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Is having a family member with chronic health concerns bad for young people's health? Evidence from a national sample of young Australians

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ABSTRACT

Objectives: Young people's perspectives on the association between having a family member with a chronic health concern (FHC) and their own health is under-researched. This study used young people's reports to assess the prevalence of FHCs and their association with negative health outcomes, with an aim of identifying potential inequalities between marginalised and non-marginalised young people. Family cohesion was examined as a moderating factor.

Design: Cross-sectional data from the Australian Child Wellbeing Project survey were used. Respondents were asked whether someone in their family experienced one or more FHCs (disability, mental illness, or drug/alcohol addiction). In addition, their experience of different psychosomatic symptoms (headache, sleeplessness, irritability, etc.) and family relationships, as well as social and economic characteristics which facilitated identification in marginalised groups (disability, materially disadvantaged, and Indigenous), was documented.

Setting: Nationally representative Australian sample.

Participants: 1,531 students in school years 4 and 6 and 3,846 students in Year 8.

Results: A quarter of students reported having an FHC (years 4&6: 23.96% (95% CI 19.30-28.62); year 8: 25.35% (95% CI 22.77-27.94)). Significantly more students with FHCs than those without reported experiencing 2 or more negative health symptoms at least weekly (OR=1.78; 95% CI 1.19 to 2.65; *p*<.01). Marginalised students and students reporting low family cohesion had an increased prevalence of FHCs and notably higher symptom loads where FHCs were present. However, an independent relationship between FHCs and symptom load was only found in the case of FHC-drug/alcohol addiction. Level of family cohesion did not impact the relationship between FHCs and symptom load.

Conclusions The burden of FHCs is inequitably distributed between marginalised and non-marginalised groups, and between young people experiencing different levels of family cohesion. More work is required regarding appropriate targets for community and family level interventions to support young people in the context of FHCs.

Strengths and limitations of the study

- The study provides nationally representative estimates of FHCs and associated characteristics as reported by young people aged 9-14 years
- Unlike most small scale studies of FHCs, the survey used in this study allowed comparison of health among subsamples with and without FHCs, by age, sex, marginalisation and family cohesion.
- The survey used in this study asked young people to report on a broad range of social and economic circumstances that allowed robust identification of marginalisation and assessment of family cohesion.
- Causation is unable to be established due to cross-sectional study design

INTRODUCTION

There is now a growing literature, much of it relying on young people's own reports, showing how social and environmental factors can influence their health, engagement in peer activities, cognitive development and wellbeing [1,2]. Having a family member who experiences a chronic and/or debilitating health concern is one such factor [3-8]. Until recently, there has been relatively little population level evidence regarding the overall prevalence of young people who had family members with chronic and/or debilitating health concern (family health concern - FHC). Previous estimates of FHC prevalence have often focused on specific health concerns involving just parents or siblings, and/or use parent, as opposed to child, report [e.g. 9]. In addition, these data were typically obtained from high risk samples such as those who access mental health or substance abuse services [9-11], rather than broader population groups.

A recent Australian study found that 29% of young people in a large school and community based survey of 9-20 year olds reported a serious physical or mental health condition in a family member [7]. Additional data from a nationally representative New Zealand survey of 12-17 year olds suggests that 11% were living with a person with a disability or long term illness, 8% were living with someone who had depression/mental illness, and 8% were living with someone addicted to alcohol or other drugs [12]. These recent estimates suggest that FHCs are a common experience among young people. Therefore, the distribution of FHCs across different groups of young people, the associations between FHCs and young people's own health, and factors that mediate this association, all warrant thorough exploration.

Evidence regarding the distribution of chronic health concerns in society suggests FHCs are likely to be highly prevalent in marginalised groups, including those who are materially disadvantaged, or (in the Australian case) Indigenous. Globally, and in Australia, poverty is associated with high rates of disability [13,14]. Research also suggests a higher prevalence of substance use, disability, chronic illness and mental health concerns among Indigenous Australians than among non-Indigenous Australians [15-18]. Moreover, young people who are themselves living with disability (another marginalised group in the Australian context) are more likely than young people without disability to have parents with disability or mental health concerns [19-21].

In the context of this inequitable distribution, understanding the association between FHCs and other aspects of young people’s wellbeing is important. In their meta-analysis of problem behaviour in children with chronically ill parents, Sieh, et al.[8] found significant overall effect sizes for both internalising and externalising problem behaviour. Adding to this, Pakenham and Cox[7] found that young people living with a family member with a serious illness had a range of negative outcomes compared to those residing with a healthy family, where negative outcomes included both social, psychological and somatic effects. However, Pakenham and Cox[7] also found effect sizes to be generally small, such that FHCs were not the main explanatory factor of these outcomes.

That an association between FHCs and young people’s health has been found is not surprising, given that experience of frequent psychosomatic health symptoms is often associated with stress in a person’s environment [22,23] with problems most often occurring in clusters (Santalahti et al. 2005; Ravens-Seiberer et al. 2009). Moreover, young people’s experience of high levels of psychosomatic symptoms is likely to reflect the multiple sources of stress within their environment, for example those that are associated with economic disadvantage, disability, and other forms of marginalisation [2,24,25].

Exactly how membership of a marginalised group modifies the association between FHCs and health outcomes is, however, disputed. Sieh, et al.[8] found that younger age and low SES tended to strengthen the association between parental illness and emotional and behavioural problems. Packenham and Cox (2014), on the other hand, found that demographic variables relating to age, ethnicity and relative economic disadvantage did not significantly modify the relationship between FHC and adjustment outcomes. Moreover, while Sieh and colleagues found no overall effect of gender on outcomes, Packenham and Cox showed more somatisation for girls than for boys, which they suggested may be because girls are more likely to take on caring roles than boys. In summary, there is no unanimity in the literature on how demographic characteristics modify the relationship between FHCs and young people's health outcomes.

In addition, the issue of how family relationships might influence the association between FHCs and young people's health is under-studied. Strong family cohesion (family members spending time together, talking or having fun together) has been shown to provide young people with connection and security, which is able to serve as a protective factor for risk of poor health outcomes, especially for adolescents, in the presence of family violence and substance use [26,27]. It has also been shown to attenuate the risk for internet addiction [28], adolescent alcohol use [29], problem gambling in youth [30], and increase resilience and schooling outcomes, even in the context of material disadvantage [31,32]. In one longitudinal study of a small sample of youth whose parents had multiple sclerosis (N=127), Pakenham and Cox[33] found that parental depression was associated with subsequent reduced family functioning, which was in turn associated with children's wellbeing (although not with indicators of somatisation). Of interest in the present analysis is whether the odds of having a high symptom load are significantly different for young people with and without FHCs after levels of family cohesion are taken into account.

The purpose of this paper is therefore to explore the relationship between FHCs and health outcomes in a nationally representative sample of young Australians aged 9-14 years. The following questions are explored:

(1) Does the *prevalence* of FHCs vary with young people's age, sex and marginalised status?

(2) Are the odds of having a high symptom load are greater for young people with FHCs, controlling for age, sex and marginalised status?

(3) Does family cohesion modify the relationship between FHCs and symptom load?

METHOD

Data

Data were drawn from a survey conducted in late 2014 as part of the Australian Child Wellbeing Project (ACWP – www.australianchildwellbeing.com.au). The survey instrument was developed following direct consultations with 97 young people in nine groups on what contributes to a 'good life' [25]. A multi-stage stratified probability sample (states/territories, sectors and schools) was used to arrive at a nationally representative sample of students in Years 4, 6 and 8 (approximately, 9-10, 11-12 and 13-14 years old) [34]. Jurisdictional educational authorities and university human research ethics committees approved the research. Informed parental and student consent was obtained in all cases. The final sample comprised 5,440 valid student responses from 180 schools in every state and territory.

Identifying FHCs: students were asked: "Is there anyone in your family who is seriously affected by: (1) disability or long term illness, (2) depression or mental illness, or (3) using alcohol or other drugs?" Students could select any combination of the three conditions or "none of these". This question was taken, slightly modified, from the New Zealand Youth 2000 Survey Series [35]. In the New Zealand survey, respondents were asked whether anyone in their home had an FHC. In the present study, the question was changed in response to direct consultations with young people who stressed the importance of family for 'the good life' and the distinction many of them made between 'family' and 'household' [36].

Symptom load: The HBSC Symptom Check List [2] was used to measure psychological and somatic symptom load. Students were asked: "In the last 6 months: how often have you had the following?" Eight symptoms were listed – feeling low, irritability or bad temper, feeling nervous, headache, stomach-ache, backache, sleeplessness, and feeling dizzy. Responses were selected from (0) "seldom or never" to (4) "almost daily". Consistent with other studies, a binary variable was derived to identify respondents who experienced at least two of the eight symptoms at least once a week, indicating a high psychosomatic symptom load [2].

Marginalised groups: Material deprivation was assessed using responses to four questions: how many cars, vans or trucks the student's family owned, whether the student had their own bedroom, how many times the student travelled away on holiday with their family in the past year, and how many computers the family owned. These questions have been widely used as a proxy for socio-economic status in surveys of young people [24,37]. The resulting scale differentiated effectively between young people who were materially disadvantaged (12.9% of Years 4 and 6s, and 8.3% of Year 8s) and those who were not [25].

