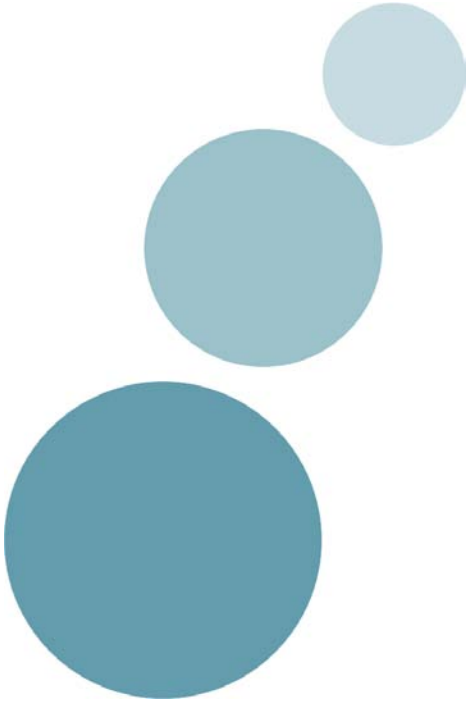
Play England

An economic evaluation of play provision

Final report

September 2010



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List of Abbreviations

CBA	Cost-benefit analysis
CHD	Coronary heart disease
DCSF	Department for Children, Schools, and Families
GCRT	Georgia Criterion Reference Test
NFER	National Foundation for Educational Research
NICE	National Institute for Clinical Excellence
ONS	Office for National Statistics
QALY	Quality adjusted life year

Contents

Executive summary

Aim and method of the research

The objective of this research was to generate economic evidence of the benefits of staffed play provision. Two specific forms of play provision were evaluated: adventure playgrounds and after school play clubs. The economic value of these forms of play provision was assessed by undertaking cost-benefit analysis (CBA). The CBA compared the costs of providing the interventions with their benefits in terms of health and educational outcomes. The CBA answered the following two questions:

- What is the economic value (£) of an adventure playground, compared with no playground?
- What is the economic value (£) of an after school club staffed with qualified play personnel, compared with an after school play club not staffed with qualified play personnel?

The research adopted the following stages:

- A review of the evidence available to estimate the benefits of staffed play provision.
- Interviews with experts to validate the evidence found and fill in gaps in the data.
- The construction of decision models to link the short term effects on children to medium and longer term benefits measured in terms of adults' educational and health outcomes.

The models were estimated assuming that the interventions are run for a 20 year period. The benefits of the interventions span however over a much extended period as the models convert children's outcomes into adults' outcomes. In accordance with H.M. Treasury's Green Book, a 3.5 per cent discount rate was applied to calculate the present value of costs and benefits. Unless stated otherwise, all monetary figures are in 2009 prices.

Results: adventure playgrounds

An adventure playground provides a good quality play space for children to take risks, explore, and experiment. The type of play an adventure playground encourages promotes the healthy development of children – physically, emotionally, mentally, socially, and creatively.

In the short run an adventure playground promotes children's physical activity and social play. How were these benefits quantified in monetary terms? It was estimated that in the long term these short-term effects will lead to improved health and educational outcomes. Increased physical activity in childhood was associated with higher levels of physical activity in adulthood, which in turn decreases the chances of experiencing a number of diseases including coronary heart disease, stroke, type II diabetes, and colon cancer. The monetary benefit of reduced incidence of these diseases was measured in terms of healthcare cost savings and increased quality adjusted life years. Similarly, it was estimated that the effect of an adventure playground on social play has a positive relationship with key stage 1 attainment. Key stage 1 performance is likely to predict key stage 2, which is a determinant of key stage 3, and in turn, GCSE's performance. The monetary benefit of improved GCSE performance was estimated by the associated increase in adult earnings.

Key messages

- The benefits generated by an adventure playground compared with no playground exceed the costs by £0.67 million.
- Every £1 invested in an adventure playground generates £1.32 in social benefits.

The CBA relied on non-UK evidence designed to measure the effects of different types of playground –e.g. an enhanced playground versus a simple playground. Since the purpose of this research was to measure the effect of an adventure playground compared with *no playground*, it is likely that the model underestimates the benefits of the intervention. Estimates provided by playground managers when asked to compare an adventure playground with a simple playground indicate that the effects could be up to three times higher than those used in the model.

Other key parameters used to generate the CBA result are necessarily subject to uncertainty. Sensitivity analysis was undertaken to observe the sensitivity of the net benefit to a change in the value of these parameters. The results of the sensitivity analysis showed that for reasonably wide ranges in the value of the parameters, the net benefits of an adventure playground remain positive.

The benefits are likely to be an underestimate as the models only capture education and physical activity outcomes. There are numerous other benefits which were not included in the analysis such as positive effects on children's emotional health, family relationships, and overall well being.

Headline figures

- It is estimated that 240 children between the ages of 5 and 12 regularly attend an average adventure playground per year.
- The total cost of an adventure playground over 20 years is estimated at £2.13 million.
- The estimated present value of the long term benefits of improved physical activity for all children attending an adventure playground is £0.31 million.
- The estimated present value of the long term benefits of increased social play and the associated improvement in educational outcomes for all children attending an adventure playground is £2.49 million.
- The estimated total present value of the benefits derived from an adventure playground is £2.80 million.

Results: afterschool play clubs

An after school club with qualified play personnel provides opportunities for children to engage in better quality play. Staff who have had play work training are more experienced at helping children develop positive relationships, promote self-directed play, and improve play practices.

In the short run the benefits of attending an after school club with qualified play personnel, compared with an after school club with non-qualified play personnel, can be estimated in terms of improved educational outcomes. Given the average age of children attending after school play clubs is 9 to 11, the improvement in educational performance was measured by the estimated change in key stage 2 score exams. As with adventure playgrounds, the long term benefits were estimated by predicting the effect of key stage 2 attainment on key stage 3 and GCSE's performance. The monetary benefit of improved GCSE performance was estimated by the associated increase in adult earnings.

Key messages

- The benefits generated by an after school club with qualified play personnel compared with an after school club with non-qualified play personnel exceed the costs by £1.19 million.
- Every £1 invested in training after school club staff generates over £210 in social benefits.

The large benefit cost ratio is due to the very low unit cost of the after school clubs (£42 per child), and an average benefit of £12,176 per child. The estimated benefits of the intervention are, however, very high and should be treated with caution. Due to the lack of evidence on the impact of play work training, the CBA relied on expert opinion. In the absence of a control group with which to compare the effect on children's outcomes of qualified personnel, it is likely that the effect measures estimated by after school play club managers represent an overestimate. However, the sensitivity analysis indicated that even if the effect of the intervention on key stage 2 exam scores was dramatically reduced to less than 10 per cent of the effect size used in the model, the net benefits would be positive.

Headline figures

- It is estimated that 25 children between the ages of 9 and 11 regularly attend an average after school club per year.
- The total present value of the costs of providing play training to the staff required to run an average after school club staff for a period of 20 years is £5,600.
- The total estimated present value of the long term benefits of increased educational outcomes for all children attending an average after school club with qualified play personnel rather than one with non-qualified personnel is £1.19 million.

Conclusion

The results of the economic analysis suggest that investing in staffed adventure playgrounds and after school clubs staffed with qualified play personnel generate positive net benefits. Even though the estimated net benefits are subject to uncertainty, the sensitivity analysis showed that the conclusion that the interventions represent an efficient use of public resources is unlikely to change. Hence, stopping investment in adventure playgrounds and after school clubs with qualified personnel would result in more costs than are saved.

1.0 Introduction

Children who access play are known to enjoy a range of benefits, including: an improved sense of well-being, emotional development, learning and interpersonal skills, health and independence. Furthermore, play provision produces a number of benefits to the families of children –e.g. the development of social relationships– and local communities –e.g. improved social capital and networks, and social cohesion.

The current knowledge on the benefits of play and play provision is based on conceptual relationships between play and outcomes, and a number of qualitative evaluations, such as case studies. Given the need to inform decision making on play provision investment, and the current economic climate and likely reductions in the size of public sector budgets, it is important to develop quantitative evidence on the costs and benefits of play provision.

As a first step to generating this evidence, in 2009 Matrix Evidence undertook a scoping study with the aim to construct a detailed conceptual model of the benefits of play provision. The model –which can be found in Appendix 1– identified nine types of play activities and illustrated how these relate to three types of outcomes: initial effects, key children's outcomes, and long-term impacts in adulthood. The model was summarised in a number of graphical representations showing that the relationships between play activities and outcomes are multiple and complex: play activities have effects on numerous outcomes, which are in turn interrelated.

The aim of this research is to generate economic evidence of the benefits associated with play provision and provide answers to the following research questions:

- What is the economic value (£) of an adventure playground compared with no playground?
- What is the economic value (£) of an after school club with qualified play personnel compared with an after school play club with non-qualified play personnel?

The economic value of these forms of play provision was assessed by undertaking cost-benefit analysis (CBA). The CBA compared the costs of providing the interventions with their benefits in terms of improved children's educational and health outcomes. These two outcomes were selected due the availability of evidence to model short term effects into longer term benefits.

The next section summarises the method employed in the research. Section 3 presents the results for adventure playgrounds and section 4 for after school play clubs. The last section discusses the implications of the research.

2.0 Methodological approach

2.1 Decision models

Each of the two interventions was assessed using CBA. A CBA compares the costs and effects of an intervention, all expressed in monetary terms. Therefore, the CBAs were built upon the following four elements:

- The ***cost*** of the resources required to deliver the interventions.
- The ***effects*** of the interventions on short term children's outcomes, expressed in natural units.
- The ***relationships*** between short term children's outcomes and longer term outcomes, expressed in natural units.
- The ***benefits*** of the interventions –i.e. the monetary value of the long term outcomes generated by the interventions.

