documents those scoring above the outcome thresholds.

Regression results for disability

There was little evidence that self-harming and suicidal behaviours differed between adolescents with and without a disability, however adolescents with a disability reported more symptoms of anxiety (30.6% vs 23.6% adjusted OR 1.69, 95% CI 1.02–2.81) (Table 2).

The EBD of adolescents, as rated by both parents and adolescents, differed between adolescents with and without a disability, for total difficulties, conduct problems and emotional symptoms (with the exception of adolescent-reported emotional symptoms). The greatest differences were found for total difficulties, where compared to adolescents without a disability, adolescents with a disability had five times greater odds of being classified as being abnormal according to parent-report (26.0% vs. 6.0% adjusted OR 5.04, 95% CI 2.81–9.05). Associations between total difficulties and disability were also strong for adolescent-report (25.7% vs. 16.5% adjusted OR 2.06, 95% CI 1.20–3.53).

Looking at emotional symptoms, adolescents with a disability had almost three times greater odds of being rated abnormal according to parent-report (26.5% vs. 11.0% adjusted OR 2.96, 95% CI 1.76–4.98). No clear differences were observed on the emotional symptoms scale according to adolescent self-reported measures. Adolescents with a disability had much greater odds of being classified as abnormal on the conduct problems measure according to both adolescent-report (11.7% vs. 3.5% adjusted OR 3.41 95% CI 1.98–5.88), and parent-report (14.6% vs. 3.6% adjusted OR 3.89 95% CI 2.00–7.57).

Regression results for BIF

Adolescents with BIF and without BIF did not differ on self-reported self-harming/suicidal thoughts or behaviours (see Table 3), nor did they differ on either the anxiety symptoms measure, or in terms of depressive symptoms.

Table 1 Prevalence of disability and BIF by covariate variables among adolescents aged 14–15 years

	Disability % (95% CI)	Borderline % (95% CI)
Sex		
Male	5.1 (3.9, 6.6)	13.1 (10.9, 15.8)
Female	3.2 (2.3, 4.4)	8.6 (6.9, 10.6)
Parents in household		
Two parents	3.6 (3.0, 4.4)	10.5 (9.1, 12.0)
Single parent	6.6 (4.3, 10.0)	12.6 (9.3, 16.9)
Education of parents in home		
1+parent completed secondary schooling	3.4 (2.7, 4.3)	8.0 (6.7, 9.4)
No parent completed secondary schooling	5.5 (3.9, 7.6)	16.0 (13.0, 19.5)
Ethnicity		
Australia	4.7 (3.7, 6.0)	11.3 (9.5, 13.4)
Anglo/Europe	4.6 (2.9, 7.4)	9.1 (6.8, 12.2)
Visible other	1.7 (0.1, 4.1)	9.3 (6.2, 13.7)
Indigenous	3.3 (0.1, 12.5)	22.3 (12.5, 36.4)
Area disadvantage		
1—most disadvantaged	3.8 (2.4, 5.8)	14.4 (11.5, 18.0)
2	4.4 (2.9, 6.7)	11.6 (9.0, 15.6)
3	4.8 (3.0, 7.7)	12.1 (8.5, 16.7)
4	2.7 (1.6, 4.5)	10.2 (7.7, 13.5)
5—least disadvantaged	5.6 (4.0, 8.3)	4.9 (3.3, 7.1)

Table 2 Prevalence and logistic regression of odds of abnormal emotional and behavioural difficulties (higher scores denotes worse EBD), poor mental health, and suicidal and self-harming thoughts and behaviours by disability status, OR (95% CI)

	Prevalence (%)		Crude OR (95% CI)	Adjusted OR (95% CI)[a]
	No disability	Disability		
Suicidal and self-harming thoughts and behaviours				
Thoughts	19.1	22.5	1.23 (0.76, 1.99)	1.33 (0.80, 2.20)
Behaviours	11.1	13.2	1.22 (0.66, 2.26)	1.22 (0.64, 2.32)
Mental health				
Anxiety symptoms	23.6	30.6	1.42 (0.88, 2.31)	1.69 (1.02, 2.81)
Depressive symptoms	26.4	32.2	1.32 (0.84, 2.07)	1.32 (0.85, 2.06)
Emotional and behavioural difficulties				
Total difficulties: adolescent[b]	16.5	25.7	1.74 (1.05, 2.90)	2.06 (1.20, 3.53)
Total difficulties: parent[c]	6.0	26.0	5.59 (3.28, 9.53)	5.04 (2.81, 9.05)
Emotional symptoms: adolescent[b]	18.7	21.2	1.17 (0.68, 2.00)	1.23 (0.71, 2.12)
Emotional symptoms: parent[c]	11.0	26.5	2.91 (1.80, 4.71)	2.96 (1.76, 4.98)
Conduct problems: adolescent[b]	3.5	11.7	3.66 (2.17, 6.18)	3.41 (1.98, 5.88)
Conduct problems: parent[c]	3.6	14.6	4.59 (2.44, 8.63)	3.89 (2.00, 7.57)

