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The Economic Cost of Child and Adolescent Bullying in Australia

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Key words:
Cost of bullying, social cost, childhood bullying

Abstract

Objective: This study conducted a systematic review and meta-analysis and estimated the economic costs attributable to child and adolescent bullying victimization in Australia.

Method: The costs of bullying victimization were measured from a societal perspective which accounts for costs associated with healthcare, education resources and productivity losses. A prevalence-based approach was used to estimate the annual costs for Australians who experienced bullying victimization in childhood and adolescence. This study updated a previous systematic review summarizing the association between bullying victimization and health and non-health outcomes. Costs were estimated by calculating population attributable fractions to determine the effects of bullying victimization on increased risk of adverse health outcomes such as anxiety disorders, depressive disorders, intentional self-harm and tobacco use. A top-down approach to cost estimation was taken for all outcomes of interest, except for costs incurred by educational institutions and productivity loss of victims' caregivers where a bottom-up cost estimation was applied.

Results: Annual costs in 2016 on health and non-health outcomes attributable to child and adolescent bullying victimization were estimated at AUD $763 million: AUD $750 million for health system costs with AUD $147 million for anxiety disorders, AUD $322 million for depressive disorders, AUD $57 million for intentional self-harm and AUD $224 million for tobacco use; AUD $7.5 million for productivity losses of victims' caregivers; and AUD $6 million for educational services.

Conclusion: The findings from this study suggest a substantial annual cost to Australian society results from bullying victimization within more than 8% of annual mental health expenditure in Australia estimated to be attributable to bullying victimization.

Key words: cost of bullying, social cost, childhood bullying

INTRODUCTION

Bullying victimization among children and adolescents is a major public health problem,[1] with strong evidence showing an association with later development of a range of adverse outcomes, such as mental health disorders and poor social functioning.[2,3] Contemporary prevalence estimates indicate that one in seven Australian children and adolescents have experienced bullying victimization within the previous 12 months.[4,5] Given the high prevalence and negative consequences associated with this exposure, it is expected that bullying victimization has a substantial societal impact. Assessing the disease and economic burden attributable to bullying are important steps in determining the impact of bullying victimization.

Review studies have concluded that bullying victimization is causally linked to an increased risk of mental disorders.[2] Another review on bullying victimization found that children who were bullied at school were twice as likely to develop depression in adulthood compared to those who had not been bullied.[6] An updated study published in 2019 showed that bullying victimization during childhood and adolescence in Australia contributes a significant proportion of the burden of anxiety and depressive disorders.[7]

To date there have been few attempts to estimate the economic cost of bullying victimization in children and adolescents. Cost of illness (COI) analyses can use either a prevalence- or incidence-based approach. A prevalence-based approach estimates the attributable costs associated with a condition or risk factor that occurs concurrently with prevalent cases, usually within an annual period.[8] Using a prevalence-based approach, the economic burden of violence against children including bullying was estimated to be US $13.5 billion in South Africa in 2015.[9] An Australian study estimated the economic impact of bullying for each individual school-year cohort over a 20-year period after leaving school equates to AUD $1.8 billion.[10] However, this estimate does not include some key mental

health-related consequences of bullying victimization such as anxiety and depression, and substance use disorders.[2] Only primary care costs and mental health costs due to injury or self-harm related to bullying were included. The prevalence-based approach measures the actual impact of existing cases.[8,11] Consequently, there is a need for a comprehensive estimate of the prevalence-based costings which include costs related to anxiety and depression associated with bullying victimization in children and adolescents.

The purpose of this study is to provide the first prevalence-based estimate of annual costs attributable to bullying victimization in childhood and adolescence to Australia. Costs of bullying victimization were measured from a societal perspective[12] and included costs associated with healthcare services such as anxiety disorders, depressive disorders, intentional self-harm, and tobacco use, costs incurred by educator time, productivity losses for caregivers associated with absenteeism, and non-financial costs related to reduced quality of life and premature mortality as a result of mental disorders. Both a top-down or population based and bottom-up or person-based costing approach[8] were used and costs were estimated for the 2016 calendar year.

METHOD

General overview

In this study, bullying was defined as *a repeated negative action from one or more individuals towards another where there is intention to harm and a power imbalance between the victim and the perpetrator(s)*.[13,14] Both traditional and cyber forms of bullying were included. Following a cost of illness methodology, the current study adopted a prevalence-based approach with prevalence-based outcomes calculated by estimating the annual attributable costs associated with bullying in childhood and adolescence in a given year, namely 2016.[8] Top down approach uses aggregated data along with a population-attributable fraction (PAF) to calculate the attributable costs while bottom up approach estimates total costs through the multiplication of unit costs by the quantities used.[15] Due to data availability, a top-down cost estimation using PAFs was applied for the majority of outcomes; anxiety, depressive disorders, intentional self-harm, and tobacco use. The two remaining outcomes, education costs and productivity losses for victims' caregivers were estimated by applying a bottom-up method. Three steps were used in the estimation of the economic burden of bullying victimization among children and adolescents in Australia. In step one, published studies and reports were synthesized through conducting a systematic review and meta-analysis. In step two, PAFs were calculated and some important estimates were identified. In the final step, cost component data were screened, and the final costs were then estimated. A model for this study was developed and is shown in Figure 1 and each step of the methodology is outlined in the following sections.

Step one: Relative risk estimates – systematic review of consequences of bullying victimization

This study updated a previous systematic review and meta-analysis.[2] The processing and reporting of results are based on the recommendations from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[16] The complete PRISMA checklist is presented in Table S1, available online. The current systematic search identified cohort studies that examined the association between bullying victimization during childhood/adolescence and health outcomes, as well as cohort and cross-sectional studies for non-health outcomes. A review protocol was developed with search methods and inclusion/exclusion criteria specified in advance (Supplement 1, available online). Four electronic databases (PubMed, EMBASE, ERIC and PsycINFO) were searched for articles published between 1 Jan 2015 and 15 May 2019 using the terms: "child*", adolescen*, "bull*", "victim*", "harass*", "outcome", "consequence", "risk*, "Jan 2015- May 2019". In addition, reference lists of included studies were screened for any other relevant studies.

Studies were included if they met the following inclusion criteria: published in a peer-reviewed journal; examined an association between exposure to bullying victimization as a child or adolescent and later development of health and non-health outcomes; and the study was population-based. Some studies reported associations for victimization as well as victim-perpetration; in these situations, both estimates were included. Where available, the unadjusted and adjusted odds ratios (ORs) for bullying victimization including victim-perpetration for health and non-health outcomes 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. All longitudinal studies for health outcomes and longitudinal and cross-sectional studies for non-health outcomes previously included in study by Moore et al[2] were also re-assessed against the inclusion and exclusion criteria.

The result of the updated systematic review for anxiety and depressive disorders as consequences of bullying in childhood and adolescence has been published elsewhere.[7] The current study focuses on other related health outcomes such as intentional self-harm and substance use as well as non-health outcomes and identified a total of 69 studies of which 28 met the inclusion criteria: 11 examined the association between bullying victimization and intentional self-harm, nine studies focused on substance use, five studies on criminality, and four measured poor academic achievement (see Figure S1, available online). The following details were extracted for each study: study design, country, sample size, gender, assessment of bullying victimization and health and non-health outcomes, as well as effect sizes and 95% confidence intervals or information from which effect sizes and confidence intervals could be calculated (see Table S2, available online).

Following the method used for anxiety and depressive disorders,[7] a quality effects meta-analytic model was used to pool the RR estimates for intentional self-harm and substance use. This model is a modified version of the fixed-effects inverse variance method which allows giving greater weight to studies of higher quality and lower weight to studies of lower quality. This is achieved by calculating quality scores for each study.[17,18] 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. Quality of studies was assessed using an adapted version of the Newcastle-Ottawa Scale.[19] This tool has been used in a previous systematic review and meta-analysis and described in more detail in Supplement 2, available online.[20] The quality assessment for each study is presented in Table S3, available online.

There was 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. In order to account for different adjustment methods, the method used for anxiety

and depressive disorders[7] was employed and separate subgroup analyses were conducted for 'victimization only' and victimization involving concurrent perpetration generally known as 'victim-perpetration'. In further analyses, RR estimates based on optimally adjusted models were used to calculate PAFs.

Weighted summary measures were computed using MetaXL version 5.3, a plugin package for Microsoft Excel.[21] Relative risks were chosen as the principal summary measure. If ORs were not reported in included studies, ORs and their 95% confidence intervals were calculated based on provided exposed/non-exposed case numbers and exposed/non-exposed non-case numbers using a cohort study odds ratio calculator in STATA 15.0.[22] All ORs were then converted to RR estimates using an imputation method which reconstructs four-fold tables and event frequency values from published and estimated ORs and their 95% confidence intervals (CI), given the sample sizes.[23] The meta-analyses were then carried out using reconstructed RR estimates. In some situations, it was necessary to use reported ORs as an approximation of RR when there was insufficient information to perform the OR-to-RR conversion.[24] This assumption has been used in a previous systematic review and meta-analysis.[7] Models were later tested with and without these studies included to ensure there were no significant differences in the RR estimates. Final estimated pooled RRs were presented in Table 1.