Young people with disability were identified by responding 'yes' to a question asking whether they had a disability and in addition indicating that the disability made it hard for them to, or stopped them doing, one or more activities (Years 4 and 6: 11.3%; Year 8: 11.0%). Students self-identified in the survey as Indigenous (Years 4 and 6: 7.0%; Year 8: 3.5%). Where reference is made to non-marginalised students, this group comprises those not included in any of the three above marginalised groups.

Family cohesion: Students were asked: "how often in the past week have you spent time doing the following things with your family?" Students rated the frequency of "talking together," "laughing together," and "learning together" from (0) not at all last week, to (3) every day last week [38]. These three items loaded onto a family cohesion scale [25], and total family cohesion scores were calculated by summing the three variables to create a total score from 0-9. In the analysis a three-category indicator was used, representing low (score = 0-4), average (5-7), and high levels (8-9) of cohesion, with the bottom and top categories each containing about 15% of all observations.

Statistical methods

Analysis was performed using Stata/SE V.14 for Windows (copyright 1985–2015 StataCorp LP). Complex survey design weights were applied, adjusting for differential non-response in terms of state/territory, school sector and socio-economic status, and student sex. Prevalence of FHCs was examined overall, and by age, sex and marginalisation. Mean symptom loads were compared across students with and without FHCs by age, sex, marginalisation and family cohesion. 95% confidence intervals were calculated for all means and percentages. T-tests were employed to assess the significance of differences between means and percentages. Analyses used logistic regression to examine the overall relationship between the different categories of FHC and experience of two or more health symptoms at least weekly, controlling for the effects of age, sex and marginalised status on this relationship, and whether family cohesion modified the relationship. Observations with missing data were excluded from parts of the analysis. Data on FHCs were missing for 13/1,544 Years 4 and 6 students (0.8%), and 50/3,896 Year 8 students (1.3%). Where all variables were included in the multivariate analysis, the level of missings was higher (338/1,544 at Years 4 and 6 – 21.9%; 865/3,896 at Year 8 – 22.2%). However, tests indicated that observed characteristics of students with missing data were similar to those of students with no missing data.

RESULTS

Table 1 shows prevalence rates for family health concerns across the two age groups, by sex, marginalisation and family cohesion. Overall, approximately one quarter of students in both age groups reported an FHC. The most common was disability/long term illness, followed by depression/mental illness and then drugs/alcohol addiction. Among the Years 4 and 6 students, there was little difference in the percentages of boys and girls reporting FHCs. Among Year 8 students, however, girls were significantly more likely than boys to report an FHC. In both age groups, students who were materially disadvantaged, students with disability and Indigenous students were considerably more likely to report all types of FHC than non-marginalised students – that is, those not in any of these groups. For example, 14.5% of materially disadvantaged students in Years 4 and 6, and 26.5% of materially disadvantaged students in Year 8 reported having a family member with depression or mental illness, compared with 7.3% and 8.9%, respectively, of non-marginalised students. For all analyses, data missing from year level total reflect where students have skipped or declined to answer all or parts of the questions included in the analysis.

Table 1. Prevalence of FHCs, by type, year level and student characteristics (%)

	Disability/long term illness	Depression/ Mental illness	Drugs/Alcohol addiction	FHC overall	N
Years 4 & 6					Year level total=1544
All	14.20 [9.88 - 18.52]	8.60 [6.21 - 10.99]	7.46 [4.72 - 10.21]	23.96 [19.30 - 28.62]	1,531
Boys	13.70 [8.01 - 19.39]	7.53 [3.49 - 11.58]	7.08 [3.4 - 10.77]	23.98 [17.22 - 30.74]	656
Girls	14.73 [10.53 - 18.93]	9.72 [6.94 - 12.5]	7.87 [4.66 - 11.07]	23.94 [19.16 - 28.72]	875
Materially disadvantaged	22.23 [13.08 - 31.39]	14.52 [9.1 - 19.93]	11.05 [3.95 - 18.15]	38.54 [25.4 - 51.69]	172
With disability	26.85 [20.82 - 32.89]	13.51 [6.16 - 20.86]	13.84 [6.87 - 20.82]	41.93 [31.23 - 52.63]	193
Indigenous	29.34 [18.39 - 40.29]	6.19 [1.29 - 11.09]	14.93 [5.85 - 24.01]	40.18 [29.93 - 50.43]	106
Not marginalised	10.69 [6.84 - 14.54]	7.25 [4.83 - 9.67]	5.96 [3.04 - 8.88]	18.92 [15.15 - 22.69]	1,112
Low family cohesion	11.72 [7.45 - 15.98]	9.51 [5.35 - 13.67]	9.31 [5.16 - 13.46]	21.16 [15.5 - 26.81]	244
Average family cohesion	11.47 [7.32 - 15.62]	7.12 [4.1 - 10.15]	5.91 [2.85 - 8.97]	20.68 [15.94 - 25.42]	672
High family cohesion	11.84 [7.35 - 16.33]	8.79 [3.32 - 14.25]	6.01 [0.45 - 11.57]	20.96 [13.68 - 28.23]	385
Year 8					Year level total=3896
All	13.68 [12.27 - 15.1]	11.53 [9.57 - 13.48]	7.78 [6.35 - 9.21]	25.35 [22.77 - 27.94]	3,846
Boys	12.23 [10.61 - 13.85]	8.02 [6.05 - 9.98]	6.81 [4.91 - 8.72]	21.73 [18.87 - 24.58]	1,922
Girls	15.18 [13.14 - 17.23]	15.16 [12.49 - 17.83]	8.78 [6.86 - 10.71]	29.10 [25.59 - 32.61]	1,924
Materially disadvantaged	28.92 [23.94 - 33.91]	26.51 [20.97 - 32.04]	17.51 [12.27 - 22.76]	50.21 [44.79 - 55.64]	397
With disability	19.43 [13.11 - 25.75]	19.37 [13.41 - 25.32]	12.92 [7.29 - 18.55]	35.05 [27.21 - 42.88]	312
Indigenous	22.76 [15.52 - 30]	17.40 [7.58 - 27.22]	15.93 [6.47 - 25.4]	42.44 [34.96 - 49.93]	133
Not marginalised	10.73 [9.26 - 12.21]	8.90 [6.82 - 10.99]	5.77 [4.48 - 7.06]	20.42 [17.83 - 23.02]	2,997
Low family cohesion	16.08 [13.03 - 19.12]	19.34 [15.24 - 23.44]	13.48 [10.27 - 16.69]	33.57 [29.12 - 38.02]	897
Average family cohesion	11.51 [9.45 - 13.56]	9.80 [7.91 - 11.69]	6.30 [4.83 - 7.77]	22.34 [19.5 - 25.18]	1,715
High family cohesion	15.79 [11.37 - 20.21]	6.07 [3.8 - 8.34]	2.82 [1.34 - 4.3]	20.97 [16.36 - 25.57]	730

Note: % are weighted; 95% confidence intervals are reported in square parentheses. Ns are unweighted. Source: ACWP survey, authors' calculations.

Table 1 also shows that while there is little relationship between family cohesion and FHCs among Years 4 and 6 students, among Year 8s, students reporting high family cohesion are notably less likely than students reporting low family cohesion to report that someone in their family has mental illness/depression or drug/alcohol addiction, although proportions with low and high family cohesion reporting disability/chronic illness are similar.

Table 2 shows percentages of students with and without FHCs who report a high symptom load of two or more health symptoms at least weekly. Overall, among both younger and older students, proportions reporting high symptom load are significantly greater for those with FHCs than for those without. Almost half of Years 4 and 6 students (48.7%), and slightly fewer Year 8 students (44.2%) with any FHC reported experiencing two or more symptoms at least weekly; this compares with 27.7% and 24.3% of students in the two year groups without FHCs, respectively.

The table also shows that while there is not a significant difference between boys and girls with FHCs reporting high symptom load in Years 4 and 6, a significant difference is apparent in Year 8 (as it is among boys and girls with no FHCs). Among students with disability and materially disadvantaged students in both year groups, those with FHCs are significantly more likely to report high symptom load than those without. Higher proportions of Indigenous students with FHCs in Years 4 and 6 also report high symptom load than those without, although the difference is not statistically significant. In Year 8 on the other hand, there is little difference in the proportions of Indigenous with and without FHCs reporting high symptom load. Finally, the table shows a strong association between level of family cohesion and proportions reporting a high symptom load, where lower cohesion in the former is associated with higher proportions of the latter. Among Year 8 students, the proportion with FHCs and low family cohesion reporting high symptom load (62.7%) is double the proportion with FHCs and high family cohesion reporting high symptom load (31.0%). Among Years 4 and 6 students, the proportion in low cohesion families *with no FHCs* reporting high symptom load (36.2%) is similar to the proportion in high cohesion families *with FHCs* reporting a high symptom loads (38.7%). Among Year 8s, the corresponding percentages are 39.6% (low cohesion, no FHCs) and 31.0% (high cohesion, FHCs).

It is worth noting that among both younger and older students with FHCs, proportions with a high symptom load are lowest where the FHC is disability or chronic illness (41.76%, 95% CI = 35.01-48.52%; and 41.74%; 95% CI = 36.59-46.88%, respectively), and highest where the FHC relates to drug/alcohol addiction among Years 4 and 6 (60.0%; 95% CI=49.51-70.49%) and mental illness among Year 8 (55.3%; 95% CI=50.01-60.60%). The incidence of high symptom load therefore varies not only according to student characteristics, but also according to FHC type.

Table 2 Symptom load by FHC, gender, marginalisation and family cohesion.

