Applied Health Economics and Health Policy
https://doi.org/10.1007/s40258-021-00676-y

ORIGINAL RESEARCH ARTICLE

Economic Evaluation of an Intervention Designed to Reduce Bullying in Australian Schools

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Accepted: 20 July 2021

Abstract

Background There is a shortage of information on the costs and benefits of anti-bullying programs implemented in Australia. Information on the costs and benefits of anti-bullying programs is vital to assist policy making regarding the adoption of these programs. The aim of this study was to estimate the changes to costs and health benefits of implementing the "Friendly Schools Friendly Families" (FSFF) anti-bullying intervention in Australia.

Methods A societal perspective cost-effectiveness analysis was undertaken based on randomised controlled trial data for an anti-bullying intervention implemented in primary schools in Western Australia. The modelling strategy addressed changes to costs comprising intervention costs, less cost-savings, and then changes to health benefits measured by avoidable disability-adjusted life years (DALYs). Costs and health benefits were identified, measured, and valued in 2016 Australian dollars. Intermediate events modelled included anxiety disorders, depressive disorders, intentional self-harm, cost-savings accrued by educator time, and reduced productivity losses for carers associated with absenteeism. Uncertainty analysis and scenario analyses were also conducted.

Results The prevalence of bullying victimisation was reduced by 18% by the Friendly Schools Friendly Families anti-bullying intervention. At a national level, this is expected to result in the avoidance of 9114 DALYs (95% CI 8770–9459) and cost-savings of A$120 million per year. The majority of cost-savings were associated with the reduction in mental healthcare. The model results demonstrated that the FSFF anti-bullying intervention is likely to be a cost-effective approach to reduce bullying in Australia, relative to a threshold of A$50,000 per DALY averted, with an ICER of A$1646.

Conclusions The Friendly Schools Friendly Families anti-bullying intervention represents a good investment compared to usual activities for the management of child and adolescent bullying in Australia. The investment and implementation of evidence-based interventions that reduce bullying victimisation and bullying perpetration in schools could reduce the economic burden associated with common mental health disorders and thereby improve the health of many Australians.

Key Points for Decision Makers

Potential economic and health benefits could arise from the implementation of programs to reduce bullying victimisation in Australia.

The investment and implementation of evidence-based interventions that reduce bullying incidences in schools should reduce the economic burden associated with common mental health disorders and thereby improve the health of many Australians.

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Published online: 09 August 2021

1 Introduction

Bullying during childhood and adolescence is defined as negative behaviour involving one or more individuals that includes intention to harm, repetition and a power imbalance between a target and the perpetrator(s) [1, 2]. Approximately 15% of Australian children and adolescents have experienced bullying victimisation every few weeks or more often within the preceding 12 months, which is similar to other high-income countries [3]. Evidence suggests experiences of bullying victimisation are causally associated with the later development of mental disorders [4, 5], which are burdensome and costly to society as a whole [6]. The negative consequences of bullying victimisation are not limited to mental health problems nor to experiences in childhood and adolescence and can persist into adulthood. Bullying victimisation contributes a significant proportion of the burden of disease due to common mental disorders, including depressive and anxiety disorders [5, 7]. Bullying victimisation is associated with an increased risk of later development of negative health and non-health outcomes [4] and results in costs to the economy [8]. 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 A$1.8 billion [9]. Another study estimated annual expenditure in 2016 on health and non-health outcomes attributable to child and adolescent bullying victimisation as being A$763 million [10].

Meta-analysis suggest that on average intervention programs reduce school bullying victimisation by 16% [11] and cyberbullying victimisation by 14% [12]. Anti-bullying interventions need to have universal components aimed at all students and their family members, as well as targeted interventions for students involved in bullying [13]. The Friendly Schools Friendly Families (FSFF) project is a whole school and system-based approach to social and emotional learning and bullying prevention and management with capacity-building support and active parent involvement. Friendly Schools anti-bullying initiative has been developed through broad research over 20 years and more than ten large empirical trials with around 30,000 children and adolescents in Australia [14]. In the past decade, the FSFF program was evaluated in seven cluster-randomised controlled trials. Of these, all but two have found significant effects in reducing bullying amongst primary students [15, 16] and secondary students [17–19], with effect sizes ranging up to 0.31 for victimisation [15] and 0.35 for bullying perpetration [19]. The latter two studies are a 3-year randomised control trial and an age-cohort study conducted in Australian schools. Results from both studies showed a significant decrease in an increasing trend of bullying experience when the FSFF student curriculum was taught compared to the usual curriculum [15, 19]. The two trials that did not show significant effects were a trial of a pre-primary aggression prevention program (unpublished), and a recent effectiveness trial that faced significant implementation problems [20]. Moreover, 3000 schools in Australia and some schools in Singapore, New Zealand, the USA and the UK have used/are using the Friendly Schools resources since they were first released in 2005.

