

- 8 Meadows P. *Cost effectiveness of implementing SSLPs: an interim report, research report*. London: Department for Education and Skills, 2006 (NESS/2006/FR/015).
- 9 Belsky J, Melhuish E, Barnes J, Leyland AH, Romaniuk H. Effects of Sure Start local programmes on children and families: early findings from a quasi-experimental, cross sectional study. *BMJ* 2006;332:1476-8.
- 10 Scott S, Spender Q, Doolan M, Jacobs B, Aspland H. Multicentre controlled trial of parenting groups for childhood antisocial behaviour in clinical practice. *BMJ* 2001;323:194-203.
- 11 Barlow J, Stewart-Brown S. Review article: behavior problems and parent-training programmes. *J Dev Behav Pediatr* 2000;21:356-70.
- 12 Webster-Stratton C, Hancock L. Parent training for young children with conduct problems. Content, methods and therapeutic process. In: Schaefer CE, ed. *Handbook of parent training*. New York: Wiley, 1998.
- 13 Mihalic S, Fagan M, Irwin K, Ballard D, Elliot D. *Blueprints for violence prevention replications: factors for implementation success*. University of Colorado, Boulder: Centre for the Study and Prevention of Violence, 2002.
- 14 Taylor TK, Biglan A. Behavioural family interventions for improving child-rearing: a review for clinicians and policy makers. *Clin Child Fam Psychol Rev* 1998;1:41-60.
- 15 Webster-Stratton C. Preventing conduct problems in Head Start children: strengthening parenting competencies. *J Consult Clin Psychol* 1998;66:715-30.
- 16 Hutchings J, Webster-Stratton C. Parenting in the community. In: Houghugh M, Long N, eds. *Handbook of parenting*. London: Sage, 2004.
- 17 Aspland H, Gardner F. Observational measures of parent-child interaction: an introductory review. *Child Adolesc Mental Health* 2003;8:136-43.
- 18 Gardner F, Burton J, Klimes I. Randomised controlled trial of a parenting intervention in the voluntary sector for reducing child conduct problems: outcomes and mechanisms of change. *J Child Psychol Psychiatr* 2006;47:1123-32.
- 19 Morch WT, Clifford G, Larsson B, Rypdal P, Tjeflaat, Lurie J, et al. *The incredible years: the Norwegian Webster-Stratton programme; 1998-2004*. www.incredibleyears.com.
- 20 National Institute of Clinical Excellence. Parent-training/education programmes in the management of children with conduct disorders. www.nice.org.uk/page.aspx?o=346134 27.09.06.
- 21 Department for Training and Education. Parenting Action Plan: supporting mothers, fathers and carers with raising children in Wales. Cardiff: Welsh Assembly Government, 2005 (Information Document No: 054-05). www.learning.wales.gov.uk/pdfs/parenting-action-plan-e.pdf.
- 22 Children's trust pathfinder. www.everychildmatters.gov.uk/strategy/childrenstrustpathfinders.

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Parenting programme for parents of children at risk of developing conduct disorder: cost effectiveness analysis

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Objective To investigate the cost effectiveness of a parenting programme.

Design An incremental cost effectiveness analysis alongside a pragmatic randomised controlled trial of the effectiveness of a group parenting programme delivered through Sure Start in the community.

Setting Sure Start areas in north and mid Wales.

Participants Parents of 116 children aged 36-59 months (87% of the clinical sample) at risk of developing conduct disorders defined by scoring over the clinical cut off on the Eyberg child behaviour inventory). Children were identified by health visitors and recruited by the research team.

Intervention The Webster-Stratton Incredible Years basic parenting programme or a six month waiting list control.

Main outcome measure Incremental cost per unit of improvement on the intensity score of the Eyberg child behaviour inventory.

Results The bootstrapped incremental cost effectiveness ratio point estimate was £73 (€109, \$142) per one point improvement on the intensity score (95% confidence interval £42 to £140). It would cost £5486 (€8190, \$10 666) to bring the child with the highest intensity score to below the clinical cut-off point and £1344 (€2006, \$2618) to bring the average child in the intervention group within the non-clinical limits on the intensity score (below 127). For a ceiling ratio of £100 (€149, \$194) per point increase in intensity score, there is an 83.9% chance of the intervention being cost effective. The mean cost per child attending the parenting group was £1934 (€2887, \$3760) for eight children and £1289 (€1924, \$2506) for 12 children, including initial costs and

materials for training group leaders. When we categorised the sample into relatively mild, moderate, and severe behaviour groups based on intensity scores at baseline the intervention seemed more cost effective in those with the highest risk of developing conduct disorder.