		Years 4 & 6 (N=1544)			Year 8 (N=3896)		
		No FHC	FHC		No FHC	FHC	
All	%	27.74	48.72	***	24.29	44.24	***
		[24.93 - 30.55]	[42.11 - 55.33]		[22.38 - 26.2]	[40.16 - 48.32]	
	N	1,096	312		2,647	859	
Boy	%	26.58	44.62	**	21.66	36.18	***
		[21.94 - 31.22]	[35.67 - 53.56]		[18.7 - 24.61]	[30.79 - 41.57]	
	N	474	130		1,362	351	
Girl	%	28.62	51.65	***	27.08	49.80	***
		[24.98 - 32.26]	[43.25 - 60.05]		[24.4 - 29.77]	[45.5 - 54.11]	
	N	622	182		1,285	508	
p(girl>boy)					*	***	
With disability	%	50.00	65.63		46.49	64.37	***
		[38.97 - 61.03]	[53.33 - 77.92]		[39.24 - 53.74]	[57.59 - 71.15]	
	N	86	64		185	174	
p(disability>not marginalised)		***	**		***	***	
Materially disadvantaged	%	38.39	51.67	*	33.52	52.73	**
		[29.38 - 47.4]	[39.65 - 63.68]		[26.55 - 40.5]	[41.5 - 63.95]	
	N	112	60		176	110	
p(materially disadvantaged>not marginalised)		**			**	*	
Indigenous	%	36.84	46.88		37.68	33.33	
		[24.44 - 49.24]	[29.67 - 64.08]		[25.32 - 50.04]	[19.32 - 47.35]	
	N	57	32		69	48	
p(Indigenous>not marginalised)					*		
Not marginalised	%	24.80	45.95	***	21.80	38.76	***
		[21.74 - 27.85]	[38.24 - 53.66]		[19.77 - 23.84]	[34.13 - 43.39]	
	N	859	185		2,229	565	
p(marginalised>not marginalised)		***			***	***	
Low family cohesion (scale score - 0-4)	%	36.21	63.33	***	39.62	62.72	***
		[26.71 - 45.7]	[52.72 - 73.94]		[34.79 - 44.46]	[56.04 - 69.41]	
	N	174	60		530	279	
‘Average’ family cohesion cohesion (scale score - 5-7)	%	28.92	45.26	**	19.90	33.05	***
		[24.58 - 33.26]	[35.99 - 54.52]		[17.63 - 22.18]	[26.97 - 39.13]	
	N	491	137		1,221	357	
High family cohesion (scale score - 8-9)	%	18.00	38.71	**	14.59	31.03	***
		[14.54 - 21.46]	[26.75 - 50.67]		[11.53 - 17.66]	[22.9 - 39.17]	
	N	300	62		555	116	
p(low cohesion> high cohesion)		***	**		***	***	

Note: Note: % are weighted; 95% confidence intervals are reported in square parentheses. Ns are unweighted. p-values in columns denote significance of difference between FHC and non-FHC samples; p-values in rows denote significance of difference between groups within FHC and non-FHC samples; **p*<.05, ***p*<.01, ****p*<.001. Source: ACWP survey, authors’ calculations.

Table 3 shows odds ratios associated with having a high symptom load, where explanatory variables include age, sex, marginalisation and family cohesion, as well as the different FHC types. The odds are derived from logistic regression models where the explanatory variables (except for FHCs) are included (model 1), and interacted with FHC-disability (model 2), FHC-mental illness (model 3), FHC-drug/alcohol addiction (model 4) and any FHC (model 5). Model 1 results therefore shows odds and 95% CIs associated with each explanatory variable with no FHC indicators and no interactions, while the remaining model results show odds for each explanatory variable, and the marginal (multiplicative) effects of interaction with each of the FHC indicators. The odds for these interactions therefore represent the increased association between FHCs and high symptom load. It is worth noting that the small improvement in McFadden's pseudo-R^2 for models 2-5 over model 1 suggest that FHCs contribute only a small proportion explained variation in symptom load [39].

Model 1, without interactions, shows that odds ratios for Year 8 and High family cohesion are significantly less than 1; odds ratios for Girl, With disability, Materially disadvantaged and Low family cohesion are all significantly greater than 1. Odds for Indigenous, on the other hand, are not significantly different to 1. None of these odds changes greatly in models 2-5. Moreover, neither the indicators for FHC-disability (model 2) nor FHC-mental illness (model 3), nor their interactions, are significant, suggesting that these two types of FHC do not increase the odds of a student having a high symptom load, over and above the odds associated with the other explanatory variables. However, Model 4 shows that the indicator for FHC-drug/alcohol addiction is associated with significantly increased odds of a student having a high symptom load (OR=2.84; 95% CI = 1.464 - 5.509; p<0.01). Model 4 also shows the Indigenous x FHC interaction being associated with significantly reduced odds of high symptom load (OR=0.37; 95% CI = 0.121 - 1.117; p<0.1). Similarly to model 4, model 5 (any FHC) shows that the FHC indicator and the Indigenous x FHC interaction are both significant. To summarise, therefore, age, sex, marginalisation and family cohesion are all significantly associated with the odds of a student having a high symptom load. Having a family member with a disability or chronic illness, or mental illness, does not increase those odds significantly. On the other hand, having a family member with a drug/alcohol addiction is associated with significantly greater marginal odds of a high symptom load. These marginal odds are the same for most groups (except Indigenous).

Table 3. Odds ratios for marginalised and non-marginalised students in Years 4 and 6 and Year 8 experiencing 2+ health complaints at least weekly, controlling for presence of FHC

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Variables		FHC disability		FHC mental illness		FHC drug/alcohol		Any FHC	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
		-		-		-		-		-
Year 8	0.796***	0.682 - 0.928	0.764***	0.647 - 0.902	0.757***	0.643 - 0.892	0.825**	0.702 - 0.970	0.793**	0.662 - 0.951
Girl	1.391***	1.209 - 1.601	1.341***	1.151 - 1.562	1.276***	1.097 - 1.484	1.385***	1.195 - 1.604	1.261***	1.067 - 1.491
Disability	3.192***	2.588 - 3.939	3.158***	2.481 - 4.020	2.701***	2.125 - 3.434	3.129***	2.498 - 3.920	2.816***	2.127 - 3.730
Materially disadvantaged	1.489***	1.185 - 1.872	1.483***	1.150 - 1.912	1.469***	1.137 - 1.899	1.523***	1.190 - 1.950	1.509***	1.130 - 2.016
Indigenous	1.120	0.793 - 1.583	1.228	0.838 - 1.800	1.231	0.842 - 1.799	1.234	0.857 - 1.777	1.432	0.931 - 2.202
Low family cohesion	2.382***	2.029 - 2.798	2.325***	1.953 - 2.768	2.169***	1.819 - 2.586	2.282***	1.925 - 2.706	2.094***	1.723 - 2.544
High family cohesion	0.692***	0.574 - 0.834	0.652***	0.531 - 0.801	0.687***	0.563 - 0.838	0.692***	0.570 - 0.840	0.652***	0.524 - 0.813
FHC			1.195	0.717 - 1.992	1.527	0.844 - 2.762	2.840***	1.464 - 5.509	1.778***	1.193 - 2.650
Year 8 x FHC			1.234	0.783 - 1.944	1.253	0.759 - 2.068	0.636	0.358 - 1.131	0.889	0.622 - 1.269
Girl x FHC			1.240	0.833 - 1.848	1.280	0.812 - 2.016	0.849	0.496 - 1.453	1.244	0.904 - 1.712
With disability x FHC			0.810	0.489 - 1.343	1.358	0.779 - 2.367	0.985	0.502 - 1.931	0.969	0.626 - 1.501
Materially disadvantaged x FHC			0.903	0.498 - 1.635	0.692	0.382 - 1.252	0.620	0.314 - 1.221	0.766	0.474 - 1.238
Indigenous x FHC			0.567	0.234 - 1.376	0.498	0.201 - 1.234	0.368*	0.121 - 1.117	0.458**	0.224 - 0.934
Low family cohesion x FHC			1.114	0.705 - 1.762	1.392	0.867 - 2.234	1.243	0.716 - 2.160	1.346	0.942 - 1.924
High family cohesion x FHC			1.456	0.867 - 2.446	1.288	0.683 - 2.428	1.244	0.549 - 2.821	1.378	0.893 - 2.125
Constant	0.284***	0.239 - 0.338	0.284***	0.236 - 0.342	0.290***	0.242 - 0.348	0.268***	0.224 - 0.321	0.265***	0.216 - 0.323
Log Likelihood (intercept only)	-2552.453		-2552.453		-2552.453		-2552.453		-2552.453	
Log Likelihood (full model)	-2364.304		-2350.158		-2328.059		-2350.192		-2322.647	
McFadden pseudo-R^2	0.074		0.079		0.088		0.079		0.090	
Observations	4,237		4,237		4,237		4,237		4,237	

Logistic regression model: two or more health symptoms at least weekly = *f*(girl, marginalised [with disability, materially disadvantaged, Indigenous], family cohesion and FHC, and interaction of Girl, marginalised and family cohesion with FHC. Separate models run for each disability type. Base case: Boy, not marginalised, no FHCs, average family cohesion. ***p<.01, **p<.05, *p<.1. McFadden's pseudo- R^2 is calculated as 1 – [Log Likelihood (full model)/ Log Likelihood (intercept only)]. Low family cohesion represents a score of 0-4 (from 9), high family cohesion represents a score of 8-9 (from 9).