Research on the cost-effectiveness of anti-bullying interventions is useful for policy making. Few economic evaluations of an anti-bullying program have been conducted globally. A US study demonstrated how savings were achieved for the healthcare and school environments [21]. The authors estimated that preventing high school bullying results in lifetime cost-savings of more than $1.4 million per individual [21]. Another study demonstrated that the KiVa anti-bullying program in the Netherlands generated a return-on-investment (ROI) of €4.04–€6.72, indicating that for every €1 invested €4–€7 would be gained [22]. The cost-effectiveness of the KiVa bullying prevention program was analysed and estimated to be 7879 SEK (€829) for each additional victim-free year gained and 131,321 SEK (€13,823) for each additional QALY gained [23]. The Olweus Bullying Prevention Program (OBPP) had been evaluated in a decision-making context of a Swedish secondary school and the incremental cost-effectiveness ratio was estimated to be 131,250 SEK per spared victim of bullying (€14,470), which was shown to be cost-effective compared to a published and relevant threshold value [24]. Australian researchers evaluated a ROI of implementing the Friendly Schools Friendly Family (FSFF) and generated a positive ROI of A$1.56–A$2.22, indicating that the total monetary benefits would exceed total costs after implementing FSFF [25]. A ROI calculation accommodates medical costs averted with improved health, but monetary values of disability-adjusted life years averted or of intangible effects such as increased well-being cannot be accounted for [26].

Globally, anti-bullying programs have not been evaluated in terms of the changes to costs and health benefits measured by DALYs. The current study aimed to estimate the changes to total costs and health outcomes, measured by DALYs of a primary school-based anti-bullying intervention known as the *Friendly Schools Friendly Families* in the Australian setting [15].

2 Method

This analysis followed the guidelines presented in the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) [27] checklist shown in Online Appendix 1.

2.1 Description of Intervention and Usual Activities

Anti-bullying intervention: The Friendly Schools Friendly Families (FSFF) project, a part of Anti-bullying Initiative-Friendly Schools, is a whole-school and system-based approach to social and emotional development and bullying prevention and management with capacity-building support and active parent involvement. The data from the FSFF program reflect one of seven cluster-randomised controlled trials published in the past decade and represent the best data available to conduct this study. The program was implemented in 20 primary schools in the state of Western Australian (WA) [15].

Usual activities: Usual activities refer to a situation where students are not involved in the activities listed under the intervention program. Under usual school program, there was no capacity support nor parent involvement. Detailed intervention activities are described in Online Appendix 2.

2.2 Economic Evaluation Overview

A cost-effectiveness analysis comparing the intervention with usual activities from a societal perspective was conducted. It was assumed that the intervention will replace the usual activities. The analysis included cost-avoidance associated with healthcare services related to anxiety disorders, depressive disorders and intentional self-harm, and cost-savings accrued relating to educator time, and reduced productivity losses for carers associated with absenteeism due to bullying victimisation. Avoidable DALYs were also estimated. A model for this study was developed and is shown in Fig. 1.

All costs and cost-savings are expressed in 2016 Australian dollars using actual data from the implementation period between 2002 and 2004. Costs were adjusted to the reference year using a standard cost converter tool [28]. To determine whether interventions should be deemed 'cost-effective' or not, a threshold of A$50,000 per DALY was used, as per a previously published study [29]. This threshold has been used in previous studies and appears to be acceptable to Australian decision makers [29]. A calculation in Microsoft Excel was programmed to estimate costs and DALYs over a year as well as a 10-year period. The 10-year time horizon reflects the long-term outcomes associated with anxiety, depression, and intentional self-harm, and were used as the measures of benefit in this economic evaluation. An advantage of decision-analytic models such as ours is that they are flexible and can be easily updated with new information—a 10-year time-horizon represents a longer follow-up than would be possible with a clinical trial, giving decision-makers a wider variety of information with which to inform their decisions. A discount rate of 3.5% was applied to costs [30]. Discounting was not applied to DALYs to comply with Global Burden of

