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Incredible Years Parenting Programme: Cost-Effectiveness and Implementation

Introduction

The economic evaluation of public health prevention initiatives brings additional challenges for health economists and the need for a wider range of outcome measures than for clinical interventions (National Institute for Health and Care Excellence (NICE) 2013a; Vos et al. 2010; Edwards et al., 2013). Costs and consequences for a range of sectors need to be accounted for, along with ripple effects, externalities and equity considerations (Drummond et al., 2005; Weatherly, 2009).

Conduct disorder (CD) is a behavioural and emotional disorder which affects children and adolescents (NICE, 2013b). CD is estimated to affect approximately 6% of children aged 5-16 years in the United Kingdom (UK) and boys are more likely than girls to have CD (Green et al., 2004). CD is the most prevalent mental disorder in children (Green et al., 2004). For children with early onset CD, problems frequently persist into adulthood (Bonin et al., 2011a; Bonin et al., 2011b; Robins, 1978; Scott et al., 2001) and, amongst other things, predict poor employment prospects, relationship breakdown and self-harming and/or anti-social criminal behaviour (Kazdin, 1989; Department of Health, 1995; Robins and McEvoy, 1990). The economic implications of severe behavioural problems in childhood are serious. It has been estimated that by age 28 the cumulative costs of publicly resourced services between the ages of 10 and 28 for those with CD in childhood are 10 times higher (£91,854 in 2009/10 prices) than for those with no childhood behavioural problems (£9,737 in 2009/10 prices) (Scott et al. 2001). Parenting is a key determinant of child behaviour (Gardner, 1987).

In the UK there is growing recognition by Government of the need to ensure early intervention to prevent the long term negative consequences of CD in young children (Allen, 2011). The Children Act 2004 (UK Parliament, 2004) introduced a set of reforms and policy in the UK which aim to ensure that every child, irrespective of circumstances or background

has the support needed to be healthy and safe; and have the opportunity to make a positive contribution. Local governments are investing significant resources into prevention initiatives (Buck and Gregory, 2013). Birmingham City Council (BCC), through its Brighter Futures programme, has been at the forefront in introducing and trialling evidence-based, prevention and early intervention initiatives for children (Little et al., 2012).

One of the interventions implemented and evaluated was the Incredible Years (IY) BASIC Parenting Programme, suitable for parents of children aged 3-6 years, which is described in more detail elsewhere (Webster-Stratton and Hancock, 1998a). As an overview, the programme aims to strengthen parent-child interactions and promote children's emotional regulation and social skills. There is growing evidence of its shorter and longer term clinical effectiveness and cost-effectiveness (Bywater et al., 2009; Hutchings et al., 2007; Furlong et al., 2012; O'Neill et al., 2013); however, research findings have not always resulted in the programme becoming established in regular service.

The present study was conducted to evaluate the cost-effectiveness of the IY BASIC Parenting Programme in Birmingham, UK, delivered as part of the Brighter Futures initiative. From the outset the BCC funding for the research trial was undertaken with a view to adopting the IY programme if it were found to be effective and cost-effective. With this in mind the programme was delivered by regular BCC early years staff who would then be in a position to continue to deliver the programme. Training and support for delivery was provided through the Children's Early Intervention Trust (http://www.childrensearlyinterventiontrust.org/).

Methods

The Purpose of Economic Evaluation

The purpose of economic evaluation is to draw up a balance sheet of the costs and

benefits associated with implementing a new or existing programme, as compared with a relevant comparator; because of the need for a comparator economic evaluations are often undertaken alongside, or as part of, a randomised controlled trial (RCT) of the programme.

Study population and recruitment

This economic evaluation took place alongside a pragmatic RCT, details of which, including sample size calculation, are given in Little et al (2012). The Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) was administered to parents of children aged 3-4 years as a screening tool. Parents who rated their child as above the cut-off for clinical concern on the SDQ (total difficulties) were invited to discuss the trial, and their potential participation, with a researcher. The researcher obtained consent from willing, and eligible, parents. A waiting list control design was adopted and control families had access to the programme after the six-month (post-baseline) follow-up.

Data collection

Service utilisation and effectiveness (outcome) measures were collected during home visits by researchers blind to condition at baseline and six-month follow-up. The sample for the economic evaluation consisted of those for whom complete cost and outcome data were available at both time-points.

Measurement of IY programme costs

We undertook our micro costing (a method of calculating unit costs) from a payer perspective, i.e. from BCC as they were the ones implementing the programme. Our micro-costing of the set up and delivery of the IY programme used both bottom up and top-down approaches (Drummond et al., 2005; Curtis, 2010; Netten and Knight, 1999). Bottom up

approaches involve collecting data from individuals to calculate certain costs. Top-down approaches use total cost data to produce an average cost of the intervention per person. The top-down approach was used to collect project management, recruitment and administration costs from local government service providers. While a top-down approach requires less intensive data collection, a disadvantage is that it does not consider variation therefore a bottom-up approach was used to collect data from group leaders using diaries to record all activities in connection with preparing for, delivering and following up the IY programme. All costs reported relate to the year 2009/2010. The costs for training IY group leaders were supplied by the Children's Early Intervention Trust. Initial group leader training costs have been annuitised over 5 years at 3.5% because they represent a one off cost with benefits accrued into the future (Netten and Knight, 1999). Costs included materials, incentives, trainer fees, supervision, administration, delivery, venue costs, travel and consumables. Costs for the group leaders to attend the training courses were based on average salaries. Group running costs included group leader salaries, materials, venue hire and travel costs. Employment overheads of 25% were added to reported salary costs to reflect national insurance and superannuation. A further 25% was added to reflect capital and managerial overheads.