Step two: Estimation of attributable effects of bullying victimization experience during childhood and adolescence

Prevalence. This study estimated the cross-section of costs incurred in one year as a result of bullying victimization during childhood or adolescence. Hence lifetime prevalence was chosen instead of 12-month period prevalence in order to encompass anyone in 2016 that may have experienced the attributable effects of child and adolescent bullying victimization. A previous meta-analysis of self-reported experiences among Australian children and adolescents5 estimated the lifetime prevalence of bullying victimization at 18.90% [95% CI:

10.50-28.98]. Population attributable fractions (PAFs) were calculated using this estimate combined with pooled RRs.

Calculation of population attributable fractions (PAFs). The contribution of a risk factor - in this situation - experiences of bullying victimization, to disease burden is quantified using the population attributable fraction (PAF). The PAF is the proportional reduction in population disease burden that would occur if exposure to a risk factor were reduced to an alternative ideal exposure scenario - in this situation, the theoretical minimum exposure level of no bullying involvement.[15] The use of PAFs is common in top-down costing approaches in estimating the costs attributable to risk factors for loss of health.[8] Specifically, it enables aggregate expenditure or costs to be disaggregated according to the proportion of those costs that are attributable to the risk factor. The estimated/extracted RRs for health and non-health outcomes were paired with the recently published lifetime prevalence estimate for bullying experience (18.9%).[5]

The following formula was used to calculate PAFs[15]: PAF= P(RR-1)/P(RR-1)+1. Where "P" is the prevalence of bullying victimization and "RR" is the relative risk of health and non-health outcomes in the exposed versus unexposed. Population attributable fractions were then applied to estimate the economic burden attributable to experiencing bullying in childhood and adolescence for the outcomes of interest including anxiety disorders, depressive disorders, intentional self-harm, and tobacco use as described in Step 3. Final estimated PAFs were presented in Table 1.

Step three: Costs included in economic analyses

The overall financial cost of bullying victimization was measured from a societal perspective and included costs associated with healthcare, education, and productivity losses of victims' carers (Figure 1). For each category, the best available secondary data was used to develop cost estimates. Data from Steps 1 and 2 were used to estimate healthcare costs

related to anxiety disorders, depressive disorders, intentional self-harm, and tobacco use attributable to bullying victimization using a top down approach, while data from single studies identified via additional search through reference lists were used to estimate costs incurred by educational institutions and productivity loss of victims' caregivers using a bottom up approach. All costs were estimated in Australian dollars (AUD). Costs were adjusted to the reference year, 2016, using a cost conversion tool.[25] Additionally, the non-financial costs of reduced quality of life and premature mortality related to the development of mental disorders as a result of bullying victimization exposure were estimated by using the value of a willingness to pay (WTP). This was applied to the annual number of disability adjusted life years (DALYs) attributed to bullying victimization in Australia for both sexes and all ages.

Financial costs. The AIHW Health Expenditure reports [26-29] were used as a source of annual expenditure on a range of health outcomes. Relevant expenditures were factored up 30% to account for unallocated expenditure. As noted in the report, unallocated expenditure included: non-admitted patient expenditure, over the counter pharmaceuticals, cost of aids/appliances, community/public health costs and administration costs. It is assumed that the unallocated costs would be equally distributed across the health outcomes of interest and hence the factoring up on each of the relevant disease group health expenditures by 30% accounts for these additional expenditures, using a similar approach to that used in a study of the cost of child maltreatment.[30] It was not applied to substance use outcome as substance use-attributable gross healthcare costs were reported.[29] The estimated expenditure on each outcome attributable bullying victimization was presented in Table 2.

Anxiety and depression. In a previously published systematic review and meta-analysis, relative risks for anxiety and depressive disorders as a result of bullying-victimization were estimated to be 1.56 (95% CI: 1.32-1.85) and 1.80 (95% CI: 1.56-2.08), respectively.[7] These

pooled relative risks were paired with a lifetime prevalence estimate for bullying victimization for Australia[5] in order to calculate population attributable fractions (PAFs) for anxiety (9.57%) and depressive disorders (13.13%). In 2004-05, it was reported that 34.08% of total mental health expenditure was spent on anxiety and depressive disorders in Australia.[26] A conservative assumption is that the proportion of the mental health budget spent on anxiety and depressive disorders in Australia has remained constant between 2004-05 and 2015-16. Annual expenditure on anxiety disorders and depressive disorders was estimated by multiplying the total expenditure on mental health related services in 2015-16 (AUD $9.0 billion)[27] by the proportion that was allocated to anxiety disorders and depressive disorders (34.08%),[26] factored up by 30% to account for the unallocated component of expenditure. Overall, 38.6% (AUD $1.5 billion) of the proportion of this mental health expenditure was allocated to anxiety disorders and 61.4% (AUD $2.4 billion) was allocated to depressive disorders. This estimation was based on the distribution of DALYs across these two groups of mental disorders in Australia.[31] The estimated PAFs for anxiety disorders and depressive disorders were applied to the annual expenditure on anxiety disorders and depressive disorders to calculate the best estimate of annual health expenditure on anxiety disorders and depressive disorders attributable to bullying victimization experience in childhood and adolescence.

Intentional self-harm. From the meta-analysis in Step 1, the relative risk for intentional self-harm as a result of bullying-victimization was estimated to be 1.96 (95% CI: 1.67-2.29) (see Table S4, available online). This pooled relative risk was paired with a lifetime prevalence estimate for bullying victimization for Australia[5] in order to calculate population attributable fractions (PAFs) for intentional self-harm. Annual health expenditure on injury treatment in 2004-05 was factored up by 30% to account for unallocated health expenditure (AUD $4.4 billion).[26] The proportion of injury expenditure due to intentional self-harm in 2014-15 was

estimated to be 6%.[32] This estimate includes completed suicide and suicide attempts, as well as occasions where people have intentionally hurt themselves, but not necessarily with suicidal ideation. After applying this proportion to the total injury cost in Australia the result equated to an expenditure of AUD $269.6 million for intentional self-harm in 2004-05. The estimated PAF for bullying victimization (15.34%) was applied to this annual expenditure on injury due to intentional self-harm and converted to 2016 Australian dollars, to quantify annual health expenditure for intentional self-harm attributable to bullying victimization in childhood and adolescence.

Substance use. When including longitudinal studies adjusting for mental health or substance outcomes at baseline, pooled relative risk for tobacco use, alcohol use, and illicit drug use following bullying victimization were estimated to be 1.52 (95% CI: 1.15-1.99), 0.91 (95% CI: 0.68-1.22), and 1.27 (95% CI: 0.82-1.96), respectively (see Tables S5, S6 and S7, available online). The pooled relative risk for tobacco use was paired with a lifetime prevalence estimate for bullying victimization for Australia[5] in order to calculate population attributable fractions (PAFs) for tobacco use (8.89%). Annual health care gross expenditure on tobacco use in 2004-05 was AUD $1.8 billion.[29] The estimated PAF for bullying victimization (8.89%) was applied to this annual expenditure on tobacco use and converted to 2016 Australian dollars, to quantify annual health expenditure for tobacco use attributable to bullying victimization in childhood and adolescence.

Poor academic achievement. Based on ORs adjusted for pre-existing demographic, family and environmental factors, pooled relative risk for poor academic achievement was estimated to be 1.22 (95% CI: 0.95 – 1.58) for bullying victimization (see Table S8, available online).

Criminality. For criminality, based on ORs adjusted for pre-existing mental health problems and/or potential criminal career, the pooled relative risk for criminality was estimated to be 0.96 (95% CI: 0.76-1.21) for bullying victimization (see Table S9, available online).

Since the increased risk of alcohol use, illicit drug use, poor academic achievement and criminality with exposure to bullying victimization in childhood and adolescence was not statistically significant, these outcomes have not been included in the cost estimation.

Productivity loss of carers' of victims. One of the non-health consequences of bullying is school absenteeism among children and adolescents who have experienced bullying victimization. This was surveyed in two previous national bullying studies.[33,34] Based on an Australian longitudinal study, where participants were followed from age 13 to 15 years, the percentage of children who stayed away from school at least once or twice during the past school term due to bullying was estimated to be 23.6% of those who were victimized by their peers.[34] This was applied to the total number of bullied children aged between 10 and 14 in 2016 and multiplied by 4 - the annual number of school terms to derive an estimated 53,415 children aged between 10 and 14 who stayed away from school at least once due do bullying victimization in Australia in 2016. If it is assumed that these children/adolescents stay at home with one of their parents/caregivers for one day, the identical number of adults are required to look after them for those days. In 2016, the national minimum wage was AUD $141.6 per day in 2016.[35] This daily wage estimate was multiplied by the total number of days when employed adults, looked after their children due to bullying victimization[36] to estimate a best estimate of annual attributable productivity loss for the parents or carers of bullying victims.