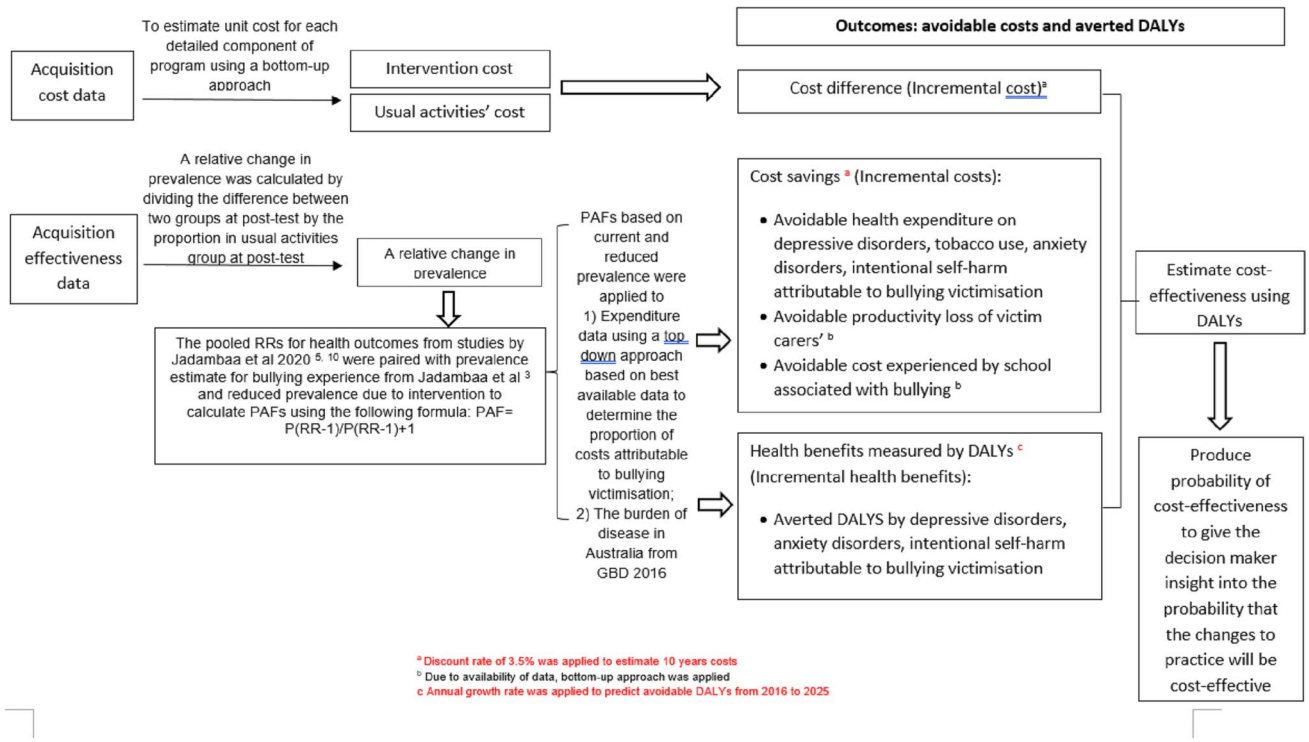

Fig. 1 Model for health benefits and cost changes due to anti-bullying intervention

Disease (GBD) studies [31]. Each step of the methodology is outlined in the following sections.

2.3 Collecting Cost Data and Estimating National Level Cost

Costs associated with the intervention and usual activities were identified, measured and valued in 2016 Australian dollars (Online Appendix 2). Program costs were identified after collaboration with the FSFF research team, drawing on published component costs from national sources such as the Australian Bureau of Statistics (ABS), and Australian CENSUS. A bottom-up approach, which estimates unit costs for each detailed component of the program, was used to calculate costs. Intervention costs were estimated for each component listed in Online Appendix 2 using the average wage rate, unemployment rate, real cost of materials including curriculum books, parent booklet, guidebook, poster pack and implementation road map. It was assumed that six people were on a project team for each school and one parent or caregiver from each family was involved in the program [32, 33]. The costs of usual activities were estimated for four activities listed in Table 2, Online Appendix 2. To calculate costs associated with time spent managing bullying incidents we used the average wage rate for staff, principal as well as parents, and contemporary prevalence of bullying victimisation. It was assumed that the school principal spends 5 h per annum documenting and reviewing behaviour management documents and 1 h per incident. Calculation was based on a hypothetical primary school consisting of 410 students and 26 teaching staff, developed to reflect the 'average primary school' in Australia [34]. To estimate national level costs, all identified and measured costs were adjusted to this hypothetical school then multiplied by the total number of primary schools in Australia, which equals to 6240—including independent, catholic and government schools [34].

