

Estimating the short term cost effectiveness of a mental health promotion intervention in primary schools.

A report prepared for the National Institute for Health and Clinical Excellence:
Public Health Interventions Programme

Christopher McCabe PhD
Professor Health Economics
Academic Unit of Health Economics
Institute of Health Sciences
University of Leeds

Fairbairn House
71-75 Clarendon Rd.
Leeds
LS2 9PL

Tel: 0113 343 6989
Email: c.mccabe@leeds.ac.uk

Acknowledgments

I would like to acknowledge the assistance of Sarah Stewart Brown and Adi Yasser of Warwick Medical School, and Bhash Naidoo and Amanda Killoran of NICE, in the preparation of this report. The usual disclaimer applies.

Abstract

A systematic review identified no published cost effectiveness analyses of universal interventions to promote mental health in primary schools. The preliminary analysis reported here uses the Health Utilities Index Mark 2 (HUI2) framework to estimate the cost effectiveness of a combined parent and classroom based intervention. If the small to moderate effect size observed in trials translates into a 1level improvement on the emotional functioning domain of the HUI2 the expected Incremental Cost Effectiveness Ratio (ICER) for the within school analysis is slightly over £10,000 per QALY. The probability that the ICER is less than £30,000 per QALY is 65%. If the intervention impacts upon school performance as measured on the cognition domain of the HUI2, as well as the emotional functioning domain, then the expected ICER is £5,500 per QALY. The probability that the ICER is below £30,000 per QALY is 66%.

The analyses are exploratory, reflecting the nature of the evidence base for the effectiveness of these interventions. They do not take account of the costs to parents of attending the parent training programme, nor any sustained health, educational or socio-economic benefits of the intervention. The results should be interpreted with caution.

Background

A systematic search of the literature did not find any published economic evaluations of universal mental health promotion interventions in primary schools.¹

This report describes the construction and initial results of an exploratory analysis of the cost effectiveness of a universal mental health promotion intervention in primary school.

The focus of the analyses is the changes in health related quality of life associated with greater emotional well-being and cognitive function, during primary school education; i.e. between the ages of 7 and 11. A separate set of analyses are being undertaken which will attempt to link these changes to longer term educational, health and justice service outcomes.

The objective of the analyses is to estimate the incremental cost per quality adjusted life year gained for universal health promotion interventions in primary school compared to no intervention.

Separate analyses are presented for the universal and focussed interventions.

Methods

Universal Intervention

The illustrative intervention is based broadly the PATH programme (ref). The intervention requires 3 20 minute sessions per week for each class in the school run by the class teacher. Each teacher attends a 3 day training course with a half refresher course at the start of years 2 and 3. There is also a school

co-ordinator responsible for managing the intervention across the school and providing the parent training.

Parent training is assumed to consist of a 10 week course of weekly sessions, with each session lasting 2 hours. Parent training sessions are delivered to groups of not more than 10 parents. For each class of 30 children it was assumed that 3 parent training sessions would be required each week.

The intervention lasts for 3 years and commences in year 3; i.e. at the start of the primary school. The effect is assumed to be maintained in year 6, even though the intervention stops at the end of year 5.

Focussed intervention

The focussed intervention is presumed to be similar in content to the universal intervention. However, children with identified problems receive the intervention outside of the classroom in small groups or individually.

Describing Health Related Quality of Life.

The HUI2 is the only preference based multi-attribute health related quality of life instrument specifically developed for use with children.[2] It consists of seven dimensions (sensation, mobility, emotion, cognition, self care, pain and fertility), each of which has between three and five levels. The levels describe a range, from 'normal functioning for age' to 'extreme disability'. [Appendix 1]. When it is being used as a generic health status instrument, the developer recommend that Fertility is excluded. The UK valuation survey excluded the fertility dimension completely. ³

Estimating Health Related Quality of Life in children in main stream education

The largest HUI2 dataset for UK children was collected by the MRC UK Paediatric Intensive Care Outcome Study.(UK PICOS).⁴ Details of the study are reported by Jones et al (2006). It is possible to identify a subset a children within this cohort who did not have a major pre-existing health problem which explained (in whole or part) their admission to intensive care. For the purposes of this evaluation, the HUI2 data for these children were used to describe the Health Related Quality of Life of children attending mainstream schools.

The UK PICOS included subjects aged from 1 month to over 18 years, we selected cases aged between 7 and 10 years at their last birthday (i.e. children of primary school age) who had no significant pre-existing health problem. ⁴

We then used these data to simulate age specific primary school children's health related quality of life. The results of this simulation were used to identify the mean Health Related Quality of Life for each primary school class group in the absence of the intervention.

Table 1 gives the mean (s.d.) health related quality of life (utility) for each primary school year group estimated by the simulation.