DISCUSSION

This study, based on a nationally representative sample of 9-14 year old students, suggests that approximately one quarter of young Australians in their middle years have an FHC. This supports findings from a national New Zealand study where similar questions to those in the present study were asked of respondents. The study shows that the three types of FHCs students were asked about are all more heavily concentrated among marginalised groups (young people with disability, materially disadvantaged young people, and indigenous young people) than among the non-marginalised. Among Year 8 students (but not among Years 4 and 6 students), both sex and scores on the family cohesion scale were also strongly associated with depression/mental illness and with drug/alcohol addiction, but not with disability/long term illness. Therefore, the evidence presented here, in response to the first research question, suggests that the *prevalence* of FHCs varies considerably with young people's marginalised status. However, variation by sex is only notable among older students for two of the three FHC types, as is variation according to level of family cohesion. These findings add to those of Sieh, et al.[8] and Pakenham and Cox[7], who do not discuss prevalence in detail.

Consistent with Sieh, et al.[8] and Pakenham and Cox[7], that students with FHCs had higher symptom loads than students without FHCs. This was true for both younger and older students, although differences in symptom load were generally larger among the older students. The logistic regression analysis showed that age, sex, marginalisation and family cohesion were all independently associated with symptom load, and interactions of these characteristics with FHC-disability and FHC-mental health were all non-significant. However, the logistic regression also showed that FHC-drug/alcohol addiction did have an independent and highly significant association with symptom load. The odds ratio for the Indigenous x FHC-drug/alcohol addiction indicator was also significantly less than 1, suggesting that while FHC-drug/alcohol addiction was associated with increased symptom load overall, this increase was moderated in the case of Indigenous students (it is worth noting that both these results flowed into the ‘Any FHC’ regression too). This finding needs further investigation. The number of Indigenous students in the analyses here is relatively small, and there is a significant amount of overlap between Indigenous and other marginalised categories [25], which may influence results. Therefore, in response to the second research question, while all FHCs are associated with higher symptom load in the student sample, only the association between FHC-drug/alcohol addiction and health outcomes is independent of age, sex, marginalised status and levels of family cohesion. These findings are consistent with existing research [7,40].

Similar to the analysis presented above, Pakenham and Cox [7] also found that while the demographic factors they examined (age, sex, relative disadvantage, ethnicity) did have an association with somatisation, health and total difficulties, “their impact is independent of the effect of the presence of a serious illness in the family.” (p.434). Pakenham and Cox[7] argue that their results are not consistent with those of Sieh, et al.[8], whose meta-analysis suggested that both age and socio-economic status moderated the relationship between illness in the family and children’s health. The analysis presented here supports Pakenham and Cox’s findings over those of Sieh et al. Moreover, it is worth noting with respect to socio-economic status that while Pakenham and Cox use a somewhat crude area-based indicator for relative disadvantage, use of a finer grained family-level material disadvantage indicator in the present analyses does not suggest different conclusions. Similar to Sieh, et al.[8], but unlike Pakenham and Cox[7], the present analysis found that there was no independent relationship between FHCs and sex. This lack of increased association with health for girls is somewhat surprising, given that the present paper’s findings also show that older girls are more likely than boys to report FHCs, and because girls are more likely than boys to take on caring roles for sick or injured family members [41].

The third research question examined whether family cohesion modified the relationship between FHCs and symptom load in young people. While there is clearly a relationship between FHCs, family cohesion and symptom load, the logistic regression showed that the relationship between family cohesion and symptom load is also independent of FHCs. In one sense, this is not surprising. The relationship between family cohesion and FHCs is perhaps not best seen through an independent effect (low family cohesion is associated with less optimal outcomes for young people across a broad range of circumstances), but more through the percentages on Table 1, which show that among older students with FHC-mental illness and FHC-drug/alcohol addiction, proportions reporting low levels of family cohesion are notably higher than proportions reporting high levels of cohesion. Therefore, while there may be no evidence of an extra marginal effect of cohesion on young people's health in the context of FHCs, the probability of being in a low cohesion family is considerably higher for young people reporting mental health or drug/alcohol addiction FHCs.

Our data add to evidence suggesting an inequitable burden on young people associated with FHCs, with that burden strongest in the case of drug/alcohol addiction. Findings about relationships between young people's characteristics, FHCs and health outcomes need to be placed in the context of findings about prevalence, which has been measured using a nationally representative sample of young Australians aged 9-14 years. Given that FHCs were found to be more prevalent among older girls, and among young people in marginalised groups, and that mental illness/depression and drug/alcohol addiction in particular were more prevalent among young people in low cohesion families, it is fair to conclude that high levels of symptom load among young people in marginalised groups with FHCs warrant policy attention.

The cross-sectional design of the study limits the development of casual explanations for the relationships seen. Additionally, no data were collected from students on who in their family had an FHC, or whether they lived with this person. Pakenham and Cox[7] show that FHCs in parents tend to be associated with worse outcomes in young people than FHCs in other family members, thus it is possible there are varying degrees of association between FHCs and health, depending on who in the family is unwell, that are not captured here. Findings with respect to Indigenous young people, which suggest a smaller association between FHC-drug/alcohol addiction and symptom load than is found among all young people, need further investigation. The sample of Indigenous students in this study is relatively small, and a larger study might usefully seek to validate the results for this group reported here.

Policy initiatives are important in this space. Linkage of support for young people with FHCs across community services, health care and schools is needed to reduce stress, and ensure better knowledge of risks for young people associated with FHCs [42]. Stigma, such as that associated with FHCs, particularly mental health and substance use, is increasingly regarded as a factor contributing to health inequalities [43] and must be targeted with a multilevel approach incorporating both community and individual level approaches [44]. Further work regarding family dynamics may also provide insight into approaches for targeted family based interventions.

CONTRIBUTORSHIP STATEMENT: Both authors have made substantial contributions to the conception, analysis and interpretation of the work. Both have contributed to drafting and revisions of the work and approve its final version. Both agree to be accountable for all aspects of the work.

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DATA SHARING STATEMENT: Survey data used in this analysis are publicly available to bona-fide researchers through the Australian Data Archive.

ETHICS: Ethics approval was obtained from all necessary committees: Flinders University Social and Behavioural Research Ethics Committee, University of New South Wales Human Research Ethics Committee, and all the required permissions from State and/or Catholic educational departments (as appropriate).

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	**Item #**	**Recommendation**	**Reported on page #**
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-9
Bias	9	Describe any efforts to address potential sources of bias	*n/a*
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	9
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	9
		(*e*) Describe any sensitivity analyses	
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	10
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10-16
		(b) Indicate number of participants with missing data for each variable of interest	10, 11, 14, 17
Outcome data	15*	Report numbers of outcome events or summary measures	10, 11, 14, 17
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-16
		(*b*) Report category boundaries when continuous variables were categorized	17 (also 7-9)
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	18
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	21
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18-21
Generalisability	21	Discuss the generalisability (external validity) of the study results	20, 22
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Is having a family member with chronic health concerns bad for young people's health? Cross-sectional evidence from a national survey of young Australians

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Is having a family member with chronic health concerns bad for young people's health? Cross-sectional evidence from a national survey of young Australians

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ABSTRACT

Objectives: Young people's perspectives on the association between having a family member with a chronic health concern (FHC) and their own health is under-researched. This study used young people's reports to assess the prevalence of FHCs and their association with negative health outcomes, with an aim of identifying potential inequalities between marginalised and non-marginalised young people. Family cohesion was examined as a moderating factor.

Design: Cross-sectional data from the Australian Child Wellbeing Project survey were used. Respondents were asked whether someone in their family experienced one or more FHCs (disability, mental illness, or drug/alcohol addiction). In addition, their experience of different psychosomatic symptoms (headache, sleeplessness, irritability, etc.), aspects of family relationships, and social and economic characteristics (disability, materially disadvantaged, and Indigenous), were documented.

Setting: Nationally representative Australian sample.

Participants: 1,531 students in school years 4 and 6 and 3,846 students in Year 8.

Results: A quarter of students reported having an FHC (years 4&6: 23.96% (95% CI 19.30-28.62); year 8: 25.35% (95% CI 22.77-27.94)). Significantly more students with FHCs than those without reported experiencing 2 or more negative health symptoms at least weekly (OR=1.78; 95% CI 1.19 to 2.65; *p*<.01). However, an independent relationship between FHCs and symptom load was only found in the case of FHC-drug/alcohol addiction. Marginalised students and students reporting low family cohesion had an increased prevalence of FHCs and notably higher symptom loads where FHCs were present. Level of family cohesion did not impact the relationship between FHCs and symptom load.

Conclusions The burden of FHCs is inequitably distributed between marginalised and non-marginalised groups, and between young people experiencing different levels of family cohesion. More work is required regarding appropriate targets for community and family level interventions to support young people in the context of FHCs.