Costs experienced by schools. A national cross-sectional study surveyed students and staff from both primary and secondary schools across Australia in 2009 and estimated that 37% of government school staff and 25% of non-government school staff spend an average of one to

three hours per week managing bullying incidents with students and/or parents.[37] If these percentages were applied to the total number of active staff including school counsellors in government and non-government schools across Australia in 2016 (249,093 and 145,670, respectively),[38] it could be assumed that a total of 128,581 staff typically spent at least one hour per week on managing bullying incidents. Based on available data for each state, an average school staff wage in 2016 was estimated to be AUD $46.69 per hour.[39,40] Then this average school staff wage was multiplied by number of hours spent on bullying victimization incidents to estimate a best estimate of annual costs experienced by school staff attributable to addressing bullying incidents.

Non-financial cost. The value of a willingness to pay (WTP) was used to estimate non-financial costs of the value of disability, illness and premature death as a result of bullying.[41] For the Australian context, the AUD $50,000 per DALY value is the best given that it is currently being used by the Pharmaceutical Benefits Advisory Committee (PBAC) to evaluate whether new drugs are value for money and should be listed on the Pharmaceutical Benefits Scheme (PBS).[42] The estimated PAFs for anxiety disorders, depressive disorders and intentional self-harm (9.57%, 13.13% and 15.34%) were applied to estimates of the burden of disease related to anxiety disorders, depressive disorders and intentional self-harm in Australia from GBD 2016.[43] In 2016, the total DALYs attributed to childhood bullying victimization in Australia for both sexes and all ages were estimated to be 61,621 which was used to estimate total non-financial cost using WTP.

Uncertainty analysis

Monte Carlo simulation-modelling techniques and MS EXCEL software were used to calculate uncertainty ranges around pooled point estimates. This interval reflects the largest sources of sampling uncertainty for the estimates (uncertainty in prevalence of exposure, relative risks, number of hours spending on bullying incidents and number of victims staying

away from school). These uncertainty ranges have been used to calculate an upper and lower bound estimate for each of the key costs attributable to childhood bullying

RESULTS

The relative risks (RRs) and population attributable fractions (PAFs) used to estimate health system costs attributable to bullying victimization are shown in Table 1. Individuals experiencing both bullying victimization in childhood and adolescence were found to have almost twice the risk of intentional self-harm compared to individuals not involved in bullying victimization.

<Insert Table 1 here>

Based on lifetime prevalence of bullying victimization, the calculated PAF for anxiety disorders was 9.57%, depressive disorders was 13.13%, intentional self-harm was 15.34%, and tobacco use was 8.89%.

The total annual costs including health system costs, productivity losses of victim-carers, costs experienced by school and non-financial costs of disability, illness and premature death are presented in Table 2. The best estimate of the annual financial costs in 2016 for those who experienced bullying victimization during childhood or adolescence was AUD $763 million while the non-financial cost related to reduced quality of life and premature mortality was estimated to be AUD $3 billion.

<Insert Table 2 here>

DISCUSSION

This is the first study to estimate the annual cost of bullying victimization using a prevalence-based approach. The total annual economic cost of health and non-health problems due to bullying victimization during childhood and adolescence in Australia was AUD $764 million in 2016. Based on included studies and reports, the major contributor to

annual cost related to healthcare service utilization results from treatment of depressive disorders, anxiety, intentional self-harm and tobacco use. In addition, the non-financial cost of reduced quality of life due to anxiety, depressive disorders, and intentional self-harm attributable to bullying victimization accounted for AUD $3 billion in 2016, Australia.

As previously mentioned, there are few studies estimating the cost of this issue. By using an incidence-based approach, [10] a previous study estimated the cost of bullying in Australian schools and showed that the cost for one student cohort over 13 years of school equated to $525 million. The findings of the current study cannot be compared directly to other studies of the economic impact of bullying victimization because of the different methods used. However, the current study adds to the findings of previous studies by demonstrating a substantial annual cost to Australian society resulting from bullying victimization.

The Australian Productivity Commission has estimated the cost for mental disorders equates to AUD $41-53 billion annually.[44] This estimate accounts for mental healthcare expenditure, employment and psychosocial support, education, housing and justice costs, out-of-pocket expenses, insurer payments, informal care provided by family/friends, and loss of productivity due to mental disorders. The Commission highlighted that these costs have been rising over time but there is no significant improvement in the mental health of the population. It indicates that the risk factors including bullying victimization preceding the later development of mental disorders should be addressed.

A variety of effective intervention programs from individual level to whole population level have been implemented to address bullying in many countries, including Australia. A systematic review and meta-analysis of anti-bullying interventions indicates that prevention programs can reduce bullying victimization by approximately 16%.[45] Using results from this study, a reduction of between 10-20% in the prevalence of bullying

victimization among children and adolescents would result in the saving of AUD $100-160 million a year in Australian health care expenditure on depressive disorders, anxiety, intentional self-harm and tobacco use. The investment and implementation of evidence-based interventions that reduce bullying victimization and bullying perpetration in schools could substantially reduce the economic burden associated with mental health disorders and improve the health of many Australians. There is also a need to evaluate the cost-effectiveness of anti-bullying interventions to better understand and quantify the costs which could be avoided through applying effective interventions in the future.

Both global and local studies found that bullying victimization makes a significant contribution to DALYs.[3,7] The findings from the current study can also confirm that bullying victimization contributes a significant proportion of the burden of anxiety disorders, depressive disorders and intentional self-harm. If it is compared with DALYs caused by another risk factor or disease, the estimated number of DALYs attributable to bullying victimization in the current study is similar to the number of DALYs caused by low physical activity (63,860) or by congenital defects (62,170) or by prostate cancer (60,530) [43], thus indicating bullying victimization is a significant issue.

The pooled findings from longitudinal cohort studies focusing on health outcomes provide the opportunity to avoid recall bias of bullying victimization. The quality effects model also allows the quantification of studies not only according to sample size but also by study quality, giving greater weight to studies of higher quality. Furthermore, these estimates provide an opportunity to quantify the economic burden that could be avoided in the future by reducing prevalence of bullying victimization through targeted and effective anti-bullying interventions. This study illustrates the potential economic benefits that could arise from the implementation of programs to reduce bullying victimization in Australia and provides

detailed cost estimates associated with bullying victimization that have not previously been established.

There are also several limitations to this study. The focus of this study was on bullying victimization alone and therefore bullying perpetration was not included. A number of studies confirm that bullying perpetration is associated with adverse outcomes later in life including criminality,[46,47] however it is not clear what the causal impact of bullying perpetration is on these later outcomes. Furthermore, the impact of bullying on employment opportunities and productivity losses because of illness such as anxiety and depressive disorders were not included due to a lack of evidence to support a direct link to lost productivity due to mental health conditions. Although the estimation was based on the studies available, it is important to note that several assumptions were used to account for the costs related to bullying victimization in this study. This may lead to either over- or under-estimation. For example, in 2005 new policy was introduced to provide subsidized mental health care to Australians, known at the "Better Access Scheme".[48] This national policy change would have increased the proportion of expenditure on anxiety and depressive disorders. A conservative assumption was used for the proportion spent on anxiety and depressive disorders in Australia 2015-16. This conservative assumption may lead to under-estimation. In addition, measurement bias with respect to health outcomes and the uncertain reliability of self-reported data may also have affected the results. This issue was dealt with in the meta-analysis by adjusting the quality score and performing subgroup analyses. For mental disorders, studies using well-validated and standardized diagnostic instruments were assigned a higher quality score than studies using self-report symptom scales. The analysis also suffered from inconsistencies in how substance abuse, criminality and poor academic achievement are defined and measured across the studies. Despite evidence of weak and inconsistent associations between bullying victimization and substance use, criminality and

poor academic achievement, further studies are needed that ensure adequate adjustment for lifetime confounders, because the attributable economic burden would be appreciable. Considering these limitations, the burden estimates derived from this study are likely to represent a conservative estimation of the annual cost of bullying in Australia.

The findings from this study suggest a substantial annual cost to Australian society results from bullying victimization, representing more than 8% of annual mental health expenditure. A practical implication of this study is that the cost estimates generated in this study provide essential information for decision-making in the allocation of resources to address bullying cases, and for investing in anti-bullying policies and interventions or programs.

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Table 1: Relative Risks and Population Attributable Fractions for Health and Non-Health Outcomes Associated With Bullying Victimization Experience in Australia

Outcomes	RRs			PAFs (95% Uncertainty Interval)
	Point RR	95% CI Lower Bound	95% CI Upper Bound	
Health outcome costs				
Anxiety [a/c]	1.56	1.32	1.85	9.57% 3.94% - 15.56%
Depression [a/c]	1.8	1.56	2.08	13.13% 6.59% - 19.81%
Alcohol use	0.91	0.68	1.22	-
Tobacco use [c]	1.52	1.15	1.99	8.89% 2.04% - 17.66%
Illicit drug use [c]	1.27	0.82	1.95	-
Intentional self-harm [d/c]	1.96	1.67	2.30	15.34% 7.78% - 23.16%
Non-health outcome costs				
Poor academic achievement [b]	1.22	0.95	1.58	-
Criminality [c]	0.96	0.76	1.21	-

Note: PAFs = Population Attributable Fractions; RRs = Risk Ratios.