Conclusion This parenting programme improves child behaviour as measured by the intensity scores of the Eyberg child behaviour inventory at a relatively low cost and was cost effective compared with the waiting list control. This parenting programme involves modest costs and demonstrates strong clinical effect, suggesting it would represent good value for money for public spending.

INTRODUCTION

Conduct disorder is estimated to affect 5-10% of children aged 5-15 years in the United Kingdom and the United States.^{1,2} For those children with early onset in preschool years, conduct disorder often persists into adulthood³ and predicts poor employment prospects, marriage breakdown, and self harming or antisocial criminal behaviour.⁴⁻⁶ The costs of publicly resourced services for those aged 28 with conduct disorder in childhood were estimated to be 10 times higher (£70 019; €104 416, \$137 450) than for those with no behavioural problems (£7423; €11 069, \$14 571).⁷

Parenting is a key determinant in child behaviour. Parents who encourage prosocial behaviour have children with fewer behaviour problems.⁸ Parenting training programmes are effective in helping families with children at risk of developing conduct disorders.⁹ The Incredible Years basic parenting programme is

described in more detail elsewhere⁹ and in the accompanying paper.¹⁰ The programme strengthens parenting competencies and reduces the risk of developing conduct problems. It is delivered by two trained leaders in 12 weekly sessions.

The recent National Institute for Health and Clinical Excellence (NICE) appraisal on parent training programmes for conduct disorders highlighted the dearth of evidence on cost effectiveness.¹¹ We carried out a full cost effectiveness analysis, alongside a pragmatic randomised controlled trial, of the Incredible Years basic parenting programme in the UK. We present the programme costs and consequences for public sector resources and child behaviour outcomes.

METHODS

Study population

This economic evaluation took place alongside a pragmatic randomised controlled trial.¹⁰ Of the 153 randomised families, 86 in the intervention group and 47 in the control group were available for follow-up. Researchers collected data on service use and measures of effectiveness during home visits at baseline and six month follow-up. We had full economic data for 73 families in the intervention group and 43 in the control group.

Measurement of costs

We examined costs from a multiagency public sector perspective, including health and special educational and social services.¹² Effectiveness was measured by reductions in the intensity and problem scores of the Eyberg intensity scores, a commonly used outcome measure in clinical trials of child behaviour interventions.¹³

Group leaders from four of the 11 groups completed weekly cost diaries to enable us to measure group running costs (including training and weekly supervision

for group leaders). We used a client service receipt inventory¹⁴ administered to parents at baseline and follow-up to collect data on children's use of health, social, and special educational services. The inventory asked about their child's use of services in the preceding six months. National costs were applied to these services, drawn from a number of published sources including *Unit Costs of Health and Social Care 2004*,¹⁵ NHS reference costs for 2003-4,¹⁶ and local NHS trusts and councils. All costs are in 2003-4 pounds sterling unless stated otherwise. As all costs fell within a one year time horizon we did not discount costs or effects.

Analysis strategy—We calculated an incremental cost effectiveness ratio point estimate with a 1000 replication bootstrap to provide a confidence interval.¹⁷ We used cost effectiveness analysis because the clinical research trial used a condition specific outcome rather than a utility measure. A cost effectiveness acceptability curve provided probabilistic analysis for a range of cost effectiveness ceilings for policy makers. More details of the analysis are on bmj.com

RESULTS

Clinical effectiveness—The clinical effectiveness findings are based on the sample used for the economic analysis (n=116). At baseline, the mean intensity and problem scores were 144.46 (SD 24.18) and 16.18 (SD 6.88) in the intervention group and 140.74 (SD 24.47) and 14.70 (SD 7.45) in the control group (see bmj.com). An independent *t* test showed no significant difference in mean intensity or problem scores between conditions at baseline ($t=1.20$, $P=0.23$). At the six month follow-up, mean intensity had fallen to 117.17 (SD=35.99) in the intervention group when we controlled for regression to the mean. Likewise, the mean problem score had fallen to 12.09 (SD 9.83). Behaviour remained constant or deteriorated among children in the control group with the mean intensity score unchanged at 140.74 (SD 40.77). The mean problem score fell to 12.95 (SD 10.87) (see bmj.com). After we determined that the data met the assumption of equivalent slopes (the decision variable was a test/non-test dummy variable), an analysis of covariance revealed that the intervention delivered a 27.29 point reduction in mean intensity score (95% confidence interval 16.41 to 36.42) when we controlled for any differences in scores before treatment between the groups. At follow-up 45 (62%) children in the intervention group and 18 (42%) in the control group had Eyberg intensity scores below the clinical cut off (127).