Table 1: Expected Health Related Quality of Life (Utility)

	Mean Utility	Standard Deviation
Year 3	0.86	0.11
Year 4	0.86	0.11
Year 5	0.84	0.11
Year 6	0.77	0.12

Effectiveness of the universal intervention

Stewart-Brown et al report a small to moderate effect size for within school interventions containing both a classroom and parenting intervention. No preference based health related quality of life data are reported in the effectiveness literature. The literature uses primarily education and behavioural outcome measures. The small to moderate effect size is assumed to translate into an improvement of 1 level on the relevant dimension of health related quality of life, with the associated increase in expected health related quality of life (utility).

The analysis reported below considers two possible models of impact upon health related quality of life. The first assumes that the intervention impacts upon the emotional well-being of the children only. The second assumes that the intervention impacts upon educational performance as well as the emotional well-being. The cognition dimension of the HUI2 uses educational performance descriptors and thus improved educational performance is assumed to translate into a 1 level improvement on the cognition dimension with the associated increase in health related quality of life.

The utility associated with the simulated HrQoL was calculated using the UK HUI2 valuation algorithm.⁴ The utility gain associated with effective therapy was taken from the same algorithm. As the magnitude of the gain depends upon starting level, the variable was specified as a distribution, based upon the distribution of initial levels seen in the UK PICOS data used to simulate the mean untreated health related quality of life. These distributions are reported in Appendix 2.

The probability that the intervention was effective was set at 80%. The uncertainty around the probability of effectiveness was characterised using a beta distribution.

Effectiveness of the focussed intervention

As the focussed intervention is provided to children with observable problems, we assumed that these children would be at level 3 or below on the emotion dimension of the HUI2 (approx 7% of the sample). We considered three alternative degrees of effectiveness:

- Intervention produces a 1 level improvement on emotion;
- Intervention produces a 2 level improvement on emotion;
- Intervention produces a 2 level improvement on both emotion and cognition.

Costs of the Universal Intervention

The cost of the intervention was calculated as follows:

Classroom intervention was costed on the basis of delivery by a class teacher on mid-point of the primary teaching scale with no management or other special responsibility points.

The co-ordination role was assumed to be undertaken by an experienced primary school teacher on the bottom of the third tertile of the primary teachers pay scale. They were assumed to receive one additional management/special responsibility point. It was assumed that the co-ordination role required 15 minutes per class per week. In addition, the co-ordinator was responsible for delivering staff training – which was assumed

to consist of 1 day staff training session per year, with 1 day allowed for preparation.

The parent training intervention was presumed to be provided by the co-ordinator or equivalent level of staff. The parent training intervention is assumed to be delivered in the first year of the programme only; i.e. to year 3 parents.

In order to estimate the cost per child, we assumed that the intervention was delivered in a primary school with two form entry, with 30 children in each class. To simplify the analysis, we have costed the steady state; i.e. in each year, only one year group receives the parent training (year 3) and 3 out of the 4 years (years 3,4 and 5) receive the classroom intervention.

Table 2 reports the constituent parts and unit costs used to estimate the annual cost of the intervention.

Costs of the Focussed Intervention

The costs of the focussed intervention are the same as for the universal intervention except for a reduction in the school co-ordinator time and the parent training resource costs. These were pro rata for the number of children involved in the programme.

Outputs of the analyses

The results report the expected incremental cost effectiveness of intervention compared to no intervention. The uncertainty around the ICER is represented as a scatterplot on the cost effectiveness plane. The decision uncertainty is represented using a cost effectiveness acceptability curve.^{5 6}