Measurement of frequency and cost of Health, Social Care and Special Educational Service use by Children and Parents

In this economic evaluation costs were examined from a public sector multi-agency perspective including health, special educational services e.g. Speech and Language Therapists and social services (Edwards et al., 2008). Data were collected on children's and parents' use of health, social and special educational services by means of an adapted Client Service Receipt Inventory (CSRI) (Beecham and Knapp, 1992; Ridyard and Hughes, 2010)

administered to parents at baseline and six-month follow-up. National costs were applied to these services (Curtis, 2010; Department of Health, 2010), supplemented by direct approaches to local authorities and programme designers. All costs are in UK £ sterling for the year 2009-2010 (See Supplementary Table 1). Costs fell within a one-year time horizon therefore it was not necessary to discount costs. Children's service use costs were used in the cost-effectiveness analyses using the SDQ and Eyberg Child Behaviour Inventory (ECBI), while parents' service use costs were used in the cost-effectiveness analysis using the Arnold-O'Leary Parenting Scale (APS).

Measurement of effectiveness

Effectiveness was measured using the SDQ total difficulties (Goodman, 1997), ECBI (Eyberg and Pincus, 1999), and the total score on the APS (Arnold et al., 1993).

The SDQ (Goodman, 1997) is a 25 item behaviour screening measure, covering both positive and negative attributes, for children aged between 3-16 years, using a 3-point scale. It has five sub-scales: Emotional Problems, Conduct Problems, Hyperactivity, Peer Problems and Pro-social Behaviour. A total difficulties score between 0-13 is considered normal, 14-16 is considered borderline and 17-40 is considered abnormal. An additional Impact Supplement scale measures the extent to which the parent or caregiver perceives the child's difficulties as impacting on their daily life.

The ECBI (Eyberg and Pincus, 1999) is a 36-item inventory measuring problem behaviour in children aged between 2-16 years old as reported by the parent or caregiver. Each behaviour is rated on two scales: a 7-point Intensity scale that measures how often the behaviour is perceived to occur, ranging in response intensity from 1 (*Never*) to 7 (*Always*); and a *Yes-No* Problem scale that identifies whether the behaviour is seen as a problem for the

parent. The clinical cut-off for the ECBI is suggested as 127 or more for the Intensity scale (ECBI-I) and 11 or more for the Problem scale (ECBI-P).

The APS (Arnold et al., 1993) is a 30-item inventory of parenting competencies each measured on a 7-point scale. The scale comprises an overall score and three subscales; laxness refers to insufficient monitoring of the child and their behaviour, over-reactivity refers to displays of anger, meanness or irritability and verbosity refers to lengthy verbal responses to inappropriate child behaviours. Arnold et al (Arnold et al., 1993) report a total mean clinic sample score of 3.1 (SD = 0.7) and a population norm total mean score of 2.6 (SD = 0.6).

Imputation of missing data was based on the last observation carried forward method.

Presentation of results

As well as presenting conventional Incremental Cost-Effectiveness Ratio (ICER) estimates, we adopted an approach we have used in previous studies (Edwards et al., 2011). In this paper we show for the intervention and control groups the proportion of children who moved from being above the clinical concern cut-off to below the SDQ clinical concern cut-off and related this to the cost per child of the IY programme, depending on the number of children per group.

Analysis strategy

The cost-effectiveness analysis involved calculating an ICER point estimate with a 1,000-replication bootstrap to provide a confidence interval (Briggs and Gray, 1999). In other words, we divided the additional costs associated with the IY programme as compared to the control condition by the additional benefits to child behaviour observed for the children of participants in the IY arm over and above the control condition to achieve an average cost per

unit of benefit- our ICER point estimate. We used a statistical method called bootstrapping to resample 1000 times from our trial data to generate a confidence interval around our average estimate of cost-effectiveness.

It would not be appropriate to try to measure utility in these young children to facilitate a cost-utility analysis (Noyes and Edwards, 2011). Cost-effectiveness planes and cost-effectiveness acceptability curves (CEAC) for the SDQ are presented. Cost-effectiveness planes are a graphical representation showing where the 1,000 ICER estimates generated by the bootstrapping fall on a graph with axes showing costs and outcomes. Points falling in the North East indicate that an intervention is both more costly and more effective than the control condition. Points falling in the North West indicate that an intervention is more costly but less effective than the control condition. CEACs indicate the probability that an intervention is cost-effective at a range of willingness to pay thresholds. For example, if society were willing to pay a maximum of £20,000 per unit improvement on a particular outcome measure, the reader can read across the CEAC to see what the corresponding probability that the intervention would be cost-effective at that willingness to pay threshold is.

Shifts in the distribution of child behaviour as measured by the SDQ are presented. Data were analysed using SPSS v20.0 and EXCEL 2013.

Sensitivity Analysis and Subgroup Analysis

Sensitivity analysis was conducted based on 12 children per each IY group delivered in addition to the base case scenario of 8, as was presented in Edwards et al., 2007. This being the range of size of IY groups typically. We also explored the effect of dose i.e. number of sessions attended by parents, on cost-effectiveness.

Results

Characteristics of the Study Families

Of the 161 consenting families in the clinical effectiveness sample, 110 were allocated to the intervention and 51 to the control. 147 families were followed-up at six months (10 were lost from the intervention and four from the control, seven of these fourteen formally withdrew and seven were uncontactable). Economic data was available for our analysis for 144 participants (97 intervention and 47 control) which is 98% of the clinical effectiveness sample at 6 months.