Following best practice, decision models were built to assess the costs and benefits of the interventions. The decision models tracked children using adventure playgrounds and after school play clubs into adulthood and converted the short term effects into longer term outcomes. These long term outcomes were valued in monetary terms and then compared against the costs of delivering the interventions.

The structures of the decision models built are presented in Appendix 4 and 5. For the adventure playground model the economic benefits of physical activity and educational attainment were modelled separately and then aggregated and compared against the cost of the intervention. The after school club model considered the benefits of educational attainment.

Estimates of the following costs and benefits were included in the models:

- ***Costs***. The analysis considered the estimated set-up and annual running costs of delivering the interventions.
- ***Effects***. The models considered effects in terms of physical activity and educational attainment. The short-term effects in terms of physical activity were measured as the percentage of children (ages 5-12) reaching at least moderate levels of physical activity. The short term effects in terms of educational attainment were measured with key stage exam scores. Due to the varying age groups of children who use adventure playgrounds and after school clubs, key stage 1 (ages 5-7) was used in the adventure playground model, and key stage 2 (ages 9-11) was used for the after school club model.
- ***Benefits***. The long term benefits of being physically active in childhood considered in the model include estimated health care cost savings and quality of life gains associated with reduced incidence of the following diseases: coronary heart disease (CHD); stroke; type II diabetes; and colon cancer. The long term benefit of educational attainment in key stage 1 and 2 was improved performance on GCSE's, and the associated to increased adult earnings.

2.2 Data collection

Given the multiplicity of effects and benefits considered, data used to populate the models was collected from a wide range of sources. The following sources were used:

Literature review. A literature review was conducted to identify the effects of adventure playgrounds and after school clubs. More details on the method employed are provided in sections 5.1 and 6.1. The literature review identified data on:

- The probability that children receiving the interventions become more physically active and perform better in the key stage national exams.
- The long term benefits of childhood physical activity and education.
- The cost of delivering each intervention.

Expert opinion. Managers of adventure playgrounds and after school clubs identified by Play England were asked to take part in a 30 minute interview. Nine adventure playground managers and six after school club mangers were interviewed. Managers of adventure playgrounds were asked to provide data on the resource costs incurred to build and run an adventure playground and the estimated benefits they have seen on children. Managers of afterschool clubs were asked to provide data on the level of training acquired by staff and the estimated benefits they have seen on children.

2.3 Models and presentation of results

The models were estimated assuming that the interventions are run for a 20 year period. The benefits of the interventions span however over a much extended period as the models converted children's outcomes into adults' outcomes. All monetary figures are in 2009 prices. Where the costs and benefits of the interventions extend over more than one year, in accordance with H.M. Treasury's Green Book, a 3.5 per cent discount rate was applied to calculate their present value.

Inevitably, the parameters required to populate the models are subject to uncertainty. To assess the impact of this uncertainty, the models were put through a series of iterations to examine the effect of variations in key parameters on the net benefits.

Two indicators are used to synthesise the results of the CBAs:

- The ***net benefit***, which is calculated as the difference between the benefits and the costs. Values higher than zero indicate that the benefits exceed the costs, and thus the intervention represents an efficient use of public resources.
- The ***benefit-cost ratio***, which is calculated as the ratio of benefits to costs. Values higher than one indicate that the benefits exceed the costs, and thus the intervention represents an efficient use of public resources.

3.0 Results: adventure playground

3.1 Literature review

The objective of the literature review was to identify articles measuring the effect of an adventure playground on childhood physical activity and educational attainment. A number of websites and databases were searched including: Play England, Science Direct, Pub Med, ERIC, Google Scholar, National Children's Bureau, National Literacy Trust and NFER. The search strategy had no restriction on time period or age groups. Examples of key terms searched along with the word 'playground' were: 'physical activity', 'emotional', 'social skill', 'behaviour', 'learning', 'activity', 'skill', 'children's outcomes', and 'school readiness'. Appendix 2 outlines the detailed search strategy used for each database. Additional studies were identified by pearl growing –i.e. following up studies referenced in studies identified through the search. Table 3 provides a summary of the results of the literature review.

Table 3. Literature review: adventure playgrounds

Source	Total Hits	Reviewed	Data Extracted	
			"Yes"	"No"
Play England	9	3	0	3
Science Direct	512	9	3	6
Pub Med	56	2	1	1
ERIC	496	16	2	14
Google Scholar	50	6	3	3
Child Database	84	20	2	18
National Children's Bureau	1	0	0	0
NFER	15	3	0	3
National Literacy Trust	8	1	0	1
Pearl growing	7	6	5	1
References from author	3	3	3	0
Duplicates			**(5)**	
Papers for review			**14**	

Of the 14 articles identified for review through the literature review, eight studies were considered within the scope of the project and useful for the economic model. Table 4 summarises the characteristics of these studies, which provide estimates of the effects of different types of playgrounds in terms of physical activity and educational attainment.

Table 4. Summary of studies relevant for adventure playground model

Physical activity (PA) or education (E) outcome	Reference	Country of study	Setting	Intervention vs. counterfactual	Effect description	Methodological quality*
PA	Colabianchi (2009)	US	School	Enhanced playground vs. functional playground	Proportion of children at least vigorously active; increase in use of playground due to enhancement.	3
PA	Willenberg (2010)	Australia	School	Simple playground vs. Enhanced playground	Increased physical activity from supervision; increased physical activity from fixed equipment	1
PA	Hannon et al (2008)	USA	Preschool	More equipped school playground vs. school playground	Decrease in sedentary activities; increase in light activities; increase in moderate activities; increase in vigorous activities	2
PA	Hughes (2008)	UK	Adventure playground	Modified adventure playground vs. adventure playground	Increase in children's locomotors play levels in a dead space	2
PA	Ridgers et al (2010)	UK	School	Modified playground vs. non-modified playground	Impact of the play intervention on VPA = vigorous physical activity; MVPA = moderate to vigorous physical activity	3
E	Jarret et al. (1998)	US	Other	Recess vs. no recess	Productivity in classroom	3
E	Pellegrini (1992)	USA	School	Regression analysis	Impact of peer interaction on GCRT scores (equivalent to KS1)	1
E	Hart and Sheehan (1986)	USA	Other	Traditional playground vs. contemporary playground	Instances of social play	1

** Methodological quality was rated using the Maryland Scale – 1 = after, 2 = before-after 3 = control non-random, 4 = control non-random with multiple units and controlling for other factors, 5 = control random*

The literature review did not identify studies that addressed the research question directly –i.e. measuring the effects of an *adventure playground* compared with *no playground*. However, evidence was found on the effects of different types of playgrounds. Therefore, estimates of the effect of the closest type of playground to an adventure playground compared to a *simple (no adventure) playground* were used in the model. The precise study from which the effect was drawn was then determined by the methodological quality of the studies identified. Based on these criteria, Colabianchi (2009) was used to model the effect of adventure playgrounds in terms of physical activity. Hart and Sheehan (1986) and Pellegrini (1992) were used in combination to model the effect of adventure playgrounds in terms educational attainment.

Colabianchi (2009) was a matched control study that examined the difference in physical activity levels of children who use an enhanced playground in comparison to a functional playground. Based on the description of both types of playgrounds given in the study, an enhanced playground was taken as a proxy for an adventure playground and a functional playground for a simple playground. Children in the playgrounds were observed ten times for 90 minutes each to determine their level of physical activity. It was observed that children on an enhanced playground increased the proportion of time spent moderately active by 16.3 per cent. Following common practice in physical activity models (Matrix, 2006), it was assumed a 50 per cent maintenance of effect –i.e. that only in 50 per cent of cases the effect lasts long enough to result in a long term effect. Therefore, the estimate of the additional proportion of children reaching at least moderate activity used in the model was 8.15 per cent.

Hart and Sheehan (1986) evaluated the increase in social play in a traditional playground in comparison to a contemporary playground. Social play was defined as “socially interactive behaviour with peers, such as walking and talking with peers, playing games, and engaging in vigorous physical play, like chase, and rough and tumble play” (Pellegrini 1992). Based on the descriptions given in the study, an adventure playground was most similar to the traditional playground. Forty children, on average five years old, alternated between playing on a traditional and a contemporary playground. The number of instances of social play was measured for each child over twelve sessions in each type of playground. Based on Hart and Sheeham (1986) it is estimated that on average there were 12.92 additional instances of social play per child over three years in an adventure playground compared to a simple playground.

Pellegrini (1992) provides a linear regression analysis of the impact of social play on a US standardised exam –the Georgia Criterion Reference Test (GCRT). Twenty-four children were observed on the playground over two years starting at the age of five. During each observation period a child was recorded as either engaging in social play, object/self play, or adult directed play. Each child was observed a minimum of 112 times each year. Social play had a positive relationship with GRCT performance. The results of the regression analysis showed that, for each unit increase in social play frequency, there was a 0.81 point increase in GCRT scores.

Data from Hart and Sheehan (1986) and Pellegrini (1992) were combined to get an estimate of the short term educational outcome associated with an adventure playground compared to a simple playground. It was assumed that the increase in GCRT scores per each unit increase in social play frequency, which was estimated based on observations over two years, can be applied to the number of instances of social play children will experience in the adventure playground over a

period of three years[1]. Based on this assumption, it was estimated that an increase in social play of 12.92 instances increases GCRT scores by 5.09 per cent. The relative increase was then applied to baseline key stage 1 exam scores in the UK, which are also taken between the ages of 5-6.

3.2 Expert opinion

Since the available literature was not UK based and required assumptions about the definition of each type of playground, expert opinion was used to confirm whether the estimates of the impact of an adventure playground compared with a simple playground were consistent with current practice in the UK.