Group costs—The table summarises the reported running costs based on weekly cost diaries completed by leaders of four groups and the cost information supplied from the Incredible Years Wales office. Costs shown are divided into non-recurrent initial training and group setup costs and recurrent costs. Further details are available on bmj.com. The mean cost per index child (based on eight families per group, as in our trial), including non-recurrent and recurrent costs, was £1933.56. We used this figure as the cost of the intervention per child in calculating the point estimate

Total costs and cost per child of running parenting group over 12 session programme*

	Total cost (£)†
Non-recurrent initial training and group setup costs	2704.86
Recurrent group running costs:	
Supervision of group leaders before start of programme	509.41
Recruitment of parents	832.14
Group costs	11 422.24
Subtotal	12 763.65
Cost of establishing and running parenting group over 12 week programme:	
Total	15 468.51
Cost/child based on 8/group	1933.56
Cost/child based on 12/group	1289.04
Cost of running parenting group excluding non-recurrent costs:	
Total	12 763.65
Cost/child based on 8/group	1595.46
Cost/child based on 8/group	1063.64

*See bmj.com for complete breakdown.

†In some cases, total costs do not equal product of mean unit costs and mean units because of rounding.

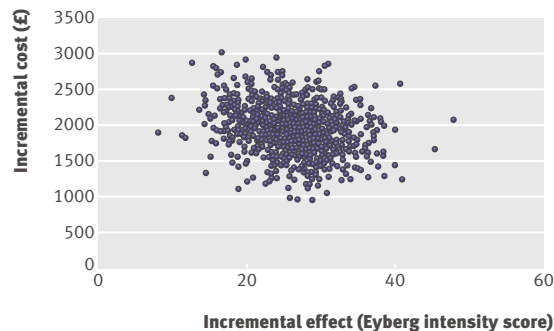


Fig 1 | 1000 replication bootstrap cost effectiveness plane

for the incremental cost effectiveness ratio. The table also shows the reduction in average cost per index child with 12 families in the group.

Service utilisation by children—We compared the client service receipt inventory for children in the two groups for the six months between baseline and follow-up. Service use costs at baseline differed between the groups but this was not significant and remained unchanged at follow-up (see www.bangor.ac.uk/imscar/healthconomics/reportspublications.php.en?menu=3&catid=2389&subid=0 for further details).

Cost effectiveness—Using the cost and clinical data gathered for 73 participants in the intervention group and 43 in the control group, we calculated a point estimate for the incremental cost effectiveness ratio of £71 ($\text{£}1992.29 - \text{£}49.14 / 27.29 = \text{£}71.20$), where £1992.29 is the change in service use costs (including costs of the parenting programme, £1933.56) for the intervention group, £49.14 is the change in service use costs for the control group, and 27.29 ($27.29 - 0$) is the incremental change in the Eyberg child behaviour index.

Bootstrapping and cost effectiveness acceptability curve—The 1000 replication bootstrap yielded a bootstrapped mean estimate of £73 (95% confidence interval £42 to £140), close to our basic calculation figure of £71. A one unit improvement in the Eyberg intensity scores over and above that provided by the waiting list control would cost £73. Figure 1 shows the cost effectiveness plane for the 1000 replication bootstrap. The density of the intervention can be seen to fall within the north east quadrant of the cost effectiveness plane. Figure 2 gives the cost effectiveness acceptability curve for a range of cost ceilings. The curve intercepts the y axis at 0 and asymptotes at 1. The points on the cost effectiveness plane fall in the north east quadrant, signifying that the programme is more costly and more effective than the control. The parenting intervention, therefore, does not dominate the waiting list control condition (that is, is clearly more effective at a lower cost). From a policy perspective, the cost effectiveness acceptability curve shows that, for example, if a cost ceiling of £100 was set, then the intervention would have an 83.9% probability of being cost effective. The point estimate of £73 per point improvement on the Eyberg intensity scores is a relatively low financial figure.