Strengths and limitations of the study

- The study provides nationally representative estimates of FHCs and associated characteristics as reported by young people aged 9-14 years
- Unlike most small scale studies of FHCs, the survey used in this study allowed comparison of health among subsamples with and without FHCs, by age, sex, marginalisation and family cohesion.
- The survey used in this study asked young people to report on a broad range of social and economic circumstances that allowed robust identification of marginalisation and assessment of family cohesion.
- Causation is unable to be established due to cross-sectional study design

INTRODUCTION

There is now a growing literature showing how social and environmental factors can influence young people's health, engagement in peer activities, cognitive development and wellbeing [1,2]. Having a family member who experiences a chronic and/or debilitating health concern [FHC] is one such factor [3-8]. Previous estimates of FHC prevalence have often focused on specific health concerns involving just parents or siblings, use parent, as opposed to child, report [e.g. 9], or have used data obtained from high risk samples such as those who access mental health or substance abuse services [9-11]. However, limited available evidence suggests that many young people experience FHCs. One study of 9-20 year olds in a large school and community based survey in Australia found that 29% reported a serious physical or mental health condition in a family member [7]. However, this study did not make claims to national representativeness. FHCs are known stressors that can impact a variety of long term outcomes for children and young people. For example, children who grow up with a parent with a mental illness are more likely to experience depression and substance use later in life [12,13]. Therefore, investigations of prevalence and associations with health are important.

In the Australian context, young people who are materially disadvantaged, Indigenous and/or have a disability can be expected to have higher rates of FHCs. Globally, and in Australia, poverty is associated with high rates of disability [14,15] mental health concerns and substance abuse [16]. Research also suggests a higher prevalence of substance use, disability, chronic illness and mental health concerns among Indigenous Australians than among non-Indigenous Australians [17-20]. Further, young people who are themselves living with disability are more likely than young people without disability to have parents with disability or mental health concerns [21-23].

Given the likely inequalities in the distribution of FHCs across different groups in Australia, understanding the association between FHCs and young people's wellbeing is important. Studies have shown that children with seriously ill family members have both internalising and externalising problem behaviour [8] and a range of negative social, psychological, somatic effects, and overall health effects, albeit with often small effect sizes [7].

That an association between FHCs and young people's health has been found is not surprising, given that experience of frequent psychosomatic health symptoms is often associated with stress in a person's environment [24,25]. Most often, psychosomatic symptoms occur in clusters [24,26], with symptom frequency of two or more symptoms per week considered to reflect a high symptom load for a young person [1]. Because multiple stressors in childhood can have a cumulative effect that is associated with exponentially worse outcomes [1,27,28], it is expected that marginalisation and FHCs would have large negative impacts on the health of young people. However, the effects of demographic characteristics on the relationship between FHCs and outcomes is disputed in previous work [7,8]. For example, while Sieh and colleagues[8] found no overall effect of gender on the relationship between FHCs and young people's outcomes, Packenham and Cox [7] showed more somatisation for girls than for boys, which they suggested may be because girls are more likely to take on caring roles than boys.

These disparities in results may be due to family relationship variables not previously considered in the relationship between FHCs and health outcomes in young people. Strong family cohesion (feelings of closeness and emotional bond sbetween family members [29] has been shown to serve as a protective factor against poorer outcomes, especially for adolescents, in the presence of family violence and substance use [30,31]. It has also been shown to attenuate the risk for internet addiction [32], adolescent alcohol use [33], problem gambling in youth [34], and increase resilience and schooling outcomes, even in the context of material disadvantage [35,36]. Therefore, high family cohesion would be expected to be associated with lower symptom load in young people, even when FHCs are present.

The purpose of this paper is therefore to explore the relationship between FHCs and health outcomes in a nationally representative sample of young Australians aged 9-14 years. The following questions are explored:

(1) Does the *prevalence* of FHCs vary with young people's age, sex and marginalised status?

(2) Are the odds of having a high symptom load greater for young people with FHCs, controlling for age, sex and marginalised status?

(3) Does family cohesion modify the relationship between FHCs and symptom load?

METHOD

Data

Data were drawn from a survey conducted in late 2014 as part of the Australian Child Wellbeing Project (ACWP – www.australianchildwellbeing.com.au). The survey instrument was developed following direct consultations with 97 young people in nine groups on what contributes to a 'good life' [37]. A multi-stage stratified probability sample (states/territories, sectors and schools) was used to arrive at a nationally representative sample of students in Years 4, 6 and 8 (approximately, 9-10, 11-12 and 13-14 years old) [38]. Jurisdictional educational authorities and university human research ethics committees approved the research. Informed parental and student consent was obtained in all cases. The final sample comprised 5,440 valid student responses from 180 schools in every state and territory. This represents a response rate of 38% at the school level and 33% at the student level within participating schools. The student participation rate was impacted by active consent procedures, where both students and their parents had to sign consent forms. Populations weights were applied to adjust for school and student level non-response, and ensure that the analysis sample was representative of Australian students in school years 4, 6 and 8 (for further information see [37]).

Identifying FHCs: students were asked: "Is there anyone in your family who is seriously affected by: (1) disability or long term illness, (2) depression or mental illness, or (3) using alcohol or other drugs?" Students could select any combination of the three conditions or "none of these". This question was taken, slightly modified, from the New Zealand Youth 2000 Survey Series [39]. In the New Zealand survey, respondents were asked whether anyone in their home had an FHC. In the present study, the question was changed in response to direct consultations with young people who stressed the importance of family for 'the good life' and the distinction many of them made between 'family' and 'household'[37].

Symptom load: The HBSC Symptom Check List [40] was used to measure psychological and somatic symptom load. Students were asked: "In the last 6 months: how often have you had the following?" Eight symptoms were listed – feeling low, irritability or bad temper, feeling nervous, headache, stomach-ache, backache, sleeplessness, and feeling dizzy. Responses were selected from (0) "seldom or never" to (4) "almost daily". Consistent with other studies, a binary variable was derived to identify respondents who experienced at least two of the eight symptoms at least once a week, indicating a high psychosomatic symptom load [1].

Marginalised groups:

Material deprivation was assessed using responses to four questions: how many cars, vans or trucks the student's family owned, whether the student had their own bedroom, how many times the student travelled away on holiday with their family in the past year, and how many computers the family owned. These questions have been widely used as a proxy for socio-economic status in surveys of young people [41,42]. The resulting scale differentiated effectively between young people who were materially disadvantaged (12.9% of Years 4 and 6s, and 8.3% of Year 8s) and those who were not[37].

Young people with disability were identified by responding 'yes' to a question asking whether they had a disability and in addition indicating that the disability made it hard for them to, or stopped them doing, one or more activities (Years 4 and 6: 11.3%; Year 8: 11.0%). Students self-identified in the survey as Indigenous (Years 4 and 6: 7.0%; Year 8: 3.5%).

As described by Redmond et al [37] there is significant overlap in students who identify as being in one or more of these marginalised groups. There is also considerable diversity within these groups. However, they share common factors, such as minority status in the Australian context, and health, educational and economic disadvantages that are greater than what is seen in non-marginalised groups on average [37]. Where reference is made to non-marginalised students, this group comprises those not included in any of the three above marginalised groups.

Family cohesion: Family cohesion was measured using a family cohesion scale from the international *Children's Worlds* survey which aims to measure belonging and emotional bonding young people feel within their family [43]. Students were asked: "how often in the past week have you spent time doing the following things with your family?" Students rated the frequency of "talking together," "laughing together," and "learning together" from (0) 'not at all last week', to (3) 'every day last week'. Students could also code (4) 'Don't know'. These three items loaded onto a family cohesion scale (α=0.74; factor loadings = 0.72 – 0.92, p<0.001), the structure of which was invariant across respondents with and without an FHC (χ^2 [*df*=8 *N*=4,534]= 32.48, *p*<0.001; CFI=0.997; RMSEA=0.037). Total family cohesion scores were calculated by summing the three variables to create a total score ranging from 0-

9. In this analysis a three-category indicator was used, representing low (score = 0-4), average (5-7), and high (8-9) levels of cohesion, with the bottom and top categories each containing about 15% of all observations. Students who did not give a response to at least one of the three items, or who responded ‘I don’t know’ were excluded from the analysis.

Statistical methods

Analysis was performed using Stata/SE V.14 for Windows (copyright 1985–2015 StataCorp LP). Complex survey design weights were applied, adjusting for differential non-response in terms of state/territory, school sector and socio-economic status, and student sex. Prevalence of FHCs was examined overall, and by age, sex and marginalisation. Mean symptom loads were compared across students with and without FHCs by age, sex, marginalisation and family cohesion. 95% confidence intervals were calculated for all means and percentages. T-tests were employed to assess the significance of differences between means and percentages. Logistic regression was used to examine the overall relationship between the different categories of FHC and experience of two or more health symptoms at least weekly, controlling for the effects of age, sex and marginalised status on this relationship, and whether family cohesion modified the relationship. Observations with missing data were excluded from parts of the analysis. Data on FHCs were missing for 13/1,544 Years 4 and 6 students (0.8%), and 50/3,896 Year 8 students (1.3%). Where all variables were included in the multivariate analysis, the level of missings was higher (338/1,544 at Years 4 and 6 – 21.9%; 865/3,896 at Year 8 – 22.2%). The majority of these missings came from missing data relating to the symptom load and family cohesion scales. Tests indicated that when missing values for these scales were imputed, results (with one exception, noted below) were not significantly different to those reported in this paper (see the online supplementary file)

RESULTS

Table 1 shows that approximately one quarter of students in both age groups reported an FHC. The most common was disability/long term illness, followed by depression/mental illness and then drugs/alcohol addiction. Among Years 4 and 6 students, there was little difference in the percentages of boys and girls reporting FHCs. Among Year 8 students, however, girls were significantly more likely than boys to report an FHC. In both age groups, students who were materially disadvantaged, students with disability and Indigenous students were considerably more likely to report all types of FHC than non-marginalised students.