Adventure playground managers were interviewed to elicit data on the below topics:

- Playground characteristics: opening hours, provision of special services – e.g. breakfast club, equipment provided, indoor facilities.
- Level and frequency of use: how many children use the adventure playground during week days and weekends, and how often children visit the playground.
- Costs: set-up and running costs, including cost of staff and volunteers.
- Effects: estimated effect of adventure playground on physical activity and social play.

Table 5, Figure 3, Figure 4, and Table 6 summarise the data collected through the interviews**.**

Table 5 provides a summary of the characteristics of the nine adventure playgrounds discussed in the interviews. Most adventure playgrounds have similar characteristics; for instance, they are run by a charity[2], offer open access, provide indoor facilities, and have loose parts available for children to play with. There are minor differences across the nine playgrounds in terms of the percentage of children attending who were disabled and the number of registered children. In particular, playground 2 catered specifically to disabled children; therefore there was a high percentage of disabled children and low number of registered children.

[1] This requires the implicit assumption that there are no instances of social play not observed in the Pellegrini (1992) study that influence the education outcomes identified in that study.
[2] This applies to the sample of playgrounds interviewed, but not all adventure playgrounds are run by charities.

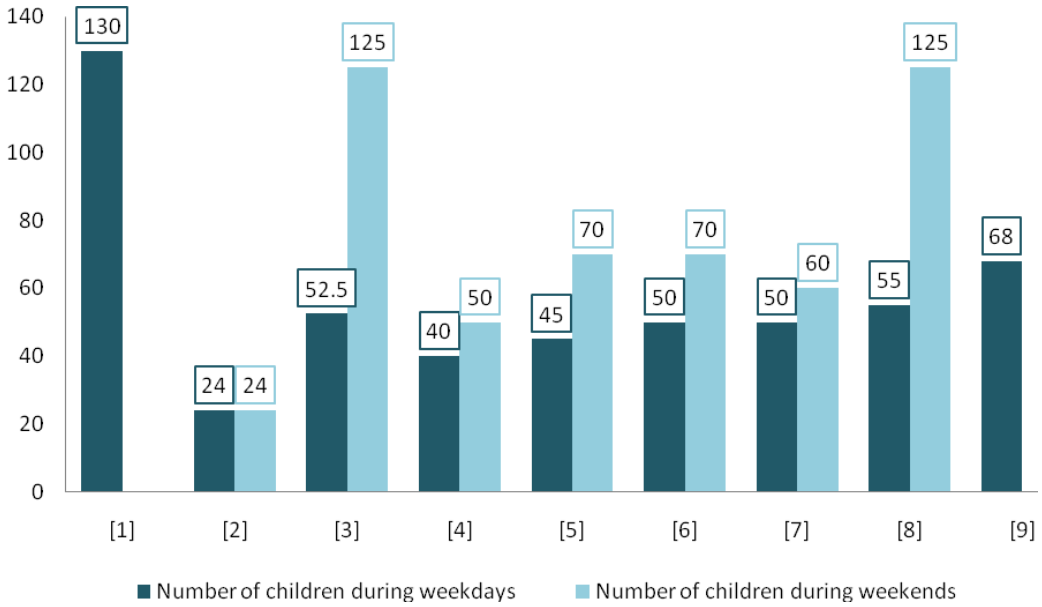
Table 5. Characteristics of adventure playgrounds

Items / Playground	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Charity or not-for-profit	√	√	√	√	√			√	√
Open access	√	√	√	√	√	√	√	√	√
Indoor facilities (e.g. lunch space, toilets, indoor play rooms)	√	√	√	√	√	√	√	√	√
Loose equipment (e.g. loose parts – balls, jump ropes)	√	√	√	√	√	√	√	√	√
Play activities (e.g. youth clubs, play groups for children, breakfast club, classes)		√	√	√		N/A	N/A	√	
Children with special needs	√	√	√	√	√	√	√	√	√
Percentage of children with special needs	10%	100%	8%	15%	N/A	1%	7.5%	10%	6%
Number children registered	300	90	550	400	400	100	275	600	3,486

N/A: not available

Figure 3 shows the level of use of the adventure playgrounds during the week. Unsurprisingly, a higher number of children use the adventure playgrounds during weekends than on weekdays. The number of children using the playground varies and is most probably reflective of the size and location of each playground. Eight out of nine managers stated that children who attend come every day and for most of the session in which the adventure playground is open. Using the weighted average of the children during the weekday and weekends, the average number of children using the playground at one point in time is 60.

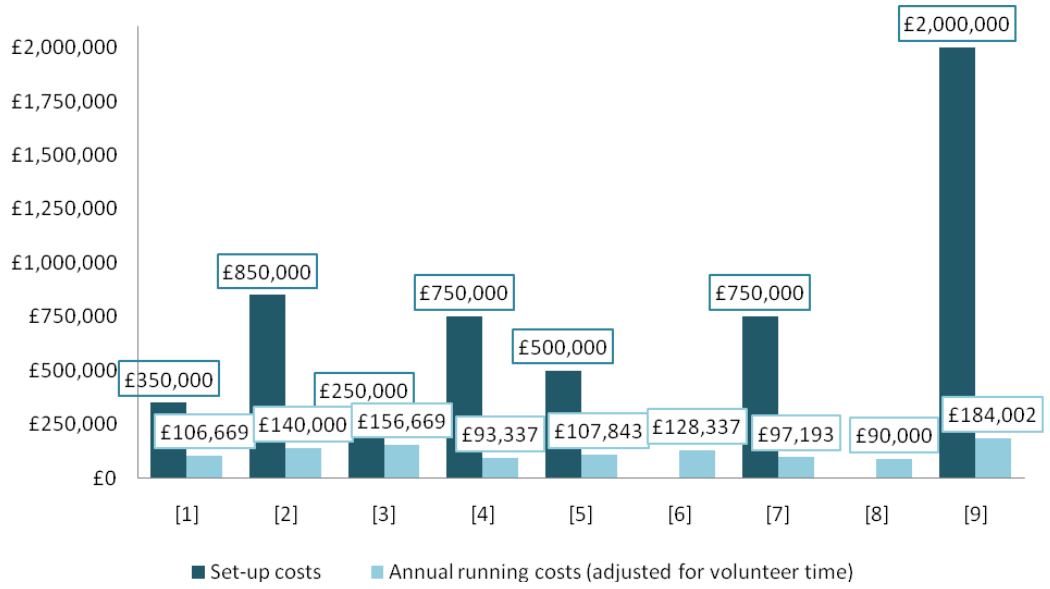
Figure 3. Level of use in adventure playgrounds (in number of children)



Averages used from ranges provided

Figure 4 summarizes the resource cost required to set-up and run an adventure playground. Managers were asked to provide the set-up cost of building their adventure playground. The variation in set-up costs could be attributed to the size of the playgrounds. In addition to set up cost, managers provided annual running cost which included: wages for staff, maintenance, and reinvestment. Seven out of the nine adventure playgrounds had part-time help from volunteers. Even though there is no financial cost attached to volunteers' time, non paid time has an implicit economic value. In order to incorporate this into the cost calculation volunteers were assumed to work 50 per cent of full time hours at the equivalent of a full time annual salary for an employee in personal services (£13,337, ONS 2009).

Figure 4. Costs of adventure playgrounds*



**These figures are not necessarily express in 2009 prices – they are ballpark figures for the cost when the playgrounds were built. In one case, the playground had been built in the 1970s and the playground manager estimated how much it would cost at current prices. Playground [9] refers to total cost for the site, not just adventure playground.*

Table 6 summarizes the effect sizes in terms of physical activity and social play estimated by playground managers. Only four playgrounds were able to participate in this part of the interview. In order to validate the estimates obtained through the literature review, managers were asked to compare a simple playground to an adventure playground in terms of the number of children out of ten to experience at least moderate physical activity level and social play. The effect size is the incremental difference in physical activity and social play between a simple and adventure playground. The physical activity effect of an adventure playground derived from interviews with playground managers is almost three times greater than the effect identified through the literature review. The social play effect estimated from the interviews is about two times greater than the effect found in the literature.

Table 6. Effect of adventure playgrounds on physical activity and social play

Question/Playground	[6]	[7]	[8]	[9]	Average
Out of 10 children on a *simple* playground how many would engage in at least moderate physical activity?	5	10	8	5	7
Out of 10 children on an *adventure* playground how many would engage in at least moderate physical activity?	8	10	10	10	9.5
Effect size - physical activity	**30%**	**0%**	**20%**	**50%**	**25%**

Question/Playground	[6]	[7]	[8]	[9]	Average
Out of 10 children on a *simple* playground how many would engage in social play?	6	9	8	10	8.25
Out of 10 children on an *adventure* playground how many would engage in social play?	10	10	10	10	10
Effect size - education	**40%**	**10%**	**20%**	**0%**	**17.5%**

3.3 Economic modelling

This section presents the models constructed to estimate the economic value of an adventure playground. The literature review and expert opinion were used to populate the short term effects of an adventure playground. The economic model converted the short term effect of an adventure playground in terms of physical activity and social play into longer term outcomes, including reduced morbidity and educational achievement. These long term outcomes were valued in monetary terms using estimates of health care cost savings, quality of life gains, and increased earnings. The long term benefits are compared against the cost of running an adventure playground over a period of 20 years. The structure of the decision models and the data used are presented in Appendix 4.

3.3.1 Short and long term effects

The short term physical activity effect estimated from the literature is an increase in the proportion of children doing at least moderate activity by 8.16 per cent. The effect size was then applied to the baseline distribution of children by physical activity levels to see the positive impact of an adventure playground. The distribution by physical activity was obtained from the Health Survey for England (2008), based on which 57 per cent of children achieve the moderate physical activity threshold. Applying the effect size, it was estimated that post-intervention the percentage of children achieving the moderate physical activity threshold increases from 57 per cent to 62 per cent.