Mann-Whitney tests showed no significant differences in baseline SDQ total difficulties scores, ECBI-I (Eyberg and Pincus, 1999) or total scores on the APS (Arnold et al., 1993) scores between the economic analysis sample and clinical effectiveness sample, indicating that our economic sample was representative of the larger sample.

Table 1 presents the characteristics of participating families. Independent t-tests showed no significant differences between the intervention and control groups at baseline (child age t=-0.26, p=0.80; child gender χ^2=0.46 p=0.50; parent age t=-0.53, p=0.96; parent gender χ^2=0.06, p=0.81). Mann-Whitney tests showed no significant difference in service use costs between intervention and control group at baseline for children (Z=-0.38, p=0.71) or parents (Z=-0.05, p=0.96). Adjustment of follow-up values is necessary when there is an imbalance between groups at baseline on variables that are related to the outcomes of interest to ensure that any difference detected between groups at follow-up is the result of an intervention effect rather than imbalanced baseline data, however, as there were no significant differences between groups on key variables the follow-up data in this analysis were not adjusted for baseline values.

Table 1 Demographics of participants at baseline

	Intervention Mean (SD) n= 97	**Control Mean (SD) n=47**
Child age	3.34 (0.57)	3.36 (0.49)
Child: female	36 (37.1%)	14 (29.8%)
Parent age	30.37[1] (6.10)	30.43 (5.94)
Parent: female	94[2] (98%)	47 (100%)

[1] n=95

[2] Percentage based on sample n=96

Clinical Effectiveness

The Birmingham Brighter Futures Initiative included evaluations of three interventions, Triple P, PATHS and IY. Full details of the effectiveness of these three programmes and RCT conditions are published as Little et al., 2012. To provide context to this paper, in the PATHS trial, modest improvements in emotional health and behavioural development after one year disappeared by the end of year two. There were no effects for Triple-P. In contrast, Little et al. (2012) reports significant benefits for the intervention group compared to the control group in the IY trial on the SDQ, ECBI and APS, upon which this economic evaluation is based.

Table 2 shows mean scores at baseline and six-month follow-up for participants in the economic analysis sample (n=144). Independent samples t-tests showed no significant differences between groups (ECBI-I t=0.51, p=0.61; APS total t=1.10, p=0.27). Mann-Whitney tests showed no significant differences between groups for the ECBI-P and SDQ at baseline (ECBI-I-P Z=-0.832, p=0.406; SDQ total Z=-0.737, p=0.46).

At six months there were statistically significant improvements across all three outcome measures. Child behaviour and self-reported parenting skills also improved in the control condition, but not as much as in the intervention condition.

Table 2 Effectiveness scores at baseline, 6 months and differences for child and parent measures (economic sample)

	Baseline score mean (SD)			6 month score mean (SD)		
Child measure (cut-off)	Intervention n=97	Control n=47	*Difference in mean score*	Intervention n=97	Control n=47	*Difference in mean score*
SDQ total difficulties baseline score (17)	23.13 (4.48)	23.68 (4.49)	*-0.55*	14.67 (5.81)	17.28 (7.39)	*-2.61**
SDQ impact	0.66 (1.13)[1]	0.93 (1.42)[2]	*-0.27*	0.13 (0.54)	0.57 (1.20)[3]	*-0.44***
ECBI-I (127)	143.23 (34.34)	146.49 (38.87)	*-3.26*	121.60 (32.58)	136.17 (43.46)	*-14.57**
ECBI-P (11)	16.72 (8.86)	17.94 (9.20)	*-1.22*	10.67 (8.80)	14.70 (9.94)	*-4.03**
APS total	3.49 (0.63)	3.62 (0.78)	*-0.13*	2.94 (0.73)	3.34 (0.84)	*-0.4***

*indicates significant at p<0.05
**indicates significant at p<0.01
[1]n= 95 [2]n= 44 [3]n=46

IY Group Costs

Table 3 summarises the set up and running costs of the Brighter Futures IY programme in this study. Costs are divided into non-recurrent initial training, project management costs associated with the establishment of the project and recruitment, group set-up costs and recurrent costs. Where possible, means and standard deviations are presented. The mean cost per child (based on eight children per group) was £2,418.

Table 3 Programme costs and cost per child of running 11 IY parenting groups over 12 session programme for 2009-10, inclusive of employers on costs of 25%