2.4 Collecting Effectiveness Data and Estimating Reduced Prevalence

For this study, the proportion of students involved in bullying as victims were estimated in the intervention and usual activities groups using data obtained from the FSFF program protocol. A relative change in prevalence was calculated by dividing the difference between two groups at post-test by the proportion in usual activities group at post-test [(19–23%)/19%] (Table 1). The raw data are drawn from a randomised control trial study in which no difference between the study conditions with regard to student gender and school size was found [15]. Consequently, the baseline difference was not adjusted according to these conditions. As previously mentioned, the bullying definition adopted in the current study recognises that repetition is one of the three core characteristics of bullying. Consequently the estimated relative prevalence change in frequent bullying victimisation was applied to the self-reported lifetime prevalence of bullying victimisation—18.90% [95% CI 10.50–28.98] from a previously published systematic review and meta-analysis by study authors [3] to estimate the reduced prevalence of bullying victimisation after implementation of the intervention.

2.5 Estimating Cost Avoidance and Avoidable Disability-Adjusted Life Years (DALYs)

2.5.1 Estimating the Reduced Prevalence of Bullying Victimisation

To estimate the reduced prevalence of bullying victimisation with intervention, the estimated relative prevalence change was applied to the self-reported lifetime prevalence of bullying victimisation [3]. This study estimated the cross-section of costs incurred in 1 year as a result of bullying victimisation during childhood or adolescence and then based on estimation this study projected 10 years' intervention costs and avoidable DALYs. Hence, lifetime prevalence was chosen to encompass anyone in 2016 who may have experienced the attributable effects of child and adolescent bullying victimisation.

2.5.2 Estimating the Reduced Expenditure

For the reduced annual health expenditure on anxiety disorders, depressive disorders, intentional self-harm and tobacco use the top-down method was used. Firstly, the reduced lifetime prevalence was paired with pooled relative risks from meta-analytic studies [5, 10] to estimate the reduced

Table 1 Effectiveness of anti-bullying intervention (unpublished data drawn from previously published studies [14, 15] and FSFF research team)

Frequency of bullying	Intervention		Usual activities		Relative prevalence change (%)
	At baseline (n = 879)	Post-test[a] (n = 737)	At baseline (n = 961)	Post-test[a] (n = 734)	
Frequently (every 2–3 weeks or more)	146 (17%)	138 (19%)	146 (15%)	168 (23%)	− 18
1–2 times a term	268 (30%)	249 (34%)	302 (31%)	288 (39%)	− 14

[a]After 1.5 years

population attributable fractions (PAFs). Then these PAFs were applied to expenditure data to determine the proportion of costs attributable to bullying victimisation. The AIHW Health Expenditure reports were used as a source of annual expenditure on these outcomes [35–38].

The two remaining outcomes, productivity losses for victims' caregivers and education costs, were estimated by applying a bottom-up method. For the productivity loss of victim-carers, the estimated relative prevalence change was applied to the number of children aged between 10 and 14 years who stayed away from school at least once during the past school year due to bullying victimisation [10]. The percentage of children who stayed away from school at least once or twice during the past school term due to bullying victimisation (23.6%) [39] was applied to the reduced number of bullied children aged between 10 and 14 years in 2016 and multiplied by the annual number of school terms. It was estimated that implementation of FSFF achieved a reduction from 53,415 to 43,800 children aged between 10 and 14 years who stayed away from school at least once due do bullying victimisation 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 were required to look after them for those days. The unemployment rate was reported as 6.9% in 2016 [32]. In 2016, the national minimum wage was A$141.6 per day [40]. This daily wage estimate was multiplied by the total number of days when employed adults looked after their children due to bullying victimisation to estimate a best estimate of annual attributable productivity loss for the parents or carers of bullying victims, after implementation of the intervention [32]. All of these assumptions and methods were used in a previously published study [10]. For costs experienced by the school, the estimated relative prevalence change was applied to the total number of hours spent on bullying victimisation incidents by staff [10]. To estimate the reduced annual costs experienced by school staff after the implementation of the intervention, the reduced number of hours spent on bullying victimisation incident was paired with the average school staff wage [41, 42].