[a] RR estimates from Jadambaa *et al*.[7]

[b] Adjusted for demographic, family and other environmental factors.

[c] Adjusted for psychological problems and/or outcome at baseline.

[d] Included intentional self-harm, suicidality and suicide attempt.

Table 2: Estimated Annual Cost of Bullying in Australia in 2016 based on Top Down and Bottom Up Approaches

Cost type	Annual costs attributable to bullying, Australia in AUD 2016
Health system costs	**749,696,403**
Expenditure on anxiety disorders attributable to bullying victimisation [a]	147,309,342
95% Uncertainty Interval	60,617,259 - 239,557,184
Expenditure on depressive disorders attributable to bullying victimisation [a]	321,554,675
95% Uncertainty Interval	161,418,733 - 484,963,258
Expenditure on intentional self-harm attributable to bullying victimisation [c/a]	56,772,497
95% Uncertainty Interval	20,986,320 - 62,439,662
Expenditure on tobacco use attributable to bullying victimisation [a]	224,059,888
95% Uncertainty Interval	51,283,088 - 444,923,755
Non-health outcome costs	**13,567,174**
Productivity losses of victim-carers [b]	7,563,581
95% Uncertainty Interval	3,724,615 - 11,456,146
Costs experienced by schools [b]	6,003,593
95% Uncertainty Interval	5,151,321 - 6,845,999
Total financial cost	**763,263,578**
Value of disability, illness and premature death as a result of bullying	3,081,100,000
95% Uncertainty Interval	2,040,903,547 - 3,870,092,187
Non-financial cost	**3,081,100,000**

Note: AUD = Australian dollar.

[a] Top down approach was used; [b] Bottom up approach was used; [c] Including intentional self-harm, suicidality and suicide attempt

Figure 1: Model for a Prevalence-Based Approach Estimating the Annual Costs in 2016 for Individuals Who Have Experienced Bullying Victimization in Childhood and Adolescence[a]

Note: ABS = Australian Buro of Statistics; AIC = Australian Institute of Criminology; AIHW = Australian Institute of Health and Welfare; DALYs = Disability Adjusted Life Years; GBD = Global Burden of Disease; OR = Odds Ratios; PAFs = Population Attributable Fractions; RRs = Risk Ratios.

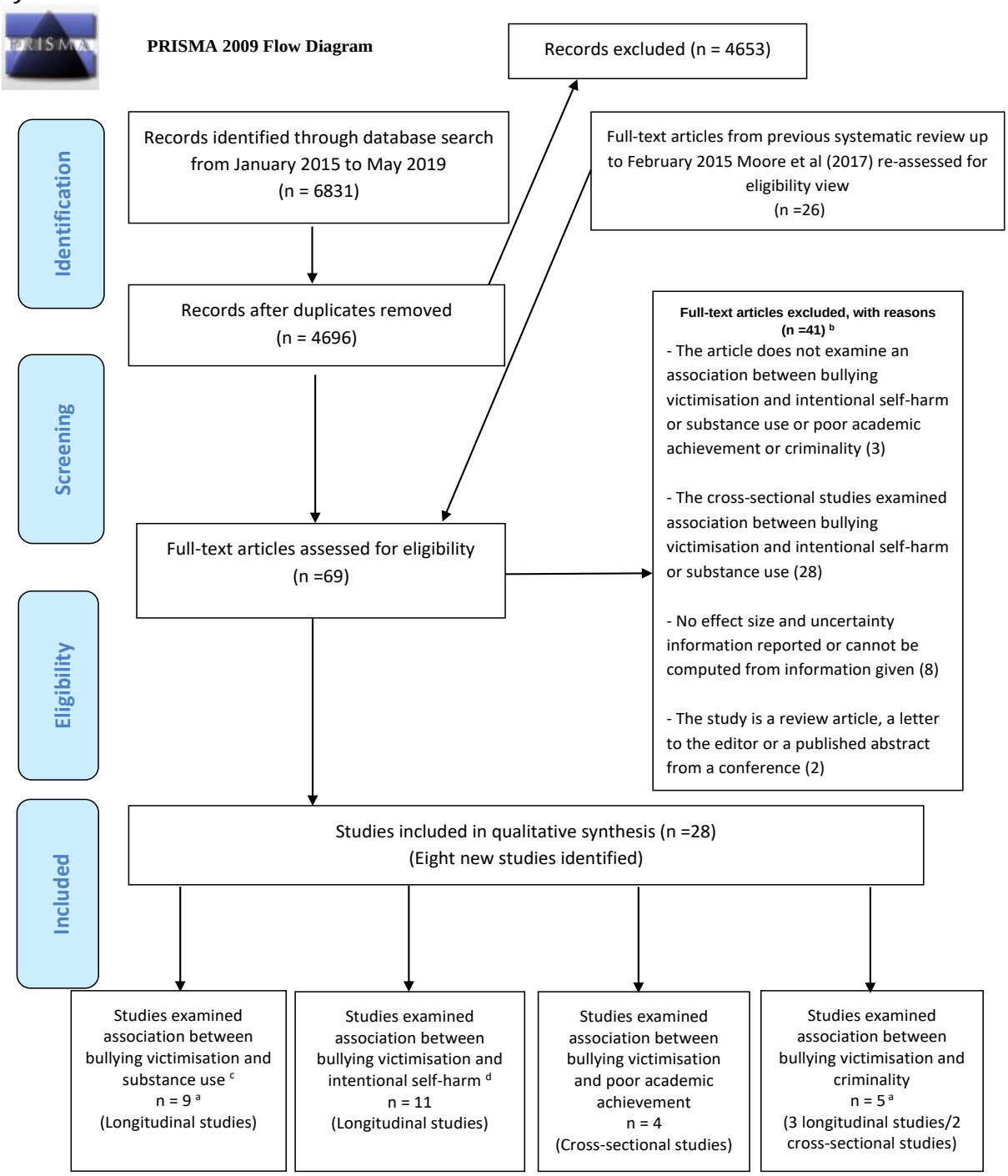
[a] From a societal perspective.

[b] RRs from previously published systematic review and meta-analysis by study authors.[7]

[c] Due to availability of data, bottom-up approach was applied.

[d] Cost was indexed to 2016 dollars using the cost converter tool.[25]

***Figure S1*:** *PRISMA flow diagram showing process of study selection for inclusion in systematic review*



[a] Total exceeds 28 because one study examined association between bullying victimisation and both substance use and criminality
[b] Six studies from Moore et al (2017)
[c] Including alcohol abuse, tobacco abuse and illicit drug use
[d] Including intentional self-harm, suicidality and suicide attempt

Supplement 1: Review protocol and Quality Assessment Tool

Review protocol:

Consequences of bullying victimization

1. Previous systematic review was conducted using PubMed, EMBASE, ERIC and PsycINFO electronic databases up to 28 February 2015 and included longitudinal and cross-sectional studies that examined association between health and psychological outcome and bullying victimisation.[1]
2. Update this systematic review until 15 May 2019 and include longitudinal studies only.

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

Search terms:

Database	**Search group**	**Search terms**
EMBASE	Bullying Victims	(bullied OR 'bullying'/exp/mj OR teas* OR harass* OR 'victimization'/exp/mj OR victimisation OR intimidate*) AND (child*:ti,ab,kw OR adolescen*:ti,ab,kw OR teen*:ti,ab,kw OR youth*:ti,ab,kw) AND (outcome* OR harm OR consequence* OR 'risk'/exp OR risk*) AND [2015-2019]/py 1108
PubMed	Bullying Victims	Search ((("Bullying"[Mesh] OR bullied OR bullying OR teas* OR harass* OR victimization OR victimisation OR intimidat*)) AND (child*[Title/Abstract] OR

		adolescen*[Title/Abstract] OR teen*[Title/Abstract] OR youth*[Title/Abstract])) AND (outcome* OR harm OR consequence* OR risk*) Filters: Publication date from 2015/01/01 to 2019/05/13 2838
ERIC	Bullying Victims	AB (bullied OR bullying OR teas* OR harass* OR victimization OR victimisation OR intimidat*) AND AB (child* OR adolescen* OR teen* OR youth*) AND TX (outcome* OR harm OR consequence* OR 'risk'/exp OR risk*) Limiters - Published Date: 20150101-20191231 Source type – Journals/Academic journals 1351
PsycINFO	Bullying Victims	DE ((bullied OR bullying OR teas* OR harass* OR victimization OR victimisation OR intimidat*) AND AB (child* OR adolescen* OR teen* OR youth*) AND (outcome* OR harm OR consequence* OR 'risk'/exp OR risk*) Limiters - Publication Year: 2015-2019 Source type – Academic journals/Dissertation 1535
Additional search:	Bullying Victims	any article pulled for possible inclusion

Reference list review		2 studies

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 health and non-health outcomes 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 health and non-health outcomes 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 reporter, parent reported, or clinician reported on either a validated scale or a questionnaire designed specifically for that study.

