The contribution of bullying victimisation to the burden of anxiety and depressive disorders in Australia

Amarzaya Jadambaa1,2, Hannah J. Thomas3,4,5, James G. Scott3,4,5,6, Nicholas Graves1,2, David Brain1,2 and Rosana Pacella1,2,7

1Australian Centre for Health Services Innovation, Institute of Health and Biomedical Innovation, Queensland University of Technology Kelvin Grove, Brisbane, QLD 4059, Australia; 2School of Public Health and Social Work, Queensland University of Technology Kelvin Grove, Brisbane, QLD 4059, Australia; 3Queensland Centre for Mental Health Research, The Park Centre for Mental Health, Wacol, QLD 4076, Australia; 4Faculty of Medicine, Centre for Clinical Research, The University of Queensland, Herston, QLD 4029, Australia; 5Faculty of Medicine, School of Public Health, The University of Queensland, Herston, QLD 4006, Australia; 6Metro North Mental Health, Royal Brisbane and Women’s Hospital, Herston, QLD 4029, Australia and 7Research Office, University of Chichester, West Sussex, UK

Abstract

Aim. There is now a strong body of literature showing that bullying victimisation during childhood and adolescence precedes the later development of anxiety and depressive disorders. This study aimed to quantify the burden of anxiety and depressive disorders attributable to experiences of bullying victimisation for the Australian population.

Methods. This study updated a previous systematic review summarising the longitudinal association between bullying victimisation and anxiety and depressive disorders. Estimates from eligible studies published from inception until 18 August 2018 were included and meta-analyses were based on quality-effects models. Pooled relative risks were combined with a contemporary prevalence estimate for bullying victimisation in Australia in order to calculate population attributable fractions (PAFs) for the two mental disorder outcomes. PAFs were then applied to estimates of the burden of anxiety and depressive disorders in Australia expressed as disability-adjusted life years (DALYs).

Results. The findings from this study suggest 7.8% of the burden of anxiety disorders and 10.8% of the burden of depressive disorders are attributable to bullying victimisation in Australia. An estimated 30,656 DALYs or 0.52% (95% uncertainty interval 0.33–0.72%) of all DALYs in both sexes and all ages in Australia were attributable to experiences of bullying victimisation in childhood or adolescence.

Conclusion. There is convincing evidence to demonstrate a causal relationship between bullying victimisation and mental disorders. This study showed that bullying victimisation contributes a significant proportion of the burden of anxiety and depressive disorders. The investment and implementation of evidence-based intervention programmes that reduce bullying victimisation in schools could reduce the burden of disease arising from common mental disorders and improve the health of Australians.

Introduction

Bullying during childhood and adolescence is a significant public health issue in Australia. Contemporary prevalence estimates indicate that approximately 15% of children and adolescents (at least one in seven) have experienced bullying victimisation within the previous 12 months (Thomas et al., 2017; Jadambaa et al., 2019). Bullying by definition is a negative action on the part of one or more individuals that includes three components: intention to harm, repetition and a power imbalance between a victim and the perpetrator(s) (Olweus, 1993; Olweus, 2013). There is now a strong body of evidence that suggests experiences of bullying victimisation (being bullied) precedes the later development of mental illness (Moore et al., 2014; Moore et al., 2017). The negative consequences of bullying victimisation are not limited to childhood and adolescence and can persist into adulthood. Victims have been consistently found to be at an increased risk of internalising problems, in particular diagnoses of later anxiety and depressive disorders in adulthood (Hemphill et al., 2011; Copeland et al., 2013; Stapinski et al., 2014; Takizawa et al., 2014). Not only is bullying victimisation associated with an increased risk of these common mental disorders, but it also results in substantial costs for individuals, their families and society at large (Wolke and Lereya, 2015; Moore et al., 2015b).

Researchers have undertaken systematic reviews and meta-analyses examining the association between bullying victimisation and a range of health outcomes. Tof of...
conducted the first systematic review and meta-analysis of longitudinal studies and concluded that children who were bullied at school were twice as likely to develop depression compared to those who had not experienced bullying. This study focused on the later development of depression only. Another systematic review and meta-analysis (studies from inception until February 2015) identified mental disorders and substance use as the main consequences of bullying victimisation (Moore et al., 2017). This analysis summarised the cross-sectional as well as longitudinal evidence separately in order to examine the dimension of time. The review concluded there was convincing evidence for a causal relationship between bullying victimisation and anxiety and depressive disorders in particular.

According to the most recent national survey, approximately one in five Australians aged 16–85 years meet the criteria for a mental disorder in the previous 12 months, which is the equivalent of 3.2 million Australians (Slade et al., 2009). Overall, anxiety and depressive disorders (14.7 and 6.2%, respectively) were among the most commonly diagnosed (Slade et al., 2009). The most recent Global Burden of Disease Study (GBD 2017) estimated that mental disorders ranked sixth in terms of overall disability-adjusted life years (DALYs) globally, and ranked fourth in Australia. Within the mental disorders group, depressive disorders (major depressive disorder and dysthymia) followed by anxiety disorders accounted for the most DALYs in Australia (Kyu et al., 2018).

In GBD 2017, the burden of disease attributable to bullying victimisation was assessed for the first time. Overall, 0.16% of total DALYs for all disease causes for both sexes and all ages in Australia were attributable to bullying victimisation (Stanaway et al., 2018). When the estimates were further disaggregated by age group and disease cause, 12.2% of total DALYs for anxiety disorders, and 9.7% of total DALYs for depressive disorders were attributable to bullying victimisation for both sexes within the age group 10–24 years in Australia (Stanaway et al., 2018). The methodology used in global studies is often not well described limiting reproducibility (AbouZahr et al., 2017). As a result, there is a need for a local study to provide understanding of the Australian context to inform policy decisions. The current study sought to better understand how bullying victimisation among Australians influences the burden of the most common mental disorders, anxiety and depression. This study can support priority-setting and resource allocation decisions in the local context. The estimates from this study are the first comparison with those reported in GBD 2017.

The first aim of this study was to summarise the longitudinal evidence of an association between bullying victimisation and the later development of anxiety and depressive disorders. The second aim of this study was to estimate the burden of anxiety and depressive disorders attributable to child and adolescent bullying victimisation in Australia, based on the 12-month point prevalence estimated in a previous systematic review and meta-analytic study (Jadambaa et al., 2019).

**Methods**

Exposure to bullying victimisation was treated as a risk factor for anxiety and depressive disorders, using counterfactual estimation and comparative risk assessment methods (Stanaway et al., 2018). This involved comparing the current local health status with the theoretical minimum risk exposure level assumed to be zero exposure to bullying victimisation. Population attributable fractions (PAFs) were determined by the prevalence of exposure to bullying victimisation in the Australian population and the relative risks (RRs) of disease occurrence given exposure. This methodology has been used to estimate the burden of a related form of interpersonal violence, exposure to child maltreatment (Moore et al., 2015a).

**Types of bullying victimisation**

Traditional bullying typically occurs face-to-face, and cyber bullying occurs in an online environment (Smith et al., 2008). Exposure to bullying victimisation was included in this study where individuals are exposed to bullying in childhood and adolescence as victims only (being bullied – bullying victimisation) or as victim-perpetrators (both being bullied and bullying others – bullying victim-perpetration). Experiences of perpetrators (bullying others – bullying perpetration) were excluded.

**Prevalence of exposure**

Prevalence estimates from another systematic review and meta-analysis were used (Jadambaa et al., 2019). This study estimated the 12-month prevalence of self-reported bullying victimisation experienced among Australian children and adolescents at 15.17%. This estimate included prevalence data for traditional as well as cyber forms of bullying victimisation (Table 1).

**Mental disorders**

In this study, mental disorders were classified according to the categories specified by the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) (APA, 2000) and the International Classification of Diseases 10 (WHO, 1992), which align with the diagnostic tools reported in published cohort studies. Anxiety disorders included generalised anxiety disorder, agoraphobia and panic disorder, and social phobia, specific phobia and anxiety disorders not otherwise specified. Depressive disorders included major depressive disorder and dysthymia.

### Table 1. Results of meta-analysis of the prevalence of bullying victimisation in childhood and adolescence in Australia (Jadambaa et al., 2019)

| Type of Involvement | Recall period | Data points | Pooled prevalence (%) | 95%CI | I² (%) | Cochran’s Q | Test for heterogeneity (p-value) |
|---------------------|---------------|-------------|-----------------------|-------|-------|------------|-------------------------------|
| Bullying victimisation exposure | 12 months | 35 | 15.17 | 9.17–22.30 | 99.65 | 9804.70 | <0.001 |

*Where studies reported victimisation only and victim-perpetration estimates, they were combined to give an overall victimisation rate that would be comparable to studies that did not specify the victim-perpetration grouping. 
Where studies reported traditional bullying, cyber bullying, traditional and cyber bullying (included both estimates), and not specified whether cyber or traditional bullying, they were combined to give an overall estimate.*
Relative risk estimates

Search strategy
This study updated a previous systematic review and meta-analysis (Moore et al., 2017) which reported studies identified from inception to January 2015. The processing and reporting of results are based on the recommendations from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2010). The complete PRISMA checklist is presented in Appendix 1. The systematic search identified cohort studies that examined the association between bullying victimisation during childhood/adolescence and the later development of anxiety and depressive disorders. A review protocol was developed with search methods and inclusion/exclusion criteria specified in advance (Appendix 2). Four electronic databases (PubMed, EMBASE, ERIC and PsycINFO) were searched between 1 January 2015 and 18 August 2018 using the terms: 'child*', 'adolescent*', 'bull*', 'victim*', 'harass*', 'outcome', 'anxiety', 'depress*', 'longitudinal', 'cohort', 'Jan 2015–Aug 2018'. In addition, reference lists of included studies were screened for any other relevant study and authors were contacted to obtain more detailed information, as needed. Articles in languages other than English were translated if they were deemed relevant.