[a] Models adjusted for: gender, household type, parental education, ethnicity, area SEP

[b] Outcome was self-reported by the adolescent

[c] Outcome reported by parent

Table 3 Prevalence and logistic regression of odds of abnormal emotional and behavioural difficulties (higher scores denotes worse EBD), poor mental health, and suicidal and self-harming thoughts and behaviours by BIF status, OR (95% CI)

	Prevalence (%)		Crude OR (95% CI)	Adjusted OR (95% CI)[a]
	No BIF	BIF		
Suicidal and self-harming thoughts and behaviours				
Thoughts	19.5	16.9	0.84 (0.58, 1.22)	0.91 (0.61, 1.35)
Behaviours	11.4	10.0	0.82 (0.52, 1.30)	0.83 (0.50, 1.36)
Mental health				
Anxiety symptoms	24.2	21.5	0.86 (0.61, 1.20)	0.98 (0.70, 1.38)
Depressive symptoms	26.2	30.5	1.24 (0.91, 1.68)	1.29 (0.94, 1.76)
Emotional and behavioural difficulties				
Total difficulties: adolescent[b]	16.6	19.3	1.20 (0.85, 1.70)	1.35 (0.94, 1.93)
Total difficulties: parent[c]	5.2	19.4	4.41 (2.87, 6.76)	4.33 (2.84, 6.62)
Emotional symptoms: adolescent[b]	18.8	19.0	1.01 (0.70, 1.45)	1.08 (0.75, 1.56)
Emotional symptoms: parent[c]	10.7	20.0	2.10 (1.46, 3.02)	2.19 (1.51, 3.18)
Conduct problems: adolescent[b]	10.4	16.7	1.73 (1.10, 2.73)	1.62 (1.02, 2.57)
Conduct problems: parent[c]	10.1	24.3	2.84(1.71, 4.72)	2.58 (1.51, 4.41)

[a] Models adjusted for: gender, household type, parental education, ethnicity, area SEP

[a] Outcome was self-reported by the adolescent

[b] Outcome reported by parent

Differences were observed between those with and without BIF on all EBD measures except for adolescent-reported emotional symptoms and total difficulties. As for adolescents with a disability, strongest associations were observed for BIF when examining parent-reported total difficulties, where compared to adolescents without BIF, adolescents with BIF had over four times greater odds of being classified as having abnormal scores (19.4% vs. 5.2% adjusted OR 4.33, 95% CI 2.84-6.62).

According to parent-report, adolescents with BIF had over two times greater odds of being outside the normal range for emotional symptoms: 20.0% vs. 10.7% adjusted OR 2.19, 95% CI 1.51–3.18. Clear associations were also observed between having BIF and being classified as abnormal on the conduct problems measure for both adolescent-report (16.7% vs. 10.4% adjusted OR 1.62, 95% CI 1.02-2.57) and parent-report (24.3% vs. 10.1% adjusted OR 2.58, 95% CI 1.51-4.41).

Sensitivity analyses were conducted using continuous outcomes for anxiety symptoms, depressive symptoms and EBD. The results of these logistic models are presented in Supplementary Table S5 and show that associations were broadly consistent with those of the main findings.

Other sensitivity analysis conducted using wave 2 covariates for the BIF models (collected prior to the measurement of BIF in wave 3) produced negligible change in the estimates (see Supplementary Table S6).

Discussion

The results of the study presented here indicate that the emotional–behavioural difficulties are worse for adolescents with either a disability or BIF, compared to those with neither disability nor BIF. The associations observed were largely consistent across measures of EBD (total difficulties, conduct problems and emotional symptoms), and for parent- and adolescent-reported measures of total difficulties and conduct problems. Emotional symptoms, as rated by adolescents, were not different for adolescents with and without a disability/BIF, nor were there differences between those with and without BIF for adolescent-reported total difficulties.