2.5.3 Estimating Avoidable DALYS

We used a two-step process to calculate attributable DALYs with and without an anti-bullying intervention. The PAFs for anxiety disorders, depressive disorders, and intentional self-harm were estimated twice—first, to represent PAFs before implementation of an anti-bullying intervention, we paired prevalence estimates from a previously published study [3] with relative risks from previously published studies [5, 10]. Second, to represent PAFs after implementation of an anti-bullying intervention, we paired a reduced prevalence, estimated in Sect. 2.5.1, with relative risks from previously published studies [5, 10]. To calculate attributable DALYs, we applied both pre- and post-intervention PAFs estimates to the 2016 burden of disease in Australia, using the global burden of disease study [43]. The burden of disease data from 2007 to 2016 were used to calculate annual growth rate using the following formula:

$$\text{Average annual growth rate} = \sqrt[n]{\frac{P_n}{P_0}} - 1$$

P_n number of cases at the end of period; P_0 number of cases at the start of period; n number of years

Then this estimated annual growth rate was applied to predict avoidable DALYs from 2016 to 2025. In summary, we calculated that avoided DALYs increase year on year.

2.6 Sensitivity Analyses

Monte Carlo simulation-modelling using MS EXCEL software were used to calculate uncertainty producing 10,000 pairs of prevalence of exposure and relative risks. All model parameters were specified with prior uncertain distributions. The prevalence of exposure and relative risks were assigned a normal distribution [44]. Before assigning distribution, relative risks were converted into log scales. The change to intervention costs and the change to averted DALYs was recorded for each model simulation, producing 10,000 pairs of incremental costs and effects. The interpretation of cost-effectiveness is based on the willingness-to-pay (WTP) threshold of A$50,000 per DALY, which has been used in previous studies for the Australian setting [29]. The WTP threshold of A$50,000 per DALY aligns with an implicit WTP threshold used by the Australian Pharmaceutical Benefits Advisory Committee (PBAC) [45, 46]. The incremental net monetary benefit (INMB) framework was used to simplify the ratio of change to costs over health benefits to a linear outcome using the following formula:

$$\text{INMB} = (\text{change in effects} \times \text{WTP threshold}) - \text{change in costs}$$

A positive INMB indicates that an intervention is cost-effective and a negative INMB indicates that an intervention is not cost-effective. It gives decision makers a clear framework for interpretation.

Univariate sensitivity analysis was performed to test the robustness of final cost-effectiveness outcomes to ± 10% changes around input parameter values, with results presented on a tornado plot. Additionally, sensitivity analysis was conducted using a fixed discount rate of 5% to reflect local guideline [47].

2.7 Scenario Analysis

Uncertainties in other aspects of the evaluation, such as under- or overestimates, also exist, and were explored through scenario analyses. Different intervention scenarios were examined when key parameters of the model were changed. Three alternative scenarios were considered: (1) the intervention cost was doubled to simulate significant underestimation of the intervention's real cost, (2) effectiveness was reduced by half to assume reduced effectiveness of the intervention due to unpredicted influences, and (3) principals' time spent managing bullying situations doubled in usual activities to simulate significant underestimation of the usual management's real cost. To test the robustness of the model and provide more broad information to decision-makers [48], some key parameter values in the model were altered to reflect plausible changes that may occur in a different local setting (Online Appendix 3).

3 Results

3.1 Effectiveness Analysis

Table 1 shows the effectiveness of the FSFF intervention and usual activities. The prevalence of frequent bullying victimisation after program implementation was estimated to be 19% for students involved in the intervention, and 23% for students who were involved in usual activities. Relative prevalence reduction was 18% for students who were frequently victimised and 14% for students who were victimised once to twice a school term (i.e., approx. 10 weeks). The findings indicated that there is a significant decrease in prevalence of bullying victimisation reported in the intervention group compared to those in the usual activities group.