Age range for exposure: bullying victimization occurred between 0-18 years but studies also included if age not reported

***Comparison*:** Individuals not exposed to bullying victimisation

***Outcome*:** Health outcomes: intentional self-harm and substance use; Non-health outcomes: Poor academic achievement and criminality.

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*: Health outcomes: only longitudinal studies; non-health outcomes: longitudinal and cross-sectional studies

No limits on language. Published since Jan 2015 up to 15 May 2019.

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 intentional self-harm or substance use or poor academic achievement or criminality (3)
- The cross-sectional studies examined association between bullying victimisation and intentional self-harm or substance use (28)
- No effect size and uncertainty information reported or cannot be computed from information given (8)
- 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
- 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 (2)

- 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

Data abstraction form

Identification of 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 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
14. Assessment of outcome

Other data:

15. Effect size and 95% confidence interval: converted to Relative risk (RR) estimates by method.[2]

Reference:

1. Moore SE, Norman RE, Suetani S, Thomas HJ, Sly PD, Scott JG. Consequences of bullying victimization in childhood and adolescence: a systematic review and meta-analysis. *World J Psychiatry*. 2017;7(1):60-76.
2. Di Pietrantonj C. Four-fold table cell frequencies imputation in meta analysis. *Stat Med.* 2006;25(13):2299-2322.

Supplement 2: *Quality Assessment:*

Quality of studies was assessed using the tool below which was adapted from a tool for assessing risk of bias in cohort studies (Newcastle – Ottawa scale for cohort studies).[1] 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 10. 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 = 2 • Retrospective Cohort = 1 • Cross-sectional/case control = 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	• Yes = 1

	the participants	• 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= 1 • Questions from published health surveys/screening instruments or own system /symptoms described/no system/not specified/self-reported = 0
8.	Appropriate	• Exposed/non-exposed case numbers reported =1

	statistical analysis and information provided	• Exposed/non-exposed case numbers not reported =0

Reference list:

1. Wells G, Shea B, O'Connell D, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Ottawa: Ottawa Hospital Research Institute; 2000.

Table S1: 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, Method and Supplement 1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Introduction Method and Supplement 1
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Introduction Method and Supplement 1
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 Supplement 1
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 Supplement 1
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 Supplement 1
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Method and Supplement 1

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 Supplement 1
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 Supplement 1
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 Supplements 1 and Table S2
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 Supplements 1 and Table S2
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	Method and Supplements 1 and Table S2
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	Method and Supplements 1, Table S2 and Table S3
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.	Method and Supplements 1, Table S2 and Table S3
RESULTS			
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.	Method and Supplements 1, Table S2 and Table S3
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.	Table S2 and Table S3
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).	NA

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.	Table S2 -S9
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Table S2 -S9
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Table S2 -S9
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	Table S2 -S9
DISCUSSION			
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).	Discussion and Supplements 1, Table S2 -S9
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).	Discussion and Supplements 1, Table S2 -S9
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Discussion and Supplements 1, Table S2 -S9
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	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

Table S2: 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
Intentional self-harm									
Fisher, Moffitt, Houts, Belsky, Arseneault, Caspi [1]	UK	The Environmental Risk longitudinal study	Both	Bullying victimisation	Before 10 years	Face to face interviews with mothers when the children were aged 7 and 10 years	Self-harm	12	Mothers were asked whether each twin had ever deliberately harmed him/herself or attempted suicide in the previous six months
Ford, King, Priest, Kavanagh [2]	Australia	Longitudinal Study of Australian Children (LSAC)	Both	Bullying victimisation /perpetration/victim-perpetration	Wave 6: 14-15	Self-reported questionnaire	Self-harm and suicide attempt	Wave 6: 14-15	Respondents were asked whether, during the past 12 months, they had considered self-harm such as overdosing on pills or cutting or burning oneself. Respondents were asked whether they had, in the past 12 months, thought of suicide or made a plan to attempt suicide. They were then asked how many times in the past 12 months they had attempted suicide.
Geoffroy, Boivin, Arseneault, Turecki, Vitaro, Brendgen, Renaud, Séguin, Tremblay, Côté [3]	Canada	The Quebec Longitudinal Study of Child Development	Both	Bullying victimisation	13	Self-report Victimisation Scale	Suicide attempt	13 and 15	Suicidal attempt was assessed with question administered to participants at 13 and 15 years: "in the past 12 months, did you ever seriously think of attempting suicide". They answered affirmatively, they were asked: "in the past 12 months, how many times did you attempt suicide
Geoffroy, Boivin, Arseneault, Renaud, Perret, Turecki, Michel, Salla, Vitaro, Brendgen, Tremblay, Côté [4]	Canada	The Quebec Longitudinal Study of Child Development	Both	Bullying victimisation	6-13	Self-report Victimisation Scale	Suicide attempt	15	Suicidal attempt was assessed with question administered to participants at 13 and 15 years: "in the past 12 months, did you ever seriously think of attempting suicide". They answered affirmatively, they were asked: "in the past 12 months, how many times did you attempt suicide
Hemphill, Tollit, Herrenkohl [5]	Australia	the International Youth Development Study (IYDS)	Both	Bullying victimisation	16-17	The self-reported measures of bullying perpetration and victimisation - a modified version of the Communities that Care survey	Self-harm	18-19	Self-harm was assessed during young adulthood using one item asking participants, "In the past year, have you ever deliberately hurt yourself or done anything that you knew might have harmed you or even killed you?"
Kim, Leventhal, Koh, Boyce [6]	South Korea	A prospective cohort study - two public middle schools	Both	Bullying victimisation perpetration	7th and 8th grade	Bullying was identified using the Korean-Peer Nomination Inventory (KPNI), both at baseline and follow-up	Suicidal behaviour	7th and 8th grade	Suicidal self-injurious behaviors and suicidal ideation during the previous 6 months were examined with two Korean Youth Self-Report (K-YSR) items, at both baseline and follow-up
Klomek, Sourander, Niemelä, Kumpulainen, Piha, Tamminen, Almqvist, Gould [7]	Finland	The Epidemiological Multicentre Child Psychiatric Study-A Nationwide study	Both	Bullying victimisation perpetration	8	Self-reported, as well as parent and teacher reported	Suicide attempt	Up to 25 years of age	The diagnostic codes for suicide attempts between 1994 and 1995 were ICD-9, codes E950 to E959, V156, or V658, and those between 1996 and 2005 were ICD-10 codes X60 to X84, Z72.8, or Z91.5. Of note, all suicide attempts in the cohort were recorded between 1996 and 2005 with ICD-10 codes X60 to X84.
Lereya, Winsper, Heron, Lewis, Gunnell, Fisher, Wolke [8]	UK	The Avon Longitudinal Study of Parents and Children (ALSPAC)	Both	Bullying victimisation	7-10	Child reports were collected at 8 and 10 years, using a modified version of the Bullying and Friendship Interview Schedule. Mother reports were collected at 7, 8 and 9 years. Teacher reports were collected at 7 and 10 years	Self-harm	16-17	A self-completion postal questionnaire
Lereya, Copeland, Costello, Wolke [9]	UK, USA	The Avon Longitudinal Study of Parents and Children (ALSPAC); The	Both	Bullying victimisation	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	Self-harm and suicidality	ALSPAC: 18 GSMS: 19,	ALSPAC: A reliable and validated self-administered computerised version of the Clinical Interview Schedule (CIS-R) GSMS: Young Adult Psychiatric Assessment (YAPA)