Table 1. Prevalence of FHCs, by type, year level and student characteristics (%)

	Disability/long term illness	Depression/ Mental illness	Drugs/Alcohol addiction	FHC overall	N
Years 4 & 6					Year level total=1544
All	14.20 [9.88 - 18.52]	8.60 [6.21 - 10.99]	7.46 [4.72 - 10.21]	23.96 [19.30 - 28.62]	1,531
Boys	13.70 [8.01 - 19.39]	7.53 [3.49 - 11.58]	7.08 [3.4 - 10.77]	23.98 [17.22 - 30.74]	656
Girls	14.73 [10.53 - 18.93]	9.72 [6.94 - 12.5]	7.87 [4.66 - 11.07]	23.94 [19.16 - 28.72]	875
Materially disadvantaged	22.23 [13.08 - 31.39]	14.52 [9.1 - 19.93]	11.05 [3.95 - 18.15]	38.54 [25.4 - 51.69]	172
With disability	26.85 [20.82 - 32.89]	13.51 [6.16 - 20.86]	13.84 [6.87 - 20.82]	41.93 [31.23 - 52.63]	193
Indigenous	29.34 [18.39 - 40.29]	6.19 [1.29 - 11.09]	14.93 [5.85 - 24.01]	40.18 [29.93 - 50.43]	106
Not marginalised	10.69 [6.84 - 14.54]	7.25 [4.83 - 9.67]	5.96 [3.04 - 8.88]	18.92 [15.15 - 22.69]	1,112
Low family cohesion	11.72 [7.45 - 15.98]	9.51 [5.35 - 13.67]	9.31 [5.16 - 13.46]	21.16 [15.5 - 26.81]	244
Average family cohesion	11.47 [7.32 - 15.62]	7.12 [4.1 - 10.15]	5.91 [2.85 - 8.97]	20.68 [15.94 - 25.42]	672
High family cohesion	11.84 [7.35 - 16.33]	8.79 [3.32 - 14.25]	6.01 [0.45 - 11.57]	20.96 [13.68 - 28.23]	385
Year 8					Year level total=3896
All	13.68 [12.27 - 15.1]	11.53 [9.57 - 13.48]	7.78 [6.35 - 9.21]	25.35 [22.77 - 27.94]	3,846
Boys	12.23 [10.61 - 13.85]	8.02 [6.05 - 9.98]	6.81 [4.91 - 8.72]	21.73 [18.87 - 24.58]	1,922
Girls	15.18 [13.14 - 17.23]	15.16 [12.49 - 17.83]	8.78 [6.86 - 10.71]	29.10 [25.59 - 32.61]	1,924
Materially disadvantaged	28.92 [23.94 - 33.91]	26.51 [20.97 - 32.04]	17.51 [12.27 - 22.76]	50.21 [44.79 - 55.64]	397
With disability	19.43 [13.11 - 25.75]	19.37 [13.41 - 25.32]	12.92 [7.29 - 18.55]	35.05 [27.21 - 42.88]	312
Indigenous	22.76 [15.52 - 30]	17.40 [7.58 - 27.22]	15.93 [6.47 - 25.4]	42.44 [34.96 - 49.93]	133
Not marginalised	10.73 [9.26 - 12.21]	8.90 [6.82 - 10.99]	5.77 [4.48 - 7.06]	20.42 [17.83 - 23.02]	2,997
Low family cohesion	16.08 [13.03 - 19.12]	19.34 [15.24 - 23.44]	13.48 [10.27 - 16.69]	33.57 [29.12 - 38.02]	897
Average family cohesion	11.51 [9.45 - 13.56]	9.80 [7.91 - 11.69]	6.30 [4.83 - 7.77]	22.34 [19.5 - 25.18]	1,715
High family cohesion	15.79 [11.37 - 20.21]	6.07 [3.8 - 8.34]	2.82 [1.34 - 4.3]	20.97 [16.36 - 25.57]	730

Note: % are weighted; 95% confidence intervals are reported in square parentheses. Ns are unweighted. Source: ACWP survey, authors' calculations.

Table 1 also shows that there is little relationship between family cohesion and FHCs among younger students (note, however, where missing values are imputed, a stronger relationship is apparent – see the online supplementary file). Among Year 8s on the other hand, students reporting high family cohesion are notably less likely to report that someone in their family has mental illness/depression or drug/alcohol addiction, although proportions with low and high family cohesion reporting disability/chronic illness are similar.

Table 2 shows that among both younger and older students, proportions reporting high symptom load (two or more symptoms at least weekly) are significantly greater for those with FHCs than for those without. Almost half of Years 4 and 6 students (48.7%), and slightly fewer Year 8 students (44.2%) with any FHC reported experiencing two or more symptoms at least weekly; this compares with 27.7% and 24.3% of students in the two year groups without FHCs, respectively.

The table also shows that while there is no significant difference between boys and girls with FHCs reporting high symptom load in Years 4 and 6, girls are significantly more likely to report a high symptom load in Year 8. Among students with disability and materially disadvantaged students in both year groups, those with FHCs are significantly more likely to report high symptom load than those without. Higher proportions of Indigenous students with FHCs in Years 4 and 6 also report high symptom load than those without, although the difference is not statistically significant. In Year 8 on the other hand, there is little difference in the proportions of Indigenous with and without FHCs reporting high symptom load. Finally, the table shows a strong association between level of family cohesion and proportions reporting a high symptom load, where, for both younger and older students, lower family cohesion is associated with more negative symptoms.

It is worth noting that among both younger and older students with FHCs, proportions with a high symptom load are lowest where the FHC is disability or chronic illness (41.76%, 95% CI = 35.01-48.52%; and 41.74%; 95% CI = 36.59-46.88%, respectively), and highest where the FHC relates to drug/alcohol addiction among Years 4 and 6 (60.0%; 95%

CI=49.51-70.49%) and mental illness among Year 8 (55.3%; 95% CI=50.01-60.60%). The incidence of high symptom load therefore varies not only according to student characteristics, but also according to FHC type.

Table 2 Symptom load by FHC, gender, marginalisation and family cohesion.

		Years 4 & 6			Year 8		
		No FHC	FHC		No FHC	FHC	
All	%	27.74	48.72	***	24.29	44.24	***
		[24.93 - 30.55]	[42.11 - 55.33]		[22.38 - 26.2]	[40.16 - 48.32]	
	N	1,096	312		2,647	859	
Boy	%	26.58	44.62	**	21.66	36.18	***
		[21.94 - 31.22]	[35.67 - 53.56]		[18.7 - 24.61]	[30.79 - 41.57]	
	N	474	130		1,362	351	
Girl	%	28.62	51.65	***	27.08	49.80	***
		[24.98 - 32.26]	[43.25 - 60.05]		[24.4 - 29.77]	[45.5 - 54.11]	
	N	622	182		1,285	508	
p(girl>boy)					*	***	
With disability	%	50.00	65.63		46.49	64.37	***
		[38.97 - 61.03]	[53.33 - 77.92]		[39.24 - 53.74]	[57.59 - 71.15]	
	N	86	64		185	174	
p(disability>not marginalised)		***	**		***	***	
Materially disadvantaged	%	38.39	51.67	*	33.52	52.73	**
		[29.38 - 47.4]	[39.65 - 63.68]		[26.55 - 40.5]	[41.5 - 63.95]	
	N	112	60		176	110	
p(materially disadvantaged>not marginalised)		**			**	*	
Indigenous	%	36.84	46.88		37.68	33.33	
		[24.44 - 49.24]	[29.67 - 64.08]		[25.32 - 50.04]	[19.32 - 47.35]	
	N	57	32		69	48	
p(Indigenous>not marginalised)					*		
Not marginalised	%	24.80	45.95	***	21.80	38.76	***
		[21.74 - 27.85]	[38.24 - 53.66]		[19.77 - 23.84]	[34.13 - 43.39]	
	N	859	185		2,229	565	
p(marginalised>not marginalised)		***			***	***	
Low family cohesion (scale score - 0-4)	%	36.21	63.33	***	39.62	62.72	***
		[26.71 - 45.7]	[52.72 - 73.94]		[34.79 - 44.46]	[56.04 - 69.41]	
	N	174	60		530	279	
'Average' family cohesion (scale score - 5-7)	%	28.92	45.26	**	19.90	33.05	***
		[24.58 - 33.26]	[35.99 - 54.52]		[17.63 - 22.18]	[26.97 - 39.13]	
	N	491	137		1,221	357	
High family cohesion (scale score - 8-9)	%	18.00	38.71	**	14.59	31.03	***
		[14.54 - 21.46]	[26.75 - 50.67]		[11.53 - 17.66]	[22.9 - 39.17]	
	N	300	62		555	116	
p(low cohesion> high cohesion)		***	**		***	***	

Note: Note: % are weighted; 95% confidence intervals are reported in square parentheses. Ns are unweighted. p-values in columns denote significance of difference between FHC and non-FHC samples; p-values in rows denote significance of difference between groups within FHC and non-FHC samples; **p*<.05, ***p*<.01, ****p*<.001. Source: ACWP survey, authors' calculations.

Table 3 shows odds ratios associated with having a high symptom load, where explanatory variables include age, sex, marginalisation and family cohesion, as well as the different FHC types. The odds are derived from logistic regression models where the explanatory variables (except for FHCs) are included (model 1), and interacted with FHC-disability (model 2), FHC-mental illness (model 3), FHC-drug/alcohol addiction (model 4) and any FHC (model 5). Model 1 results therefore shows odds and 95% CIs associated with each explanatory variable with no FHC indicators and no interactions, while the remaining model results show odds for each explanatory variable, and the marginal (multiplicative) effects of interaction with each of the FHC indicators. The odds for these interactions therefore represent the increased association between FHCs and high symptom load. It is worth noting that the small improvement in McFadden's pseudo-R^2 for models 2-5 over model 1 suggest that FHCs contribute only a small proportion of 'explained variation' in symptom load [44].