Previous research has shown that physical activity in childhood can be used as a predictor of physical activity in adulthood. Based on Telama et al (2010), it was estimated that children with access to an adventure playground are 1.64 per cent more likely to be physically active in adulthood. This number is based on the odds ratio of being a physically active adult if physically active child (compared to a physically active adult if physically inactive child) and the proportion of physically (in)active children and adults in the population. For more details on calculation, see Table A4.2 in Appendix 4.

To estimate the health effects of physical activity and their monetary value previous economic research undertaken by Matrix (2006; 2010) was used. Numerous epidemiological studies compare physical activity levels with the incidence of diseases. Based on this evidence, Matrix (2010) estimated the health care cost savings of being physically active in adulthood as £2,110. The quality

of life gain –measured in terms of quality adjusted life years (QALY)[3] – associated with being physically active in adulthood is 1.31 QALYs. Since children with access to an adventure playground are 1.64 per cent more likely to be physically active in adulthood, the healthcare cost savings in the long term for £35 and 0.022 QALYs gained per child using an adventure playground. The QALYs gained were valued at £20,000 per QALY, the lower end of the range of QALY values implicit in the decision making process followed by the National Institute of Clinical Excellence (NICE) and commonly used in economic evaluations valuing health outcomes. Therefore, the total long term monetary benefit from increased physical activity including both health care cost savings and the monetary value associated with the QALY gain is £465 per child.

The short term educational benefit estimated from the literature is an increase in key stage 1 score of 5.09 per cent. The effect size was applied to the baseline distribution of key stage 1 exam scores to see the positive impact of an adventure playground on educational achievement. The distribution of key stage 1 exam scores was obtained from educational statistics published by the Department for Children, School and Families (DCSF, 2003). Table 7 summarizes the impact of social play on key stage 1 performance.

Table 7. Performance on key stage 1 exam pre and post use of adventure playground

Key stage 1 grades	Minimum points required	Percentage of students at baseline	Percentage of students post intervention
Incomplete	1	12.00%	11.3%
L1	9	4.00%	4.02%
L2C	13	13.25%	9.07%
L2B	15	30.50%	22.76%
L2A	17	16.25%	24.67%
L3	21	24.00%	28.13%
Total		100%	100%

Key stage 1 performance can be used as a predictor of key stage 2 performance, which is a determinant of key stage 3, and in turn GCSE's performance. Thereby the effect of an adventure playground in key stage 1 can be translated into improved GCSE's performance. The DCFS report tracks children's performance in key stage 1 to GCSEs. Based on this, transition probabilities were calculated to link short term outcomes to long term outcomes in the economic model. These probabilities are reported in Appendix 3. Due to the increased performance in key stage 1 it is estimated that access to an adventure playground was associated with an increased likelihood of attaining 5 GCSE's A*-C of 2.61 per cent.

[3] The QALY is a standardised measure of health gain widely used in health economics. It comprises two dimensions: time and quality of life. The latter is measured on a scale between 0 (death) and 1 (perfect health). For instance, 1 year if perfect health is measured as 1 QALY. The advantage of this scale is twofold: not only does it allow different health effects to be expressed on a single scale; but there are also accepted monetary values for QALYs that allows these effects to be expressed as monetary values.

Previous economic literature was employed to value improved GCSE performance in monetary terms. Cummings et al (2007) estimated the incremental adult earnings per person attaining 5 GCSE's A*-C compared to no 5 GCSE A*-C as £156,863. Since children with access to an adventure playground are 2.61 per cent more likely to attain 5 GCSE's A*-C, this is equivalent to an increase in adult earnings of £4,096 per child.

Aggregating the benefit per child to estimate the benefit for all children attending an adventure playground required that a number of assumptions be made:

- Based on interviews with playground managers, the average number of children using an adventure playground at one point in time is 60 children aged between 5 and 12.
- Assuming the variety of children changes by a churn factor of 4 –i.e. as one child leaves another new child attends– it is estimated that 240 children regularly use an adventure playground during the year.
- It is assumed that the 240 children are distributed evenly between the ages of 5 to 12 – i.e. 30 children at each age.
- After one year of attending an adventure playground a child will realise the physical activity benefit; therefore all 240 children attending the playground in the first year of implementation receive the benefit.
- It is assumed that children between the ages of 5 and 7, which is the key stage 1 age range, are eligible for the education benefit.
- After three years of attending an adventure playground a child will realise the education benefit; therefore 30 children receive the education benefit.
- In each subsequent year of the model children who will turn 5 are eligible for both the education and physical activity benefit; which is 30 children.
- It is assumed that the presence of a new adventure playground is likely to generate increased use. Based on Colabianchi (2009) it is estimated that the number of children using the playground will increase by 40.4 per cent. Therefore, from year 2 onwards, 42 children will realise the education and physical activity benefit.
- As a result, across the 20 years of implementation of the playgrounds, 830 children will realise the education benefit and physical activity benefit and 1,040 children will realise the physical activity benefit.

3.3.2 Costs

In discussions with Play England the set-up cost for an adventure playground was estimated to be £800,000 and the annual running costs £100,000. These values are similar to the average of the values reported by playground managers. It was assumed that the playground has an expected life span of 20 years. Reinvestment in the playground was assumed to take place after 10 years and cost 10 per cent of the initial set up costs. Table 8 shows the discounted costs per year.

Table 8. Cost of adventure playground per year (£ in 2009 prices)

Year	Total cost discounted	Year	Total cost discounted
0	£140,000	**10**	£107,249
1	£135,266	**11**	£103,622
2	£130,691	**12**	£100,118
3	£126,272	**13**	£96,732
4	£122,002	**14**	£93,461
5	£117,876	**15**	£90,300
6	£113,890	**16**	£87,247
7	£110,039	**17**	£84,296
8	£106,318	**18**	£81,446
9	£102,722	**19**	£78,692

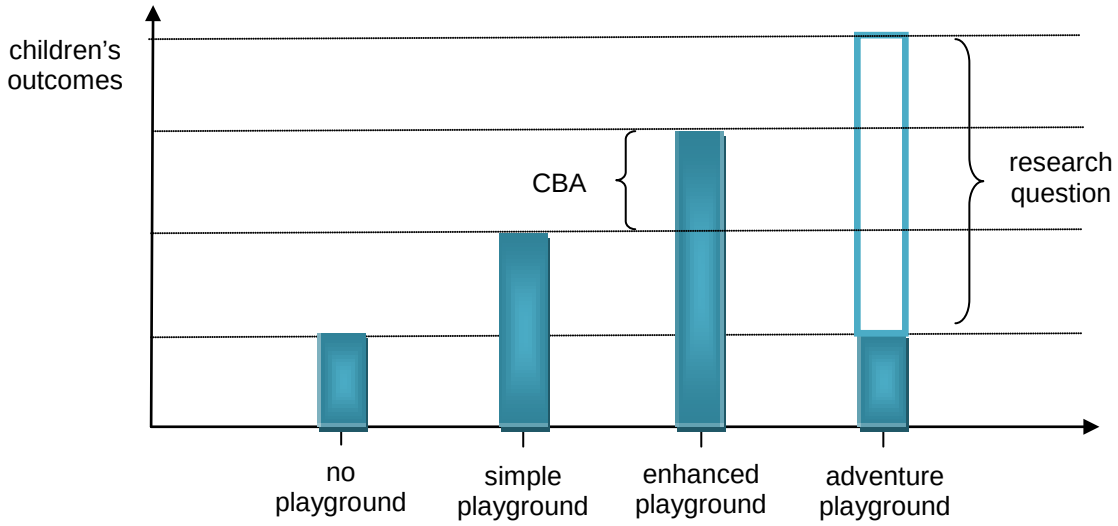
3.3.3 Results

The net economic benefit of the adventure playground was calculated by aggregating the benefits from the physical activity and education models and comparing them against the costs. Table 9 presents the present value of the costs and benefits. The total present value of the costs of an adventure playground over 20 years is £2.12 million. The present value of the benefits of the physical activity model is £0.30 million and that for the education model is £2.49 million. Therefore, the present value of the net benefits of an adventure playground, compared with a simple playground, is £0.67 million. The benefit to cost ratio is 1.32.

Table 9. Costs and benefits of an adventure playground (£ in 2009 prices)

	Adventure playground
Costs	
Total over 20 years	£2.12m
Monetary benefits	
Benefit – physical activity	£0.30m
Benefit – education	£2.49m
Total over 20 years	£2.80m
Net benefit	£0.67m

These results suggest that investment in an adventure playground has a positive rate of return and is therefore a good use of public resources. Even though the benefit cost ratio is relatively small, it is likely that the benefits are underestimated. The figure below illustrates this point. The purpose of the research was to measure the effect of an adventure playground compared with *no playground*. However, the CBA relied on non-UK evidence designed to measure the effects of an enhanced playground versus a simple playground. Opinion elicited by playground managers when asked to compare an adventure playground with a simple playground suggest that the effects could be up to three times higher than those obtained from the literature review and used in the model.



Both the physical activity and education effects as well as other parameters used in the models are subject to varying degrees of uncertainty. Therefore, additional analysis was undertaken to observe the sensitivity of the net benefit to a change in the model parameters. The sensitivity analysis suggests that the results of the model are robust –i.e. the conclusion that investing in an adventure playground represents an efficient use of public resources does not change.

Table 10 summarises the parameters which were tested along with the ranges used for the sensitivity analysis. Figures 5 to 11 show the impact on net benefit.

Table 10. Sensitivity analysis

Parameter	Value in model	Sensitivity analysis range	
		Low	High
Number of children using the adventure playground at one point	60	30	80
Churn factor	4	1	6
Increased likelihood of using an adventure playground	40.4%	0%	5%
Set up cost	£800,000	£800,000	£2,800,000
Running cost	£100,000	£100,000	£190,000
Physical activity effect size	8.15%	0%	10%
Education effect size	5.09%	1%	4.5%

Figure 5 demonstrates that, holding all other parameters constant, the net benefit remains positive as long as the number of children using an adventure playground at one point is above 45 (compared with the number of children using an adventure playground of 60 included in the model) .