Non-recurrent group set-up costs to train group leaders in pre-school BASIC and BASIC (n=60) (based on costs from IY Centre Wales)		**Total**	**Cost (£)[1] Group**
Inclusive of training and accreditation, supervision, materials, programme kit, venue and accommodation		20,000	
3 day training for 60 group leaders (based on average salary cited below)		46,616	
Non-recurrent cost total		66, 616	
Non-recurrent cost per group (2 leaders)			2,221
Non-recurrent cost per group (2 leaders) annuitised over 5 years at 3.5%/yr			***492***
Recurrent group running costs across 11 groups			
Project management and recruitment of parents (based on costs supplied by BCC)			
	Gross salary	**Time employed**	
Pilot Project Manager	54,325 / year	1 WTE for 3 months.	13,581
Pilot Project Manager (Interim Consultant)	£68,821 / year	1 WTE for 4 months	22,940
Engagement & Recruitment Project Officer (mid point grade 4)	16,584 / year	0.5WTE for 6 months	4,146
Engagement & Recruitment Project Officer (mid point grade 5)	14,640 / year	0.2 WTE for 12 months	2928
Administrative support for TP (Benefits Registration role)	13,287 / year	0.33 WTE for 1 yr.	4,429
Wrap round coordination[2] (£4000 per group)			44,000
Project management sub total			*92,024*
Project management for 1 parenting group (total/11 groups)			***8,366***
On-going supervision cost for IY group leaders (based on costs from BCC)			
Trainer costs	£600 / day	39 days	23,400
Venue (accommodation and food)			8,789
Accreditation			600
Course administration			1,754
Supervision sub total			*34,543*
Supervision for 1 parenting group (total/11 groups)			***3,140***
Parenting programme delivery cost (based on mean from 11 groups, except item 1)			
Group material cost (includes basic parenting pack, parent handouts and IY book). Based on costs from IY Office			1221
	Mean (SD) Unit time	**Mean (SD) unit**	
Preparation time for 2 leaders, including room preparation	23.87 (12.06) / hr	78.99 (52.16) hrs.	1885
Session time for 2 leaders	23.87 (12.06) / hr	46.11 (33.02) hrs	1101
Follow-up time including travel, home visits, phone, admin	23.87 (12.06) / hr	14.04 (14.63) hrs	335
Mileage[3]	40p / mile[4]	75.75 miles (145.03)	30
Parents transport, taxi, refreshment and DVD[3]		£850.8 (£1249.30)	851
Supervision including travel time	23.87 (12.06) / hr	80.58 hrs (55.09 hrs)	1923
Group subtotal			***7,346***

Cost of establishing and running 1 parenting group over 12 week programme, inclusive of training for 2 leaders annuitized over 5 yrs at 3.5% / yr	
Total (project management, supervision and delivery)	19,344
Cost per child based on 8 per group	2,418
Cost per child based on 12 per group	1,612
Cost of running 1 parenting group over 12 week programme, includes project management and supervision	
Total	18,852
Cost per child based on 8 per group	2,357
Cost per child based on 12 per group	1,571

[1] rounded to the nearest whole pound and all salaries include employers on-costs

[2] including salaries for facilitators, travel and subsistence for parents, room hire, materials, interpreter

[3] based on info from 3 respondents incurred before WAC in post [4] HM customs statutory mileage rate 2010

Service Use

A summary of service use between baseline and 6-month follow-up is provided in Tables 4a and 4b. Primary care service use was similar in both groups, although mean contact with speech therapists was higher in the control group, whilst children in the intervention group had on average more contacts with social workers, respite foster care and other social services. Children in the control group had more additional contacts with class teachers and head teachers, whilst there was a higher rate of 1-1 help and special needs teaching for those in the intervention group.

Table 4a: Mean NHS and Local Authority costs for children (£) over 6 months follow-up by group (economic analysis sample)

	Control[1]		**Intervention[1]**		
Type of cost	**Mean £**	**S.D. £**	**Mean £**	**S.D. £**	**Mean Difference (Bootstrapped 95% CI)**
NHS primary, community and local authority care sector[2]	N=47		N=97		
GP consultations	69	76	82	93.3	14
Practice nurse	5	16	5	9	0
Health visitor	5	21	8	28	3
Speech therapist	31	166	5	21	-26
Physiotherapist	1	7	4	33	3
Social worker	4	29	54	231	50
CAMS	18	77	1	7	-18
Community paediatrician	19	74	12	60	-7
Homestart volunteer	0		1	9	1
Other contacts	16	59	44	245	29
Respite foster care	0		49	480	49
Total primary care and social services cost	***169***	***259***	***266***	***739***	***97(-56, 283)***
Additional educational cost					
Extra parental consultation with head teacher	92	345	9	38	-83
Extra parental consultation with class teacher	77	212	30	119	-47
School nurse	2	12	4	14	2
One-to-one help	12	41	149	672	137
Small group work	6	23	4	29	-1
Special teaching in main stream school	13	92	18	177	5
Special Educational Needs Statement	5	32	7	38	2
Psychological assessment	5	32	9	44	4
Special needs school	7	49	101	766	94
All other educational costs	16	59	22	126	7
Total additional education cost	***226***	***614***	***353***	***1170***	**127 (-33, 301)**

NHS secondary sector					
A&E	26	63	13	40	-14
Ambulance	21	69	0	0	-21
Out patients	65	115	64	196	-1
In patients stays			73	721	73
Other contacts			0	3	0
Total secondary care cost	***113***	***165***	***150***	***852***	**38 (-87, 237)**
Total NHS and social care cost	**508**	**825**	**769**	**1625**	**261 (-149, 662)**
IY parenting programme cost	0	-	2465	0	2465
Total NHS, social care and parenting programme cost	**508**	**825**	**3234**	**1625**	**2726 (2334, 3158)**

[1] Costs rounded to the nearest £
[2] Consultations costs include face to face, telephone and/or home visits

Table 4b: Mean NHS and Local Authority costs for parent (£) over 6 months follow-up by group (economic analysis sample)

Type of cost	**Control[1]**
Parent or carer contacts **NHS primary, community and local authority care sector[2]**	**Mean £** N=47
GP	87
Practice nurse	6
Health visitor	0
CPN	30
Social worker	8
Counselling	62
Parent primary care and social services subtotal	**193**
NHS Secondary sector	
OP	73
A&E	13
In patient stays	106
Other contacts	46
Parent secondary care subtotal	***239***
All parent primary, secondary and social services subtotal	***432***

[1] Costs rounded to the nearest £
[2] Consultations costs include face to face, telephone and/or home visits

Cost-effectiveness

ICERs are presented in Table 5. A one-point improvement in the SDQ over and above that provided by the waiting-list control would cost £1,295 on a 40 point scale. A one-point improvement in the ECBI-I would cost £237 on a 216 point scale. A one-point improvement in the APS would cost £9,477 on a seven point scale.