Adolescents with a disability had greater odds of reporting symptoms of anxiety. There were no apparent differences in anxiety or depressive symptoms according to whether or not an adolescent had BIF. Furthermore, while there was no consistent relationship between either BIF or disability status and self-harming/suicidal thoughts (potentially due to a lack of statistical power), the estimates for disability suggest that these associations are worthy of further investigation.

The EBD results are consistent with other studies that have shown poorer mental health (as measured by higher SDQ scores), among children with an intellectual disability [14, 44], BIF [14] or a chronic illness or disability [45]. The fact there was mostly consistency in associations across all raters, with greater odds of having abnormal EBD in adolescents with either a disability or BIF, strengthens our findings.

It is noteworthy that associations for EBD differed depending on whether parents or adolescents reported EBD. While it is widely accepted that a multi-informant approach to the assessment of child and adolescent mental health is preferable [21, 22], agreement between informants is typically low [21, 46]. Among those adolescents in this sample who were not classified as having a disability or BIF, adolescent-reported EBD was substantially higher than that of parent-reported EBD. However, among those classified as having BIF or a disability, there was little difference between parent- and adolescent-reported EBD. There are two potential reasons underpinning such observations. Firstly, it is possible that parents are misperceiving or overinterpreting behaviours among those with a disability or BIF, or have a lower threshold for the behaviours of those with BIF or disability, leading to differential misclassification. It is also possible that adolescents who have a disability or BIF may be less likely to report difficulties even when they have them, or have less capacity to assess their own behaviour. This may lead them to underestimate the extent to which their behaviours and feelings are atypical, leading to differential misclassification. Also of relevance, there is some evidence that parent–child agreement is higher for externalising behaviours, and lower for internalising behaviours [47]: this being attributed to the fact that externalising behaviours are more noticeable, and behavioural manifestations of internalising behaviours can be mis-interpreted [48]. This was observable in this sample among those not classified as having a disability or BIF, where the prevalence of abnormality on the conduct problems measure was almost identical for parent- and adolescent-report, but was different between raters on the emotional symptoms scale. Also of relevance, among a sample of 10–13 year olds, parent-reported adolescent mental health was found to be more consistent than self-reported adolescent health, leading the authors to argue that children/adolescents may be more likely to report minor disturbances in behaviour and feelings (that may have little impact) than parents [21].

The results observed here are important for several reasons. Firstly, they suggest that adolescents with BIF or a disability are at higher risk of abnormal EBD. Given that the SDQ is known to be a useful instrument in the detection of child psychopathology [49], it is possible that our results flag early signs of psychopathology that are not yet detectable on other measures of psychiatric distress such as the anxiety and depression measures used here.

Furthermore, as it is known that children and adolescents with low intellectual functioning contribute to a disproportionate amount of overall child and adolescent psychiatric morbidity [14], the detection of early signs of abnormal EBD among adolescents with a disability and BIF is of acute importance to policy makers and mental health practitioners, as it highlights opportunity for early intervention. Further to this point, the attenuated differences in EBD when based on self-report highlight the importance of obtaining information from multiple informants, as there is a risk that reliance on self-report may lead to vulnerable adolescents being missed.

Secondly, and relatedly, given that there is some evidence that adolescent mental health problems predict adult mental health problems [5], it is critically important that early signs of abnormal EBD in these vulnerable groups of adolescents are recognised, as early intervention is known to improve the mental health outcomes of adolescents at risk of poor mental health [50]. Of relevance, there is growing application of the biopsychosocial model to disability: this explicitly recognises the complex interplay of environmental, social, physical and biological factors that lead to disablement [7]. Previous research among adolescents with a disability has shown that a substantial proportion of the detrimental mental health effects of disability is mediated through bullying [51]. It is possible that similar associations exist for BIF, thus highlighting the importance of identifying and intervening on the social determinants of mental health (such as bullying) that are most pertinent to adolescents with disability.

Thirdly, the results presented here contribute to the modest, but growing literature on the mental health and wellbeing of adolescents with BIF, and adolescents with a disability.