		Great Smoky Mountains Study in the USA (GSMS)				teased or bullied others (part of Child and Adolescent Psychiatric Assessment (CAPA))		21, 24-26	
Sigurdson, Undheim, Wallander, Lydersen, Sund [10]	Norway	The Youth and Mental Health Study	Both	Bullying victimisation	mean age 13.7	Participants reported if they have ever been (1) teased, (2) physically assaulted, or (3) excluded from peer relationships at school or while traveling to or from school during the last 6 months	Self-harm and suicide attempt	mean age 13.7, 14.9 and 27.2	Self-harm was measured by the question: Have you ever deliberately taken an overdose of pills or in any other way tried to hurt yourself? Suicide attempts were measured using the question Have you ever tried to commit suicide?
Sutin, Robinson, Daly, Terracciano [11]	Australia	Longitudinal Study of Australian Children (LSAC)	Both	Bullying victimisation	14-15	Participants were asked, ''During the last 12 months, since [month at time of interview] last year has.''	Intentional self-harm and suicide behaviour	14-15	Respondents were asked whether, during the past 12 months, they had considered self-harm such as overdosing on pills or cutting or burning oneself. Respondents were asked whether they had, in the past 12 months, thought of suicide or made a plan to attempt suicide.
Substance use									
Cénat, Blais, Lavoie, Caron, Hébert [12]	Canada	the Quebec Youths' Romantic Relationships Survey (QYRRS)	Both	Cyberbullying victimisation	10--12	Self-reported	Alcohol use	after 12 months	Three (3) items from the Screening Grid for Detection of Alcohol and Drug Problems in Adolescents measuring substances use frequency for alcohol, cannabis and other drugs such as ecstasy, amphetamine, speed, cocaine and acid (eg. "In the past 6 months, how many times have you consumed these products?")
Copeland, Wolke, Angold, Costello [13]	USA	The Great Smoky Mountain Study	Both	Bullying victimisation Bullying perpetration 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))	Alcohol abuse Marijuana abuse	19, 21, 24-26	The Young Adult Psychiatric Assessment (YAPA) - Structured diagnostic interview-diagnoses made included any DSM-IY anxiety disorders and depressive disorders, antisocial personality disorder**, alcohol abuse** or dependence, and **marijuana abuse** or dependence.
Hemphill, Kotevski, Herrenkohl, Bond, Kim, Toumbourou, Catalano [14]	Australia	The International Youth Development Study: Victorian sample	Both	Bullying victimisation Bullying perpetration	Grade7 and 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)	Marijuana use, Binge drinking	Grade 11	Marijuana use was assessed with the item 'In the past 30 days on how many occasions have you used marijuana (pot, weed, and grass)?' Binge drinking was measured by asking students how many times in the last 2 weeks they have had five or more drinks in a row rated from 1 (none) to 6 (10 or more times)(self-reported).
Kelly, Newton, Stapinski, Slade, Barrett, Conrod, Teesson [15]	Australia	The control group of the Climate and Preventure (CAP) study	Both	Bullying victimisation Bullying perpetration Bullying victim-perpetration	mean age: 13.4 years	Bullying prevalence was measured using an amended version of the Revised Olweus Bully/Victim Scale (self-reported)	Risky drinking, Tobacco use, Cannabis use	15 (after 24 months of exposure)	Past six month substance use was measured, including any drinking (at least a standard drink), risky drinking (5 or more standard drinks in one episode as defined by the National Health and Medical Research Council (2009); this is a sub-set of 'any drinking'), any use of tobacco, and any use of cannabis. (self-reported)
Niemelä, Brunstein-Klomek, Sillanmäki, Helenius, Piha, Kumpulainen, Moilanen, Tamminen, Almqvist, Sourander [16]	Finland	Nationwide Finnish study "From a boy to a man"	Males	Bullying victimisation Bullying perpetration Bullying victim-perpetration	8	Child's self-reported and parent and teacher questionnaires	Frequent drunkenness, daily heavy smoking, illicit drug use	18	Self-reported: drunkenness at least once a week in the last 6 months was chosen to indicate frequent drunkenness/smoking at least 10 cigarettes a day in the last 6 months was chosen to indicate heavy daily smoking/ illicit drug use within the past six months was dichotomized into "no" and "yes" for the analysis.
Sigurdson, Wallander, Sund [17]	Norway	The Youth and Mental Health Study	Both	Bullying victimisation Aggressive toward others including parent and teachers* (excluded)	12-15	Bullying victimisation: Participants were asked if they have ever been (a) teased, (b) physical assaulted, or (c) frozen out of friend-ships at school or on the way to school during the last 6 months Aggressive toward others including parent and teachers: Four questions "I treat others badly," "I physically attack people," "I tease others a lot"and"I threaten to hurt people."	Tobacco use, Alcohol use, Illegal drug use	26-29	Participants were asked: "In the past 6 months, about how many times per day did you use tobacco (including smokeless tobacco)?" Participants responded to the statement "I drink too much alcohol and get drunk" for the last six-months. Participants were asked: "In the past 6 months, on how many days did you use drugs for nonmedical purposes (including marijuana, cocaine, and other drugs, except alcohol and tobacco)?"

				Bullying victim-perpetration					
Sourander, Jensen, Rönning, Niemelä, Helenius, Sillanmäki, Kumpulainen, Piha, Tamminen, Moilanen [18]	Finland	From a Boy to a Man	Males	Bullying victimisation/Bullying victim-perpetration (Frequent)	8	Child, teacher, and parent were asked about bullying victimisation	Substance use disorders (ICD-10 codes F10-F19)	18-23	The ICD-10 diagnoses were made for all subjects at the mental health examination at call-up.
Sourander, Gyllenberg, Brunstein Klomek, Sillanmaki, Ilola, Kumpulainen [19]	Finland	Finnish Nationwide 1981 Birth Cohort Study	Both	Bullying victimisation/Bullying victim-perpetration (Frequent)	8	Child, teacher, and parent were asked about bullying victimisation	Substance use disorders (ICD-10 codes F10-F19)	16-29	Use of specialized services for psychiatric disorders from 16 to 29 years of age was obtained from a nationwide hospital register, including outpatient and inpatient treatment
Wolke, Copeland, Angold, Costello [20]	USA	The Great Smoky Mountain Study	Both	Bullying victimisation/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))	Illicit drug use	19, 21, 24-26	Assessed through interviews with the young adults with the Young Adult Psychiatric Assessment (YAPA)
Poor academic achievement									
Due, Holstein, Jørgensen [21]	Denmark	55 schools in Denmark/Cross-sectional study	Both	Bullying victimisation	11-15	self-reported questionnaire	Doing poorly in school	11-15	the students' self-reported health, well-being, self-perception and health behaviour questionnaire (35 variables)
Hammig, Jozkowski [22]	US	Youth Risk Behaviour Survey/Cross-sectional study	Both	Bullying victimisation	Grades 9 through 12	Self-reported global single questionnaire	Academic performance: Mostly Ds and Fs	Grades 9 through 12	Academic performance was measured by response to the following question, "During the past 12 months, how would you describe your grades in school?"
Nansel, Overpeck, Pilla, Ruan, Simons-Morton, Scheidt [23]	US	The Health Behaviour of School-aged Children survey (HBSC)/Cross-sectional study	Both	Bullying victimisation /victim-perpetration	6-10 grades	A self-reported questionnaire	Academic achievement: below average	6-10 grades	Academic achievement was assessed by an item querying perceived school performance
Woods, Wolke [24]	UK	74 classes from 34 primary schools in Hertfordshire and North London, UK/Cross-sectional study	Both	Relational bullying victimisation	6-7 years	A face to face interview	Underachieving for Key Stage Level I National Curriculum (SAT) test	6-7 years	Key Stage Level I National Curriculum results (SATs)
Criminality									
Luukkonen, Riala, Hakko, Rasanen [25]	Finland	the STUDY-70/cross-sectional	Both	Bullying victimisation /victim-perpetration	12-17	Self-reported questionnaire	Any crime, Violent crime, Non-violent crime	15-17	The data from the criminal records
Sourander, Jensen, Rönning, Elonheimo, Niemelä, Helenius, Kumpulainen, Piha, Tamminen, Moilanen, Almqvist [26]	Finland	The nationwide From a Boy to a Man study/prospective cohort	Both	Bullying victimisation /victim-perpetration	8	Parents, teachers, and the children themselves self-reported questionnaire	Criminal offenses:	16-20	National police register information about criminal offenses

Sourander, Brunstein Klomek, Kumpulainen, Puustjarvi, Elonheimo, Ristkari, Tamminen, Moilanen, Piha, Ronning [27]	Finland	The nationwide From a Boy to a Man study/prospective cohort	Both	Bullying victimisation	8	Parents, teachers, and the children themselves self-reported questionnaire	Criminal offenses:	23-26	National police register information about criminal offenses
Wolke, Copeland, Angold, Costello [20]	USA	The Great Smoky Mountain Study is a population-based study of three cohorts of children	both	Bullying victimisation /victim-perpetration	9--16	the child and their parent reported on whether the child had been bullied/teased or bullied others in the 3 months immediately prior to the interview as part of the Child and Adolescent Psychiatric Assessment (CAPA)	Official Felony Charge/ Police contact/Break into property	19, 21, and 24–26	North Carolina Administrative Offices of the Courts records

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Table S3: Quality Assessment