Table 5: Incremental cost-effectiveness for the three measures (economic analysis sample)

Measure	Incremental difference in cost	Incremental difference in effect	ICER (Bootstrapped 95% CI)
SDQ total	£2679.62	2.07	£1,295 (£593,[A])
ECBI-I	£2679.62	11.31	£237 (£113, [B])
APS total	£2,492.49	0.263	£9,477 (£4,869 to £92,822)

[A] 3.6% of replications are more costly and less effective giving a dominant upper CI of -£9,150.
[B] 4.1% of replications are more costly and less effective giving a dominant upper CI of -£2.289.

Distributional shifts

Distributional shifts of outcome measure scores are shown in Figures 1a and 1b. All children at baseline were within the cause for concern range on the SDQ total difficulties scale. On the SDQ, 21/47 (45%) of children in the control group moved from above to below the cause for concern cut-off. By contrast, 66/97 (68%) children in the intervention group moved from above to below the cause for concern cut-off, resulting in an incremental difference of 23% between groups. The cost of running the IY programme for all 97 participants was £212,784 (excluding health and social service use), making the average cost to move a child below the SDQ cut-off £9,672 per child in the intervention group over and above the proportion who would have moved without intervention.

Figure 1a Intervention SDQ score between baseline and 6 months

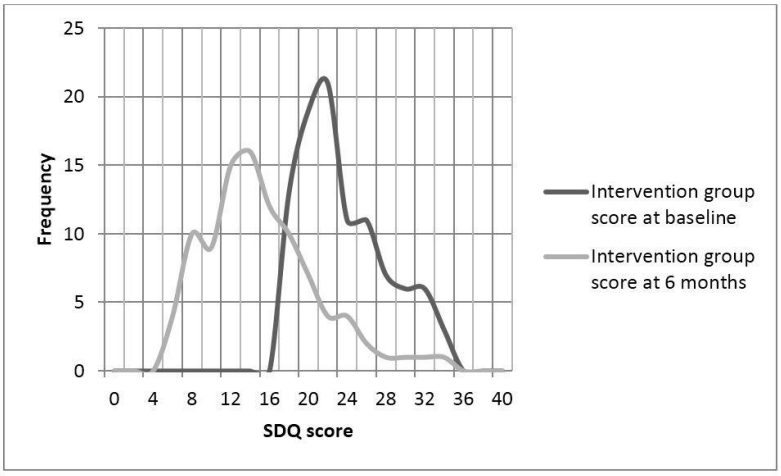
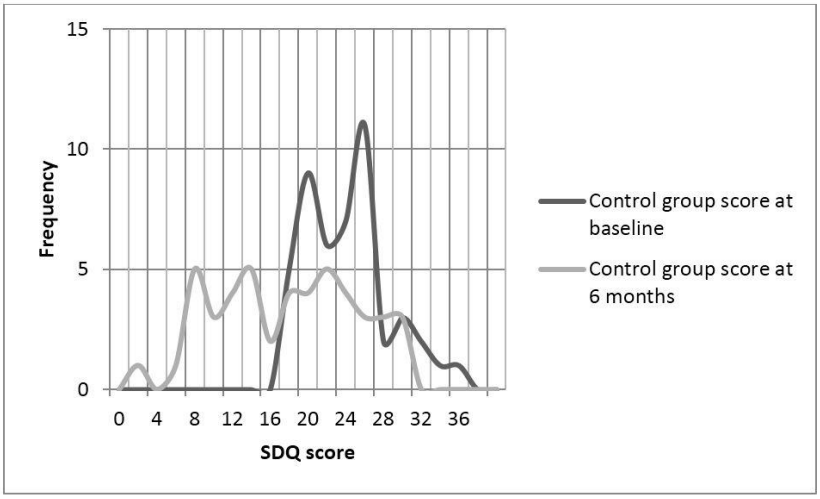


Figure 1b Control SDQ score between baseline and 6 months



Bootstrapping and Cost-Effectiveness Acceptability Curves (CEACs)

Figure 2a shows the cost-effectiveness planes for the SDQ. The majority of point estimates fell in the NE quadrant of the cost-effectiveness planes, indicating that the intervention is both more costly and more effective than the waiting list control. The CEAC in Figure 2b shows the probability that the intervention is cost-effective for a range of willingness to pay thresholds. For example, if society is willing to pay £2,500 for a point improvement on the SDQ there is an 82% probability of the IY programme being cost-effective.

Figures 2a Cost-effectiveness plane as measured by the SDQ

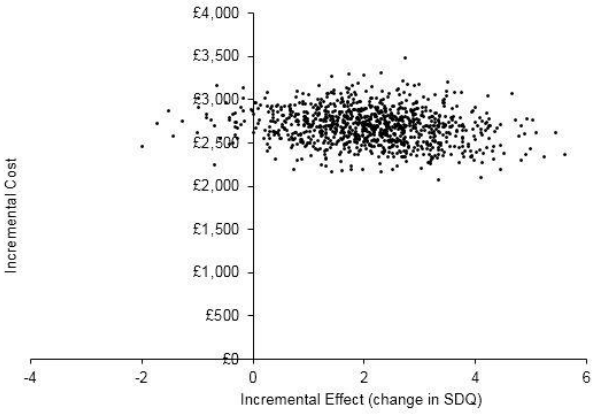
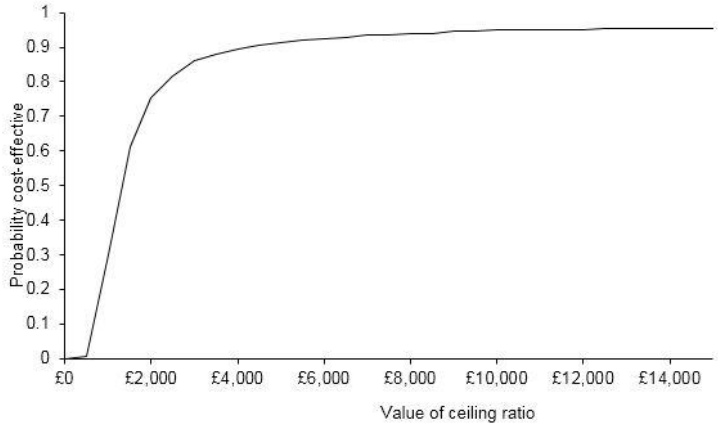