The fact that we observed strong associations for EBD, but less clear associations for anxiety and depression is intriguing. While it is possible that the SDQ, is more sensitive to the early signs of psychopathology than other mental health assessment tools, it is also possible that the instruments used to measure anxiety and depression lack sensitivity and specificity—we note that neither measure is used as a diagnostic test.

There are several strengths and limitations of this research. A key strength is the use of two different reports (parent- and adolescent- report) of three measures of EBD (conduct problems, total difficulties and emotional symptoms). The overall agreement between informants for associations between disability/BIF and EBD (both showing greater odds of abnormal EBD in adolescents with a disability, and adolescents with BIF), strengthens our findings.

Further supporting our findings, sensitivity analysis conducted with total difficulties, conduct problems and emotional symptoms analysed as continuous variables resulted in findings consistent with the main analyses (see Supplementary Table S5). Other sensitivity analysis conducted with anxiety and depressive symptoms analysed as continuous variables also produced results consistent with those of the principal analyses, providing support for the use of dichotomous variables for this analysis (see Supplementary Table S6). Finally, we also note that we minimised bias arising from conflation of exposure and outcome by using a measure of disability that did not include mental illness.

In terms of limitations, it is firstly important to acknowledge that wave 6 of LSAC did not collect exhaustive information on all types of psychopathology.

Secondly, the measure of disability used in LSAC is focused on functional limitations or impairment, and may not have adequately captured disability as a construct: it combines several different conditions and does not distinguish between levels of severity, nor between those who may have one versus those with multiple disabilities. It is likely that experiences vary substantially depending on type of disability, level of severity, and whether an individual has one or multiple morbidities. This limitation is somewhat offset by the fact that we used two measures of disability in an attempt to triangulate and substantiate observed associations. We also note that the measure of BIF is an objective measure based on performance on the Learning Outcomes Index in wave 3.

Our results may also have been limited by sample size: while the proportion of adolescents who reported suicidal and self-harming ideation and behaviours was alarming, it was nonetheless relatively small in terms of absolute numbers among adolescents with a disability, and our ability to detect differences between those with and without a disability may have been compromised by a lack of statistical power.

There is also some potential that our study was affected by selection bias due to missing data. There were slight differences in the characteristics of those included in the analysis and those excluded due to missing data. Those with missing data were slightly more likely to have a disability or BIF and experience socio-economic disadvantage. However, the proportion of the eligible sample with missing data was less than 12%, therefore it is unlikely that selection bias substantially affected the results.

We also acknowledge that like many intelligence and learning measures, there is potential imprecision with this classification of BIF. It is widely recognised that not all of those classified as BIF solely on the basis of general intellectual functioning, need support or have problems with conceptual, social and practical skills [12]. Furthermore, false positives and false negatives, if present, will likely have diluted the findings, meaning that the observed estimates will have underestimated the true effects.

Finally, it is also important to recognise that adolescents with BIF may have had difficulties understanding and completing the questionnaires, potentially biasing results towards the null. However, the general consistency of the associations for EBD across different informants suggests that this is unlikely to have substantially biased the EBD results. While there is some evidence that those with intellectual difficulties may report at the extremes of scales, there is negligible evidence of this reporting pattern among those with BIF [52] and indeed there was no evidence of this reporting pattern in this study. As a further point, while further research is needed to assess the suitability of the self-reported outcomes in populations of adolescents with BIF and disability, we argue that it is vital that outcome information is collected from multiple informants.

Conclusions

In conclusion, this study presents evidence that adolescents with either BIF or a disability are at higher risk of poor mental health. In particular, there is evidence that adolescents with either BIF or a disability are at higher risk of abnormal EBD than those with neither disability nor BIF. Further, there is evidence that adolescents with a disability are at higher risk of anxiety than adolescents without a disability. These mental health inequalities observed between adolescents with BIF or disability, and those without, underscore the importance of identifying and intervening on factors that underpin these differences.

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Compliance with ethical standards

Conflict of interest None to declare.

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Ethical standards The LSAC study has ethics approval from the Australian Institute of Family Studies Ethics Committee. The Ethics Committee is registered with the Australian Health Ethics Committee, a subcommittee of the National Health and Medical Research Council (NHMRC). Written informed consent was obtained from the caregiver on behalf of each of the study children.

Availability of data and materials Data used in this study are not available for sharing due to ethical and data management requirements. The researchers welcome potential collaborations.

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