DISCUSSION

The Incredible Years basic parenting programme delivered a point estimate for the incremental cost effectiveness ratio of £73 per one point improvement on the Eyberg intensity scale compared with parents and children who remained on the waiting list. The cost effectiveness acceptability curve showed that for a cost ceiling of £100 the intervention was 83.9% likely to be cost effective. A sensitivity analysis of the sample subdivided by children's intensity score showed that the intervention became more cost effective in children at greater risk of developing conduct disorder. Mean intensity for the intervention group at baseline was 144.46. This means that a 17.46 point fall would be required to return the average child in this intervention to below the clinical cut-off point at a cost of just over £1344, while it would cost £5486 to bring the child with the highest intensity score in our study to below the clinical cut-off point. The clinical study also found important benefits to the parents' mental health and the behaviour of siblings that are not reflected in the incremental cost-effectiveness ratio.¹⁰ Policy makers and commissioners within the NHS and local government must balance the modest extra costs involved in providing this parenting programme against the clinically significant amelioration in intensity scores in deciding whether or not to introduce or rollout the intervention.

There are few analyses of cost effectiveness of parenting interventions. Thompson et al also used a six month waiting list control in their evaluation of the common sense parenting intervention.¹⁸ Their study was not a true economic evaluation, however, and made only basic cost calculations in terms of staff time. The short follow-up period of both our study and the work of Thompson et al¹⁸ is a characteristic of research in this topic.¹⁹ Hutchings et al¹³ and Muntz et al²⁰ conducted a four year follow-up of a similar parenting programme and found sustained benefits.

Our findings are timely given the government's "Respect" agenda. The UK government has prioritised support for young children and their families in high risk communities via the Sure Start programme but until recently has failed to specify the use of evidence based programmes, resulting in failure to achieve effective outcomes.

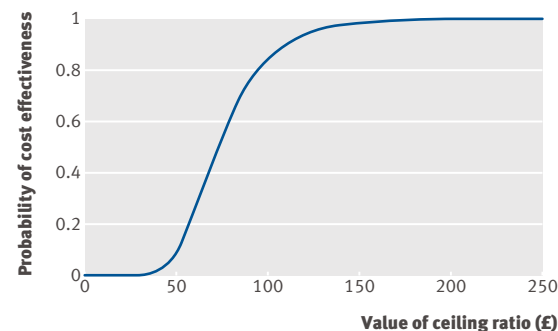


Fig 2 | Cost effectiveness acceptability curve

WHAT IS ALREADY KNOWN ON THIS TOPIC

The costs of conduct disorder in childhood and associated costs in later life are potentially high to the family, the NHS, social care services, and the legal justice system

Parenting is now at the top of government policy agendas

The National Institute for Health and Clinical Excellence has argued that investment in parenting programmes should be based on evidence of effectiveness and cost effectiveness

WHAT THIS STUDY ADDS

Compared with children remaining on a waiting list, the Incredible Years basic parenting programme improved children's behaviour at a cost of £1344 (€2005, \$2638) per child

The recent National Institute for Health and Clinical Excellence (NICE) appraisal on conduct disorder in children states that programmes should be clinically effective and cost effective.¹¹ We have shown that if the Incredible Years parenting intervention with proved effectiveness is delivered with fidelity, it can provide value for money in terms of public resources within the Sure Start framework.

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Competing interests: JH is paid by Incredible Years for running occasional training courses in the delivery of the parent programme and has served as an expert witness for the NICE appraisal on parenting and conduct disorder.

Ethical approval: North West Wales research ethics committee.

- 1 Offord DR, Boyle MH, Racine Y. Ontario child health study: correlates of disorder. *J Am Acad Child Adolesc Psychiatry* 1989;28:850-60.
- 2 Office for National Statistics. *The mental health of children and adolescents in Great Britain. Summary report.* London: Office for National Statistics, 1999.