Inclusion and exclusion criteria
This systematic review included studies meeting the following inclusion criteria: (1) published in a peer-reviewed journal, (2) examined an association between exposure to bullying victimisation as a child or adolescent and later development of anxiety and depressive disorders, and (3) the study was longitudinal and population-based. Some studies reported associations for victimisation as well as victim-perpetration; in these cases, both estimates were included. Where available, the unadjusted and adjusted odds ratios (ORs) for bullying victimisation including victim-perpetration for anxiety and depressive disorders were extracted separately. Included studies reported effect sizes and 95% confidence intervals (CIs) comparing those exposed and not exposed. Alternatively, included studies provided the information from which effect sizes and CIs could be calculated. In the few instances where the same sample was reported across different publications, the most informative article was selected: for example, studies reporting sex- or age-specific prevalence estimates were selected over those providing combined estimates. All longitudinal cohort studies previously included by Moore et al. (2017) were also assessed against inclusion and exclusion criteria.

Data extraction and synthesis
The full text of papers that met inclusion criteria was retrieved and examined. The first author (AJ) independently assessed the articles for eligibility and any uncertainties were resolved through discussion with HT and RP. The following details were extracted for each study: study design, country, sample size, gender, follow-up period, assessment of bullying victimisation and health outcomes (Appendix 3).

There was a significant variation across studies in terms of model adjustments, which meant it was necessary to further explore the effects of adjustment over a series of sub-group analyses. Some studies controlled for demographics only (e.g. gender and age), environmental and/or family factors only (e.g. having a friend and parental social class) or outcomes at baseline only (e.g. anxiety or depression), whereas others controlled for a combination of variables. Also, a few studies reported unadjusted effect sizes. In order to account for different adjustment methods, the extracted data points were grouped so they were analysed in three sub-group analyses: (i) unadjusted, (ii) adjusted for demographic, family and/or environmental factors and (iii) adjusted for mental health outcomes at baseline in addition to demographic, family and/or environmental factors (Table A2, Appendix 3). Similarly, separate subgroup analyses were conducted for victimisation only and victimisation including victim-perpetration.

Quality assessment
Quality of studies was assessed using an adapted version of the Newcastle–Ottawa Scale for cohort studies (Wells et al., 2000). This tool has been used in a previous systematic review and meta-analysis and described in more detail in Appendix 2 (Norman et al., 2012). The quality assessment for each study is presented in Appendix 3. The total quality score for each study was the sum of the scores for individual assessment items. This was converted to a proportional quality score (the total quality score divided by 11, which was the maximum score possible) for use in a tool for meta-analysis in Microsoft Excel namely Meta-XL version 5.3.

Statistical analyses
Relative risk estimates and meta-analyses. Weighted summary measures were computed using MetaXL version 5.3, a plugin package for Microsoft Excel (Barendregt et al., 2013). RRs were chosen as the principal summary measure. If ORs were not reported in included studies, ORs and their 95% CIs were calculated based on provided exposed/non-exposed case numbers and exposed/non-exposed non-case numbers using a cohort study OR calculator in STATA 15.0 (StataCorp, 2017). All ORs were then converted to RR estimates using an imputation method which reconstructs fourfold tables and event frequency values from published and estimated ORs and their 95% CIs, given the sample sizes (Di Pietrantonj, 2006). The meta-analyses were then carried out using reconstructed RR estimates. In some cases, it was necessary to use reported ORs as an approximation of RR when there was insufficient information to do the OR-to-RR conversion (Davies et al., 1998). Specifically, four studies did not report the prevalence of depressive/anxiety disorders in the non-exposed group, and in these instances, the OR = RR assumption was made. Models were later tested with and without these four studies included to ensure there were no significant differences in the RR estimates.

A quality effects meta-analytic model was used to pool the RR estimates. This is a modified version of the fixed-effects inverse variance method that allows giving greater weight to studies of high quality and lower weight to studies of lesser quality by using the quality scores assigned to each study (Doi and Thalib, 2008; Doi et al., 2011). Heterogeneity was quantitatively assessed using the Cochran’s Q and I^2 statistics to evaluate whether the pooled studies represent a homogeneous distribution of effect sizes. Evidence of publication bias was investigated by means of funnel plots using the standard error on the y-axis.

Calculation of PAEs and attributable burden. The estimated pooled RRs calculated for anxiety and depressive disorders which were adjusted for key confounders including the presence of mental disorders at baseline were paired with the prevalence estimate for bullying victimisation (Jadambaa et al., 2019) to
A total of 402 articles were identified by the electronic database search, of which 143 were duplicates. Titles and abstracts for 259 unduplicated references were reviewed and a further 217 articles were excluded. Of the 64 studies assessed for eligibility, 22 longitudinal studies satisfied the pre-determined inclusion criteria [including 15 studies from the original published systematic review (Moore et al., 2017), and seven newly identified studies] (Fig. 1, Appendix 4). Length of follow-up time ranged from 6 months to 34 years. Studies were all conducted in high-income regions consisting of Europe (N = 12), North America (N = 7) and Australia (N = 3). Some studies examined the association between bullying victimisation and both depressive and anxiety disorders, while others examined the association between bullying victimisation and anxiety disorders only or depressive disorders only. Characteristics for all included studies are summarised in Appendix 3 (Table A1), along with the quality assessment procedure (Wells et al., 2000) and the total quality score for each study (Appendix 3, Table A2). Scores ranged from 4.5 to 10 out of 11. The test for heterogeneity was highly significant, with p < 0.001 for all groups. Forest plots and funnel plots to visualise individual analyses as well as pooled estimates are presented in Appendix 4 (Figs 2, 3).

The results of the meta-analysis for RR estimates for bullying victimisation and anxiety disorders only or depressive disorders only. Characteristics for all included studies are summarised in Appendix 3 (Table A1), along with the quality assessment procedure (Wells et al., 2000) and the total quality score for each study (Appendix 3, Table A2). Scores ranged from 4.5 to 10 out of 11. The test for heterogeneity was highly significant, with p < 0.001 for all groups. Forest plots and funnel plots to visualise individual analyses as well as pooled estimates are presented in Appendix 4 (Figs 2, 3).

The results of the meta-analysis for RR estimates for bullying victimisation and anxiety disorders only or depressive disorders only. Characteristics for all included studies are summarised in Appendix 3 (Table A1), along with the quality assessment procedure (Wells et al., 2000) and the total quality score for each study (Appendix 3, Table A2). Scores ranged from 4.5 to 10 out of 11. The test for heterogeneity was highly significant, with p < 0.001 for all groups. Forest plots and funnel plots to visualise individual analyses as well as pooled estimates are presented in Appendix 4 (Figs 2, 3).

The results of the meta-analysis for RR estimates for bullying victimisation and anxiety disorders only or depressive disorders only. Characteristics for all included studies are summarised in Appendix 3 (Table A1), along with the quality assessment procedure (Wells et al., 2000) and the total quality score for each study (Appendix 3, Table A2). Scores ranged from 4.5 to 10 out of 11. The test for heterogeneity was highly significant, with p < 0.001 for all groups. Forest plots and funnel plots to visualise individual analyses as well as pooled estimates are presented in Appendix 4 (Figs 2, 3).

The results of the meta-analysis for RR estimates for bullying victimisation and anxiety disorders only or depressive disorders only. Characteristics for all included studies are summarised in Appendix 3 (Table A1), along with the quality assessment procedure (Wells et al., 2000) and the total quality score for each study (Appendix 3, Table A2). Scores ranged from 4.5 to 10 out of 11. The test for heterogeneity was highly significant, with p < 0.001 for all groups. Forest plots and funnel plots to visualise individual analyses as well as pooled estimates are presented in Appendix 4 (Figs 2, 3).

The results of the meta-analysis for RR estimates for bullying victimisation and anxiety disorders only or depressive disorders only. Characteristics for all included studies are summarised in Appendix 3 (Table A1), along with the quality assessment procedure (Wells et al., 2000) and the total quality score for each study (Appendix 3, Table A2). Scores ranged from 4.5 to 10 out of 11. The test for heterogeneity was highly significant, with p < 0.001 for all groups. Forest plots and funnel plots to visualise individual analyses as well as pooled estimates are presented in Appendix 4 (Figs 2, 3).
twice the risk \( [RR = 1.98 (95\% CI 1.71–2.30)] \) of later development of anxiety disorders compared to individuals not involved in bullying. When adjusting for baseline anxiety, the pooled RR was reduced to 1.56 (95\% CI 1.32–1.85).

The results of the meta-analysis for RR estimates for bullying victimisation and depressive disorders are presented in Table 3. The pooled RR for depressive disorders for individuals who experienced bullying victimisation (including victim-perpetration) compared to those not involved in bullying was 1.90 (95\% CI 1.56–2.32). Those exposed to bullying victimisation including victim-perpetrators had 1.9 times higher risk of later development of depressive disorders. The pooled RRs calculated based on ORs after adjusting for baseline depression was 1.80 (95\% CI 1.56–2.08), indicating that those who had been bullied had 1.8 times higher risk of later development of depressive disorders. For both health outcomes, this study pooled RRs with and without OR = RR assumption and there were no significant differences in the RR estimates.