Table 2: Resources and costs required for the Intervention

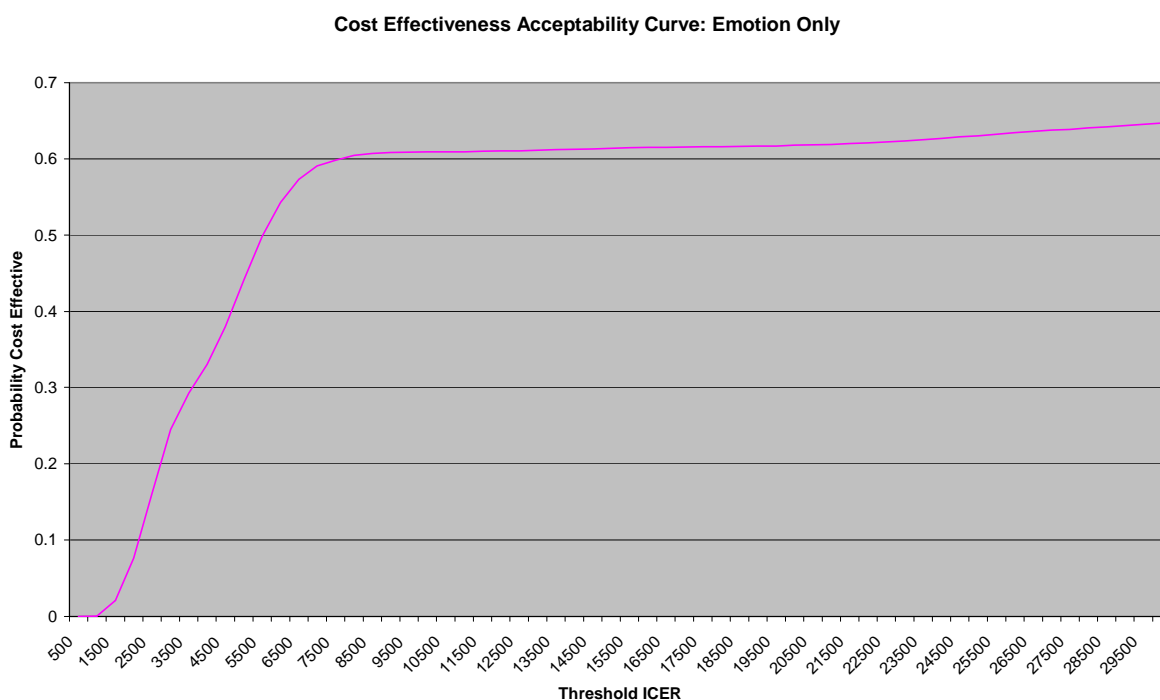
Class Teacher			School Co-ordinator		Ta	Materials
Salary plus on-costs	£43,070		Salary plus on costs	£57,670		Cost of Parent Course Book £3
Number in class	30		Time per Class in School per week (hours)	0.25		Children per family 1.80
Number of weeks per year	40		Number of classes	8		Number of Books required 33
Number of Sessions per week	3		Staff Training Preparation and Delivery (hours)	16		Total Cost of Parent Course Books £100
Duration of Sessions	0.33		Parent session preparation (hours)	8		
Training hours	8		Parent session delivery (hours)	2.5		Cost of Teacher Course Book £10
Administration per week	1		Number of Parent Sessions	60		Number of Books required 9
Total Annual Hours	87.6		Total intervention hours per year	254		Total Cost of Teacher Course Book £90
Intervention hours as % of total worked hours	5.84		Intervention hours as % of total worked hours	17		Total Cost of Materials £190
Salary cost attributable to intervention	£2,515		Salary cost attributable to intervention	£9,765		
Salary cost per child receiving intervention	£84		Salary cost per child receiving intervention	£41		Materials Cost per Child £1
Total cost per child per year	£125					

Results

Universal Intervention

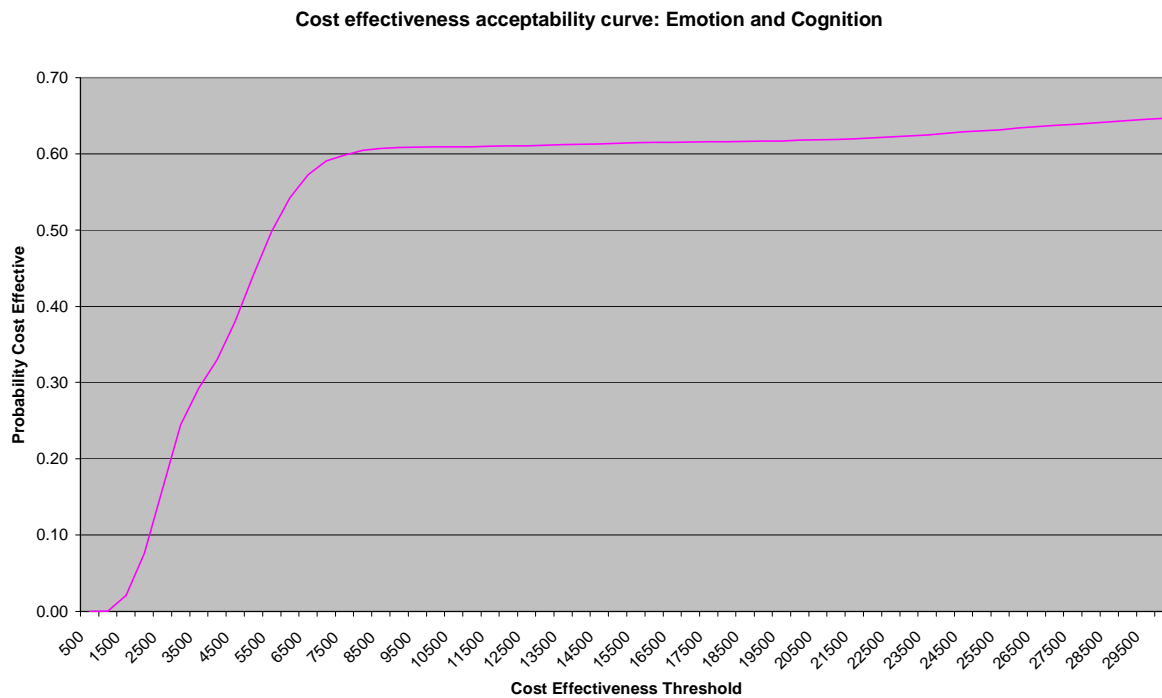
Assuming that the intervention impacts upon emotional functioning only, the Expected ICER for Universal Mental Health Promotion Intervention in Schools is £10,594 per QALY.