	Total score (maximum 10)	Study design: •Prospective Cohort = 1 •Retrospective Cohort = 0 Study design: •Prospective Cohort = 2 •Retrospective Cohort = 1 •Cross-sectional/case control = 0	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	Selection of the non-exposed cohort/controls: • Drawn from the same population=1 • Drawn from a different source/no description=0	Definition of bullying provided for the participants: • Yes = 1 • No/no description = 0	Ascertainment of exposure to bullying: How the exposure to bullying was measured? Responses coded: • Yes = 1 (If yes to both questions) • Partial = 0.5 (If yes to one question) • No = 0 (If no to both questions)			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/ SES only/ environmental and family factor only/there was no confounding controlled for/no statement = 0	Ascertainment of outcome: How was the outcome measured? • Clinician reported or objective measure(Use of the diagnostic codes for suicide attempts/mental disorders) =1 • Questions from published health surveys/screening instruments or own system /symptoms described/no system/not specified/self-reported = 0	Appropriate statistical analysis and information provided •Exposed/non-exposed case numbers reported =1 •Exposed/non-exposed case numbers not reported =0
						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")?	overall			
Intentional self-harm											
Fisher, Moffitt, Houts, Belsky, Arseneault, Caspi [1]	6.5[a]	2	1	1	1	Yes	No description	0.5	0	0	1
	7.5[b]	2	1	1	1	Yes	No description	0.5	1	0	1
	8.5[c]	2	1	1	1	Yes	No description	0.5	2	0	1
Ford, King, Priest, Kavanagh [2]	7[b]	2	1	1	1	No	No description	0	1	0	1
Geoffroy, Boivin, Arseneault, Turecki, Vitaro, Brendgen, Renaud, Séguin, Tremblay, Côté [3]	5[b]	2	0	1	0	Yes	Yes	1	1	0	1
	6[c]	2	0	1	0	Yes	Yes	1	2	0	1
Geoffroy, Boivin, Arseneault, Renaud, Perret, Turecki, Michel, Salla, Vitaro, Brendgen, Tremblay, Côté [4]	5[b]	2	0	1	0	Yes	Yes	1	1	0	1
	6[c]	2	0	1	0	Yes	Yes	1	2	0	1
Hemphill, Tollit, Herrenkohl [5]	7[b]	2	0	1	1	Yes	Yes	1	1	0	1
Kim, Leventhal, Koh, Boyce [6]	5[c]	2	0	1	0	No description	No description	0	2	0	0
Klomek, Sourander, Niemelä, Kumpulainen, Piha, Tamminen, Almqvist, Gould [7]	6.5[a]	2	1	1	0	Yes	No description	0.5	0	1	1
	8.5[b]	2	1	1	0	Yes	No description	0.5	2	1	1
Lereya, Winsper, Heron, Lewis, Gunnell, Fisher, Wolke [8]	4[a]	2	1	1	0	Yes	Yes	1	0	0	0
	5[b]	2	1	1	0	Yes	Yes	1	1	0	0
	6[c]	2	1	1	0	Yes	Yes	1	2	0	0
Lereya, Copeland, Costello, Wolke [9]	6.5[b]	2	1	1	0	Yes	No	0.5	1	0	1
Sigurdson, Undheim, Wallander, Lydersen, Sund [10]	5[a]	2	0	1	0	Yes	Yes	1	0	0	1
Sutin, Robinson, Daly, Terracciano [11]	5[c]	2	1	1	0	No	No description	0	2	0	0
Substance use											
Cénat, Blais, Lavoie, Caron, Hébert [12]	7[a]	2	1	1	1	yes	yes	1	0	0	1
Copeland, Wolke, Angold, Costello [13]	8[a]	2	1	1	1	yes	yes	1	0	1	1
	9[a]	2	1	1	1	yes	yes	1	0	1	0
	10[b]	2	1	1	1	yes	yes	1	2	1	1
Hemphill, Kotevski, Herrenkohl, Bond, Kim, Toumbourou, Catalano [14]	4[a]	2	0	1	0	yes	yes	1	0	0	0
	6[c]	2	0	1	0	yes	yes	1	2	0	0

Kelly, Newton, Stapinski, Slade, Barrett, Conrod, Teesson [15]	8 [c]	2	0	1	1	yes	yes	1	2	0	1
Niemelä, Brunstein-Klomek, Sillanmäki, Helenius, Piha, Kumpulainen, Moilanen, Tamminen, Almqvist, Sourander [16]	5 [a]	2	1	1	0	yes	yes	1	0	0	1
	7 [c]	2	1	1	0	yes	yes	1	2	0	1
Sigurdson, Wallander, Sund [17]	5 [a]	2	1	1	0	yes	yes	1	0	0	1
	6 [b]	2	1	1	0	yes	yes	1	1	0	1
Sourander, Jensen, Rönning, Niemelä, Helenius, Sillanmäki, Kumpulainen, Piha, Tamminen, Moilanen [18]	6 [a]	2	0	1	0	yes	yes	1	0	1	1
Sourander, Gyllenberg, Brunstein Klomek, Sillanmaki, Ilola, Kumpulainen [19]	7.5 [b]	2	1	1	0	Yes	No	0.5	1	1	1
	8.5 [c]	2	1	1	0	Yes	No	0.5	2	1	1
Wolke, Copeland, Angold, Costello [20]	8 [a]	2	1	1	1	yes	yes	1	0	1	1
Poor academic achievement											
Due, Holstein, Jørgensen [21]	5 [a]	0	1	1	0	yes	yes	1	0	1	1
Hammig, Jozkowski [22]	4 [a]	0	1	1	1	no	no	0	0	0	1
Nansel, Overpeck, Pilla, Ruan, Simons-Morton, Scheidt [23]	6 [b]	0	1	1	1	yes	yes	1	1	1	0
Woods, Wolke [24]	4 [a]	0	1	1	0	yes	yes	1	0	1	0
Criminality											
Luukkonen, Riala, Hakko, Rasanen [25]	3 [a]	0	0	1	1	no description	no description	0	0	1	0
	5 [c]	0	0	1	1	no description	no description	0	2	1	0
Sourander, Jensen, Rönning, Elonheimo, Niemelä, Helenius, Kumpulainen, Piha, Tamminen, Moilanen, Almqvist [26]	8 [b]	2	1	1	0	yes	yes	1	1	1	1
Sourander, Brunstein Klomek, Kumpulainen, Puustjarvi, Elonheimo, Ristkari, Tamminen, Moilanen, Piha, Ronning [27]	8 [b]	2	1	1	0	yes	yes	1	1	1	1
	9 [c]	2	1	1	0	yes	yes	1	2	1	1
Wolke, Copeland, Angold, Costello [20]	7 [a]	2	1	1	1	yes	yes	1	0	0	1
	8 [a]	2	1	1	1	yes	yes	1	0	1	1

[a] 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

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Table S4: Relative Risk (RR) estimates for bullying victimisation and intentional self-harm [d] from meta-analyses [a]

Adjustment status	Included or not included OR=RR assumption	Data points	Pooled RR	Lo95%CI	Hi95%CI	I^2 (%)	Cochran's Q	Test for Heterogeneity (*p*-Value)
Unadjusted	Pooled RR Victimisation only	16	3.05	2.66	3.5	0	9.83	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	19	2.54	2.16	3.01	47.13	34.04	<0.001
	Pooled RR Victimisation including Victim-Perpetration	-	-	-	-	-	-	-
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	-	-	-	-	-	-	-
Adjusted for demographic, family and other environmental factors [b]	Pooled RR Victimisation only	10	1.93	1.55	2.39	74.67	35.54	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	15	1.71	1.28	2.28	93.78	225.34	<0.001
	Pooled RR Victimisation including Victim-Perpetration	12	2.07	1.69	2.54	80.04	55.12	<0.001
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	17	1.77	1.33	2.35	94.08	270.55	<0.001
Adjusted for psychological problems and/or intentional self-harm at baseline	Pooled RR Victimisation only	5	2.16	1.72	2.72	0	3.58	<0.001
	Pooled RR Victimisation only, including OR=RR assumption [c]	**10**	**1.95**	**1.66**	**2.29**	**3.75**	**9.35**	**<0.001**
	Pooled RR Victimisation including Victim-Perpetration	-	-	-	-	-	-	-
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	-	-	-	-	-	-	-

[a] Odds ratios (ORs) for bullying experience and substance use: ORs from original papers converted to RR estimates [23]; Included studies reported either traditional bullying only, cyberbullying only, traditional bullying and cyberbullying as a single estimate, or traditional bullying and cyberbullying as separate estimates (both estimates included); If studies reported two or more levels of frequency, higher level of frequency included.

[b] Where studies adjusted for demographics, environmental factors and family factors separately and/or some variables combined, best adjusted estimates were included.

[c] For further analyses, RR estimates based on best adjusted and informed by the greatest number of data points were used to calculate PAFs.

[d] Included intentional/non-suicidal self-harm, suicidality and suicide attempt

Table S5: Relative Risk (RR) estimates for bullying victimisation and alcohol use from meta-analyses [a]

Adjustment status	Included or not included OR=RR assumption	Data points	Pooled RR	Lo95%CI	Hi95%CI	I^2 (%)	Cochran's Q	Test for Heterogeneity (*p*-Value)
Unadjusted	Pooled RR Victimisation only	6	1.28	1.07	1.52	0	3.68	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	8	1.19	1.01	1.42	18.65	8.60	<0.001
	Pooled RR Victimisation including Victim-Perpetration	10	1.25	1.06	1.49	0	5.88	<0.001
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	12	1.18	1.02	1.38	0	10.66	<0.001
Adjusted for demographic, family and other environmental factors [b]	Pooled RR Victimisation only	3	1.24	0.92	1.68	13.16	2.3	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	-	-	-	-	-	-	-
	Pooled RR Victimisation including Victim-Perpetration	6	1.21	0.97	1.52	4.72	5.24	<0.001
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	-	-	-	-	-	-	-
Adjusted for psychological problems and/or intentional self-harm at baseline	Pooled RR Victimisation only	6	0.78	0.54	1.14	55.84	11.32	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	7	0.84	0.61	1.17	55.25	13.41	<0.001
	Pooled RR Victimisation including Victim-Perpetration	13	0.87	0.63	1.22	62.74	32.21	<0.001
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration [c]	**14**	**0.91**	**0.68**	**1.22**	61.04	33.37	<0.001

[a] Odds ratios (ORs) for bullying experience and substance use: ORs from original papers converted to RR estimates [23]; Included studies reported either traditional bullying only, cyberbullying only, traditional bullying and cyberbullying as a single estimate, or traditional bullying and cyberbullying as separate estimates (both estimates included); If studies reported two or more levels of frequency, higher level of frequency included.

