

TITLE: Cost-utility analysis of a complex intervention to reduce school-based bullying and aggression: an analysis of the INCLUSIVE RCT

HIGHLIGHTS

What is already known on the topic?

Two previous cost-effectiveness studies of bullying interventions in schools in Sweden have concluded that these would be cost-effective and a further study in Northern Ireland assessed the impact on prosocial behaviour. However, these studies lacked evidence on the treatment effect on bullying from an RCT.

What does the paper add to existing knowledge?

This study provides strong evidence collected prospectively from a large randomised study conducted in 40 schools in the UK that this intervention is highly cost-effective over three years.

What insights does this paper provide for informing health care-related decision making?

Education- and health-sector policy-makers should consider investment in scaling up this intervention.

ABSTRACT

OBJECTIVES: Bullying and aggression among children and young people (CYP) are key public mental health priorities. In this study, we evaluated the cost-effectiveness of a complex school-based intervention to address these outcomes within a large cluster randomised trial (INCLUSIVE).

METHODS: Forty state secondary schools were randomly allocated (1:1) to receive the intervention or continue with current practice as controls. Data were collected using paper questionnaires completed in classrooms including measures of their health-related quality of life using the Childhood Utility Index (CHU-9D) and police and NHS resource use. Further detailed data were collected on the cost of delivering the intervention. We calculated incremental cost-effectiveness ratios following the intention-to-treat principle using multilevel linear regression models that allowed for clustering of pupils at the school level.

RESULTS: Overall we found that the intervention was highly cost-effective with cost-per-QALY thresholds of £13,284 and £1,875 at two years and three years respectively. Analysis of uncertainty in the result at two years revealed a 65% chance of being cost-effective, but after three years there was a 90% chance that it was cost-effective.

CONCLUSION: In conclusion, this study provides strong evidence collected prospectively from a randomised study that this school-based intervention is highly cost-effective. Education- and health-sector policy-makers should consider investment in scaling up this intervention.

INTRODUCTION

Bullying and aggression among children and young people (CYP) are key public mental health priorities. (1,2) A recent cluster randomised controlled trial (RCT) (INCLUSIVE) in 40 state secondary schools in England assessed the Learning Together (LT) intervention which involved students in efforts to modify their school environment using restorative approaches, student participation in policy, and a social and emotional skills classroom curriculum.(3) The study found that one of the primary outcomes, bullying victimisation (measured by the Gatehouse Bullying Scale), was significantly lower in intervention than control schools at 36 months (adjusted mean difference [95% CI];-0.03 [-0.06, 0.00]). The intervention also had significant effects on a range of secondary outcomes at 36 months; students in intervention schools had higher quality of life measured by the Paediatric Quality of Life Inventory (1.44 [0.07, 2.17];) and psychological wellbeing scores (0.33 [0.00, 0.66]); lower psychological total difficulties (SDQ) score (-0.54 [-0.83, -0.25]); and lower odds of having smoked (OR [95% CI]; 0.58 [0.43, 0.80]; drunk alcohol (0.72 [0.56, 0.92]; been offered or tried illicit drugs (0.51 [0.36, 0.73]); and being in contact with police in the past 12 months (0.74 [0.56, 0.97]. Full details of these findings are published elsewhere (3) In this paper, we report the cost-utility analysis conducted as an integral component of this trial.

Two previous cost-effectiveness studies of bullying interventions in schools in Sweden have concluded that these would be cost-effective. A Swedish study modelled the Olweus Bullying Prevention Program and found it to be cost-effective in reducing bullying (4). A second study modelled the cost-effectiveness of the KiVa anti-bullying programme and estimated a cost-effectiveness ratio of €13,823 per QALY which would be cost-effective in Sweden (5). However, both these studies lacked evidence on the treatment effect on bullying from an RCT. A further study in Northern Ireland assessed a school based programme in primary schools to improve prosocial behaviour and reduction in difficult behaviour and found this to be cost-effective (6). This economic evaluation was undertaken prospectively within a cluster RCT. The primary economic evaluation was a cost-consequence analysis which we have reported elsewhere (3). Here, we report the results of the cost-utility analysis using quality-adjusted life years as the outcome measure.