Figure 5. Number of children using an adventure playground at one point versus net benefits

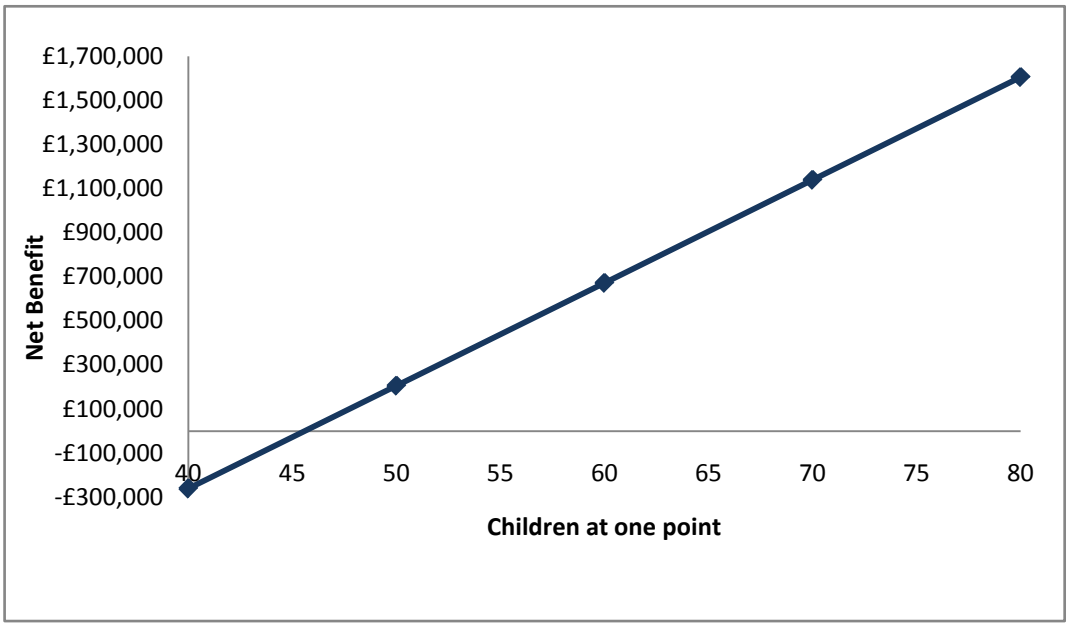


Figure 6 demonstrates that, holding all other parameters constant, the net benefit remains positive as long as the churn factor is above 3 (compared with the churn factor of 4 included in the model) For the net benefit to be positive on average a minimum of 180 different children need to use an adventure playground regularly per year.

Figure 6. Churn factor versus net benefits

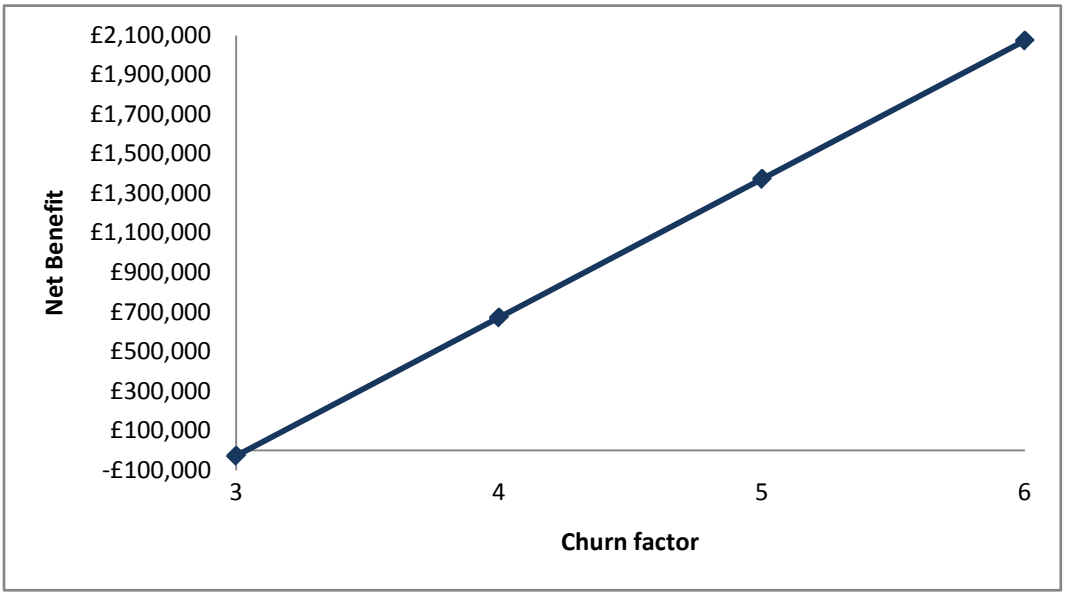


Figure 7 demonstrates that, holding all other parameters constant, the net benefit remains positive as long as the per cent increase use is above 3.6 per cent (compared with the 40.4 per cent included in the model).

Figure 7. Increased likelihood of using adventure playground versus net benefit

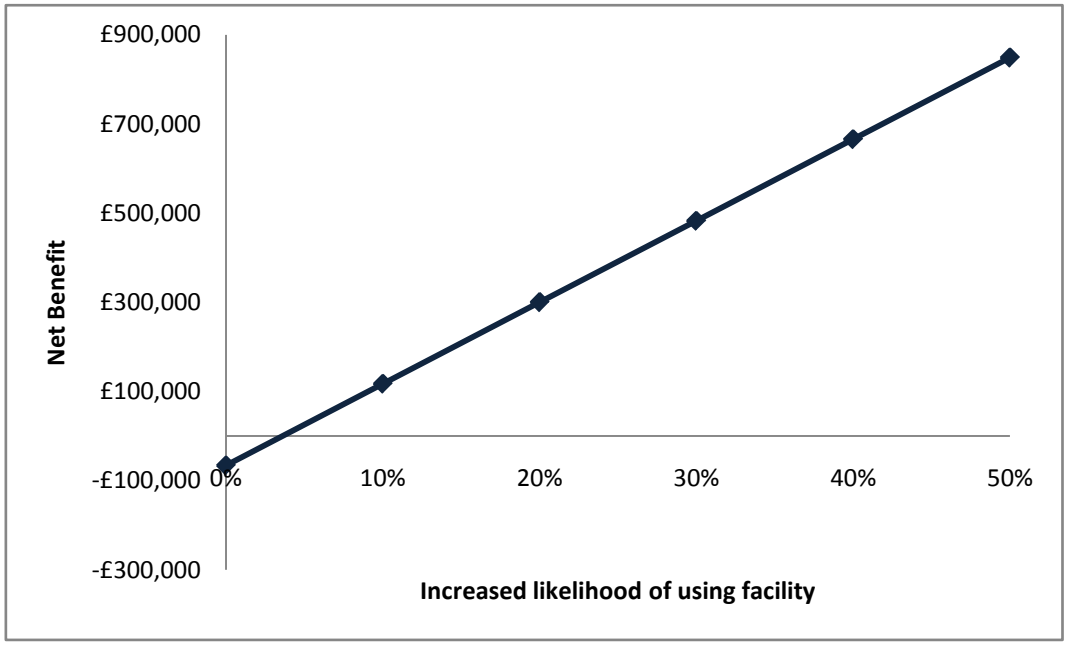


Figure 8 demonstrates that, holding all other parameters constant, the net benefit remains positive as long as the set up costs are below £1,600,000 (compared with the £800,000 included in the model).

Figure 8. Set up cost versus net benefits

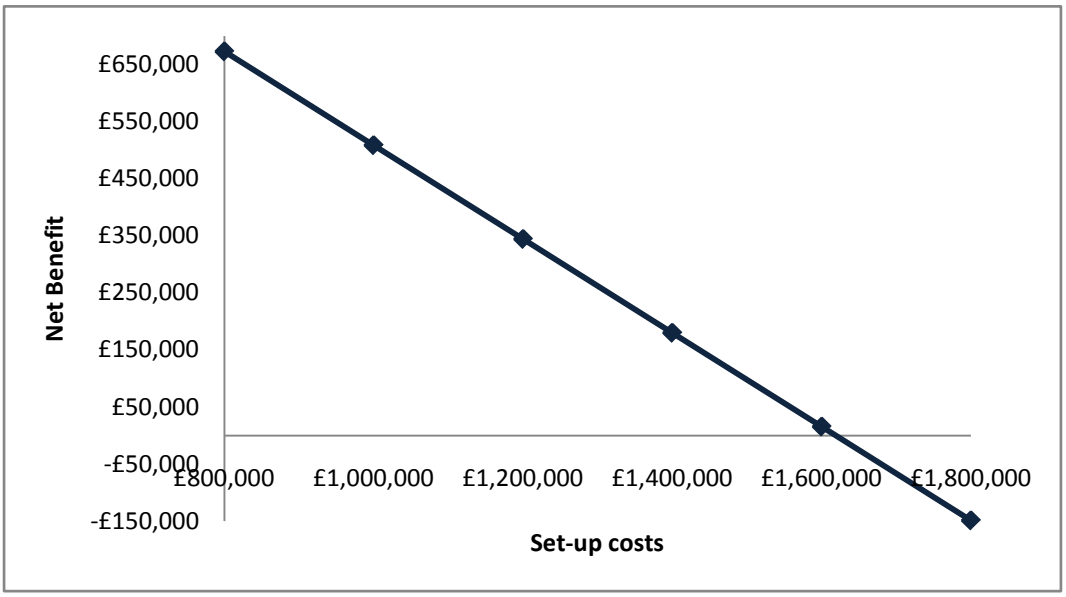


Figure 9 demonstrates that, holding all other parameters constant, the net benefit remains positive as long as the running costs are below £145,000 (compared with the £100,000 included in the model).