### Population attributable fractions and attributable burden

For exposure to bullying victimisation, the calculated PAF for depressive disorders was 10.82\% (95\% uncertainty interval 5.71–16.05\%) and for anxiety disorders was 7.83\% (95\% uncertainty interval 3.51–12.73\%) (Table 4). Overall, bullying victimisation during childhood and adolescence accounted for 0.52\% of all DALYS (95\% uncertainty interval 0.33–0.72\%) for both sexes and all ages (Table 4) in Australia in 2017. For both sexes in the age group 10–24 years, 1.39\% of all DALYS in Australia were attributable to bullying victimisation (95\% uncertainty interval 0.87–1.90\%).

### Discussion

The current study assessed the burden of disease attributable to bullying victimisation during childhood and adolescence in Australia. The systematic review identified 22 longitudinal studies reporting an association between bullying victimisation in childhood and later development of anxiety and depressive disorders. Results showed that bullied children are at a significantly increased risk of later developing anxiety and depressive disorders compared with children not involved in bullying. This association remained statistically significant after controlling for demographic, family and other environmental factors, as well as baseline anxiety and/or depression. This result supports a causal relationship between bullying victimisation and the two outcome variables. Anxiety and depressive disorders have a high prevalence and are significant contributors to the burden of disease.
The current study estimated that 7.83% of anxiety disorders and 10.82% of depressive disorders are attributable to exposure to bullying victimisation during childhood and adolescence. It is important to understand not only the prevalence of mental disorders, but also the burden of illness that is attributable to their associated disability. This form of evidence informs the allocation of resources aimed at improving the health outcomes of people with mental disorders. Mental disorders are ranked fourth in Australia in terms of overall DALYs, and anxiety and depressive disorders are the most prevalent mental illnesses (Kyu et al., 2018). An estimated 30,656 DALYs (95% uncertainty interval 19,304–42,260) or 0.52% of DALYs for all causes in both sexes and all ages; and 6,578 DALYs (95% uncertainty interval 4,129–9,018) or 1.39% of DALYs for all causes in both sexes in the age group 10–24 years in Australia were attributable to bullying victimisation during childhood and adolescence.

Recently, GBD 2017 comparative risk assessment added bullying victimisation as a risk factor for anxiety and depressive disorders (Stanaway et al., 2018). The methodology used in GBD 2017 combined anxiety and depressive disorders data into a single estimate that pooled the RRs for both disorders together [RR = 1.79 (95% CI 1.63–1.98)]. Although a different type of meta-analytic method was used, this estimate is consistent with estimated RRs for those health outcomes in this study [anxiety disorders RR = 1.56 (95% CI 1.32–1.85) and depressive disorders RR = 1.80 (95% CI 1.56–2.08)]. Furthermore, the global study used adjusted prevalence estimates and reported results for specific age groups. The current study used the pooled prevalence of bullying victimisation and reports attributable DALYs across all age groups and for ages 10–24 years. The overall estimates of attributable DALYs due to bullying victimisation are higher (1.39%) for ages 10–24 years compared to other age groups – a result consistent with GBD 2017. Although these studies reported the burden attributable to bullying victimisation in different ways, they are broadly consistent in finding that bullying victimisation makes a significant contribution to DALYs.

It has been proposed that a reduction in the population prevalence of mental disorders in Australia and other high-income countries could be achieved through a systematic effort to prevent bullying victimisation (Scott et al., 2014). A variety of effective intervention programmes have been implemented to address bullying in many countries. A systematic review and meta-analysis evaluating school-based anti-bullying programmes reported that interventions can reduce bullying victimisation by 15–16% and bullying perpetration by 19–20% (Gaffney et al., 2018b). Programmes to specifically address cyberbullying have also been developed, and are reported to reduce cyberbullying victimisation by 14% and cyberbullying perpetration by 10–15%.

| DALYs by cause | PAF | DALYs for both sexes and all ages for Australia (GBD 2017) | DALYs attributable to bullying victimisation in Australia for both sexes and all ages (N/%) | DALYs for both sexes and ages 10–24 years for Australia (GBD 2017) | DALYs attributable to bullying victimisation in Australia for both sexes and ages 10–24 years (N/%) |
|---------------|-----|---------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------------------------|
| Anxiety disorders | 7.83% | 138,296 | 10,829 | 30,877 | 2,418 |
| 95% Uncertainty interval | 3.51% | 12.73% | | | |
| Proportion of total DALYs | 0.18% | | | 0.51% |
| 95% Uncertainty interval | 0.08% | 0.30% | 0.23% | 0.83% |
| Depressive disorders | 10.82% | 183,205 | 19,827 | 38,449 | 4,161 |
| 95% Uncertainty interval | 5.71% | 16.05% | | |
| Proportion of total DALYs | 0.34% | | | 0.88% |
| 95% Uncertainty interval | 0.18% | 0.50% | 0.46% | 1.30% |
| Anxiety + depressive disorders | 30,656 | | 6,578 | | |
| 95% Uncertainty interval | 19,304 | 42,260 | 4,129 | 9,018 | |
| All causes | 5,868,041 | | 473,825 | | |
| Proportion of total DALYs | 0.52% | | | 1.39% |
| 95% Uncertainty interval | 0.33% | 0.72% | 0.87% | 1.90% |

PAF, population attributable fraction; DALYs, disability-adjusted life years.

GBD 2017 = source data for the number of DALYs for anxiety and depressive disorders (Kyu et al., 2018).
Using results from this study, a reduction of between 10 and 20% in the prevalence of bullying victimisation among children and adolescents would result in the avoidance of between 10 and 20% in the prevalence of bullying victimisation in Australia. To further support the case for implementation of bullying prevention, there is a need to quantify the costs related to anxiety and depressive disorders associated with bullying victimisation, as well as the value of lost productivity due to consequences of exposure to bullying victimisation during childhood and adolescence.

Strengths and limitations

There are several strengths of this study. The pooled findings from longitudinal cohort studies provide the opportunity to avoid recall bias of bullying victimisation. Also, the quality effects model allows quantifying studies not only according to sample size but also by study quality, giving greater weight to studies of high quality. Furthermore, this study controlled for pre-existing mental health problems by using pooled RRs adjusted for baseline mental health outcomes in order to quantify PAFs. Otherwise, the results would be an overestimate of the burden because the continuation of pre-existing psychopathology would not have been accounted for (Moore et al., 2014). Finally, PAF estimates provide an opportunity to quantify the burden of mental disorders that could be avoided in future by reducing bullying victimisation prevalence through anti-bullying interventions.

The current study also had limitations. Due to the limited number of studies, the RR estimates for bullying victimisation and mental disorders were derived from research where the bullying victimisation was reported from different sources (self-reported, teacher and/or parent reported), while the prevalence estimate of bullying victimisation experience was from meta-analyses which were derived only from studies where bullying victimisation was self-reported. In addition, there was a large variance in the follow-up period of included longitudinal cohort studies. The influence of this variation has not been examined. For some included studies, both the exposure and the outcome occurred within the period of childhood and adolescence (i.e. 18 years or younger). In addition, there is a waning effect on outcomes with effect sizes that likely diminish over time (Stanaway et al., 2018). Hence, applying PAFs based on current prevalence in childhood and adolescence and a single RR value to the burden of anxiety and depressive disorders across all ages may overestimate the overall attributable burden. Finally, the focus of this study was on anxiety and depressive disorders only. But there are also other consequences of bullying victimisation including poor general health, non-suicidal self-injury and substance use, which were not included (Moore et al., 2017). However, the evidence-base for a causal relationship for many of these outcomes is limited and no firm conclusions have yet been made.

Conclusion

The quantification of the disease burden attributable to bullying victimisation demonstrates the significant morbidity caused by this exposure during childhood and adolescence. For this reason, the prevention of bullying victimisation should be a priority for public health policy and action. Health and education systems need to respond by implementing evidence-based intervention programmes that reduce bullying in schools. The provision of a more preventive approach has the potential to reduce the burden of disease and improve the mental health of Australians.

Availability of Data and Materials. The datasets used and analysed during the systematic review and meta-analyses are available from the corresponding author on request.

Acknowledgements. The authors would like to acknowledge the support of the Australian Centre for Health Service Innovation (AussHSI) team members, Nicole White and Xing Lee, who provided advice on statistical analyses.

Financial support. This research is part of Amarzaya Jadambaa’s PhD project which is funded by the Queensland University of Technology Postgraduate Research Award. JGS is supported by a National Health and Medical Research Council Practitioner Fellowship Grant APP1105807. JGS and HJT are employed by the Queensland Centre for Mental Health Research which receives its core funding from the Queensland Department of Health. The funder had no role in the design of the study and data collection, analysis and interpretation of results and in writing the manuscript or submitting for publication.

Conflict of interest. The author(s) declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Ethical standards. Not applicable.

References

AbouZahr C, Boerma T and Hogan D (2017) Global estimates of country health indicators: useful, unnecessary, inevitable? Global Health Action 10, 1290370.

APA (2000) Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR), Washington, D.C.: American Psychiatric Association.

Barendregt JJ, Doi SA, Lee YY, Norman RE and Vos T (2013) Meta-analysis of prevalence. Journal of Epidemiology and Community Health 67, 974–978.

Bowes L, Joinson C, Wolke D and Lewis G (2015) Peer victimisation during adolescence and its impact on depression in early adulthood: prospective cohort study in the United Kingdom. The British Medical Journal 350, h2469.

Copeland WE, Wolke D, Angold A and Costello EJ (2013) Adult psychiatric outcomes of bullying and being bullied by peers in childhood and adolescence. Journal of the American Medical Association: Psychiatry 70, 419–426.

Davies HTO, Crombie IK and Tavakoli M (1998) When can odds ratios mislead? British Medical Journal 316, 989–991.

Di Pietrantonj C (2006) Four-fold table cell frequencies imputation in meta analysis. Statistics in Medicine 25, 2299–2322.