METHODS

Inclusive trial

The INCLUSIVE trial was a cluster RCT conducted in 40 state secondary schools in south-east England and the main trial report has been published elsewhere (3). Schools were randomly assigned to receive the 'Learning Together' intervention for a period of three years and compared with schools allocated to the control which continued with their current provision. The intervention involved: a) staff training in restorative practices (RP) to address interpersonal conflict and improve relationships; b) provision of a manual, an external facilitator (deployed for the first two but not the third year of intervention) and reports of survey data on student needs in that school to help convene an action group comprising a diverse group of at least six staff and sex students to help revise rules and policies; and c) a social and emotional skills classroom curriculum. The study population consisted of all students in the school at the end of year 7 (11-12 year-olds) at baseline, and at 24-months (end year 9) and 36-months (end year 10; 14-15 year-olds) follow-up, as well as school teaching and teaching assistant staff at each time point.

Eligible schools were mainstream secondary schools within the state education system not in special measures. All eligible schools in Greater London and surrounding counties were contacted. 40 schools agreed to take part and these were randomly allocated (1:1) with 3347 students in the control and 3320 students in the intervention arm. All schools in both control and intervention arm participated in data collection at baseline 24 and 36 months.

Paper questionnaires were completed in a classroom setting with trained researchers overseeing and teachers present to maintain order but unable to read student responses. A verbal explanation and written information and consent forms were provided before distribution of the questionnaires; only those students who gave written consent participated in the survey. Parents were also provided with written information and could withdraw their child from research if they wished. The paper questionnaire was informed by the results of an earlier pilot trial study (7).

Economic evaluation design

In planning the design of the economic evaluation, we drew from data in our pilot study. (7) These data suggested that there was only a weak correlation between the CHU-9D and the proposed primary outcome measures. Therefore, there was a concern that QALYs were unlikely to capture all of the intervention effects. We therefore planned to perform a cost-consequence analysis as the ‘primary analysis’, as recommended by NICE’s public health methods guidance (8) and this has been reported in the main trial paper. (3) We found the costs of trainers, facilitators, and school staff were an additional £47–58 per pupil in the intervention group compared with control schools over the 3 years. (3) It was also planned in our protocol to perform a cost-utility as a secondary analysis. (9) However, once the baseline data had been collected, we were able to conduct further analysis from the baseline participants of the trial and this showed that bullying and aggression were strongly correlated with health-related quality of life which supported conducting a cost utility analysis. (10)

Measurement of quality of life

The Child Health Utility (CHU) 9D measure (11) was used to assess health-related quality of life. This measure was chosen because it is a utility measure specifically developed for young people. The CHU-9D includes nine dimensions (worried, sad, pain, tired, annoyed, sleep, school, daily routine and activities), with each represented by a single question with five response options.

The CHU-9D questionnaire was incorporated into the questionnaire administered to all students in the trial at baseline, and 24 and 36 months. We calculated quality-adjusted life years (QALY) for each participant using tariffs (12) and used ‘area under the curve’ approach: that is, the weighted average of time spent in the study and health-related quality of life. (13)

Resource use measurement and costing

The cost analyses took a public-sector perspective following NICE’s methods guidelines (13). We used a public-sector perspective to cover education, NHS and police costs.

The costs of intervention (trainer, facilitator and staff costs) and costs of NHS and police resources by the students were considered. In calculating the total cost per school, the attribution of costs such as facilitator and staff time recognised that only a percentage of time would be spent on the year group forming the trial study population relative to the total number of students in each school. For the main trial analysis outcomes, the costs were expressed pro rata to the proportion of the total number of students in the school involved in the trial study

population. The only exception was that the curriculum was only delivered to the trial study population so these were costed at 100%.

We collected costs on the delivery of the intervention as incurred during the trial. The costs of the trainers' and facilitators' time were available from the trainers and facilitators invoices, which included preparation and organization time.

Staff time included the time staff spent dealing with bullying or aggression which was identified in the teacher survey. The amount of time spent with action groups was taken from the facilitator diary and, in addition, there were questions in a survey of action group members about the time involved in preparation for and follow-up of group actions. The staff time involved in curriculum delivery was taken from logs completed by teachers delivering the curriculum. The amount of time spent training was taken from diaries kept by the trainers and the number of teachers attending training was recorded on attendance sheets. In the interviews with staff we inquired whether the training was additional or instead of other training and, if the latter, what it had replaced.

Teacher salaries for each intervention and control school were obtained through the Department for Education (DfE) website. (2) To estimate an hourly rate, we divided salaries by the DfE statutory guidance on school teachers' pay and conditions document detailing the annual hours of work.