Figure 1 shows the cost effectiveness acceptability curve under the assumption that the intervention impacts upon the Emotion dimension of Health Related Quality of life only. The scatterplot on the cost effectiveness plane is reported in Appendix 2.



Assuming that the intervention impacts upon emotional and Cognition (functioning in school), the Expected ICER for Universal Mental Health Promotion Intervention in Schools is £5,278 per QALY.

Figure 2 shows the Cost Effectiveness Acceptability Curve assuming that the intervention impacts upon the emotional and cognition dimensions of Health Related Quality of Life. The scatterplot on the cost effectiveness plane is reported in Appendix 3.



Focussed Intervention

The expected ICER for the focussed intervention ranges from £177,560 per QALY assuming a two level improvement on both the emotion and cognition dimensions to £988,404 per QALY if the intervention produces only a 1 level improvement on the emotion dimension.

Discussion

If we accept the analysis presented above, then the expected cost effectiveness of universal interventions is sufficient to justify its provision, assuming the cost effectiveness threshold utilised in the NICE Appraisal Programme are appropriate for the Public Health Interventions programme.

By contrast, the focussed interventions are not cost effective in the short term for any realistic cost effectiveness threshold. The difference in the results is driven by the large reduction in the number of children who benefit from the focussed intervention compared to the universal programme without a proportionate reduction in the cost of providing the intervention.

There are a number of issues to consider. First, there must be some doubt that the sample used to describe the health related quality of life in children in mainstream schools is genuinely representative. A different distribution would lead to different magnitude of benefit, and by extension, different degrees of cost effectiveness.

Second, the evidence for effectiveness has been operationalised within this analysis by assuming that the small to moderate effect size reported in the review of effectiveness of intervention translates into a single level improvement in the emotion and/or cognition domains of the instrument. Whilst this assumption is plausible, there is no direct evidence of this.

The analyses do not consider the costs incurred by the parents to attend the training sessions. Perhaps more importantly, nor does it consider the potential longer term benefits of the intervention. Observational evidence supports the hypothesis that improved mental well being/social functioning during school is associated with better outcomes in health, educational attainment, income and reduced risk of criminal activities on the long term. Work on the feasibility of modelling the long term cost effectiveness of these interventions is on-going.

Substantial reductions in the cost of the focussed intervention may be achievable if the provision was co-ordinated across a number of schools to achieve economies of scale. In addition, the analysis of the focussed intervention did not consider the possibility of improvements in the quality of life of their peers due to the reduction in the incidence of the treated children's problem behaviours.

Published economic evaluations of focussed interventions indicate that the long term costs savings to the public purse, in the health, education, social care and legal arenas, from effective treatments mean that these interventions are cost saving in total. (e.g.Sutcliffe et al, NICE 2005). However, further work is required to establish the long term cost effectiveness of focussed interventions in primary school.

Appendix 1: Dimension and Level Descriptions for the Health Utilities Index Mark 2

Dimension & Levels	Description	Dimension & Levels	Description
Sensation Level 1	Able to see, hear and speak normally for age	Self Care Level 1	Eats, bathes, dresses and uses the toilet normally for age
Level 2	Requires equipment to see or hear or speak	Level 2	Eats, bathes, dresses or uses the toilet independently with difficulty
Level 3	Sees, hears, or speaks with limitations even with equipment	Level 3	Requires mechanical equipment to eat, bathe, dress, or use the toilet independently
Level 4	Blind, deaf, or mute	Level 4	Requires the help of another person to eat, bathe, dress or use the toilet
Mobility Level 1	Able to walk, bend, lift, jump and run normally for age	Cognition Level 1	Learns and remembers schoolwork normally for age
Level 2	Walks, bends, lifts, jumps or runs with difficulty but does not require help	Level 2	Learns and remembers schoolwork more slowly than classmates as judged by parents and/or teachers
Level 3	Requires mechanical equipment (such as canes, crutches, braces or a wheelchair) to walk or get around independently	Level 3	Learns and remembers very slowly and usually requires special educational assistance
Level 4	Requires the help of another person to walk or get around and requires mechanical equipment	Level 4	Unable to learn and remember
Level 5	Unable to control or use arms or legs	Pain Level 1	Free of pain and discomfort
Emotion Level 1	Generally happy and free from worry	Level 2	Occasional pain. Discomfort relieved by non-prescription drugs or self-control activity without disruption of normal activities
Level 2	Occasionally fretful, angry, irritable, anxious depressed or suffering from "night terrors"	Level 3	Frequent pain. Discomfort relieved by oral medicines with occasional disruption of normal activities
Level 3	Often fretful, angry, irritable, anxious depressed or suffering from "night terrors"	Level 4	Frequent pain. Frequent disruption of normal activities. Discomfort requires prescription narcotics for relief
Level 4	Almost always fretful, angry, irritable, anxious, depressed	Level 5	Severe pain. Pain not relieved by drugs and constantly disrupts normal activities.
Level 5	Extremely fretful, angry, irritable, anxious or depressed usually requiring hospitalisation usually requiring hospitalisation or psychiatric institutional care	Fertility Level 1	Able to have children with a fertile spouse
		Level 2	Difficulty in having children with a fertile spouse
		Level 3	Unable to have children with a fertile spouse