Doi SA and Thalib L (2008) A quality-effects model for meta-analysis. Epidemiology 19, 94–100.

Doi SA, Barendregt JJ and Mozurkevich EL (2011) Meta-analysis of heterogeneous clinical trials: an empirical example. Contemporary Clinical Trials 32, 288–298.

Fahy AE, Stansfeld SA, Smuk M, Smith NR, Cummins S and Clark C (2016) Longitudinal associations between cyberbullying involvement and adolescent mental health. Journal of Adolescent Health 59, 502–509.

Farrington DP, Loeber R, Stallings R and Tofii MM (2011) Bullying perpetration and victimization as predictors of delinquency and depression in the Pittsburgh Youth Study. Journal of Aggression, Conflict and Peace Research 3, 74–81.

Fekkes M, Pijpers FJ, Fredriks AM, Vogels T and Verloove-Vanhorck SP (2006) Do bullied children get ill, or do ill children get bullied? A prospective cohort study on the relationship between bullying and health-related symptoms. Pediatrics 117, 1568–1574.

Gaffney H, Farrington DP, Espelage DL and Tofii MM (2018a). Are cyberbullying intervention and prevention programs effective? A systematic and meta-analytical review. Aggression and Violent Behavior 45, 134–153.
Gaffney H, Ttofi MM and Farrington DP (2018b). Evaluating the effective-
ness of school-bullying prevention programs: an updated meta-analytical
review. Aggression and Violent Behavior 45, 111–133.
Geoffroy M-C, Boivin M, Arseneault L, Renaud J, Perret LC, Turecki G,
Michel G, Salla J, Vitaro F and Brendgen M (2018) Childhood trajectories of
peer victimization and prediction of mental health outcomes in midado-
lescence: a longitudinal population-based study. Canadian Medical
Association Journal 190, E37–E43.
Hemphill SA, Koteski A, Herrenkohl TI, Bond L, Kim MJ,
Toumbourou JW and Catalano RF (2011) Longitudinal consequences of
adolescent bullying perpetration and victimisation: a study of students in
Victoria, Australia. Criminal Behaviour and Mental Health 21, 107–116.
Hemphill SA, Tollitt M and Herrenkohl TI (2014) Protective factors against
the impact of school bullying perpetration and victimization on young adult
externalizing and internalizing problems. Journal of School Violence 13,
125–145.
Hemphill SA, Koteski A and Heerde JA (2015) Longitudinal associations
between cyber-bullying perpetration and victimization and problem behav-
ior and mental health problems in young Australians. International
Journal of Public Health 60, 227–237.
Jadambaa A, Thomas HJ, Scott JG, Graves N, Brain D and Pacella R (2019)
Prevalence of traditional bullying and cyberbullying among children and
adolescents in Australia: a systematic review and meta-analysis. Australian
& New Zealand Journal of Psychiatry 53, 879–888.
Kaltiala-Heino R, Fröjd S and Marttunen M (2010) Involvement in bullying
and depression in a 2-year follow-up in middle adolescence. European Child
& Adolescent Psychiatry 19, 45.
Klomke AB, Sourander A, Kumpulainen K, Piha J, Tamminen T,
Moilanen I, Almqvist F and Gould MS (2008) Childhood bullying as a
risk for later depression and suicidal ideation among Finnish males.
Journal of Affective Disorders 109, 47–55.
Kyu HH, Abate D, Abate KH, Abay SM, Abbafati C, Abbasi N,
Abbastabar H, Abd-Allah F, Abdela J and Abdalaim A (2018) Global,
regional, and national disability-adjusted life-years (Daly’s) for 359 diseases
and injuries and healthy life expectancy (Hale) for 195 countries and terri-
tories, 1990–2017: a systematic analysis for the Global Burden of Disease
Study 2017. The Lancet 392, 1859–1922.
Lereya ST, Copeland WE, Costello EF and Wolke D (2015) Adult mental
health consequences of peer bullying and maltreatment in childhood: two
cohorts in Two countries. The Lancet Psychiatry 2, 524–531.
Levin ML (1953) The occurrence of lung cancer in man. Acta – Unio interna-
tionalis Contra Cancrum 9, 531–941.
Moher D, Liberati A, Tetzlaff J, Altman DG and Group P (2010) Preferred
reporting items for systematic reviews and meta-analyses: the Prisma state-
ment. International Journal of Surgery 8, 336–341.
Moore SE, Norman RE, Sly PD, Whitehouse AJ, Zubrick SR and Scott J (2014)
Adolescent peer aggression and its association with mental health and
substance use in an Australian cohort. Journal of Adolescence 37, 11–
21.
Moore SE, Scott JG, Ferrari AJ, Mills R, Dunne MP, Erskine HE,
Devries KM, Degenhardt L, Voos T, Whiteford HA, McCarthy M and
Norman RE (2015a). Burden attributable to child maltreatment in
Australia. Child Abuse Neglect 48, 208–220.
Moore SE, Scott JG, Thomas HJ, Sly PD, Whitehouse AJ, Zubrick SR
and Norman RE (2015b). Impact of adolescent peer aggression on later
educational and employment outcomes in an Australian cohort. Journal of ado-
lescence 43, 39–49.
Moore SE, Norman RE, Suetani S, Thomas HJ, Sly PD and Scott JG (2017)
Consequences of bullying victimization in childhood and adolescence:
a systematic review and meta-analysis. World Journal of Psychiatry 7, 60–76.
Norman RE, Byambaa M, De R, Butchart A, Scott J and Voos T (2012)
The long-term health consequences of child physical abuse, emotional
abuse, and neglect: a systematic review and meta-analysis. PLoS Medicine 9,
e1001349.
Olweus D (1993) Bullying at School: What We Know and What We Can Do.
Cambridge, MA: Blackwell.
Olweus D (2013) School bullying: development and some important chal-
genues. Annual Review of Clinical Psychology 9, 751–780.
Patton GC, Olsson C, Bond L, Toumbourou JW, Carlin JB, Hemphill SA
and Catalano RF (2008) Predicting female depression across puberty: a
two-nation longitudinal study. Journal of the American Academy of Child
& Adolescent Psychiatry 47, 1424–1432.
Ranta K, Kaltiala-Heino R, Fröjd S and Marttunen M (2013) Peer victimiza-
tion and social phobia: a follow-up study among adolescents. Social
Psychiatry and Psychiatric Epidemiology 48, 533–544.
Rothen C, Head J, Klineberg E and Stansfeld S (2011) Can social support protect
bullied adolescents from adverse outcomes? A prospective study on the effects
of bullying on the educational achievement and mental health of adolescents at sec-
ondary schools in East London. Journal of Adolescence 34, 579–588.
Schoon I and Montgomery S (1997) The relationship between early life
experiences and adult depression. Zeitschrift fur Psychosomatische
Medizin und Psychoanalyse 43, 319–333.
Scott JG, Moore SE, Sly PD and Norman RE (2014) Bullying in children and
adolescents: a modifiable risk factor for mental illness. Australian & New
Zealand Journal of Psychiatry 48, 209–212.
Silberg JI, Copeland W, Linker J, Moore AA, Roberson-Nay R and York TP
(2016) Psychiatric outcomes of bullying victimization: a study of discordant
monozygotic twins. Psychological Medicine 46, 1875–1883.
Slade J, Teesson W and Burgess P (2009) The Mental Health of Australians 2:
Report on the 2007 National Survey of Mental Health and Wellbeing.
Canberra, Australia: Department of Health and Ageing.
Smith PK, Michádó J, Carvalho F, Figueira S, Russell S and Tippett N (2008)
Cyberbullying: its nature and impact in secondary school pupils. Journal of Child
Psychology and Psychiatry 49, 376–385.
Sourander A, Jensen P, Rönning JA, Niemelä S, Helenius H, Sillanmäki L,
Kumpulainen K, Piha J, Tamminen T and Moilanen I (2007) What is the
early adulthood outcome of boys who bully or are bullied in childhood? The
Finnish ‘from a Boy to a Man’ study. Pediatrics 120, 397–404.
Sourander A, Ylönén WG, Klomke AB, Sillanmäki L, Ilola A-M and
Kumpulainen K (2016) Association of bullying behavior at 8 years of age
and use of specialized services for psychiatric disorders by 29 years of age.
Journal of the American Medical Association: Psychiatry 73, 159–165.
Stanaway JD, Afshin A, Gakidou E, Lim SS, Abate D, Abate KH,
Abbafati C, Abbasi N, Abbastabar H, Abd-Allah F, Abdela J,
Abdelalim A, Abdollahpour I, Abdulkader RS, Abebe M, Abeze B,
Abera SF, Abil OZ, Abraha HH, Abraham AR, Abu-Raddad LJ,
Abu-Rmelleh NM, Allocemme M, Acharya D, Achariya P, Adamu AA,
Adane AA, Adeyobo OM, Adeoyin RA, Adenkumari V,
Ademi Z, Adetokunbobi OO, Adig MB, Admasie A, Adusur AC,
Afani KA, Afarideh M, Agarwal G, Agarwal A, Aghayen SA,
Agrawal A, Agrawal S, Ahmad A, Ahmadi A, Ahmadihie AH,
Ahmed MA, Aichour AN, Aichour I, Aichour MTE, Akbari ME,
Akinremi A, Akeem N, Ali-Y AL-Y, Aleyadih A, Al-Meklli HM,
Alahdab F, Alam K, Alam S, Alam T, Alashi A, Alaviani SM,
Alene KA, Ali K, Ali SM, Aljanzadeh M, Alizadeh-Navaei R,
Aljunid SM, Alkerwi A, Alla F, Alsharif U, Altirkawi K,
Alvis-Guzman N, Amare AT, Ammar W, Anber NH, Anderson JA,
André CL, Andrioudis S, Annimud MT, Anjomshoa M, Ansga MA,
Antó JM, Antonio CAT, Anwari P, Appiah LT, Appiah SCI,
Arabio J, Arenou O, Arnhov J, Artamaan A, Aryal KK, Asayesh H,
Atar A, Azuols M, Avokpah EFGA, Awasthi A, Ayala Quintanilla BP, Ayer R, Ayuk TB, Azzopardi PS, Babazadeh A,
Badali H, Badawi A, Balakrishnan K, Bali AG, Ball K, Ballow SH,
Banach M, Banoub JAM, Barac A, Barker-Collo SL, Birnighausen TW,
Barrero LH, Basu S, Baune BT, Bazargan-Hejazi S, Bedi N, Beghi E,
Behzadifar M, Behzadifar M, Béjot Y, Bekele BB, Bekru ET, Belay E,
Belay YA, Bell MI, Bello AK, Bennett DA, Benson IM, Bergeron G,
Berhanie A, Benabe E, Bernstein RS, Beuran M, Beyrandt V,
Bhala N, Bhalla A, Bhattarai S, Bhatta ZA, Biadgo B, Bijani A,
Bikbov B, Bilano V, Billign N, Bin Sayeed MS, Bisanzio D, Biswas T,
Björk T, Blacker BF, Bleyer A, Borschmann R, Bou-OmR IM,
Boufous S, Bourne R, Brady OJ, Brauer M, Brazinova A,
Breitbart NJK, Brenner H, Briko AN, Brutton G, Brugha T,
Buchbinder R, Burnett RT, Busse R, Butt ZA, Cahill LE,
Cahuana-Hurtado L, Campos-Nonato IR, Cárdenas R, Carreras G,
Carrero JJ, Carvalho F, Castañeda-Orjuela CA, Castillo Rivas J,
Smith M, Sobaih BH, Sobhani S, Somayaji R, Soofi M, Sorensen RJD, Soriano JB, Soyirin IN, Spinelli A, Sposato LA, Sreeramareddy CT, Srinivasan V, Starodubov VI, Steckling N, Stein DJ, Stein MB, Stevanovic G, Stockfelt L, Stokes MA, Struwa L, Subart ML, Sudaryanto A, Sufiyam MB, Sulo G, Sunguya BF, Sur PJ, Sykes BL, Szoeke CEI, Tabárés-Seisdedos R, Tabuchi T, Tadakamadla SK, Takahashi K, Tandon N, Tassew SG, Tavakkoli M, Taveira N, Tehrani-Banihashemi A, Tekaalign TG, Tekeledhemin SW, Tekle MG, Temesgen H, Temsah MH, Temsah O, Terkawi AS, Tessema B, Teweldeemedhin M, Thakkappan KR, Theis A, Thirunavukkarasu S, Thomas HJ, Thomas ML, Thomas N, Thurston GD, Tilahun B, Tillmann T, To QQ, Tobollik M, Tonelli M, Topor-Madry R, Torre AE, Tortajada-Girbés M, Touvier M, Towbin JA, Tran BX, Tran KB, Truelsen TC, Truong NT, Tsadik AG, Tudor Car I, Tuzcu EM, Tynelius P, Tyrväinen L, Ukwaja KN, Ullah I, Uthman OA, Vaduganathan M, Vaezi A, Valdez PR, Van Donkelaar A, Varavikova E, Varughese S, Vasankari TJ, Venketaswaran V, Vlassof V, Vollset SE, Vos T, Vosoughi K, Vu GT, Vujcic IS, Wagenknecht LE, Waheed Y, Waller SG, Walson JL, Wang Y, Wang T, Wang YP, Weiderpass E, Weintraub RG, Welge C, Werdecker A, Werknesh AA, West JF, Westerman R, Whiteford HA, Widera T, Vijayaratnam T, Wickens BT, Wijsman M, Wijsink A, Wijesinghe CS, Wolke CDA, Won Y, Wu S, Xavier D, Xu G, Yadgar S, Yadollahpour A, Yahyazadeh Jabbari SH, Yamada T, Yan LL, Yano Y, Yasemi M, Yasui Y, Yasmeen A, Yimer EM, Yip P, Yisma E, Yonemoto N, Yoo SI, Yotiebieng M, Younis MZ, Yousefi-Fard M, Yu C, Zaidi Z, Zaman SB, Zanini M, Zavala-Arciniega I, Zhang AL, Zhang H, Zhang K, Zhou M, Zimsen SRM, Zodpey S, Murray CJL and Collaborators GBDRF (2018) Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet* **392**, 1923–1994.