Student costs included data from the student surveys on NHS resource use in terms of visits and hospital stays, and policing costs associated with stops and arrests. The unit cost of inpatient stay in hospital was estimated as £298. (15) The unit cost of an NHS visit was calculated as the weighted average unit costs of GP consultation and outpatient visit. (15,16) The percentage of GP visits and outpatient visits as reported in other published study (17) were applied. The unit costs for police attendance were estimated as £267 for those who were not arrested and £457 for those who were arrested. These unit costs were obtained from previously published work. (18) Total costs up to 24 and 36 months were calculated by combining the resource use with unit costs. Where there were missing costs at the school level, we used mean imputation unless there was evidence from the process evaluation that these costs had not been incurred. There was missing health-related quality of life (and therefore QALY) and costs data for those students who did not complete the required items required for valuing the CHU-9D utility score and resource use items. The percentage of missing outcome data at each timepoint was: at 24 months: costs (14.59%), QALY (24.79%); at 36 months: cost (32.97%), QALY (37.08%). There was also missing data in baseline covariates that were used in the adjusted analysis. The percentage of missing data

in baseline covariates was: at 24 months: baseline costs (<1%), sex (<1%), ethnicity (<1%), family affluence (1.37%); at 36 months: baseline costs (<1%), sex (1.47%), ethnicity (<1%), family affluence (1.27%).

Modelling and adjustments for timing of costs and benefits

We considered the potential for longer-term modelling as part of the pilot phase and concluded that while there are longer-term implications for bullying, given limitations with current evidence, such an exercise would be likely to produce cost-effectiveness estimates that are so uncertain as to be of little practical use.

The time-horizon encompassed costs and outcomes within the trial. We conducted the analysis at two years (for the period where an external facilitator supported intervention), and at three years (when schools implemented the intervention without external support). All costs and outcomes were discounted at 3.5%.

Statistical analysis and uncertainty

The cost-utility analysis followed the intention-to-treat principle and used multilevel linear regression models that allowed for clustering of pupils at school level (19) to report mean (95% CI) incremental costs and QALYs of the intervention compared to standard practice at 24 and 36 months. The cost-utility analysis also allowed for correlation between costs and QALYs (20) to report mean (95% CI) incremental costs and QALYs of the interventions compared to standard practice at 24 and 36 months. These missing data in costs and QALY at each time point were handled by multilevel bivariate linear regression model, assuming that missing QALY and costs data were ‘missing at random’, conditional on the baseline covariates included in the adjusted analysis model (21) .

The cost-utility analyses reported unadjusted and adjusted differences in mean (95% CI) costs and outcomes (mentioned above) between trial arms. In the adjusted analysis, the following baseline variables were adjusted for: baseline measures of outcomes, sex, ethnicity, family affluence and school-level stratifying factors (single-sex versus mixed-sex school; school-level deprivation measured by percentage of students eligible for free school meals; and school-level attainment as measured by each student’s ‘best eight’ examination attainment in GCSE exams accounting for student attainment on entry to the school).

The differences in average costs and QALYs between trial arms were used to calculate the incremental cost-effectiveness ratio (ICER) of the intervention versus standard practices. These were compared with the National Institute for Clinical Excellence (NICE) threshold of £20,000 to £30,000 per QALY. We also reported cost-effectiveness acceptability curves, by calculating the probability that, compared to standard school-based

practices, the intervention is cost-effective given the data, at alternative levels of willingness to pay for a QALY gain. We also performed a number of sensitivity analysis, exploring the inclusion of police and NHS costs and the exclusion of costs of school staff time training.

RESULTS

Resource use and costs

Table 1 reports school staff time associated with delivery of the intervention and dealing with bullying and aggression per student. The main time components for school staff were attending the training and curriculum development. In the interviews with staff in year one, it was revealed that the training was not attended as an additional training but as part of an existing planned training period, suggesting that these staff costs might not need to be included; the implications of this is further explored in the sensitivity analysis. Staff in intervention schools spent slightly more time dealing with bullying than in the control arm. The effect of this was more marked in years one and two compared with year three.

[TABLE 1 ABOUT HERE]

Table 2 gives the costs of trainers, facilitators and staff associated with delivery of the intervention and with dealing with bullying and aggression per student. The costs of trainers was £3.44 and for facilitators £5.00 and £3.36 respectively per student. The largest component of cost for school staff related to curriculum delivery and staff training. Overall in the first two years, the total cost of trainers, facilitators and school staff time were £116 in the control arm compared to £163 in the intervention arm per student. As expected, in the third year the difference in cost was much lower as there was no training nor facilitators, and in addition, the time spent by school staff dealing with bullying was lower. In the third year, the total costs of trainers, facilitators and staff per student were £63 for the control and £74 for the intervention groups.