3.2 Fixed-Value Analysis

The fixed-value results of the decision-analytic model are shown in Table 2. At a nation-wide level, the annual cost of usual activities is A$135 million lower than the annual cost of the intervention. If the intervention was applied to the whole nation, the cost of treating the later development of mental disorders attributable to bullying victimisation decline by A$120 million per annum. Overall, the total reduced costs including mental health-system costs, productivity losses of victim-carers, and costs experienced by schools associated with childhood bullying was A$1 billion and accounted for 96,890 avoidable DALYs over 10 years. More detailed analysis and the confidence intervals around parameter estimates have been added in tabular format in Table 2, Online Appendix 3.

Using the incremental cost and incremental health benefit to assess cost-effectiveness, the results confirm that the

Table 2 Costs and outcomes of implementing anti-bullying programs—Friendly Schools Friendly Families to whole nation during the 10-year period from 2016

	Intervention	Usual activities	In 2016	In 10 years
			Differences between intervention and usual activities groups	
Prevalence of bullying victimization	15.50% [95% CI 8.61–23.76]	18.90% [95% CI 10.50–28.98]	Relative prevalence 18%	Assumed to be same for each year
Intervention cost	A$226,393,404[a]	A$91,725,613	A$134,667,791	A$1,031,509,225[b]
Total expenditure on health outcome associated with bullying victimisation (95% CIs)	A$628,677,051 (623,873,535–633,480,568)	A$745,891,158 (740,303,581- –751,478,735)	– A$117,214,107 (112,772,031- –121,656,182)	– A$1,003,747,013[b]
Total expenditure on non-health outcome associated with bullying victimisation (95% CIs)	A$11,122,090 (11,083,973–11,160,206)	A$13,569,566 (13,522,641- –13,616,490)	– A$2,447,476 (2,396,460- –2,498,492)	– A$20,958,627[b]
			Change to attributable disease burden	Change to avoidable disease burden
DALYs attributable to bullying victimisation (95% CIs)	50,317 (49,954–50,679)	59,431 (59,012–59,850)	9114 (8770–9459)	96,890[c]

[a]Some activities were organised at the beginning only

[b]Discounted at 3.5%[30]

[c]Average annual growth rate was applied

FSFF anti-bullying intervention is likely to be a cost-effective approach to reduce bullying in Australia, relative to a threshold of A$50,000 per DALY averted, with an ICER of A$1646.

3.3 Probabilistic Sensitivity Analysis

The probability of cost-effectiveness at different WTP thresholds as well as the incremental net monetary benefits changes when different WTP thresholds were estimated. These are presented in Online Appendix 3. The cost-effectiveness acceptability curve in Online Appendix 3 shows at a threshold of A$10,000 it is 75% probable that FSFF is cost-effective, and at a threshold of A$20,000 it is 94% probable. The results of the univariate sensitivity analysis are also presented in Online Appendix 3. A ± 10% change in the parameters for usual activities such as productivity loss of victim-carers, expenditure on tobacco use, and depressive disorders attributable to bullying victimisation led to the greatest impact on the resulting ICERs. The next largest impact on the ICER was when averted DALYs and expenditure on depressive disorders attributable to bullying victimisation for intervention were changed by ± 10%. Additionally, the result of sensitivity analysis using a fixed discount rate of 5% is presented in Table 1, Online Appendix 3.

3.4 Scenario Analyses

The results of scenario analyses are summarised in Table 3. The FSFF intervention was the optimal strategy for all scenarios with the probability that the intervention is cost-effective in more than 90% of all 10,000 simulations in all scenarios (Table 3 and Fig. 2).

4 Discussion

This study illustrates the potential economic and health benefits that could arise from the implementation of evidence-based programs to reduce bullying victimisation in Australia and provides detailed cost-saving estimates associated with bullying victimisation that have not previously been established. The focus of this economic evaluation has been to provide evidence about the value for money of an

Table 3 Results from probabilistic sensitivity analysis, including scenario analyses

Model	Average ICER (95% CI) A$ per DALY averted	Mean NMB (Min : Max)	Probability of being less than A$50,000 per DALY averted (%)
Baseline	1,646 (95% CI 1,486–1,933)	A$444,856,293 (A$197,976,309–A$688,942,789)	100
Intervention cost doubled (scenario 1)	26,486 (95% CI 26,429–26,943)	A$213,876,319 (– A$64,918,724 to A$483,197,439)	96
Effectiveness reduced by half (scenario 2)	16,206 (95% CI 15,863–16,813)	A$151,121,292 (– A$113,061,746 to A$416,587,891)	91
Principals' spending hours on bullying doubled in usual activities (scenario 3)	Dominant	A$516,976,997 (A$264,155,929–A$782,307,929)	100