Stapinski LA, Bowes L, Wolke D, Pearson RM, Mahedy L, Button KS, Lewis G and Araya R (2014) Peer victimization during adolescence and risk for anxiety disorders in adulthood: a prospective cohort study. *Depression and Anxiety* **31**, 574–582.

StataCorp (2017) Release 15. Statistical Software. StataCorp LLC: College Station, TX.

Takizawa R, Maughan B and Arseneault L (2014) Adult health outcomes of childhood bullying victimization: evidence from a five-decade longitudinal British birth cohort. *American Journal of Psychiatry* **171**, 777–784.

Thomas HJ, Connor JP, Lawrence DM, Hafekost JM, Zubrick SR and Scott JG (2017) Prevalence and correlates of bullying victimisation and perpetration in a nationally representative sample of Australian youth. *Australian & New Zealand Journal of Psychiatry* **51**, 909–920.

Ttofi MM, Farrington DP, Lösel F and Loeber R (2011) Do the victims of school bullies tend to become depressed later in life? A systematic review and meta-analysis of longitudinal studies. *Journal of Aggression, Conflict and Peace Research* **3**, 63–73.

Wells G, Shea B, O’Connell D, Peterson J, Welch V, Losos M and Tugwell P (2000) The Newcastle-Ottawa Scale (NOS) for assessing the quality of non-randomised studies in meta-analyses. Ottawa: Ottawa Hospital Research Institute.

WHO (1992) *The Icd-10 Classification of Mental and Behavioural Disorders: Clinical Descriptions and Diagnostic Guidelines*. Geneva: World Health Organization, pp. 227–227.

Wolke D and Lereya ST (2015) Long-term effects of bullying. *Archives of Disease in Childhood* **100**, 879–885.

Zwierzynska K, Wolke D and Lereya TS (2013) Peer victimization in childhood and internalizing problems in adolescence: a prospective longitudinal study. *Journal of Abnormal Child Psychology* **41**, 309–323.
# Appendix 1: PRISMA checklist

## PRISMA 2009 Checklist

| Section/topic          | # | Checklist item                                                                                                                                                                                                 | Reported on page # |
|------------------------|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| **TITLE**              |   |                                                                                                                                                                                                             |                   |
| Title                  | 1 | Identify the report as a systematic review, meta-analysis, or both.                                                                                                                                          | Abstract          |
| **ABSTRACT**           |   |                                                                                                                                                                                                             |                   |
| Structured summary     | 2 | Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number. | Abstract          |
| **INTRODUCTION**       |   |                                                                                                                                                                                                             |                   |
| Rationale              | 3 | Describe the rationale for the review in the context of what is already known.                                                                                                                                | Introduction      |
| Objectives             | 4 | Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).                                                                            | Introduction      |
| **METHODS**            |   |                                                                                                                                                                                                             |                   |
| Protocol and registration | 5 | Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.                                              | Method and Appendix 2 |
| Eligibility criteria   | 6 | Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.                                             | Method and Appendix 2 |
| Information sources    | 7 | Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.                                                      | Method and Appendix 2 |
| Search                 | 8 | Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.                                                                                | Method and Appendix 2 |
| Study selection        | 9 | State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).                                                            | Method and Appendix 2 |
| Data collection process | 10| Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.                                                   | Method and Appendix 2 |
| Data items             | 11| List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.                                                                        | Method and Appendix 2 |
| Risk of bias in individual studies | 12| Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis. | Method and Appendix 2 |
| Summary measures       | 13| State the principal summary measures (e.g., risk ratio, difference in means).                                                                                                                                  | Method and Appendix 2 |
| Synthesis of results   | 14| Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I², for each meta-analysis.                                                                 | Method and Appendix 2 |
| **Risk of bias across studies** | 15 | Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies). |
|--------------------------------|----|-------------------------------------------------------------------------------------------------------------------------------|
| **Additional analyses**       | 16 | Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified. |
| **RESULTS**                   |    | Method and Appendix 2                                                                                                          |
| **Study selection**           | 17 | Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram. |
| **Study characteristics**     | 18 | For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations. |
| **Risk of bias within studies** | 19 | Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12). |
| **Results of individual studies** | 20 | For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot. |
| **Synthesis of results**      | 21 | Present results of each meta-analysis done, including confidence intervals and measures of consistency. |
| **Risk of bias across studies** | 22 | Present results of any assessment of risk of bias across studies (see Item 15). |
| **Additional analysis**       | 23 | Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]). |
| **DISCUSSION**                |    | Results and Tables 1 and 2                                                                                                       |
| **Summary of evidence**       | 24 | Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers). |
| **Limitations**               | 25 | Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias). |
| **Conclusions**               | 26 | Provide a general interpretation of the results in the context of other evidence, and implications for future research. |
| **FUNDING**                   |    | No external funding to declare                                                                                                    |

*From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097*
Appendix 2: Review protocol

(1) Previous systematic review was conducted using PubMed, EMBASE, ERIC and PsycINFO electronic databases from inception until 28 February 2015 and included longitudinal and cross-sectional studies that examined the association between health and psychological outcome and bullying victimisation (Moore et al., 2017).