[TABLE 2 ABOUT HERE]

Table 3 presents the student health service and police resource use and Table 4 the related costs. Overall, the health service and police resource use were similar in both arms. However, there were slightly more students stopped or told off by police in the control arm. Unexpectedly, there were more nights in hospital in the intervention arm related to accident or injury but it could not be determined whether or not these directly related to bullying. As these additional costs of nights in hospital in the intervention arm may not be directly related to bullying, this is further explored in the sensitivity analysis by excluding police and NHS costs.

[TABLE 3 AND 4 ABOUT HERE]

Cost-utility

Overall, the intervention was associated with higher costs (Table5) but the mean gain in CHU-9D was slightly higher in the intervention arm, but the QALY gained was not significant. The adjusted ICERs were £13,284 and £1875 per QALY at two years and three years respectively. These baselines ICERs are well below the threshold that NICE considers interventions to be cost-effective: at £20000 to £30000 per QALY gain.

[TABLE 5 ABOUT HERE]

Graphically, we present the uncertainty in cost-effectiveness acceptability curves in Figure 1a and Figure 1b. At two years, there is a 65% probability that the intervention was cost-effective at a willingness-to-pay threshold of £20,000 per QALY. At three years, there was a 90% probability that the intervention was cost-effective at the £20,000 per QALY threshold. Overall, there is some uncertainty at two years whether the intervention was cost-effective, but at three years there was a high degree of certainty that it was.

[FIGURE 1 ABOUT HERE]

In further sensitivity analysis, we explored the impact of excluding teacher time training as this was provided as part of routine training days. This had little impact on our results and conclusions. Again, there was considerable doubt that the increased hospital days in the intervention arm were related to the intervention, but exclusion of NHS and police costs did not have a significant impact on results.

DISCUSSION

Overall, we found that it would be cost-effective to implement the 'Learning Together' intervention in schools with cost per QALY thresholds of £13,284 and £1,875 at two years and three years respectively. This is well below the NICE threshold of £20,000-£30,000 per QALY. Probabilistic sensitivity analysis revealed uncertainty in the results at two years with a 65% chance of being cost-effective, but after three years there was a 90% chance that it was cost-effective. Having said this, the confidence in the QALYs are very wide reflecting the small difference in utility values between the two arms.

Given these results, the implication is that implementing the 'Learning Together' intervention in schools would be a good use of resources given the gain in health-related quality of life for students. Interestingly the outcomes of this analysis were from the health perspective (health-related quality of life), but the intervention was implemented in the education sector. Compared with other health interventions, this would be a good buy. However, it is unclear whether school managers would regard the provision of interventions aiming to promote students' health as being within their remit and budget. One possibility is that public health commissioners might fund interventions deployed in the education sector and this would also potentially be influenced by the forthcoming results on educational attainment.

A previous study in Northern Ireland conducted alongside an RCT assessed a school based programme in primary schools to improve prosocial behaviour and reduction in difficult behaviour and found this to be cost-effective (6). As far as we are aware, our study is the first cost-effectiveness analysis of a whole-school intervention targeting bullying and aggression conducted prospectively within an RCT. However, our findings that such an intervention would potentially be cost-effective are consistent with previous modelling studies conducted in Sweden (4,5).. Indeed, our result at three years is even more cost-effective than previous estimates of cost per QALY.

Our analysis only considered a three-year time horizon. However, there is evidence that children who are bullied continue to be at risk for a wide range of poor social, health, and economic outcomes long into adulthood. (22) Therefore, given our finding that even after three years the intervention was cost-effective, the possibility exists that it could be even more cost-effective if the longer-term outcomes were incorporated. In addition, there are other important outcomes beyond CYP's health-related quality of life: for example, potentially a reduction in bullying could increase educational attainment. This question is being assessed in the next phase of the research.

Any reported impact on educational outcomes could potentially strengthen schools' incentives to invest in such anti-bullying measures.

Participating schools were representative of the approximately 500 schools initially approached and all schools were retained in the trial, however a limitation is that these were all within the Greater London or surrounding counties area which has implications for scaling up to other areas. A further limitation of our analysis is not knowing exactly what bullying interventions were being delivered in the control schools so that it could be costed appropriately.

In conclusion, this study provides strong evidence collected prospectively from an RCT that this school-based intervention is highly cost-effective. Education- and health-sector policy-makers should consider investment in scaling up this intervention.