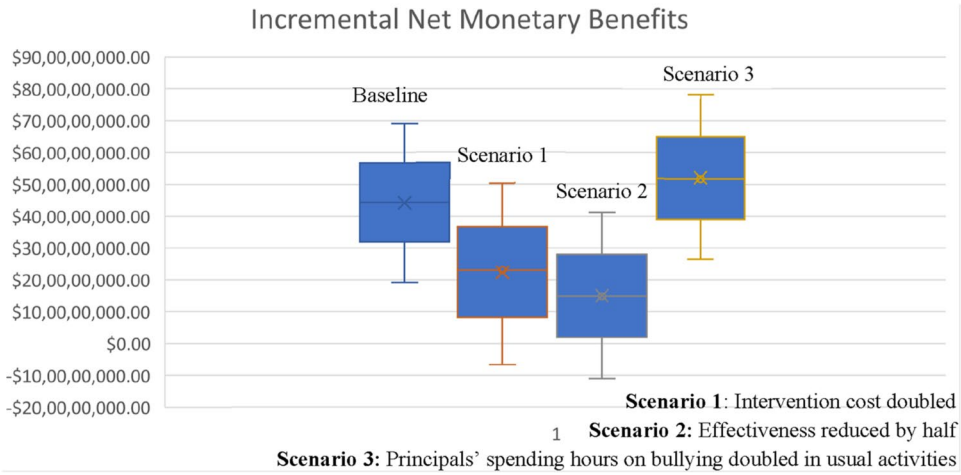

Fig. 2 Incremental net monetary benefits for baseline and scenarios.

anti-bullying intervention to inform public policy and decision-making in Australia. This study shows that FSFF anti-bullying intervention provides good value for money when compared to usual activities and resulted in health improvements, indicated by a large number of averted DALYs. The cost-savings and averted DALYs were driven by a reduction in the prevalence of bullying victimisation as a result of the implementation of an effective anti-bullying intervention when compared with the prevalence of bullying victimisation without an anti-bullying intervention. This reasoning is evidenced by the following findings.

As previously mentioned, FSFF was evaluated in an age-cohort study as well as in a 3-year randomised control trial conducted in Australian schools, and both studies found a significant decrease in reported bullying experience when the FSFF student curriculum was taught compared to the usual curriculum [15, 49]. The current study confirms that the prevalence of bullying victimisation has been reduced by 18% as a result of the implementation of FSFF. This result is also consistent with a meta-analytic study of anti-bullying interventions, which reports interventions can reduce bullying victimisation by approximately 16% [11]. Even though this study shows usual activities were A$22,150 cheaper (per model school, per annum; Online Appendix 2) than FSFF anti-bullying interventions, implementing the effective intervention would result in the annual avoidance of 9114 DALYs due to anxiety disorders, depressive disorders and intentional self-harm in both sexes and across all ages in Australia. If this effective anti-bullying intervention was applied to the whole nation, it would result in a saving of A$120 million a year in Australian healthcare expenditure on anxiety and depressive disorders, intentional self-harm, and tobacco use, as well as a reduction in costs borne by schools associated with childhood bullying and the productivity loss of bullying victims' carers. The most important contributors to cost savings were associated with the mental healthcare system.

Economic arguments are highly influential in progressing policy reform and action in areas such as child protection and childhood development [50, 51]. There are few studies evaluating anti-bullying interventions from an economic perspective [21, 22]. Recently, Australian researchers evaluated return on investment of implementing the FSFF and found total cost benefits exceed total intervention costs [25]. The findings of the current study cannot be compared directly to this study because of the different methods used. However, the current study adds to the findings of previous studies by demonstrating a substantial annual cost to society and a significant health benefit could be saved via implementing an effective anti-bullying intervention.

At the assumed decision-makers' threshold of A$50,000/DALY averted, the intervention is likely to be cost-effective. This means that FFSF can be considered as the optimal intervention to reduce bullying experience among children and adolescents in Australia, compared with usual activities. The modified scenario analyses show that the error probability associated with this decision increases as the intervention cost increases and effectiveness of intervention decreases.