Model 1, without interactions, shows that odds ratios of high symptom load for Year 8 and High family cohesion are significantly less than 1; odds ratios for Girl, With disability, Materially disadvantaged and Low family cohesion are all significantly greater than 1. Odds for Indigenous, on the other hand, are not significantly different to 1. None of these odds changes greatly in models 2-5. Moreover, neither the indicators for FHC-disability (model 2) nor FHC-mental illness (model 3), nor their interactions, are significant, suggesting that these two types of FHC do not increase the odds of a student having a high symptom load, over and above the odds associated with the other explanatory variables. However, Model 4 shows that the indicator for FHC-drug/alcohol addiction is associated with significantly increased odds of a student having a high symptom load (OR=2.84; 95% CI = 1.464 - 5.509; p<0.01). Model 4 also shows the Indigenous x FHC interaction being associated with significantly reduced odds of high symptom load (OR=0.37; 95% CI = 0.121 - 1.117; p<0.1). Similarly to model 4, model 5 (any FHC) shows that the FHC indicator and the Indigenous x FHC interaction are both significant. To summarise, therefore, having a family member with a disability or chronic illness, or mental illness, does not significantly increase the odds of a high symptom load. On the other hand, having a family member with a drug/alcohol addiction is associated with significantly greater marginal odds of a high symptom load.

Table 3. Odds ratios for marginalised and non-marginalised students in Years 4 and 6 and Year 8 experiencing 2+ health complaints at least weekly, controlling for presence of FHC

	Model 1 Variables		Model 2 FHC disability		Model 3 FHC mental illness		Model 4 FHC drug/alcohol		Model 5 Any FHC	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
		-		-		-		-		-
Year 8	0.796***	0.682 - 0.928	0.764***	0.647 - 0.902	0.757***	0.643 - 0.892	0.825**	0.702 - 0.970	0.793**	0.662 - 0.951
Girl	1.391***	1.209 - 1.601	1.341***	1.151 - 1.562	1.276***	1.097 - 1.484	1.385***	1.195 - 1.604	1.261***	1.067 - 1.491
Disability	3.192***	2.588 - 3.939	3.158***	2.481 - 4.020	2.701***	2.125 - 3.434	3.129***	2.498 - 3.920	2.816***	2.127 - 3.730
Materially disadvantaged	1.489***	1.185 - 1.872	1.483***	1.150 - 1.912	1.469***	1.137 - 1.899	1.523***	1.190 - 1.950	1.509***	1.130 - 2.016
Indigenous	1.120	0.793 - 1.583	1.228	0.838 - 1.800	1.231	0.842 - 1.799	1.234	0.857 - 1.777	1.432	0.931 - 2.202
Low family cohesion	2.382***	2.029 - 2.798	2.325***	1.953 - 2.768	2.169***	1.819 - 2.586	2.282***	1.925 - 2.706	2.094***	1.723 - 2.544
High family cohesion	0.692***	0.574 - 0.834	0.652***	0.531 - 0.801	0.687***	0.563 - 0.838	0.692***	0.570 - 0.840	0.652***	0.524 - 0.813
FHC			1.195	0.717 - 1.992	1.527	0.844 - 2.762	2.840***	1.464 - 5.509	1.778***	1.193 - 2.650
Year 8 x FHC			1.234	0.783 - 1.944	1.253	0.759 - 2.068	0.636	0.358 - 1.131	0.889	0.622 - 1.269
Girl x FHC			1.240	0.833 - 1.848	1.280	0.812 - 2.016	0.849	0.496 - 1.453	1.244	0.904 - 1.712
With disability x FHC			0.810	0.489 - 1.343	1.358	0.779 - 2.367	0.985	0.502 - 1.931	0.969	0.626 - 1.501
Materially disadvantaged x FHC			0.903	0.498 - 1.635	0.692	0.382 - 1.252	0.620	0.314 - 1.221	0.766	0.474 - 1.238
Indigenous x FHC			0.567	0.234 - 1.376	0.498	0.201 - 1.234	0.368*	0.121 - 1.117	0.458**	0.224 - 0.934
Low family cohesion x FHC			1.114	0.705 - 1.762	1.392	0.867 - 2.234	1.243	0.716 - 2.160	1.346	0.942 - 1.924
High family cohesion x FHC			1.456	0.867 - 2.446	1.288	0.683 - 2.428	1.244	0.549 - 2.821	1.378	0.893 - 2.125
Constant	0.284***	0.239 - 0.338	0.284***	0.236 - 0.342	0.290***	0.242 - 0.348	0.268***	0.224 - 0.321	0.265***	0.216 - 0.323
Log Likelihood (intercept only)	-2552.453		-2552.453		-2552.453		-2552.453		-2552.453	
Log Likelihood (full model)	-2364.304		-2350.158		-2328.059		-2350.192		-2322.647	
McFadden pseudo-R^2	0.074		0.079		0.088		0.079		0.090	
Observations	4,237		4,237		4,237		4,237		4,237	

Logistic regression model: two or more health symptoms at least weekly = *f*(girl, marginalised [with disability, materially disadvantaged, Indigenous], family cohesion and FHC, and interaction of Girl, marginalised and family cohesion with FHC. Separate models run for each disability type. Base case: Boy, not marginalised, no FHCs, average family cohesion. ***p<.01, **p<.05, *p<.1. McFadden's pseudo- R^2 is calculated as 1 – [Log Likelihood (full model)/ Log Likelihood (intercept only)]. Low family cohesion represents a score of 0-4 (from 9), high family cohesion represents a score of 8-9 (from 9).

DISCUSSION

This study, based on a nationally representative sample of 9-14 year old students, suggests that approximately one quarter of young Australians in their middle years have an FHC. This supports findings from a school and community study in Queensland, and from a national New Zealand study where similar proportions of young people reported an FHC. The study shows that FHCs are more heavily concentrated among marginalised groups (young people with disability, materially disadvantaged young people, and Indigenous young people) than among the non-marginalised. Among Year 8 students, both sex and scores on the family cohesion scale were also strongly associated with depression/mental illness and with drug/alcohol addiction, but not with disability/long term illness. Variation by sex is notable among older students for two of the three FHC types (disability and mental illness), as is variation according to level of family cohesion (mental illness and drugs/alcohol. These findings add to those of Sieh, et al.[8] and Pakenham and Cox[7], who do not discuss prevalence in detail.

Consistent with Sieh, et al.[8] and Pakenham and Cox[7], we found that that students with FHCs had poorer health than students without FHCs. This was true for both younger and older students, although differences in symptom load were generally larger among the older students. The odds ratio for the Indigenous x FHC-drug/alcohol addiction indicator was significantly less than 1, suggesting that while FHC-drug/alcohol addiction was associated with increased symptom load overall, this increase was moderated in the case of Indigenous students (it is worth noting that both these results flowed into the ‘Any FHC’ regression too). This finding needs further investigation. The number of Indigenous students in the analyses here is relatively small, and there is a significant amount of overlap between Indigenous and other marginalised categories[37], which may influence results.

Similar to the analysis presented above, Pakenham and Cox[7] also found that while the demographic factors they examined (age, sex, relative disadvantage, ethnicity) did have an association with somatisation, health and total difficulties, “their impact is independent of the effect of the presence of a serious illness in the family.” (p.434). It is worth noting with respect to socio-economic status that while Pakenham and Cox use a somewhat crude area-based indicator for relative disadvantage, use of a finer grained family-level material disadvantage indicator in the present analysis does not suggest different conclusions. Similar to Sieh, et al.[8], but unlike Pakenham and Cox[7], the present analysis found that the relationship between FHCs and health symptoms was not stronger for girls than for boys when other factors were taken into account This lack of increased association with health for girls is somewhat surprising, given that the present paper’s findings also show that older girls are more likely than boys to report FHCs, and because girls are more likely than boys to take on caring roles for sick or injured family members[45].

The third research question examined whether family cohesion modified the relationship between FHCs and symptom load in young people. While there is clearly a relationship between FHCs, family cohesion and symptom load, the logistic regression showed that the relationship between family cohesion and symptom load is also independent of FHCs. In one sense, this is not surprising. The relationship between family cohesion and FHCs is perhaps not best seen through an independent effect (low family cohesion is associated with less optimal outcomes for young people across a broad range of circumstances), but more through the percentages on Table 1, which show that among older students with FHC-mental illness and FHC-drug/alcohol addiction, proportions reporting low levels of family cohesion are notably higher than proportions reporting high levels of cohesion. Therefore, while there may be no evidence of an extra marginal effect of cohesion on young people’s health in the context of FHCs, the probability of being in a low cohesion family is considerably higher for young people reporting mental health or drug/alcohol addiction FHCs. It is also possible that reporting of FHCs is lower for children in families with high cohesion, perhaps due to perceived, rather than actual, absence of FHC in some high cohesion families. However, previous studies suggest that children are aware of parent's illness, even when parents do not believe their children recognise their health concerns[46] . Regardless, there is certainly scope for further investigation around this, especially considering that the prevalence of FHCs was different across family cohesion levels for the FHCs with the greatest stigma attached (substance use and mental health[47]).