REFERENCES

1. Department of Health. Public mental health priorities: investing in the evidence. Annual Report of the Chief Medical Officer, 2013. London; 2014.
2. <https://www.gov.uk/government/organisations/department-for-education>. [Accessed October 17, 2019]
3. Bonell C, Allen E, Warren E, et al. Effects of the Learning Together intervention on bullying and aggression in English secondary schools (INCLUSIVE): a cluster randomised controlled trial. *The Lancet*. 2018;392:2452-652.
4. Beckman L, Svensson M. The cost-effectiveness of the Olweus Bullying Prevention Program: Results from a modelling study. *J Adolesc*. 2015;45:127-37.
5. Perrson M, Wennberg L, Beckman L, Salmivalli C, Svensson M. The Cost-Effectiveness of the Kiva Antibullying Program: Results from a Decision-Analytic Model. *Prevention Science*. 2018.19, 728–737
6. Connolly P, Miller S, Kee F et al. A cluster randomised controlled trial and evaluation and cost-effectiveness analysis of the Roots of Empathy schools-based programme for improving social and emotional well-being outcomes among 8- to 9-year-olds in Northern Ireland. Editors Southampton (UK): NIHR Journals Library; 2018 Mar. Public Health Research.
7. Bonell C, Fletcher A, Fitzgerald-Yau N, et al. Initiating change locally in bullying and aggression through the school environment (INCLUSIVE): a pilot randomised controlled trial. *Health Technology Assessment*. 2015;19 (53).
8. NICE. Methods for the development of NICE public health guidance (3rd edition). National Institute for Health and Care Excellence; 2012.
9. Bonell C, Allen E, Christie D, et al. Initiating change locally in bullying and aggression through the school environment (INCLUSIVE): study protocol for a cluster randomised controlled trial. *Trials* 2014.15:381
10. Fantaguzzi C, Allen E, Miners A, et al. Health-related quality of life associated with bullying and aggression: a cross-sectional study in English secondary schools. *European Journal of Health Economics*. 2018. 19, 641-651
11. Stevens K. Assessing the performance of a new generic measure of health related quality of life for children and refining it for use in health state valuation. *Appl Health EconHealth Policy*. 2011;9:157-69.
12. Stevens K. Valuation of the Child Health Utility 9D Index. [PharmacoEconomics](#). 2012; 30, 8: 729–747
13. Manca A, Hawkins N, Sculpher MJ. Estimating mean QALYs in trial-based cost-effectiveness analysis: the importance of controlling for baseline utility. *Health economics*. 2005;14:487-96.
14. National Institute of Clinical Excellence. Developing NICE guidelines: the manual. London; 2014.
15. Department of Health. NHS reference costs 2015-2016. London: Department of Health; 2016.

16. Curtis L, Burns A. Unit costs of health and social care. University of Kent, UK: Personal Social Services Research Unit; 2016.
17. The Kings Fund. Improving the quality of care in general practice. London; 2011.
18. Heslin M, Callaghan L, Barrett B et al. Costs of the police service and mental healthcare pathways experienced by individuals with enduring mental health needs. *British Journal of Psychiatry*. 2017;;157-64.
19. Grieve R, Nixon R, Thompson SG, Normand C. Using multilevel models for assessing the variability of multinational resource use and cost data. *Health economics*. 2005;14:185-96.
20. Willan AR, Briggs AH, Hoch JS. Regression methods for covariate adjustment and subgroup analysis for non-censored cost-effectiveness data. *Health economics*. 2004;13:461-75.
21. Rubin D. Inference and missing data. *Biometrika*. 1976;63:581-92.
22. Takizawa R, Maughan B, Arseneault L. Adult health outcomes of childhood bullying victimization: Evidence from a five decade longitudinal British birth cohort. *American Journal of Psychiatry*. 2014.

Acknowledgments

This study was funded by the National Institute for Health Research in England under its Public Health Research Board (12/153/60) and the Education Endowment Foundation. The views expressed in this publication are those of the authors and do not necessarily reflect those of the UK NHS, the National Institute for Health Research, or the Department of Health for England. Miranda Perry played a key role in developing the intervention and coordinated its implementation in the pilot and phase 3 trials. We are grateful to the staff and students of participating schools for their dedication to the intervention and completion of the outcome surveys and process evaluation surveys and interviews. We are very grateful for the advice and support of our Trial Steering Committee and Data Monitoring Committee. We acknowledge the work of and mourn the loss of Dr Farah Jamal during the trial, whose death at the age of 30 was a tragic loss for public health research.