- 3 Loeber R. Development and risk factors of juvenile anti-social behavior and delinquency. *Clin Psychol Rev* 1990;10:1-41.
- 4 Kazdin AE. Hospitalization of anti-social children: clinical course, follow-up status, and predictors of outcome. *Adv Behav Res Ther* 1989;11:1-67.
- 5 Robins LN, McEvoy L. Conduct problems as predictors of substance abuse. In: Robins LN, Rutter M, eds. *Straight and devious pathways from childhood to adulthood.* New York: Oxford University Press, 1990.
- 6 NHS Health Advisory Service. *Child and adolescent mental health services: together we stand.* London: Stationery Office, 1995.
- 7 Scott S, Knapp M, Henderson J, Maughen B. Financial cost of social exclusion: follow up study of anti-social children into adulthood. *BMJ* 2001;323:191.
- 8 Gardner FEM. Positive interaction between mothers and children with conduct problems: is there training for harmony as well as fighting? *J Abnormal Child Psychol* 1987;15:283-93.
- 9 Webster-Stratton C, Hancock L. Training for parents of young children with conduct problems: content, methods, and therapeutic processes. In: Schaefer CE, Briesmeister JM, eds. *Handbook of parent training.* New York: John Wiley, 1998.
- 10 Hutchings J, Gardner F, Bywater T, Daley D, Whitaker C, Jones K, et al. Parenting intervention in Sure Start services for children at risk of developing conduct disorder: pragmatic randomised controlled trial. *BMJ* 2007 doi=10.1136/bmj.39126.620799.55.
- 11 *Parent-training/education programmes in the management of children with conduct disorders.* National Institute for Health and Clinical Excellence, July 2006. www.nice.org.uk/page.aspx?o=TA102
- 12 Knapp M, Scott S, Davies J. The cost of antisocial behaviour in younger children. *Clinical Child Psychol Psychiatry* 1999;4:457-73.
- 13 Hutchings J, Lane E, Kelly J. Comparison of two treatments for children with severely disruptive behaviours: a four year-follow-up. *Behav Cognitive Psychother* 2004;32:15-30.
- 14 Beecham J, Knapp M. Costing psychiatric interventions. In: Thornicroft G, Brewin C, Wing J, eds. *Measuring mental health needs.* Oxford: Oxford University Press, 1992.
- 15 Netten A, Curtis L. *Unit costs of health and social care.* Canterbury: Personal Social Services Research Unit, University of Kent, 2004.
- 16 NHS reference costs 2004. www.dh.gov.uk/PublicationsAndStatistics/fs/en
- 17 Briggs AH, Gray AM. Handling in uncertainty in economic evaluations of healthcare interventions. *BMJ* 1999;319:635-8.
- 18 Thompson RW, Ruma PR, Schuchmann LF, Burke RV. A cost-effectiveness analysis evaluation of parent training. *J Child Fam Stud* 1996;5:415-29.
- 19 Kazdin AE. Multisystematic therapy reduces long-term rearrest compared with usual treatment. *Evid Based Ment Health* 2006;9:8.
- 20 Muntz R, Hutchings, Edwards RT, Hounsoms B, O Cailleachair A. Economic evaluation of treatments for children with severe behavioural problems. *J Mental Health Policy Econ* 2004;7:177-89.

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CORRECTIONS AND CLARIFICATIONS**Childhood intelligence and being a vegetarian**

In this editorial by Marcus Richards the benefit of a vegetarian diet was inflated owing to an error in the reporting of a study (*BMJ* 2007;334:216-7, doi: 10.1136/bmj.39107.671412.80). In the second paragraph, Key et al, in their collaborative analysis (reference 5), found 24% (not 76%) lower mortality in vegetarians, and this reduction related to mortality from ischaemic heart disease, not overall mortality. The death rate ratio was 0.76 (95% confidence 0.62 to 0.94).

Obituary of William Ian McDonald

This obituary of William Ian McDonald by Caroline Richmond contained two errors (*BMJ* 2007;334:160, 20 Jan, doi: 10.1136/bmj.39097.535093.FA). Firstly, it stated that he was born in 1913; in fact, he was born in 1933. Secondly, we said that in 1995 Anita Harding (who preceded him as departmental chairman) retired from work. In fact, she died that year (in her early 40s) from disseminated colon cancer, shortly before she was due to take up the chair of clinical neurology at the Institute of Neurology in London.

Obituary: Roland Jacob Levinsky

Roland Jacob Levinsky's MA was in the history of shell shock, not in Russian history as the author, Caroline Richmond, stated (*BMJ* 2007;334:264, 3 Feb, doi: 10.1136/bmj.39108.594352.FA).

Modelling the cost effectiveness of interferon beta and glatiramer acetate in the management of multiple sclerosis

During further recent study, the authors of this paper, J Chilcott and colleagues (*BMJ* 2003;326:522-5, doi: 10.1136/bmj.326.7388.522), found a coding error in the model that was not identified in any of the review procedures in the original project. The effect of the error, say the authors, was that the model allocated treatment benefits to patients who had stopped treatment. The revised model implements correctly an assumption that patients who stop therapy revert to a natural course of disease progression.

The authors have rerun the analysis using the correct coding, and a revised version of the table that was published in the abridged article (which was table 2 in the full article) is available at www.bmj.com/cgi/data/326/7388/522/DC1/1. The revised data indicate higher costs per quality adjusted life year for interferon beta and glatiramer acetate than given in the published article. This should be borne in mind when reading other sections of the article (the results in the abstract and in the main text; the figure showing cost effectiveness acceptability curves; and the "What this study adds" section of the summary box). The authors state that the coding error and revised results do not affect the conclusions of their paper.