[b] Where studies adjusted for demographics, environmental factors and family factors separately and/or some variables combined, best adjusted estimates were included.

[c] For further analyses, RR estimates based on best adjusted and informed by the greatest number of data points were used to calculate PAFs.

Table S6: Relative Risk (RR) estimates for bullying victimisation and tobacco use from meta-analyses [a]

Adjustment status	Included or not included OR=RR assumption	Data points	Pooled RR	Lo95%CI	Hi95%CI	I^2 (%)	Cochran's Q	Test for Heterogeneity (*p*-Value)
Unadjusted	Pooled RR Victimisation only	3	1.05	0.81	1.36	0	1.63	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	-	-	-	-	-	-	-
	Pooled RR Victimisation including Victim-Perpetration	5	1.11	0.88	1.42	0	0.29	<0.001
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	-	-	-	-	-	-	-
Adjusted for demographic, family and other environmental factors [b]	Pooled RR Victimisation only	3	1.44	1.14	1.83	0	0.60	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	-	-	-	-	-	-	-
	Pooled RR Victimisation including Victim-Perpetration	6	1.44	1.17	1.77	9.84	5.54	<0.001
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	-	-	-	-	-	-	-
Adjusted for psychological problems and/or intentional self-harm at baseline	Pooled RR Victimisation only	4	1.60	1.24	2.04	0	0.92	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	-	-	-	-	-	-	-
	Pooled RR Victimisation including Victim-Perpetration [c]	**8**	**1.51**	**1.15**	**1.99**	29.12	9.87	<0.001
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	-	-	-	-	-	-	-

[a] Odds ratios (ORs) for bullying experience and substance use: ORs from original papers converted to RR estimates [23]; Included studies reported either traditional bullying only, cyberbullying only, traditional bullying and cyberbullying as a single estimate, or traditional bullying and cyberbullying as separate estimates (both estimates included); If studies reported two or more levels of frequency, higher level of frequency included.

[b] Where studies adjusted for demographics, environmental factors and family factors separately and/or some variables combined, best adjusted estimates were included.

[c] For further analyses, RR estimates based on best adjusted and informed by the greatest number of data points were used to calculate PAFs.

Table S7: Relative Risk (RR) estimates for bullying victimisation and illicit drug use from meta-analyses [a]

Adjustment status	Included or not included OR=RR assumption	Data points	Pooled RR	Lo95%CI	Hi95%CI	I^2 (%)	Cochran's Q	Test for Heterogeneity (*p*-Value)
Unadjusted	Pooled RR Victimisation only	8	1.39	1.15	1.68	18.85	8.62	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	10	1.36	1.15	1.62	15.66	10.67	<0.001
	Pooled RR Victimisation including Victim-Perpetration	13	1.36	1.17	1.59	0	11.45	<0.001
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	15	1.34	1.16	1.55	0	13.35	<0.001
Adjusted for demographic, family and other environmental factors [b]	Pooled RR Victimisation only	3	1.47	1.00	2.15	21.54	2.55	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	-	-	-	-	-	-	-
	Pooled RR Victimisation including Victim-Perpetration	6	1.45	1.10	1.90	9.12	5.50	<0.001
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	-	-	-	-	-	-	-
Adjusted for psychological problems and/or intentional self-harm at baseline	Pooled RR Victimisation only	4	1.36	0.84	2.20	40.73	5.06	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	6	1.27	0.94	1.71	16.04	5.95	<0.001
	Pooled RR Victimisation including Victim-Perpetration	9	1.36	0.76	2.44	68.91	25.73	<0.001
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration [c]	**11**	**1.27**	**0.82**	**1.95**	63.35	27.29	<0.001

[a] Odds ratios (ORs) for bullying experience and substance use: ORs from original papers converted to RR estimates [23]; Included studies reported either traditional bullying only, cyberbullying only, traditional bullying and cyberbullying as a single estimate, or traditional bullying and cyberbullying as separate estimates (both estimates included); If studies reported two or more levels of frequency, higher level of frequency included.

[b] Where studies adjusted for demographics, environmental factors and family factors separately and/or some variables combined, best adjusted estimates were included.

[c] For further analyses, RR estimates based on best adjusted and informed by the greatest number of data points were used to calculate PAFs.

Table S8: Relative Risk (RR) estimates for bullying victimisation and poor academic achievement from meta-analyses [a]

Adjustment status	Included or not included OR=RR assumption	Data points	Pooled RR	Lo95%CI	Hi95%CI	I^2 (%)	Cochran's Q	Test for Heterogeneity (*p*-Value)
Unadjusted	Pooled RR Victimisation only	2	1.25	1.03	1.52	0	0.37	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	3	1.31	0.93	1.84	57.97	4.75	<0.001
	Pooled RR Victimisation including Victim-Perpetration	-	-	-	-	-	-	-
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	-	-	-	-	-	-	-
Adjusted for demographic, family and other environmental factors [b]	Pooled RR Victimisation only	2	1.18	0.83	1.68	71.90	3.55	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	3	1.11	0.86	1.43	56.00	4.54	<0.001
	Pooled RR Victimisation including Victim-Perpetration	-	-	-	-	-	-	-
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration [c]	**4**	**1.22**	**0.95**	**1.58**	63.15	8.14	<0.001
Adjusted for psychological problems at baseline	Pooled RR Victimisation only	-	-	-	-	-	-	-
	Pooled RR Victimisation only, including OR=RR assumption	-	-	-	-	-	-	-
	Pooled RR Victimisation including Victim-Perpetration	-	-	-	-	-	-	-
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	**-**	**-**	**-**	**-**	-	-	-

[a] Odds ratios (ORs) for bullying experience and substance use: ORs from original papers converted to RR estimates [23]; Included studies reported either traditional bullying only, cyberbullying only, traditional bullying and cyberbullying as a single estimate, or traditional bullying and cyberbullying as separate estimates (both estimates included); If studies reported two or more levels of frequency, higher level of frequency included.

[b] Where studies adjusted for demographics, environmental factors and family factors separately and/or some variables combined, best adjusted estimates were included.

[c] For further analyses, RR estimates based on best adjusted and informed by the most number of data points were used to calculate PAFs.

Table S9: Relative Risk (RR) estimates for bullying victimisation and criminality from meta-analyses [c]

Adjustment status	Included or not included OR=RR assumption	Data points	Pooled RR	Lo95%CI	Hi95%CI	I^2 (%)	Cochran's Q	Test for Heterogeneity (*p*-Value)
Unadjusted	Pooled RR Victimisation only	3	1.03	0.75	1.41	0	0.38	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	6	0.86	0.57	1.31	50.29	10.05	<0.001
	Pooled RR Victimisation including Victim-Perpetration	6	1.41	0.84	2.36	65.20	14.37	<0.001
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	12	1.23	0.77	1.97	68.31	34.71	<0.001
Adjusted for demographic, family and other environmental factors [b]	Pooled RR Victimisation only	8	1.12	0.87	1.45	69.68	23.09	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	-	-	-	-	-	-	-
	Pooled RR Victimisation including Victim-Perpetration	10	1.14	0.87	1.49	69.57	29.57	<0.001
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration	-	-	-	-	-	-	-
Adjusted for psychological problems and/or criminality at baseline	Pooled RR Victimisation only	6	0.98	0.79	1.22	49.20	9.84	<0.001
	Pooled RR Victimisation only, including OR=RR assumption	9	0.96	0.74	1.25	54.49	17.57	<0.001
	Pooled RR Victimisation including Victim-Perpetration	-	-	-	-	-	-	-
	Pooled RR including OR=RR assumption/Victimisation including Victim-Perpetration [c]	**11**	**0.96**	**0.76**	**1.21**	43.41	17.67	<0.001

[a] Odds ratios (ORs) for bullying experience and substance use: ORs from original papers converted to RR estimates [23]; Included studies reported either traditional bullying only, cyberbullying only, traditional bullying and cyberbullying as a single estimate, or traditional bullying and cyberbullying as separate estimates (both estimates included); If studies reported two or more levels of frequency, higher level of frequency included.

[b] Where studies adjusted for demographics, environmental factors and family factors separately and/or some variables combined, best adjusted estimates were included.

[c] For further analyses, RR estimates based on best adjusted and informed by the greatest number of data points were used to calculate PAFs.