Figure 2b Cost-effectiveness acceptability curve as measured by the SDQ



Sensitivity Analysis

Sensitivity analysis was conducted to see the effects of running the IY programme with 12 participants (the suggested maximum) per group compared with the base case scenario of 8 (including full set-up and running costs). As the group running costs are mostly fixed (i.e. preparation and delivery time is unchanged regardless of the number of participants), we divided the running costs per group by 12 to calculate the mean cost per child for a group of 12. The ICER reduced from £1,295 to £905 per one point improvement on the SDQ (95% lower bootstrapped confidence interval (CI) £388, upper is dominant as 2.6% of replications were more costly and less effective). The ICER reduced from £237 to £166 per one point improvement on the ECBI-I score (95% CI £73, upper is dominant as 3.3% of replications were more costly and less effective) and from £9,477 to £6,413 per one point improvement on the APS (95% CI £3,313 to £54,047).

Table 6: Sensitivity analysis (economic analysis sample)

Measure	Incremental difference in cost	Incremental difference in effect	ICER (Bootstrapped 95% CI)
Group size of 12			
SDQ total	£1,873.62	2.07	£905 (£388, [a])
ECBI-I	£1,873.62	11.31	£166 (£73, [b])
APS total	£1,686.49	0.263	£6,413 (£3,313 to £54,047)
Participants attending 7 or more sessions			
SDQ total	£2,528.79	3.67	£689 (£414 to £1,964)
ECBI-I	£2,528.79	14.32	£177 (£91 to £1,684)
APS total	£2,533.95	0.35	£7,240 (£4,167 to £27,012)

[a] 2.6% of replications are more costly and less effective giving a dominant upper CI of -£306,223

[b] 3.3% of replications are more costly and less effective giving a dominant upper CI of -£2,331

Sub-group analysis

We repeated our analysis for a sub-group of parents who attended seven or more of the 12 sessions (55/97 in the intervention group). In this case, the ICER fell from £1,295 to £689 per one point improvement on the SDQ (95% CI £414 to £1,964); the ICER fell from £237 to £177 per one point improvement on the ECBI-I (95% CI £91 to £1,684) and the ICER fell from £9,477 to £7,240 per one point improvement on the APS (95% CI £4,167 to £27,012). The sub-group analysis should be considered indicative as the analysis loses power with the reduction in participant numbers.

Discussion

Main Findings

This paper reports an evaluation of the IY parent programme, delivered as part of BCC's Brighter Futures initiative. Inflating costs to 2009/10, previous cost-effectiveness analyses of the IY BASIC Parenting Programme showed an ICER of £84 per one point improvement in ECBI-I scores (95% CI of £57 to £191) (Edwards et al., 2007) and £63 per one point improvement in ECBI-I scores (90% CI £34 to £113) (O'Neill et al., 2013). Our findings were considerably higher, with an ICER of £237 per point improvement on the

ECBI-I; however, the cost of running IY with existing staff trained to deliver the programme, has been shown to be lower in the long run. Programmes that may seem expensive at the time of set up are vital for generating evidence on effectiveness and cost-effectiveness for policymakers to be able to develop evidence-based longer term investment plans.

Interpretation and Commissioning Implications

The findings led BCC to reconfigure services, train additional staff and roll out the IY parent programme across the city for parents of identified high risk three and four year olds (using the SDQ as a screener). In 2015, BCC were using a 16 area locality model, with twenty IY BASIC parent groups currently running. Two or three groups are run per locality per year, dependent upon level of need, with a minimum of 32 groups per annum. During the course of the research trial 12 BCC group leaders became certified leaders in the programme. This involves passing a rigorous quality control mechanism involving videotape review, self-reflection and parent feedback. Five certified leaders have undertaken peer coach training that enables them to provide in house supervision to newer group leaders and two leaders have been identified to train as in house trainers or mentors, which will further reduce costs by bringing the whole process in-house. An IY administrator has been employed to oversee this strategy and a further 15 staff were trained as group leaders in 2013 and 20 in 2014. Based on this reconfiguration, and given the benefits of scale and the earlier infrastructure support in terms of training and materials, the cost of the ongoing service is considerably lower than that reported for the research trial (see Supplementary Table 2). Lower costs after programme roll-out have also been found in previous studies of IY (Charles et al., 2013). This is likely to be because the supervision led to leader certification and bought leader support in house.

From a policy perspective, we need to ask how much BCC is prepared to pay for a one point improvement on the SDQ, ECBI or APS. Difficulty interpreting the clinical

significance of one-point improvements on these scales leads us to explore how resources invested lead to shifts in the distribution of scores of children's behaviour and parenting skills. In order to assess the probability of cost-effectiveness for each of the measures we need to set payer thresholds which are by nature arbitrary. It appears that for the IY BASIC parent programme, roll-out after a research study is costing less due to the prior investment in training, resources and supervision.