Appendix 2: Distributions used in probabilistic sensitivity analysis

Crystal Ball Report - Assumptions

No Simulation Data

Assumptions

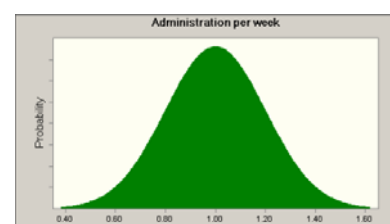
Worksheet: [CEQALYsimulation1.xls]CE Emotion&Cognition

Assumption: Administration per week

Cell:
D27

Normal distribution with parameters:

Mean	1.00
Std. Dev.	0.20

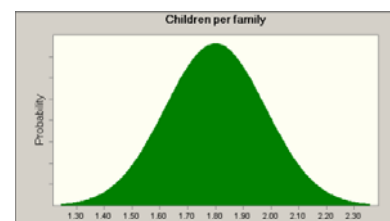


Assumption: Children per family

Cell:
J22

Normal distribution with parameters:

Mean	1.80
Std. Dev.	0.18

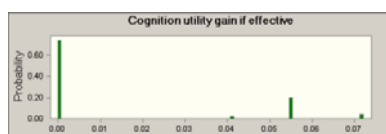


Assumption: Cognition utility gain if effective

Cell:
R7

Custom distribution with parameters:

Value	Probability
0.00	73.90
0.04	2.20
0.06	19.60
0.07	4.30

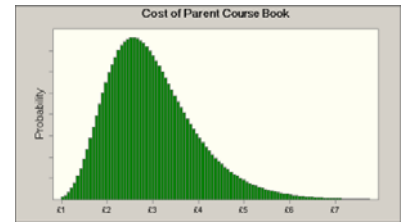


Assumption: Cost of Parent Course Book

Cell:
J21

Lognormal distribution with parameters:

Mean £3
Std. Dev. £1

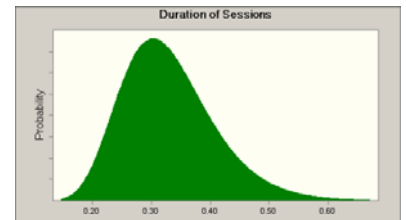


Cell:
D25

Assumption: Duration of Sessions

Lognormal distribution with parameters:

Mean 0.33
Std. Dev. 0.08

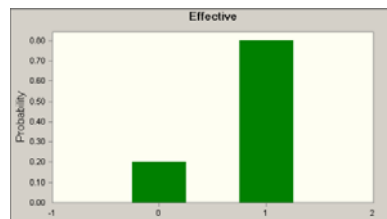


Cell:
S7

Assumption: Effective

Yes-No distribution with parameters:

Probability of Yes(1) 0.8 (=S8)



Cell:
L5

Assumption: Effectiveness

Yes-No distribution with parameters:

Probability of Yes(1) 0.15

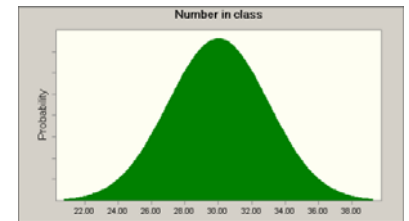


Cell:
D22

Assumption: Number in class

Normal distribution with parameters:

Mean 30.00
Std. Dev. 3.00

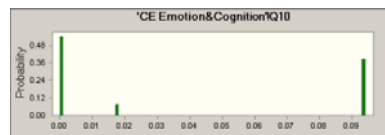


Assumption: Q10

**Cell:
Q10**

Custom distribution with parameters:

Value	Probability
0.00	53.80
0.02	7.70
0.09	38.50

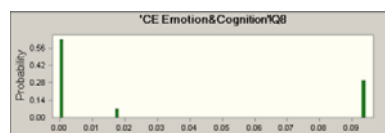


Assumption: Q8

**Cell:
Q8**

Custom distribution with parameters:

Value	Probability
0.00	62.80
0.02	7.00
0.09	30.20

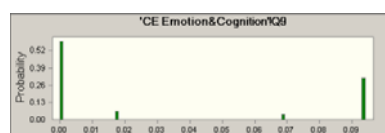


Assumption: Q9

**Cell:
Q9**

Custom distribution with parameters:

Value	Probability
0.00	58.80
0.02	5.90
0.07	3.90
0.09	31.40



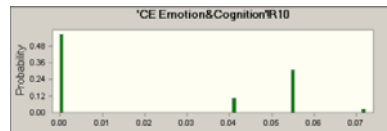
Assumption: Q9 (cont'd)

**Cell:
Q9**

Assumption: R10**Cell:
R10**

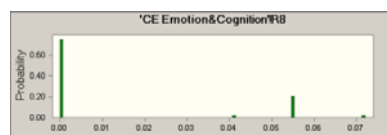
Custom distribution with parameters:

Value	Probability
0.00	56.40
0.04	10.30
0.06	30.80
0.07	2.60

**Assumption: R8****Cell:
R8**

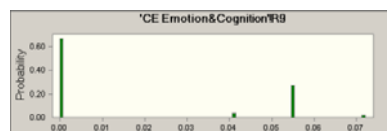
Custom distribution with parameters:

Value	Probability
0.00	75.00
0.04	2.30
0.06	20.50
0.07	2.30

**Assumption: R9****Cell:
R9**

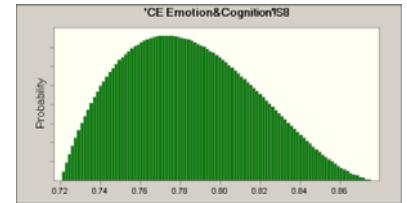
Custom distribution with parameters:

Value	Probability
0.00	66.70
0.04	3.90
0.06	27.50
0.07	2.00

**Assumption: R9 (cont'd)****Cell:
R9****Assumption: S8****Cell:
S8**

Beta distribution with parameters:

Minimum	0.72
Maximum	0.88
Alpha	2
Beta	3

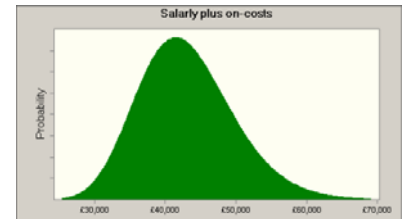


Cell:
D21

Assumption: Salary plus on-costs

Lognormal distribution with parameters:

Mean	£43,070
Std. Dev.	£6,800

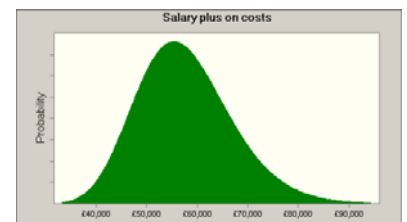


Cell:
G21

Assumption: Salary plus on costs

Lognormal distribution with parameters:

Mean	£57,670
Std. Dev.	£9,500

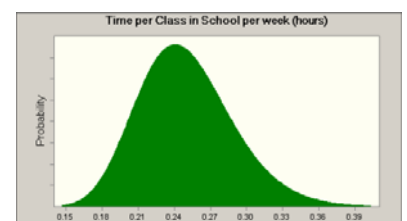


Cell:
G22

Assumption: Time per Class in School per week (hours)

Lognormal distribution with parameters:

Mean	0.25
Std. Dev.	0.04

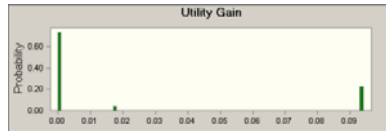


Cell:
Q7

Assumption: Utility Gain

Custom distribution with parameters:

Value	Probability
0.00	73.30
0.02	4.50
0.09	22.20



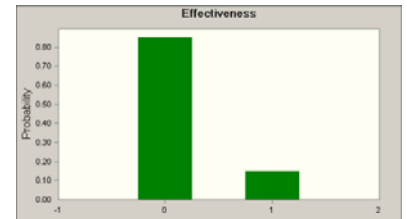
Worksheet: [CEQALYsimulation1.xls]Control Group QALYs

Assumption: Effectiveness

Cell:
L5

Yes-No distribution with parameters:

Probability of Yes(1) 0.15



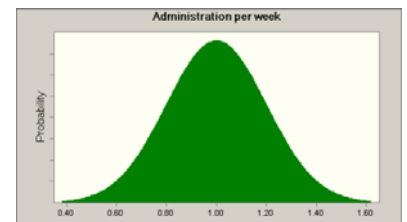
Worksheet: [CEQALYsimulation1.xls]Cost Effectiveness Emotion

Assumption: Administration per week

Cell:
D27

Normal distribution with parameters:

Mean 1.00
Std. Dev. 0.20

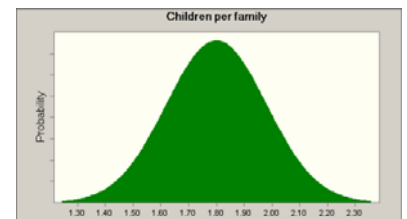


Assumption: Children per family

Cell:
J22

Normal distribution with parameters:

Mean 1.80
Std. Dev. 0.18

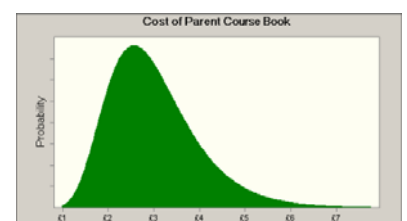


Assumption: Cost of Parent Course Book

Cell:
J21

Lognormal distribution with parameters:

Mean £3



Std. Dev.