Figure 9. Running cost versus net benefits

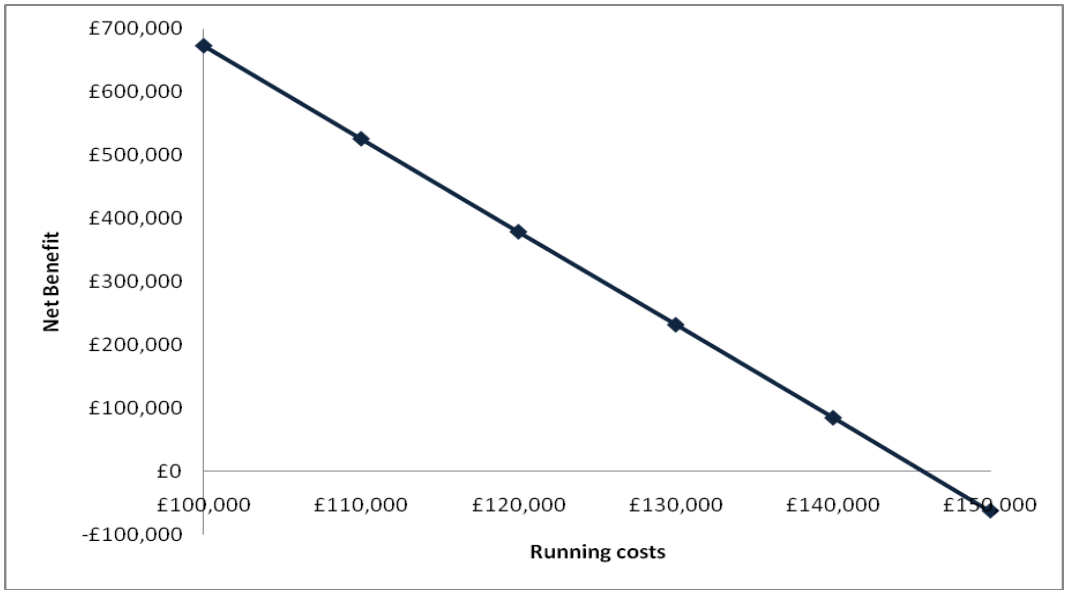


Figure 10 demonstrates that, holding all other parameters constant, the net benefit remains positive even if the physical activity effect size is zero per cent (compared with 8.16 per cent included in the model).

Figure 10. Physical activity effect size versus net benefits

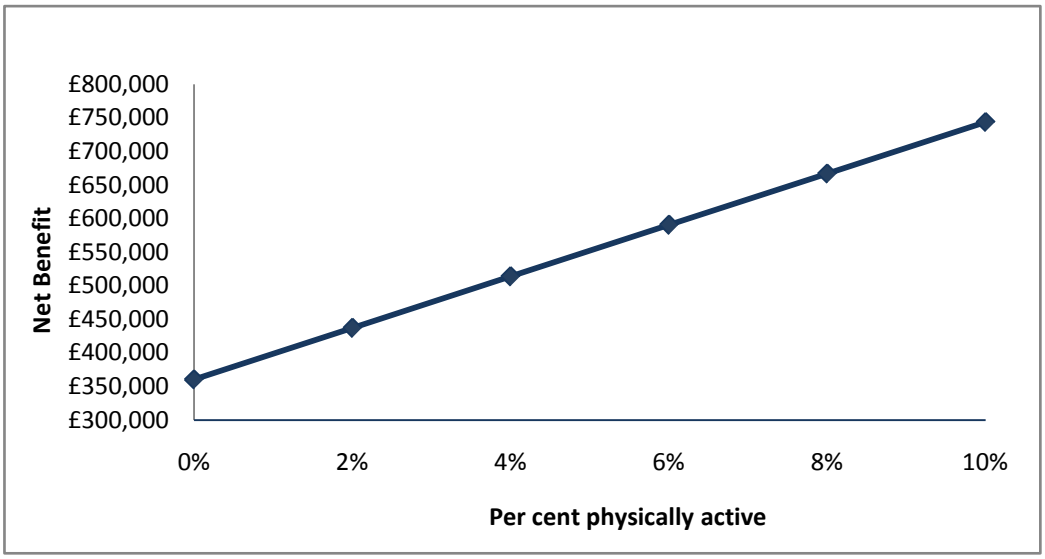
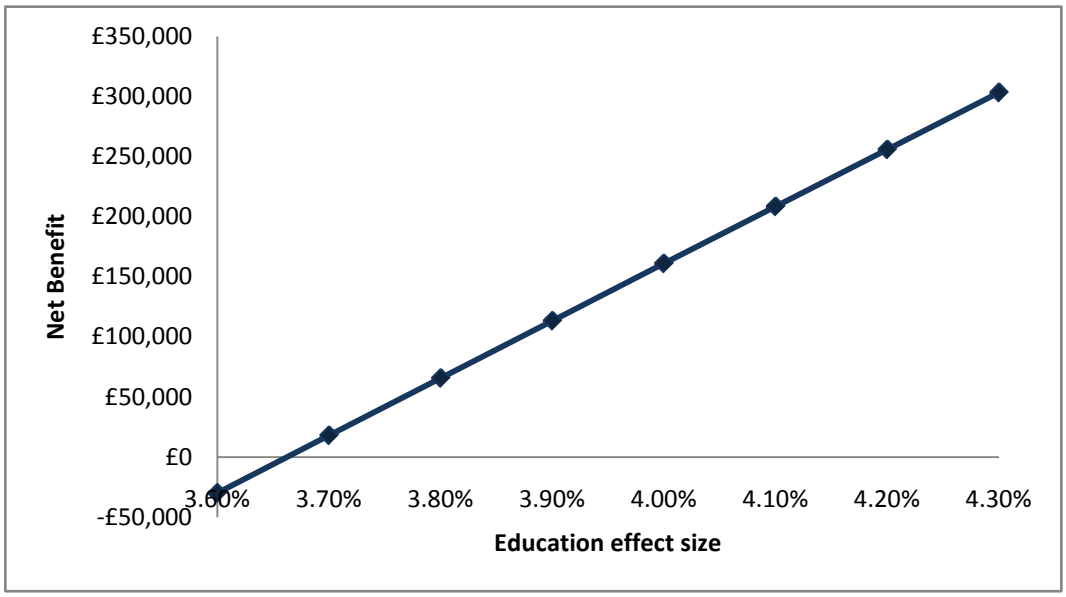


Figure 11 demonstrates that, holding all other parameters constant, the net benefit remains positive if the education effect size is above 3.5 per cent (compared with 5.09 per cent included in the model).

Figure 11. Education effect size versus net benefits



4.0 Results: afterschool play clubs

4.1 Literature review

The objective of the literature review was to identify articles measuring the impact of afterschool play clubs with qualified personnel on educational attainment. A number of websites and databases were searched including: Science Direct, Pub Med, ERIC, Google Scholar, National Children's Bureau, National Literacy Trust and NFER. The search strategy had no restriction on time period or age groups. An example of key terms searched along with words effect and evaluation were: 'after school programs', 'play benefits', 'play rangers', 'extended schools', 'playgroups', 'play schemes', 'play club', and 'after school care'. Appendix 2 outlines the detailed search strategy used for each database. Additional studies were identified by pearl growing –i.e. following up studies referenced in studies identified through the search. Table 11 provides a summary of the results of the literature review.

Table 11. Literature review: after school play clubs

Source	Total Hits	Reviewed	Data Extracted	
			"Yes"	"No"
Play England	5	5	2	3
Science Direct	4	1	1	0
Inter Science	10	4	2	2
Pub Med	20	10	0	10
ERIC	114	10	3	7
Google	6	6	1	5
Child Database	119	14	3	11
NFER	2	2	0	2
Pearl growing	30	30	15	15
References from author	3	3	0	3
Duplicates			**(2)**	
Papers for review			**25**	

Table 12 summarizes the 25 articles for which data was extracted. In discussions with Play England it was decided that none of the articles was useful for the purpose of answering the research question. The three main reasons these articles could not be used include:

1. Impact of training not valued: none of the articles were able to identify the impact of trained personnel on children's outcomes. The articles examined the provision of after school care versus no care, which was not the scope of the economic model.
2. Intervention was not play specific: articles provided analysis of after school clubs that were not play specific –e.g. academic, sports, music.
3. Age group: articles focused on early years setting (ages 0-4) which was considered below the average age of after school club children

Table 12: Summary of studies for after school club model

Reference	Country of study	Setting	Intervention vs. counterfactual	Effect description	Methodological quality*	Reason not relevant for economic model
Bundy (2009)	Australia	School playground	Free play vs. no free play	Increase in physical activity	2	Intervention not appropriate
Burdumy (2007)	USA	School	Activity centre vs. no activity centre	Impact on time spent with adults, watching TV, socializing, on computer, playing sports	5	Effect not relevant to model
Community Matters (2003)	USA	N/A	Provision of after school activities vs. N/A	Cost data	1	No effect data
Department for Children, School and Families (2007)	UK	School	Schools with extended school services vs. national average	Performance on key stage exams	2	No data on training
Department for Education and Skills (2007)	UK	School	After school program vs. N/A	Key stage 1 performance	2	No data on training
Drulak (2007)	USA	School	After school program vs. all other options	Performance on standardize math and reading exam	4	No data on training
Eagle (2009)	USA	Varied	Participation in after school activities vs. NA	Before and after teacher rating language, reading, and study skills	1	No data on training
Gottfredson (2007)	USA	School	After school program vs. no after school program	Decrease in substance abuse and delinquency	4	Effect not relevant to model
Grossman (2002)	USA	School	After school program vs. no after school program	Behavioural problems, alcohol abuse, absence from school, attention in class	4	Effect not relevant; no data on training
Hollister (2003)	USA	N/A	After school program vs. N/A	Salaries of qualified staff	1	No effect data