While research findings do not always lead to wider implementation and roll-out, this study confirmed to BCC and policy-makers that the Brighter Futures' IY Parenting Programme provides benefits on a range of child behaviour and parental competence measures at a modest additional cost and by using regular children's centre staff this left the BCC with a cadre of trained and experienced staff. This was the only one of the three programmes trialled under the Brighter Futures Initiative that showed effectiveness (Little et al., 2012) and as a consequence the only programme that has continued to receive ring-fenced Brighter Futures funding. BCC's work in implementing evidence based service provision and investment in early prevention initiatives has been recognised in the Children's and Adolescents' Mental Health and CAMHS report (House of Commons, 2015).

Approximately 57% of parents in the intervention arm attended at least seven out of 12 sessions. This was lower than in previous studies; Hutchings et al. (2007) had an 83% rate of attendance of 7+ sessions and Webster-Stratton (1998b) had an 88% rate of attendance for 6+ sessions. The benefits of attending 7+ sessions compared to the waiting list control are clear; parents who attended 6 or less sessions performed comparably to parents in the waiting list condition, whereas parents attending 7+ sessions had an incremental improvement of 3.67 SDQ points over the control condition. A practical implication of this result is the need to encourage parents to attend the sessions to reduce drop-out rates.

Strengths of the Study

Economic evaluation of Public Health initiatives, including prevention and early intervention services, requires a broader set of costs and outcomes than economic evaluations of clinical interventions to be considered. This paper does this by including outcomes for both children and parents, and presenting results not only as conventional ICERs but also in terms of the proportion of children who move from clinical concern to below clinical concern cut off on the SDQ. Also we undertake sub-group analysis to further explore the impact of dose, i.e. the number of sessions attended by parents, on the ICER estimate.

Limitations of the Study

There are two main limitations to the design of the Birmingham Brighter Futures IY Trial. Firstly, this trial was fairly small, with an economic analysis based on 144 participants, representing 98.0% of the clinical sample of 147 participants. However, a sample size and power calculation was conducted and we recruited to that target so we can have confidence in our findings. Secondly, participating index children and families were only followed up for six months so that the control families could be offered the intervention as soon as possible.

Implications for Future Research

There is a growing evidence base for the effectiveness of the IY Basic parent programme and this paper adds to an increasing number of published articles on the cost-effectiveness of IY. Commissioners are interested in the longer term benefit-cost ratio or return on investment in childrens services. Our study provides further data for the construction of future economic models to forecast such longer term benefit-cost ratios. Future trials with accompanying economic evaluation studies would benefit from longer follow-up, greater attention to context and potential effects of other programmes running

simultaneously; and greater attention to the impact of dose of intervention on cost-effectiveness.

Comparison of Findings with Published Literature

There are a small but growing number of cost-effectiveness analyses of parenting interventions (O'Neill et al., 2013; Edwards et al., 2007; Charles et al., 2011; Simkiss et al., 2013) with some attempt to look at the longer-term effectiveness of these programmes (O'Neill et al., 2013; Bywater et al., 2009; Muntz et al., 2004). This trial would have benefited from a longer follow-up period, although ethically it is considered inappropriate to withhold intervention from control families for a programme with an increasingly strong evidence base for its effectiveness. Previous authors have estimated the longer-term return on investment of parenting programmes (O'Neill et al., 2013; Muntz et al., 2004). Recently two reports have been published by the Social Research Unit focusing on Youth Justice and Early Years and Education (The Social Research Unit, 2012a; The Social Research Unit, 2012b). These reports highlight interventions that provide the best value for money in terms of benefit-cost ratios and return on investment and, as the Birmingham Brighter Futures Initiative demonstrates, costs fall significantly when the appropriate infrastructure is developed to build on research findings and roll the programme out in a widespread way. The cost of £9,672 to move a child in the intervention group from above to below the SDQ cut-off over and above the proportion who would have moved without intervention is considerably higher than the average cost per family of parenting programmes of £1,507 reported in Furlong et al. (2012) and £700-£4,273 reported in Dretzke et al. (2005), largely due to the higher intervention cost in this study.

Conclusions

The costs of CD in childhood and associated costs in later life are potentially great to the family, the National Health Service, social care services and the judicial system. Despite funding cuts BCC is making a major financial commitment to public health prevention and early intervention. Based on cost-effectiveness findings from the Birmingham Brighter Futures IY RCT, which showed an additional 23% of children moved from above the cause for concern cut-off to below on the SDQ in the IY intervention group at a cost of £2,418 per child (8 per group) or £1,612 per child (12 per group), BCC has rolled-out the IY parenting programme across the city; demonstrating the effect of evidence-based policy making in action.

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Ethical Approval: North West Wales Ethics Committee.