£1

Assumption: Duration of Sessions

Cell:
D25

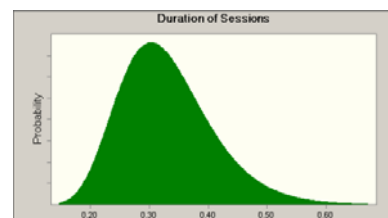
Lognormal distribution with parameters:

Mean

0.33

Std. Dev.

0.08



Assumption: Effective

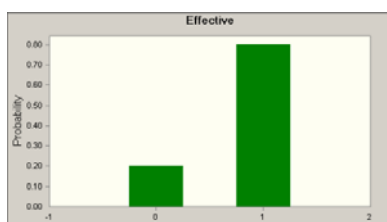
Cell:
R7

Yes-No distribution with parameters:

Probability of Yes(1)

0.8

(=R8)



Assumption: Effectiveness

Cell:
L5

Yes-No distribution with parameters:

Probability of Yes(1)

0.15



Assumption: Number in class

Cell:
D22

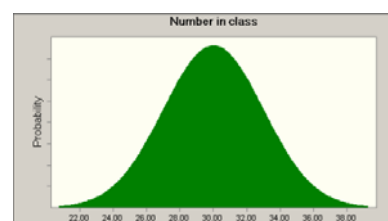
Normal distribution with parameters:

Mean

30.00

Std. Dev.

3.00



Cell:
Q10

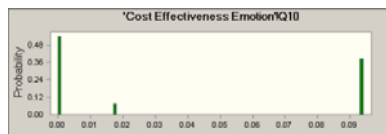
Assumption: Q10

Custom distribution with parameters:

Value	Probability
0.00	53.80
0.02	7.70
0.09	38.50

Cell:
Q10

Assumption: Q10 (cont'd)

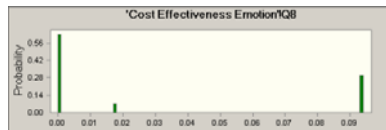


Cell:
Q8

Assumption: Q8

Custom distribution with parameters:

Value	Probability
0.00	62.80
0.02	7.00
0.09	30.20

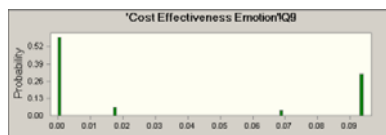


Cell:
Q9

Assumption: Q9

Custom distribution with parameters:

Value	Probability
0.00	58.80
0.02	5.90
0.07	3.90
0.09	31.40

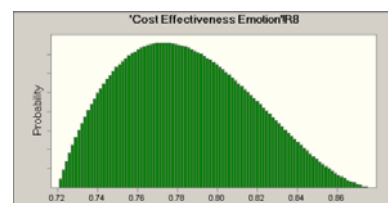


Cell:
R8

Assumption: R8

Beta distribution with parameters:

Minimum	0.72
Maximum	0.88
Alpha	2
Beta	3

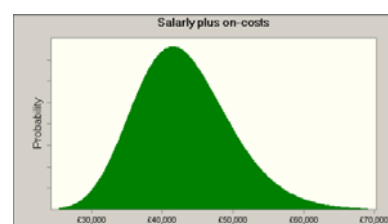


Assumption: Salarly plus on-costs

**Cell:
D21**

Lognormal distribution with parameters:

Mean	£43,070
Std. Dev.	£6,800



Assumption: Salary plus on costs

**Cell:
G21**

Lognormal distribution with parameters:

Mean	£57,670
Std. Dev.	£9,500

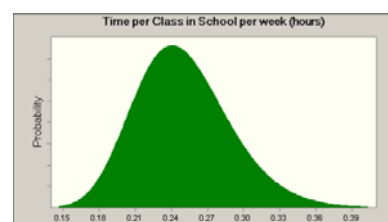


Assumption: Time per Class in School per week (hours)

**Cell:
G22**

Lognormal distribution with parameters:

Mean	0.25
Std. Dev.	0.04



Assumption: Utility Gain

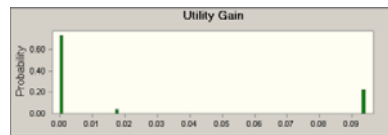
**Cell:
Q7**

Custom distribution with parameters:

Value	Probability
0.00	73.30
0.02	4.50

0.09

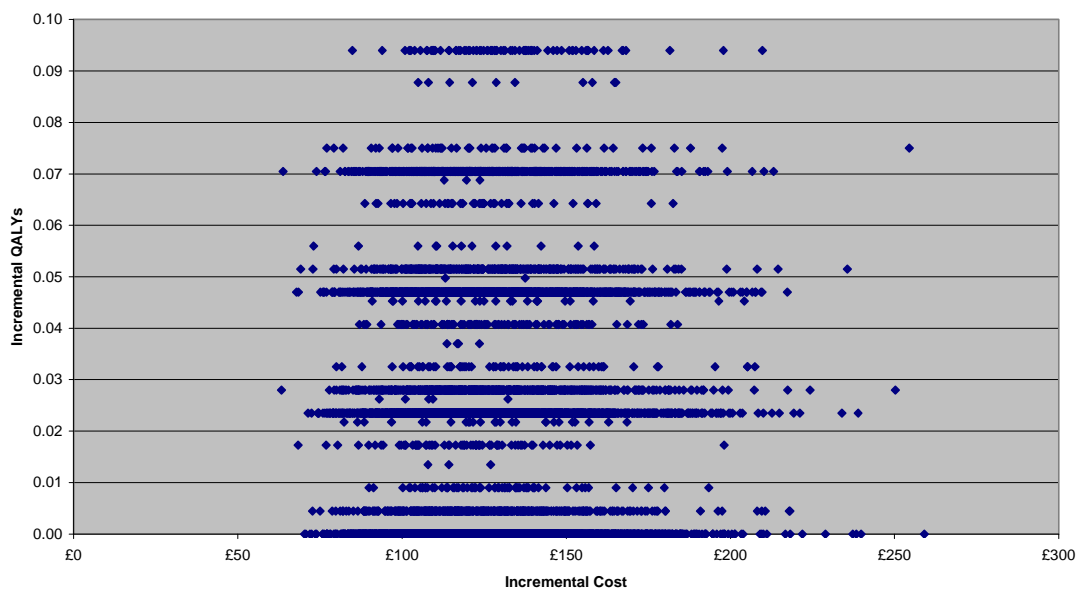
22.20



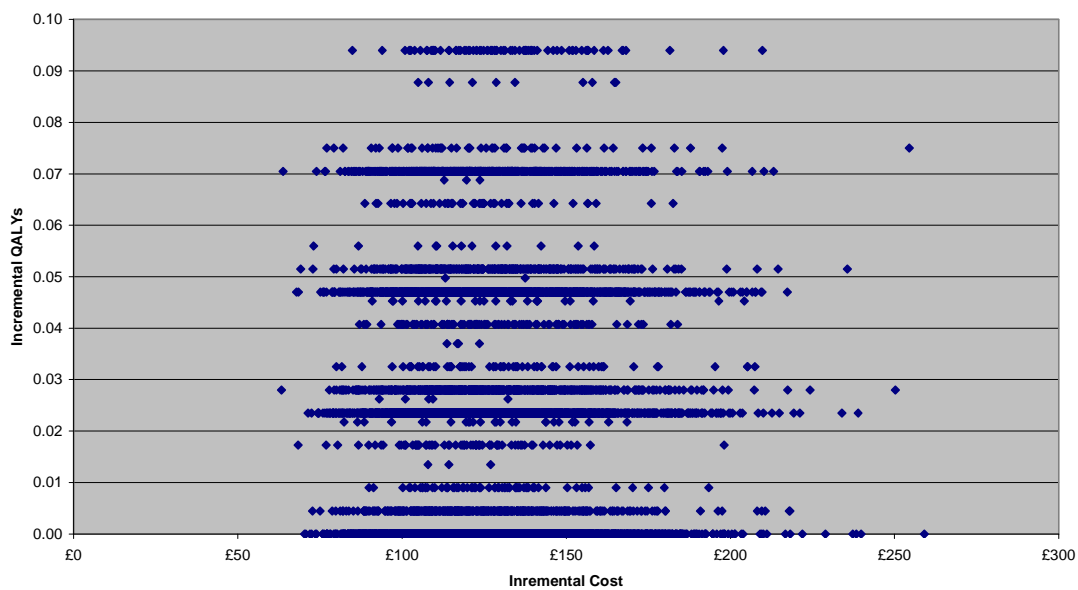
End of Assumptions

Appendix 3: Scatter plots on the Cost Effectiveness Plane

Figure 1: Scatterplot CE Plane: Emotion



Scatterplot on CE Plane: Emotion and Cognition



References

- ¹ McCabe C A systematic review of the cost effectiveness of universal mental health promotion interventions in primary schools. Report to the NICE Public Health Interventions Programme June 2007.
- [2] Feeny D. Furlong W. Barr R.D. Torrance G.W. Rosenbaum P. Weitzman S. A comprehensive multi-attribute system for classifying the health status of survivors of childhood cancer Journal of Clinical Oncology 1992; 10(6):923-928
- ³ McCabe C. Stevens K., et al Health state values for the Health Utilities Index Mark 2 descriptive system: Results from a UK valuation survey. Health Economics 2005;14(4):231-244
- ⁴ Jones, S.. Rantell, K. Stevens, K. et al. Outcome at 6 months after admission for paediatric intensive care: A report of the National study of Paediatric Intensive Care Units in the United Kingdom. Pediatrics. 2006;118:2101-2108
- ⁵ Briggs A, Fenn P. Confidence intervals or surfaces? Uncertainty on the cost-effectiveness plane. Health Economics. 1998;7:723-40.
- ⁶ Van Hout B A, Al M J, Gordon G S, Rutten F F. Costs, effects and C/E ratios alongside a clinical trial. Health Econ. 1994;3:309-319