Our data add to evidence suggesting an inequitable burden on young people associated with FHCs, with that burden strongest in the case of drug/alcohol addiction. We have good understanding of how adolescents and adults can experience shame and stigma in relation to family member's substance use or mental health, sometimes due to the perception that they are responsible for it[47]. However, findings about relationships between young people's characteristics, FHCs and health outcomes need to be placed in the context of findings about prevalence. Given that, in this study, FHCs were found to be more prevalent among older girls, and among young people in marginalised groups, and that mental illness/depression and drug/alcohol addiction in particular were more prevalent among young people in low cohesion families, it is fair to conclude that high levels of symptom load among young people in marginalised groups with FHCs warrant policy attention.

The cross-sectional design of the study limits the development of casual explanations for the relationships seen. Additionally, no data were collected from students on who in their family had an FHC, or whether they lived with this person. Pakenham and Cox[7] show that FHCs in parents tend to be associated with worse outcomes in young people than FHCs in other family members. Thus it is possible there are varying degrees of association between FHCs and health, depending on who in the family is unwell, that are not captured here.

Findings with respect to Indigenous young people, which suggest a smaller association between FHC-drug/alcohol addiction and symptom load than is found among all young people, need further investigation. The sample of Indigenous students in this study is relatively small, and a larger study might usefully seek to validate the results for this group reported here.

Policy initiatives are important in this space. Linkage of support for young people with FHCs across community services, health care and schools is needed to reduce stress, and ensure better knowledge of risks for young people associated with FHCs[48]. Stigma, such as that associated with FHCs, particularly mental health and substance use, is increasingly regarded as a factor contributing to health inequalities[49] and must be targeted with a multilevel approach incorporating both community and individual level approaches[50]. Further work regarding family dynamics may also provide insight into approaches for targeted family based interventions.

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COMPETING INTERESTS: The authors have no competing interests to declare.

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DATA SHARING STATEMENT: More information on the Australian Child Wellbeing Project is available from the project website: http://australianchildwellbeing.com.au/ Survey data used in this analysis are publicly available to bona-fide researchers through the Australian Data Archive. http://australianchildwellbeing.com.au/

ETHICS: Ethics approval was obtained from all necessary committees: Flinders University Social and Behavioural Research Ethics Committee, University of New South Wales Human Research Ethics Committee, and all the required permissions from State and/or Catholic educational departments (as appropriate).

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Supplementary file- Plausible values calculations

Plausible values are values that are imputed to resemble individual responses and have approximately the same distribution as the construct being measured. Their value is dependent on the observed values of the recorded responses and related variables. For information regarding plausible value calculations in the context of the ACWP, please see the technical report [1].

The table below highlights plausible value calculations for Table One where the family cohesion variable was used. Only calculations for the younger year levels appear to alter the results in that the gradient increases across family cohesion levels.

Table 1. Plausible values calculations of prevalence of FHCs in years 4&6, by type and family cohesion level (%)

Family cohesion level	Disability	Mental Illness	Drugs	FHC Overall
Years 4&6				
Low family cohesion	19.7 (8.47-30.98)	12.1 (6.29-17.91)	10.8 (4.86-16.65)	31.5 (19.92-43.06)
Average family cohesion	13.6 (8.84-18.30)	7.6 (4.67-10.53)	6.5 (3.52-9.58)	22.3 (16.81-27.85)
High family cohesion	11.7 (4.91-18.54)	9.6 (-0.52-19.75)	8.3 (0.47-16.12)	23.9 (10.39-37.4)
Year 8				
Low family cohesion	17.21 [12.36 - 22.06]	20.78 [14.18 - 27.37]	15.49 [10.01 - 20.97]	37.03 [28.75 - 45.3]
Average family cohesion	12.80 [10.92 - 14.67]	10.80 [8.6 - 13]	7.13 [5.44 - 8.82]	24.16 [21.09 - 27.23]
High family cohesion	14.19 [8.47 - 19.92]	6.06 [3.22 - 8.9]	3.41 [-0.01 - 6.83]	19.60 [13.22 - 25.97]

Table 2. Plausible values calculations of symptom load by FHC and family cohesion.

	Years 4 & 6		Year 8	
	No FHC	FHC	No FHC	FHC
Low family cohesion	35.66 [23.94 - 47.38]	57.78 [37.24 - 78.32]	38.55 [29.67 - 47.43]	55.51 [43.64 - 67.38]
Average family cohesion	28.90 [24.13 - 33.68]	46.41 [34.28 - 58.54]	23.95 [20.44 - 27.46]	39.61 [33.48 - 45.74]
High family cohesion	20.59 [11.52 - 29.66]	35.71 [13.83 - 57.6]	17.06 [11.09 - 23.03]	29.55 [13.49 - 45.62]

Table 3. Plausible values calculations for odds ratios for marginalised and non-marginalised students in Years 4 and 6 and Year 8 experiencing 2+ health complaints at least weekly, controlling for presence of FHC.

	Model 1		Model 2		Model 3		Model 4		Model 5	
		Controls		FHC disability		FHC mental illness		FHC drug/alcohol addiction		Any FHC
Variables	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Year 8	0.82***	0.71 - 0.95	0.80***	0.68 - 0.93	0.79***	0.67 - 0.92	0.84**	0.72 - 0.98	0.81**	0.68 - 0.96
Girl	1.53***	1.33 - 1.75	1.49***	1.29 - 1.72	1.37***	1.18 - 1.59	1.50***	1.29 - 1.74	1.37***	1.17 - 1.61
Disability	3.37***	2.73 - 4.21	3.26***	2.57 - 4.13	3.03***	2.31 - 3.96	3.29***	2.62 - 4.13	2.99***	2.22 - 4.02
Materially Disadvantaged	1.23*	0.98 - 1.55	1.27**	1.00 - 1.6	1.15	0.90 - 1.48	1.17	0.92 - 1.50	1.15	0.87 - 1.51
Indigenous	1.10	0.79 - 1.52	1.13	0.78 - 1.64	1.19	0.83 - 1.72	1.16	0.81 - 1.66	1.30	0.85 - 2.01
Low family cohesion	1.82***	1.49 - 2.23	1.86***	1.50 - 2.31	1.66***	1.34 - 2.06	1.78***	1.43 - 2.22	1.70***	1.34 - 2.16
High family cohesion	0.64***	0.50 - 0.81	0.64***	0.50 - 0.83	0.67***	0.52 - 0.86	0.66***	0.52 - 0.84	0.68***	0.51 - 0.91
FHC			1.33	0.86 - 2.08	1.65*	0.91 - 2.97	2.67***	1.40 - 5.10	1.80***	1.26 - 2.57
Year 8 xFHC			1.19	0.79 - 1.79	1.11	0.65 - 1.88	0.72	0.39 - 1.30	0.94	0.67 - 1.32
Girl x FHC			1.161	0.77 - 1.74	1.59*	0.99 - 2.56	1.07	0.62 - 1.84	1.30*	0.97 - 1.75
With disability x FHC			0.97	0.59 - 1.57	1.10	0.58 - 2.10	1.00	0.51 - 1.95	1.00	0.62 - 1.61
Materially disadvantaged x FHC			0.76	0.42 - 1.37	0.99	0.53 - 1.84	0.97	0.51 - 1.85	0.97	0.60 - 1.55
Indigenous x FHC			0.79	0.32 - 1.95	0.48	0.19 - 1.26	0.51	0.22 - 1.19	0.54*	0.27 - 1.11
Low family cohesion xFHC			0.85	0.48 - 1.51	1.36	0.71 - 2.59	0.93	0.48 - 1.79	1.08	0.68 - 1.72
High family cohesion x FHC			0.95	0.50 - 1.82	0.80	0.34 - 1.89	0.66	0.24 - 1.86	0.83	0.46 - 1.48
Constant	0.34***	0.29 - 0.40	0.33***	0.28 - 0.39	0.34***	0.29 - 0.41	0.32***	0.27 - 0.38	0.31***	0.26 - 0.38
Observations	5,220		5,220		5,220		5,220		5,220	

Computed using plausible values calculations. Logistic regression model: two or more health symptoms at least weekly = *f*(girl, marginalised [with disability, materially disadvantaged, Indigenous], family cohesion and FHC, and interaction of Girl, marginalised and family cohesion with FHC. Separate models run for each disability type. Base case: Boy, not marginalised, no FHCs, average family cohesion. ***p<.01, **p<.05, *p<.1. McFadden's pseudo- R^2 is calculated as 1 – [Log Likelihood (full model)/ Log Likelihood (intercept only)]. Low family cohesion represents a score of 0-4 (from 9), high family cohesion represents a score of 8-9 (from 9).

References

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	**Item #**	**Recommendation**	**Reported on page #**
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-9
Bias	9	Describe any efforts to address potential sources of bias	*n/a*
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	9
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	9
		(*e*) Describe any sensitivity analyses	
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	10
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10-16
		(b) Indicate number of participants with missing data for each variable of interest	10, 11, 14, 17
Outcome data	15*	Report numbers of outcome events or summary measures	10, 11, 14, 17
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-16
		(*b*) Report category boundaries when continuous variables were categorized	17 (also 7-9)
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	9, 11-12 (and appendix)
Discussion			
Key results	18	Summarise key results with reference to study objectives	18
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	21
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18-21
Generalisability	21	Discuss the generalisability (external validity) of the study results	20, 22
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.