Trial No. ISRCTN48762440

Supplementary Table 1: Unit cost of health, social care and education costs in UK pounds for 2009-10) with source of costs[1]

Healthcare resource	Unit	Unit cost	Details
GP (surgery)	Visit	36	Per consultation (11.7 mins). (10.8b, [*])
GP (home visit)	Visit	120	Per consultation includes travel (23.4 mins) [*]
GP (phone)	Phone	22	Per telephone consultation lasting 7.1 minutes [*]
GP (clinic)	Visit	53	Per consultation (17.2 mins) [*]
Practice nurse (surgery/clinic)	Visit	12	Per consultation (15.5 mins.) (10.6, [*])
Practice nurse (home)	Visit	20	Per consultation (27 mins.) (10.6, [*])
Specialist nurse (clinic or surgery)	Visit	17	Per consultation (15 mins) (10.7, [*])
Health visitor, specialist or LAC nurse) (home visit)	Visit	42	Per consultation (20min) (10.3, [*])
Community speech therapist, occupational or physiotherapist	Visit	17	Per clinic consultation (30min) (9.3, [*])
Community speech therapist, occupational or physiotherapist (home)	Visit	47	Per home visit (9.3, [*])
Play therapist	Visit	47	Based on above
CPN	Visit	56	Per face-to face session (1hr) (10.2, [*])
Dietitian	Clinic	32	Per hr consultation (13.4, [*])
Social care resource			
Social worker (children)	Office	72	Per client related hour (11.3, [*])
Social worker (children)	Home	199	Per face-to face session (1hr) (11.3, [*])
Assistant social worker, sessional worker or link worker	Office	33	Per client related hour [*]
Assistant social worker, sessional worker or link worker	Home	103	Per face-to face session (1hr) (11.4, [*])
Community paediatrician	Clinic /hospital	300	NHS Reference Costs 2009-10, CP60FCPH TCSCMO
Generic multidisciplinary CAMHS team	Clinic /hospital	72	Per team member per contact hour (12.7, [*])
Home Start	Home	29	Per hour visit (p.27 Curtis & Netten [+] inflatedusing Inflation Indices P 189 & Curtis p. 225, [*])
Sure Start	Centre	6	Per hour Toddler Group or Stay & Play (p.26 Curtis & Netten [+] inflated using Inflation Indices Curtis p. 225 [32])
Sure Start	Home	71	Per hour visit (p.27 Curtis and Netten [+] inflated using Inflation Indices Curtis p. 225 [*])
Flying Start	Home	71	Based on above
Family support (parenting skills intervention)	Outreach	38	Per hour visit (p.31 Curtsi & Netten [+] inflated using Inflation Indices P 189 & Curtis p. 225 [*])
Counsellor		71	Per consultation (2.14, [*])
Fostering respite care		676	Per week [*]

Education care resource			
Head teacher	School	56	Per hour consultation (based on mid Pt L14-27 qualified teacher salary scale 2009-10 £61,302)
Classroom teacher	School	27	Per hour consultation (based on mid Pt M4-6 qualified teacher salary scale 2009-10 £29,328)
School Nurse	School	37	Per consultation (30mins) [*]
Educational Social Worker	School	199	Costed as social worker child fact to face contact per hour (11.3, [*])
School doctor	School	283	Per face-to-face contact (CP60FO, NHS Reference Costs 2009-10)
Educational psychologist	School	81	Per hour per patient contact (9.5, [*])
One-to-one classroom assistant	School	16	Per hour (Gwynedd Council Education Dept) (Edwards et al. [~]) [2]
Small group assistance	School	5	Per hour / child (based on 3 children / group) (Gwynedd Council Education Dept) [~])[2]
Special teaching	School	35	Per hour (Gwynedd Council Education Dept) [~] [3]
Educational needs statement	School	219	Per statement (Assumes 4hrs: 1hr face-to-face + 3hrs related activity) [~] & 9.5, [*])
Psychological assessment	School	219	Per statement (Assumes 4hrs: 1hr face-to-face + 3hrs related activity) [~] & 9.5, [*])
Special Education Cost (Special Communication with Headmaster, 23rd June 2009 cost year 2008-09, inflated to 2009/10 as Curtis 2010 p227) **Unit cost**			
Cost per child per school year attending LEA funded school on day basis = £14,000			
Cost per child per week (= £14,000/42 school weeks in a year)			£337
Cost per child per school year attending LEA funded residential school = £28,000			
Cost per child per week (= £28,000/42 school weeks in a year)			£674
Secondary care costs (DH *NHS Reference costs 2009-10)*			
Costed on an individual level by consultation, day cases and in-patients. Further details on request			Various

[1] All rounded to the nearest £
[2] Cost extracted from Edwards, R.T. et al. 2008 inflated from cost year 2003/04 to 2009/10 using Hospital & Community Health Service (HCHS) inflation indices Curtis, L. 2010, p.225
[3] Linck, P. et al 2011
* Curtis, L. 2010
+Curtis, L. & Netten, A. 2004
~Edwards, R.T. et al 2008

Supplementary Table 2: Programme costs and cost per child of running IY parenting groups over a 14 session programme since the research trial, exclusive of non-recurrent (training costs) inclusive of employers on costs of 21% and 10% management costs for 2012-13.

Recurrent group costs to deliver the IY pre-school BASIC and BASIC (n=300, 30 groups) (based on costs from BCC)			**Total Cost (£)[1] Per Group**	
Project management and recruitment of parents (based on costs supplied by BCC)				
	Gross salary	**Time employed**		
Project Manager	24,000 / year	0.7 FTE	24,000	
Administrative support	14,000 / year	0.5 FTE.	14,000	
Project management sub total			*38,000*	
Project management for 1 parenting group (total/30 groups)				***1,267***
Parenting programme delivery cost (based costs supplied by BCC for 30 groups)				
	Mean (SD) Unit time	**Mean (SD) unit**		
Group Delivery consisting of Preparation time for 2 leaders (including room preparation), Session time for 2 leaders and Follow-up time (including travel, home visits, phone and admin)	23.87 (12.06) / hr	15 hrs.		5013
Supervision including travel time	£2,000 / supervision	3 supervisions per year	6,000	200
Group subtotal				***5,213***
Cost of running 1 parenting group over 14 week programme, including project management and supervision				
Total				6,480

[1] rounded to the nearest whole pound and all salaries include employers on-costs