(2) Update this systematic review from 1 January 2015 until 18 August 2018 and include longitudinal studies only.

Primary database: Four electronic databases (PubMed, EMBASE, ERIC and PsycINFO)

Search terms:

| Database | Search group | Search terms |
|----------|--------------|--------------|
| Embase   | Bullying victims | (bullied OR ‘bullying’/exp OR bullying OR teas* OR harass* OR victimization OR victimisation OR intimidat*) AND (child* OR adolescent*) AND (outcome OR harm OR consequences OR ‘risk’/exp OR risk) AND (‘depress*’:ab,ti OR ‘anxiety’:ab,ti) AND (‘longitudinal’:ab,ti OR ‘cohort’:ab,ti) AND [2015-2018]/py 99 |
| PubMed   | Bullying victims | ((((((bullied OR bullying OR teas* OR harass* OR victimization OR victimisation OR intimidat*) AND (child* OR adolescent*) AND (outcome OR harm OR consequences OR risk))) AND (depress* OR anxiety))) AND [2015/01/01][PDat] : ’2015/01/01’ AND [PDat] : ‘3000/12/31’[PDat]) AND Humans[Mesh]) AND (longitudinal[Title/Abstract] OR cohort[Title/Abstract]) 111 |
| ERIC     | Bullying victims | (i(keywords:bullied OR Keywords:bullying OR Keywords:teas* OR Keywords:harass* OR Keywords:victimization OR keywords:victimisation OR Keywords:intimidat*) AND (Keywords:child* OR Keywords:adolescent*) AND (Keywords:outcome OR Keywords:Keywdoms:Vor or Keywords:consequences OR Keywords:risk)), and Publication Type: Journal Articles) AND (longitudinal OR cohort) AND (depress* OR anxiety) Limiters – Published Date: 20150101–20181231 77 |
| PsycINFO | Bullying victims | ((Bullying OR bullied OR teas* OR harass* OR victimization OR victimisation OR intimidat*) AND (child* OR adolescent*) AND (outcome OR harm OR consequences OR risk)) AND AB (depress* OR anxiety) AND AB (longitudinal OR cohort) Limiters: Publication year: 2015–2018 115 |

Additional searching:

- Reference list review (any article pulled for possible inclusion)
- Contact with study authors
- Any article deemed suitable by reviewers is included for closer examination

Inclusion/exclusion criteria

Inclusion criteria:

Studies were included if they were published in a peer-reviewed journal, reported an association between exposure to bullying victimisation and anxiety disorders or depressive disorders and were population based.

(1) Question of interest: Are individuals who have experienced bullying victimisation in childhood and adolescence at an increased risk of later development of anxiety disorders and depressive disorders compared with those who are not exposed?

Population: General population, children adolescents or adults.

Exposure: Victims of bullying – exposure to negative actions repeatedly and over time from one or more people and involves a power imbalance between the perpetrator/s and the victim.

Exposure measurement: Bullying victimisation could be self-reported, teacher reported, parent reported or clinician reported on either a validated scale or a questionnaire designed specifically for that study.

Age range for exposure: Bullying victimisation occurred between 0 and 18 years but studies also included if age not reported.

Comparison: Individuals not exposed to bullying victimisation.

Outcome: Two main health consequences of bullying: anxiety disorders and depressive disorders.

Outcome measurement: Diagnosed by a health professional or an objective measure, standardised/non-standardised screening instrument or self-reported outcomes also accepted.

(2) Study designs of interest: Prospective and retrospective cohort

No limits on language. Published since January 2015 up to 18 August 2018.

Articles in languages other than English deemed relevant based on its abstract are translated.

Exclusion criteria:

Articles initially excluded if they are duplicates or if the title clearly demonstrates that the exposure and outcome of interest are not the focus of the article. Articles are then excluded based on the following:

- The article does not examine an association between bullying victimisation and depression or anxiety (7).
- The study used cross-sectional data. Subsequently, one paper based on a longitudinal study was excluded because analyses were based on data within one wave, making them essentially cross-sectional in character (3).
- No effect size and uncertainty information reported or cannot be computed from information given (22).
- Bullying is considered as a risk factor/mediator between two other exposure and outcome variables.
- The study investigated the promotive and protective role of environmental, social and family support on the longitudinal relationship between victimisation and health outcomes (1).
- There is no control group or comparison group (just looked at the characteristics of the exposed group).
- The study was not population based.
- The study is a review article, a letter to the editor or a published abstract from a conference.
- The study based on unique population such as youth with disabilities, HIV/AIDS affected children and adolescents, bisexual and lesbian women, adults born at extremely low birth weight (4).
- Where there were multiple papers that reported on the same study population, the study that reported more detailed information was included (2).
- Studies used a dimensional peer nomination indicator (1).
- Studies examined mental and emotional wellbeing predictors of bullying victimisation (1).
- Studies examined bullying victimisation and health outcome at preschool age (1).
Data abstraction form

Identification of the study:

1. Record the first authors’ last name, initials
2. Record the journal name
3. Record the year of publication
4. Record the volume number
5. Record the page numbers

Characteristics of the study:

6. Study period
7. Study design
8. Sample size and gender
9. Retrospective/prospective analysis
10. Country
11. Type of bullying, frequency of bullying
12. Assessment of exposure
13. Outcomes (depression or anxiety)
14. Assessment of outcome

Other data:

15. Effect size and 95% confidence interval: converted to relative risk (RR) estimates by Di Pietranonj’s (2006) method.

Quality assessment: Quality of studies was assessed using the tool above which was adapted from a tool for assessing the risk of bias in cohort studies (Newcastle–Ottawa scale for cohort studies) (Wells et al., 2000). The total quality score for each study is the sum of the scores for individual assessment items, the maximum quality score for this study was 11. This is converted to a proportional quality score for use in Meta-XL version 5.3 (the total quality score divided by the maximum score possible).
### Quality assessment tool:

| Quality criteria | Quality score |
|------------------|---------------|
| **Selection**    |               |
| 1. Study design  |   • Prospective cohort = 1  
|                  |   • Retrospective cohort = 0 |
| 2. Representativeness of the population | Representativeness of the wider population:  
|                  |   • Population-based representative/clear description by authors that study sample is representative of the wider population = 1  
|                  |   • No description of sample/inadequate description/targeted study or sample not representative (i.e. based on boys only or girls only) = 0 |
| 3. Selection of the non-exposed cohort/controls |   • Drawn from the same population = 1  
|                  |   • Drawn from a different source/no description = 0 |
| 4. Definition of bullying provided for the participants |   • Yes = 1  
|                  |   • No/no description = 0 |
| 5. Ascertainment of exposure to bullying: How the exposure to bullying was measured? | a. Was bullying measured/operationalised according to frequency (as opposed to a yes/no response)? b. Was prevalence estimated using a threshold that meets the criteria of repetition (threshold greater than ‘once or twice’)?  
|                  |   • Responses coded: yes = 1 (if yes to both questions)  
|                  |   • Partial = 0.5 (if yes to one question)  
|                  |   • No = 0 (if no to both questions) |
| **Comparability** |               |
| 6. Appropriate methods to control confounding: |   • Controlled for prior psychological problems or outcome measure at baseline only/controlled for prior psychological problems or outcome measure at baseline and demographic or SES or environmental and family factors = 2  
|                  |   • Controlled for demographic + SES or environmental and family factors only = 1  
|                  |   • Controlled for demographic factors only or there was no confounding controlled for = 0 |
| **Outcome**      |               |
| 7. Ascertainment of outcome: How was the outcome measured? |   • Clinician reported or objective measure [use of a structured diagnostic interview for DSM-III/IV (DIS, DISC, CIDI) (mental health)] = 1  
|                  |   • Questions from published health surveys/screening instruments or own system/symptoms described/no system/not specified/self-reported = 0 |
| 8. Adequacy of follow-up of cohorts |   • Completeness good (>80%), with description of those lost to follow-up = 1  
|                  |   • Completeness poor (<80%) or no statement = 0 |
| 9. Was follow-up long enough for depression and anxiety to occur |   • More than 6 months = 1  
|                  |   • Less than 6 months = 0 |
| 10. Appropriate statistical analysis and information provided |   • Exposed/non-exposed case numbers reported = 1  
|                  |   • Exposed/non-exposed case numbers not reported = 0 |
### Table A1. Summary of study characteristics