** Methodological quality was rated using the Maryland Scale – 1 = after, 2 = before-after 3 = control non-random, 4 = control non-random with multiple units and controlling for other factors, 5 = control random*

Table 12 (Continued)

Reference	Country of study	Setting	Intervention vs. counterfactual	Effect description	Methodological quality*	Reason not relevant for economic model
Newman et al (2000)	USA	Community	After school hours supervised vs. after school hours unsupervised	Likelihood of graduation high-school	1	No data on training
Newman et al (2000)	USA	Community	After school hours supervised vs. after school hours unsupervised	Likelihood of smoking and drug abuse	1	Effect not relevant to model
Oaff (2006)	UK	School	Extended services vs. no extended services	Cost of co-ordinator of program	1	No effect data
Ofsted (2008)	UK	School	Provision of extended services vs. N/A	Improved punctuality, increase in physical activity and sports, improved academic performance, positive effect on vulnerable groups	1	No effect data
Posner (1994)	US	After school care	Formal care vs. other care	Increase in grades for math, reading and standardized scores	3	No data on training
Posner and Vandell (1999)	USA	Varied	Formal care vs. other types of care	Impact of time spent on different after school activity on 5th grade academic performance	1	No data on training
Rhodes (2000)	Ireland	Playgroups	Training vs. no training	Performance on cognitive play scale due to training	3	Early years setting; training not same in UK
Sacramento START (2009)	UK	School	After school program vs. no after school program	Standardized English exam performance	2	Intervention not appropriate

** Methodological quality was rated using the Maryland Scale – 1 = after, 2 = before-after 3 = control non-random, 4 = control non-random with multiple units and controlling for other factors, 5 = control random*

Table 12 (Continued)

Reference	Country of study	Setting	Intervention vs. counterfactual	Effect description	Methodological quality*	Reason not relevant for economic model
Shiver (2009)	USA	School	Lessons on nutrition, media, and physical activity vs. no lesson	Test scores and behaviour improvement	5	Intervention not appropriate
Ullman (2006)	UK	School	After school program vs. N/A	Frequency of after school club provided in England	1	No effect data
US Department of Education (2003)	USA	School	Activity centre vs. no activity centre	Performance on math exam	2	Intervention not appropriate; no data on training
Vandell and Corasaniti (1988)	USA	School	After school program vs. mother care, no formal care and sitter	Academic improvement measured in grade point average scores (GPA)	3	No data on training
Vandell and Ramanan (1991)	USA	School	Adult supervision vs. Parental supervision and self care	Performance on Peabody picture vocabulary Test	1	No data on training
Weinbaum (1996)	USA	Community	After school program – academic focus vs. no after school program	Improved reading and writing sills	2	Intervention not appropriate
Witt (1996)	USA	School	After school program vs. no after school program	Reading, science and math scores	2	Intervention not appropriate; no data on training

** Methodological quality was rated using the Maryland Scale – 1 = after, 2 = before-after 3 = control non-random, 4 = control non-random with multiple units and controlling for other factors, 5 = control random*

4.2 Expert opinion

Due to the inability to use the articles identified in the literature review, the economic model relied fully on expert opinion for the estimated educational effect on children in after school play clubs. Play England identified after school club managers which had a close relationship with nearby schools. Within the time frame allowed six after school club mangers were contacted. Managers were asked about current staff and the estimated effect of trained staff on key stage 2 exams. Managers were told the focus of the project was to compare the benefits of training specifically; therefore the comparator was an after school club with non-qualified personnel.

Managers were asked if they believed after school programs with qualified play personnel provided a positive effect on key stage 2 score in comparison to after school programs with non-qualified play personnel. If they answered yes, they were asked to measure this effect by stating how many children out of 10 see a benefit from qualified play personnel. Then managers were asked out of the children who see a benefit what the magnitude of the effect is in terms of percentage increase in key stage 2 exam performance. The effect size was the number of children thought to see a benefit multiplied by the magnitude.

Table 13 summarizes the results from interviews. It is evident from the interviews that there is a wide range in the percentage of children for whom play qualified personnel would improve key stage 2 performance as well as in the magnitude of improvement. The percentage of children ranges between 40 and 100 per cent, while the magnitude of improvement varies between 10 and 80 per cent.

Table 13. Data from after school club interviews

Data/After school club	[1]	[2]	[3]	[4]	[5]	[6]
Number of staff	3	5	5	3	5	N/A
% of staff with play qualification	67%	100%	100%	100%	75%	N/A
Minimum level of training	NVQ 2	NVQ 2	NVQ 2	NVQ 2	NVQ 3	N/A
Average number of children attending after school club	14	35	30	12	35	N/A
Does training have a positive effect on key stage 2 performance?	Yes	Yes	Yes	Yes	Yes	Yes
What % of children would improve key stage 2 scores?	80%	100%	N/A	60%	70%	40%
What is the magnitude (%) of improvement?	10%	10%	N/A	5%	70%	80%

4.3 Economic modelling

This section presents the economic model constructed to measure the value of an after school club with qualified play personnel. The economic model follows the same logic as the model used for an adventure playground. The structure of the decision models and the data used are presented in Appendix 5.

4.3.1 Short and long term effects

Two of the five interviews estimated particularly high effect sizes; to be conservative, the average effect size from interviews 1, 2, and 4 was used. This is equivalent to 80 per cent of children experiencing an 8.33 per cent increase in key stage 2 scores. The effect size was applied to the baseline distribution of key stage 2 exam scores to see the positive impact of after school clubs with qualified personnel on educational attainment. Table 14 presents the distribution of scores pre and post access to an after school club with qualified personnel.

Table 14. Performance on key stage 2 exam pre and post access to an after school club with qualified personnel

Key stage 2 grades	Minimum points required	Percentage of students at baseline	Percentage of students post intervention
Incomplete	1	5.00%	4.59%
L2	15	0.67%	0.90%
L3	21	12.67%	8.46%
L4	27	44.33%	29.96%
L5	33	37.33%	56.09%
Total		100%	100%

Using the same transition probabilities as in the adventure playground model, key stage 2 performance was used to predict key stage 3 performance, and then the probability of attaining 5 GCSE's A*-C. Due to the increased performance in key stage 2 from access to an after school club with qualified personnel the incremental difference in attaining 5 GCSE's A*-C is estimated to be 7.76 per cent. The increased likelihood of attaining 5 GCSE's A*-C translates into estimated increased earnings for £12,176 per child.

Aggregating the benefit per child to estimate the benefit for all children attending an after school club required that a number of assumptions be made:

- Based on interviews with after school club managers, the average number of children attending an after school play club at one point in time is 25 children between the ages of 9 and 11.

- Assuming the 25 children are distributed evenly across the ages of 9 and 11, there are 7 children in the age range of key stage 2 that are eligible for the education benefit in the first year.
- In each subsequent year only the children who enter the 9 to 11 age range will see the benefit. This is equivalent to 7 children per each subsequent year after the first.

4.3.2 Costs

The cost of providing qualified personnel is a onetime cost after school clubs incur. Based on interviews most staff had NVQ Level 2 and NVQ Level 3 training. The cost of NVQ 2 and NVQ 3 training is estimated to be £518 and £708 respectively. Details on the sources used to obtain the cost of training can be found in Appendix 6.

Under Ofsted recommendations, an after school club should have a ratio of 1 staff for every 8 children. The average number of children attending an after school club from interviews was 25. Therefore it is estimated that 3.13 staff are required. Using the average cost of NVQ 2 and NVQ 3 training, the total cost per after school club to provide training for all staff is £1,915. An assumption was made that staff would be replaced after 5 years; therefore additional staff would be trained every 5 years. The intervention was assumed to run for a 20 year period. Table 15 shows the cost per year.

Table 15. Cost of training per year (£ in 2009 prices)

Year	Total cost discounted	Year	Total cost discounted
0	£383	**10**	£271
1	£370	**11**	£262
2	£358	**12**	£254
3	£346	**13**	£245
4	£334	**14**	£237
5	£323	**15**	£229
6	£312	**16**	£221
7	£301	**17**	£213
8	£291	**18**	£206
9	£281	**19**	£100

4.3.3 Results

The net benefit of the after school play club model was calculated by aggregating the benefits per child from the education model and comparing them against the costs. Table 16 presents the present value of the costs and benefits. The incremental cost of an after school play club with qualified play personnel compared with the cost of an after school play club with non-qualified play personnel over 20 years is £5,600. The total estimated increase in adult earnings from improved

performance on GCSE's is £1.194 million. Therefore, the net benefits of an after school club with qualified personnel are £1.188 million. The corresponding benefit to cost ratio is 212.

Table 16. Costs and benefits of after school club with qualified personnel (£ in 2009 prices)

	After school play club with qualified personnel
Costs	
Total over 20 years	£0.0056
Monetary benefits	
Total over 20 years	£1.194m
Net benefit	£1.188m

The results suggest that investment in an after school play club with qualified play personnel, compared with an after school play club with non-qualified play personnel, has a positive rate of return and is therefore a good use of public resources. However, these results should be treated with caution given the large magnitude of the estimated benefits. Due to the lack of evidence on the impact of play work training, the CBA relied on expert opinion. In the absence of a control group with which to compare the effect on children's outcomes of qualified personnel, it is likely that the effects estimated by after school play club managers represent an overestimate. Sensitivity analysis was carried out to assess the impact of this uncertainty on the net benefits.

The sensitivity analysis shows that even with uncertainty around certain parameters overall the results of the model are robust –i.e. the conclusion that investing in an after school club with qualified personnel is an efficient use of public resources does not change.