4.1 Strengths and Limitations

A core strength of the study is its data obtained from a prospective group randomised controlled trial (RCT) study conducted in Australia [15]. The advantage of an RCT is that bias is essentially eliminated by the simple act of randomisation [52]. Consequently, analysis of RCT data is considered the gold standard for evaluating efficacy in implementation programs [53]. Another strength of this study is that several data on equipment cost and human cost of intervention were sourced from a current price list from catalogues that sell Friendly Schools social and emotional learning and anti-bullying resources and current estimates for the average wage rate and unemployment rate in Australia. These contemporary data sources make the costs reasonable and generalisable.

A key limitation of the current study is that the results are specific to the implementation of bullying intervention among primary school-aged children (e.g., 9–11 years). A series of biological and cognitive changes occur during adolescence [54]. These changes likely lead to age-related differences in both the prevalence of bullying victimisation experiences as well as the effectiveness of an anti-bullying program. Researchers have conducted a meta-analysis of studies that administered the same program to multiple age groups and measured the magnitude of bullying experience. However, this meta-analytic evidence found that effectiveness seems to decrease significantly after the age of 13 years [55]; other studies found that anti-bullying intervention had a positive impact on student bullying and health and well-being outcomes after the school transition that occurs as students move from primary to secondary school [18, 49]. Given age is an important factor, age-specific anti-bullying programs should continue to be evaluated. A further limitation is that the estimates of reduction in bullying victimisation used in this study were achieved with the FSFF program between 2002 and 2004. In the past decade, there has been significantly increased awareness in Australia of the harmful effects of bullying victimisation. Reductions achieved with FSFF compared to usual activities in 2021 may be different to those from 17 years ago. The model covers a 10-year timespan, so we did not project costs and outcomes beyond this period and use a life-time horizon. Furthermore, the impact of bullying victimisation 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. In this study, pooled relative

risks (RRs) adjusted for baseline mental health outcomes from longitudinal cohort studies [5] were employed; it is important to note that there is a lack of strong experimental or quasi-experimental evidence study to check causal effect of bullying on mental outcomes. Also, it is important to note that several assumptions were used in this study. This may lead to either over- or underestimation. For example, the program has equal effectiveness in all primary schools and across different grade levels. A conservative approach was used for the treatment effect of anti-bullying intervention. It means relative change in prevalence was used as a treatment effect instead of absolute change in prevalence, which is more than relative change. This conservative approach may lead to underestimation. Future evaluation studies are needed to address these limitations.

5 Conclusion

This study provides some evidence of cost-effectiveness from the Friendly Schools Friendly Families anti-bullying intervention, and that mental health outcomes are likely to be improved. This information should promote decisions that address efficiency in resource allocation by governments. There are caveats and assumptions associated with this work that indicate the results should be interpreted with some caution. But this reflects the reality of pragmatic research for complex public policy questions. On balance we suggest the results support further investment in anti-bullying intervention.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s40258-021-00676-y.

Funding This research is part of Amarzaya Jadambaa's PhD project, which is funded by a Queensland University of Technology Postgraduate Research Award (QUTPRA) and a Faculty Write Up Scholarship, QUT. James Scott was supported by a National Health and Medical Research Council (NHMRC) Practitioner Fellowship Grant #1105807 for prevention of youth mental illness. Donna Cross was supported by a NHMRC Research Fellowship Grant #1119339.The funders had no role in the design of the study and data collection, analysis and interpretation of results, and in writing the manuscript or submitting it for publication. The authors wish to thank Erin Erceg and Melanie Epstein, of Telethon Kids Institute, for assistance in acquisition of cost data and Prof. Elizabeth Geelhoed, of the University of Western Australia, for reviewing the manuscript from an economic evaluation perspective.

Declarations

Conflict of interests Amarzaya Jadambaa, Nicholas Graves, Donna Cross, Rosana Pacella, Hannah J Thomas, James G Scott, Qinglu Cheng and David Brain declare that they have no conflicts of interest.

Availability of data and material The data used for the study are provided as Online Supplementary Material. More detailed data will be provided upon request.

Code availability The developed model is available as Fig. 1.

Authors' contributions Conception and design of work: AJ, RP, DB. Data collection: AJ, DC, DB. Data analyses and interpretation: AJ, DB, NG, QC, RP. Drafting the article: AJ, DB. Critical revision of the article: AJ, DC, NG, RP, HT, JS, QC, DB. Final approval for publication: AJ, DC, NG, RP, HT, JS, QC, DB.

Ethics approval Not applicable.

Consent to participate Not applicable.

Consent for publication Not applicable.

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