| First author/publication year | Setting | Sample source | Gender | Type of exposure | Age of exposure (year) | Ascertainment of exposure | Health outcome | Age of outcomes assessed (years) | Assessment of health outcome |
|-------------------------------|---------|---------------|--------|------------------|-----------------------|--------------------------|-----------------|---------------------------------|------------------------------|
| **1** Bowes et al. (2015)     | Avon, UK, Europe | Avon Longitudinal Study of Parents and Children (ALSPAC) | Males and females | Bullying victimisation (frequent and sometimes) | 8,10,13 | A modified version of the bullying and friendship interview (self-reported) | Depression | 18 | A self-administered computerised version of the clinical interview schedule-revised CIS-R |
| **2** Copeland et al. (2013)  | 11 counties in Western North Carolina, USA, North America | The Great Smoky Mountain Study (GSM) | Males and females | Bullying victimisation and bullying victim-perpetration | 9-16 | The child and their parent reported on whether the child had been bullied or teased or bullied others [part of Child and Adolescent Psychiatric Assessment (CAPA)] | Anxiety disorders, general anxiety, panic disorder, agoraphobia and depressive disorders: major/minor depression, and dysthymia | 19, 21, 24-26 | The Young Adult Psychiatric Assessment (YAPA) – structured diagnostic interview-diagnoses made included any DSM-IV anxiety disorders and depressive disorders |
| **3** Fahy et al. (2016)      | East London, UK, Europe | The Olympic Regeneration in East London (ORiEL) study | Males and females | Cyberbullying victimisation and cyberbullying victim-perpetration | 11-12 | A six-item scale (self-reported) | Depressive symptoms and social anxiety symptoms | 12-14 | Short Mood and Feelings Questionnaire (SMFQ) |
| **4** Farrington et al. (2011) | PA, USA, North America | The Pittsburgh Youth Study | Males | Bullying victimisation | 10-14 | A specific questionnaire on bullying was completed by the boy and his mother | Depression | 11-16 | The boys completed the Recent Mood and Feelings Questionnaire and the mothers and teachers completed the child behaviour checklist (CBCL) |
| **5** Fekkes et al. (2006)    | The Netherlands, Europe | The study population was derived from 18 Dutch elementary schools | Males and females | Bullying victimisation | 9-11 | The Dutch version of the Olweus Bully/Victim Questionnaire (self-reported) | Anxiety and depression | 10-12 | KIVPA, a Dutch instrument to measure psychosocial problems among children |
| **6** Geoffroy et al. (2018)  | Quebec, Canada, North America | The Quebec Longitudinal Study of Child Development | Males and females | Physical, verbal, relational and cyber bullying victimisation (moderate and severe) | 7-13 | A modified version of the Self-Report Victimization Scale | Generalised anxiety problems, social anxiety problems and depression/dysthymia problems | 15 | The Mental Health and Social In-adaptation Assessment |
| **7** Hemphill et al. (2011)  | Victoria, Australia and Washington State, USA, North America | The International Youth Development Study (IVDS) | Males and females | Bullying victimisation | Year 7 and year 10 | A modified version of the Communities that Care: bullying victimisation was assessed by asking students if they had been ‘bullied recently’ (teased or called names, had rumours spread about you, been deliberately left out of things, threatened physically or actually hurt) (self-reported) | Depressive symptoms | Year 11 | The self-report Short Mood and Feelings Questionnaire (SMFQ) |

(Continued)
| First author/publication year | Setting | Sample source | Gender | Type of exposure | Age of exposure (year) | Ascertainment of exposure | Health outcome | Age of outcomes assessed (years) | Assessment of health outcome |
|------------------------------|---------|---------------|--------|------------------|-----------------------|---------------------------|----------------|-------------------------------|------------------------------|
| 8 Hemphill et al. (2014)     | Victoria, Australia | The sample for this study comprised Victorian students from the International Youth Development Study (IYDS) | Males and females | Bullying victimisation | 16–17 | A modified version of the Communities that Care: bullying victimisation was assessed by asking students if they had been 'bullied recently' (teased or called names, had rumours spread about you, been deliberately left out of things, threatened physically or actually hurt) (self-reported) | Depressive symptoms | 18–19 | Depressive symptoms were measured using the Kessler Psychology Distress Scale |
| 9 Hemphill et al. (2015)     | Victoria, Australia and Washington State, USA, North America | The International Youth Development Study (IYDS) | Males and females | Cyberbullying victimisation and cyberbullying victim-perpetration | 14–16.5 | Global single question: been bullied by another student who has used technology such as mobile-phones, the Internet, computers, answering machines or cameras? (self-reported) | Depressive symptoms | 16–18.5 | Depressive symptoms were measured using the self-report Short Mood and Feelings Questionnaire |
| 10 Kaltiala-Heino et al. (2010) | Tampere and Vantaa, Finland, Europe | The Adolescent Mental Health Cohort Study (AMHC) | Males and females | Bullying victimisation (frequent and sometimes) | 15 | Question derived from the WHY Youth Health Study: the respondents were asked how frequently they had been bullied during the ongoing school term (self-reported) | Depression | 17 | R-BDI, a Finnish modification of the 13-item Beck Depression Inventory |
| 11 Klomek et al. (2008)      | Finland, Europe | From a Boy to a Man Study | Males | Bullying victimisation (being bullied only refers to being bullied by peers in at least one time point) | 8 | The child himself/herself, a parent, and a teacher were asked about being victims of bullying | Depression symptoms (mild and severe) | 18 | The Beck’s Depression Inventory (BDI) |
| 12 Lereya et al. (2015)      | Avon, South West England, UK, North Carolina, USA, Europe and North America | The Avon Longitudinal Study of Parents and Children in the UK (ALSPAC) and the Great Smoky Mountains Study in the USA (GSMS) longitudinal studies | Males and females | Bullying victimisation (being bullied only refers to being bullied by peers in at least one time point) | ALSPAC: 8–13; GSMS: 9–16 | ALSPAC: child interviewed. Bullying and Friendship Interview Schedule; GSMS: the child and their parent reported on whether the child had been bullied or teased or bullied others [part of Child and Adolescent Psychiatric Assessment (CAPA)] | ALSPAC: anxiety (generalised anxiety disorder, social phobia, specific phobia, panic disorder or agoraphobia); GSMS: anxiety disorder (generalised anxiety, agoraphobia, panic disorder, social phobia, obsessive-compulsive disorder and post-traumatic stress disorder) | ALSPAC: 18; GSMS: 19, 21, 24–26 | ALSPAC: a reliable and validated self-administered computerised version of the Clinical Interview Schedule (CIS-R); GSMS: Young Adult Psychiatric Assessment (YAPA) |

(Continued)
| First author/publication year | Setting | Sample source | Gender | Type of exposure | Age of exposure (year) | Ascertainment of exposure | Health outcome | Age of outcomes assessed (years) | Assessment of health outcome |
|-------------------------------|---------|---------------|--------|------------------|----------------------|--------------------------|-----------------|-------------------------------|-----------------------------|
| 13 Patton et al. (2008)       | Washington (WA), USA, and Victoria (VIC), Australia | The International Youth Development Study (IYDS) | Females | Bullying victimisation | 10–15 (annually) | Self-reported global single question: Have you been bullied recently (teased or called names, had rumours spread about you, been deliberately left out of things, threatened physically or actually hurt)? | High depressive symptoms (12 months later) | 10–15 (annually) | The Short Mood and Feelings Questionnaire designed for epidemiological survey research with adolescents. The onset of new depressive symptoms in the female subjects |
| 14 Ranta et al. (2013)        | Finland, Europe | The Adolescent Mental Health Cohort Study (AMHCS) | Males and females | Direct bullying victimisation and relational bullying victimisation | 15 | The self-reported question assessing subjection to bullying was derived from a WHO youth health study: ‘How frequently have you been bullied during the ongoing school term?’ Relational victimisation was assessed with a question: ‘How frequently have other pupils not wanted to be with you and you had to be by yourself during the ongoing school term?’ | Social phobia | 17 | Social phobia was assessed with the Social Phobia Inventory (SPIN): a 17-item self-report questionnaire for measuring fear, avoidance behaviours and physiological arousal in performance or social situations |
| 15 Rothon et al. (2011)       | London, UK, Europe | The Research with East London Adolescents: Community Health Survey (RELACHS) | Males and females | Bullying victimisation | 11–14 | Self-reported questions: ‘How often have you been bullied in school this term?’ A further category of ‘never bullied’ was added based on another item: ‘Have you ever been bullied at school?’ | Depressive symptoms | 13–16 | The Short Moods and Feelings Questionnaire (SMFQ) |
| 16 Schoon and Montgomery (1997) | UK, Europe | The National Child Development Study (NCDS) | Males and females | Bullying victimisation (frequent and sometimes) | Birth to 7 | The parents were asked to indicate whether the description is ‘often’, ‘sometimes’ or ‘never’ applies. Description: ‘The child is harassed by other children.’ | Depression | 33 | To assess emotional distress and somatic symptoms associated with a depressive state, Ruter’s Malaise questionnaire was used |
| 17 Silberg et al. (2016)      | Virginia, USA, North America | The Virginia Twin Study of Adolescent Behavioural Development (VTSABD) and The Young Adult Follow-Up Study (YAFU) | Males and females | Bullying victimisation | 8–17 | Self-reported and mother reported (CAPA) assessment of bullying victimisation has been used | Major depressive episode, generalised anxiety and panic attacks | ≥18 | The DSM-III-R based Structured Clinical Interview (SCID) |
| First author/ publication year | Setting | Sample source | Gender | Type of exposure | Age of exposure (year) | Ascertainment of exposure | Health outcome | Age of outcomes assessed (years) | Assessment of health outcome |
|-------------------------------|---------|---------------|--------|------------------|-----------------------|---------------------------|----------------|-------------------------------|------------------------------|
| 18 Sourander et al. (2007)    | Finland, Europe | From a Boy to a Man | Males | Bullying victimisation | 8 | The child himself/herself, a parent, and a teacher were asked about being victims of bullying | Depressive disorders and anxiety disorders | 18–23 | The ICD-10 psychiatric diagnoses were based on health examinations performed by general physicians or senior psychiatrists |
| 19 Sourander et al. (2016)    | Finland, Europe | Finnish Nationwide 1981 Birth Cohort Study | Males and females | Bullying victimisation and bullying victim-perpetration (frequent) | 8 | Child, teacher, and parent were asked about bullying victimisation | Depressive disorders (ICD-10 codes F32-F39); anxiety, stress-related, adjustment, and somatoform disorders (ICD-10 codes F40-F48; abbreviated anxiety) | 16–29 | Use of specialised services for psychiatric disorders from 16 to 29 years of age was obtained from a nationwide hospital register, including outpatient and inpatient treatment |
| 20 Stapinski et al. (2014)    | Avon, UK, Europe | The Avon Longitudinal Study of Parents and Children (ALSPAC) | Males and females | Bullying victimisation (frequent and occasional) | 13 | A modified version of the Bullying and Friendship Interview Schedule (self-reported) | Any depression diagnosis, any anxiety disorders, general anxiety disorders, social phobia, specific phobia, panic disorder and agoraphobia | 18 | A self-administered computerised version of the CIS-R |
| 21 Takizawa et al. (2014)     | England, Scotland and Wales, Europe | The British National Child Development Study (NCDS) | Males and females | Bullying victimisation (frequent and occasional) | 7 and 11 | Parents were interviewed when participants were 7 and 11 years old | Any depression and any anxiety disorder | 45 | The depression and anxiety modules of the Revised Clinical Interview Schedule, administered by trained research nurses using computer-assisted personal interviewing as part of a clinical examination in the participants’ homes |
| 22 Zwierzynska et al. (2013)  | Avon, UK, Europe | Avon Longitudinal Study of Parents and Children (ALSPAC) | Males and females | Bullying victimisation (stable and unstable) | 8 and 10 | Child reports were derived from a modified version of the Bullying and Friendship Interview Schedule at 8 and 10 years. Mother and teacher reports were derived from a single item ‘Child is picked on or bullied by other children’ at 7, 8 and 9 years from the mothers, and at 7 and 10 years from the teachers | Any anxiety disorder diagnosis and major depressive disorder diagnosis at 13 years, early (at 11–12 years) and late depression symptoms (at 13–14 years) | 11–14 | The Short Mood and Feelings Questionnaire at ages 11, 12, 13 and 14 years; depressive disorder and anxiety disorder at 13 years measured by the Development and Well-Being Assessment |
| Study Design | Representativeness of the wider population | Selection of the non-exposed cohort/controls | Definition of bullying provided for the participants | Ascertainment of exposure to bullying: How the exposure to bullying was measured? Responses coded | Appropriate method to control confounding | Appropriate statistical analysis and information provided |
|-------------|------------------------------------------|--------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------------------------|
| Prospective cohort | Population-based representative/clear description by authors that study sample is representative of the wider population = 1 | Drawn from the same population = 1 | a/ Was bullying measured/operationally defined according to a threshold that meets the criteria of repetition (threshold greater than ‘once or twice’)? | - Yes = 1 (if yes to both questions) | - Controlled for prior psychological problems or outcome measure at baseline only/controlled for prior psychological problems or outcome measures at baseline and demographic or SES or environmental and Family factors = 2 | - Exposed/non-exposed case numbers reported = 1 |
| Retrospective cohort | No description of sample/inadequate description/targeted study or sample not representative (i.e. based on boys only or girls only) = 0 | Drawn from a different source/no description=0 | b/ Was prevalence estimated using a threshold that meets the criteria of repetition (threshold greater than ‘once or twice’)? | - No = 0 (if no to both questions) | - Controlled for demographic < SES or environmental and Family factors only = 1 | - Disclosure of follow-up of cohorts |
| | | | | | | - Completed good (>80%), with description of those lost to follow-up = 1 |
| | | | | | | - More than 6 months or less than 6 months or not stated = 0 |
| | | | | | | - More than 6 months = 1 |
| | | | | | | - Less than 6 months = 0 |

| Study | Total Score (maximum 11) | Study Design | Representativeness of the wider population | Selection of the non-exposed cohort/controls | Definition of bullying provided for the participants | Ascertainment of exposure to bullying: How the exposure to bullying was measured? Responses coded | Appropriate method to control confounding | Appropriate statistical analysis and information provided |
|-------|--------------------------|-------------|------------------------------------------|------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------------------------|
| Bowes et al. (2015) | 7a | 1 | 1 | 0 | Yes | Yes | 1 | 0 | 1 | 1 |
| | 8b | 1 | 1 | 0 | Yes | Yes | 1 | 1 | 0 | 1 | 1 |
| Copeland et al. (2013) | 7a | 1 | 1 | 0 | Yes | Yes | 1 | 2 | 1 | 0 | 1 | 1 |
| | 8b | 1 | 1 | 0 | Yes | Yes | 1 | 1 | 0 | 1 | 1 | 1 |
| Fally et al. (2013) | 4.5a | 1 | 1 | 1 | Yes | No | 0.5 | 0 | 0 | 0 | 1 | 0 |
| | 5.5b | 1 | 1 | 1 | Yes | No | 0.5 | 1 | 0 | 0 | 1 | 0 |
| Farrington et al. (2012) | 6a | 1 | 0 | 1 | No description | No description | 0 | 0 | 1 | 1 | 1 |
| | 7b | 1 | 0 | 1 | No description | No description | 0 | 1 | 1 | 1 | 1 |
| Folkes et al. (2012) | 6a | 1 | 0 | 1 | Yes | Yes | 1 | 0 | 0 | 0 | 1 | 1 |
| | 7b | 1 | 0 | 1 | Yes | Yes | 1 | 1 | 0 | 0 | 1 | 1 |
| Geoffroy et al. (2012) | 6.5a | 1 | 1 | 1 | Yes | No | 0.5 | 0 | 0 | 0 | 1 | 1 |
| | 7.5b | 1 | 1 | 1 | Yes | No | 0.5 | 1 | 0 | 0 | 1 | 1 |
| Hemphill et al. (2011) | 5.5a | 1 | 0 | 1 | Yes | No | 0.5 | 2 | 0 | 0 | 0 | 1 |
| | 6.5b | 1 | 0 | 1 | Yes | No | 0.5 | 1 | 0 | 1 | 1 |
| Hemphill et al. (2014) | 6a | 1 | 0 | 1 | Yes | Yes | 1 | 0 | 0 | 1 | 1 |
| | 7b | 1 | 0 | 1 | Yes | Yes | 1 | 2 | 0 | 1 | 1 |
| Hemphill et al. (2015) | 6a | 1 | 0 | 1 | Yes | Yes | 1 | 0 | 0 | 1 | 1 |
| | 7b | 1 | 0 | 1 | Yes | Yes | 1 | 2 | 0 | 1 | 1 |
| Kaltiala-Heino et al. (2010) | 6a | 1 | 0 | 1 | Yes | Yes | 1 | 0 | 0 | 0 | 1 | 1 |
| | 7b | 1 | 0 | 1 | Yes | Yes | 1 | 1 | 0 | 0 | 1 | 1 |
| Klomek et al. (2010) | 8.5a | 1 | 0 | 1 | Yes | No | 0.5 | 0 | 1 | 1 |
| | 9.5b | 1 | 0 | 1 | Yes | No | 0.5 | 1 | 1 | 1 |
| Longa et al. (2016) | 6.5a | 1 | 0 | 1 | Yes | No | 0.5 | 0 | 1 | 1 |
| | 7.5b | 1 | 0 | 1 | Yes | No | 0.5 | 1 | 1 | 0 | 0 | 1 | 1 | 1 |

![Table A2: Quality assessment](https://doi.org/10.1017/S2045796019000489) Published online by Cambridge University Press.
| Study                          | Typea | n | T | S | P | D | F | R | C | E | T | R |
|-------------------------------|-------|---|---|---|----|----|----|----|----|----|----|----|
| Patton et al. (2008)         | 8.5   | 1 | 1 | 1 | 0  | Yes| No | 0.5| 1  | 1  | 1  | 1  |
| Banka et al. (2013)          | 8.5   | 1 | 0 | 0 | 0  | Yes| Yes| 1  | 0  | 0  | 0  | 1  | 1  |
| Ranta et al. (2013)          | 5.5   | 1 | 0 | 1 | 1  | Yes| Yes| 1  | 1  | 0  | 0  | 1  | 1  |
| Rothon et al. (2013)         | 6.5   | 1 | 0 | 1 | 1  | Yes| Yes| 1  | 1  | 1  | 0  | 1  | 1  |
| Schors and Montgomery (1997) | 6.5   | 1 | 1 | 1 | 0  | Yes| No | 0.5| 0  | 0  | 0  | 1  | 1  |
| Silberg et al. (2016)        | 8.5   | 1 | 0 | 1 | 0  | No description| No description| 0  | 0  | 1  | 1  | 1  | 1  |
| Sourander et al. (2010)      | 8.5   | 1 | 0 | 1 | 0  | Yes| No | 0.5| 1  | 1  | 1  | 1  | 1  |
| Sourander et al. (2010)      | 7.5   | 1 | 1 | 1 | 0  | Yes| No | 0.5| 1  | 1  | 1  | 1  | 1  |
| Stempnati et al. (2014)      | 8.5   | 1 | 1 | 1 | 0  | Yes| No | 0.5| 1  | 1  | 1  | 1  | 1  |
| Takano et al. (2014)         | 8.5   | 1 | 0 | 0 | 1  | Yes| No | 0.5| 0  | 1  | 0  | 1  | 1  |
| Zwernycka et al. (2010)      | 8.5   | 1 | 1 | 1 | 0  | Yes| No | 0.5| 1  | 1  | 0  | 1  | 1  |

* There was no confounding controlled for/no statement.

b Controlled for demographic factors only/SES only/environmental and family factor only/demographic + SES or environmental and family factors only.
c Controlled for prior psychological problems or outcome measure at baseline only/controlled for prior psychological problems or outcome measure at baseline and demographic or SES or environmental and family factors.
Appendix 4
See Figs 1–3.

Fig. 1. PRISMA flow diagram showing the process of study selection for inclusion in systematic review. *Total exceeds 22 because some studies examined association between bullying victimisation and both depression and anxiety. **Seven studies from Moore et al. (2017).
Fig. 2. Relationship between bullying victimisation and anxiety disorders (adjusted for baseline anxiety). Individual and combined relative risks.

Fig. 3. Relationship between bullying victimisation and depressive disorders (adjusted for baseline depression). Individual and combined relative risks.