Table 17 summarises the parameters which were tested along with the ranges used for the sensitivity analysis. Figures 12 to 14 show the impact on net benefits.

Table 17. Sensitivity analysis for after school play clubs with qualified personnel

Parameter	Value in model	Sensitivity analysis range	
		Low	High
Number of children attending an after school club	20	1	7
Cost of training each staff	£613	£500	£10,000
Education effect size	7.00%	0.1%	0.8%

Figure 12 demonstrates that, holding all other parameters constant, the net benefit remains positive when the number of children attending an after school club is above 1 (compared with 20 children included in the model).

Figure 12. Number of children attending an after school club regularly versus net benefits

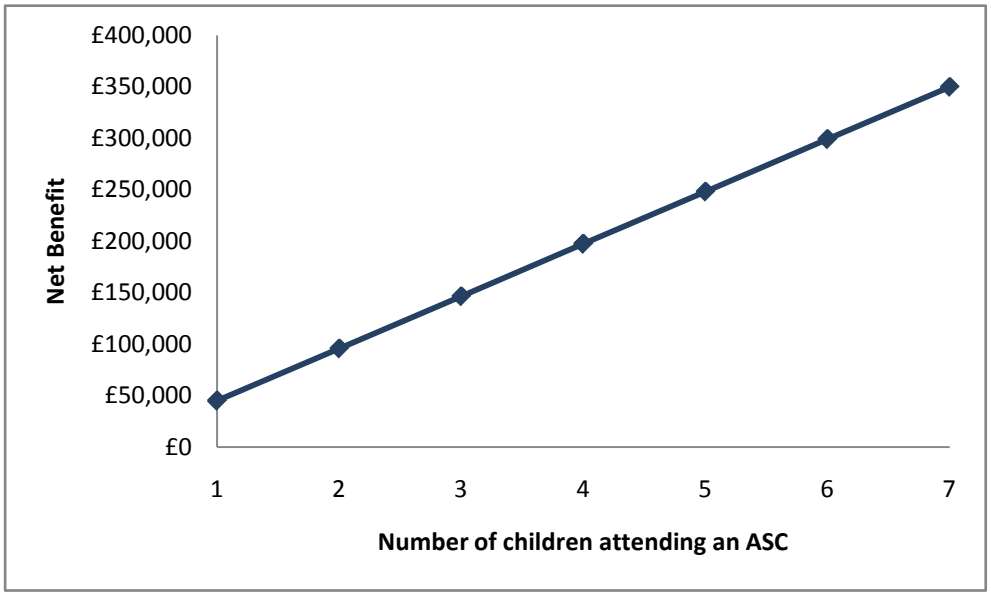


Figure 13 demonstrates that, holding all other parameters constant, the net benefit remains positive even if the cost of training is increased to £10,000 per staff (compared with £613 per staff included in the model).

Figure 13. Cost of training per staff member versus net benefits

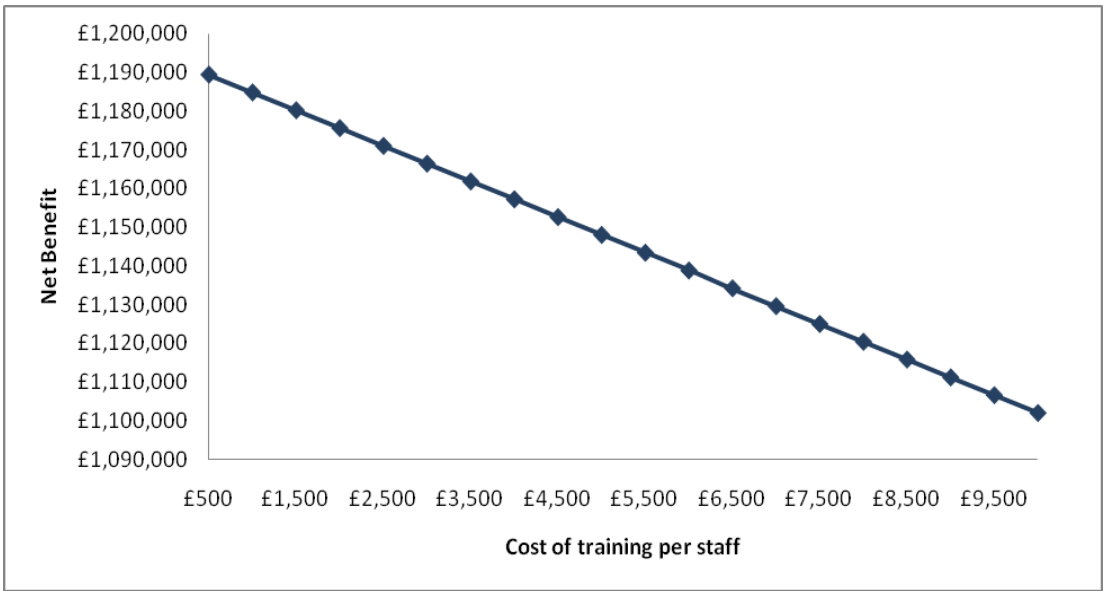
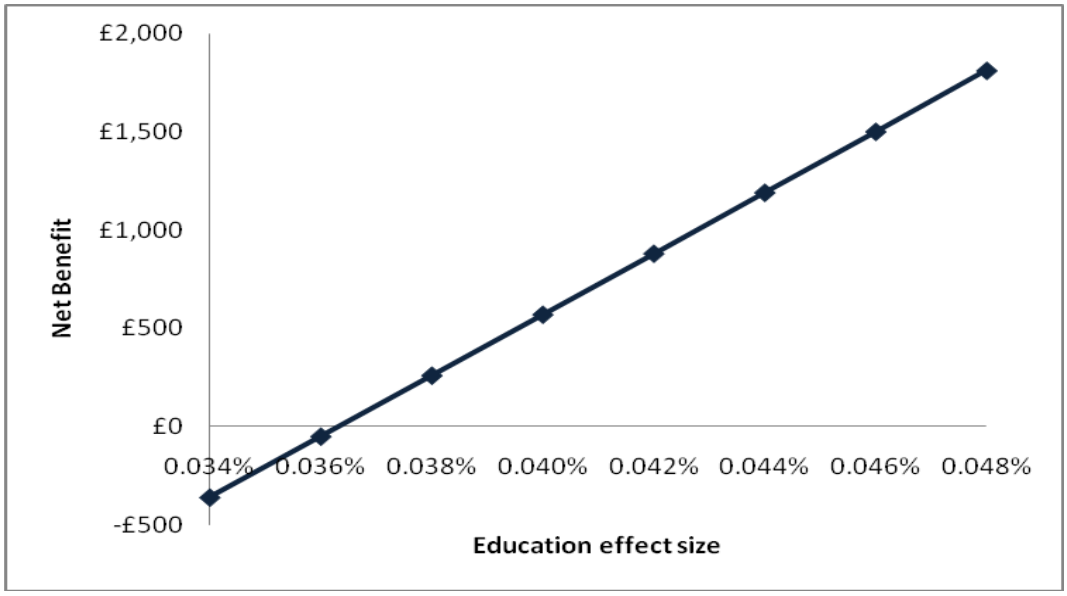


Figure 14 demonstrates that, holding all other parameters constant, the net benefit remains positive as long as the education effect size is above 0.036 per cent (compared with 7.0 per cent included in the model).

Figure 14: Education effect size versus net benefit



5.0 Discussion

The results of the CBA for the two interventions suggest that the net benefits are positive (Table 18). In other words, the benefits generated by the interventions exceed the costs, and the interventions represent an efficient use of public resources. Hence, stopping investment in adventure playgrounds and after school clubs with qualified personnel would result in more costs than are saved.

Table 18. Net benefits and benefit-cost ratios (£ in 2009 prices)

Intervention	Net benefit	Benefit-cost ratio
Adventure playground	£0.67m	1.32
After school club with qualified personnel	£1.19m	212.00

In interpreting these results it is important to keep in mind the following considerations:

- Given the limited availability of high quality data in the literature, it was difficult to generate robust estimates of the effects of the interventions on education and physical activity. In this scenario, the analysis for the two interventions was based on the best available evidence.
    - In the education model for adventure playgrounds this meant using non-UK evidence comparing the effect of playgrounds that are likely to be less 'adventurous' than an adventure playground versus a simple playground. This implies that the benefits of the intervention are likely to be underestimated.
    - For after school clubs the lack of evidence meant that the measures of effect were obtained through interviews with managers; the benefits are thus likely to be overestimated. This emphasised the need to test the sensitivity of the results to the effect measures. The results of the sensitivity analysis indicate that, even if the effect of the intervention was dramatically reduced, the net benefits would still be positive. This suggests that the conclusion of the analysis –that the intervention is cost-effective and an efficient use of resource– is not impacted by this uncertainty.
- The estimation of the educational benefits relies on descriptive data linking key stage 1 scores to GCSE's. This data does not measure the causal link between key stage 1 and GCSE's performance. That is, factors other than key stage 1, 2 and 3 performance that may impact on GCSE's performance have not been accounted for. It is likely that this uncertainty overestimates the impact of play.
- The benefits captured in the model are education and physical activity. There are numerous other benefits which were not included in the analysis. From interviews with managers of adventure playgrounds and after school clubs it was evident that these interventions positively influence children's emotional health, family relationships, and overall well being. Limiting the scope of the model to education and physical activity implies that the CBA underestimates the total benefit of these interventions.
- The economic model overlooks the benefits seen by children with disabilities. A significant percentage of children using adventure playgrounds and after school clubs experience physical and learning disabilities. It was pointed out several times through interviews that

these interventions have a significant impact on helping these children cope with daily activities. The economic model does not capture the benefits realised by these children due to the narrow definition of physical activity levels and educational attainment.

This research provides a first attempt to generate economic evidence on the value of staffed play provision in the UK. Despite its limitations, mainly driven by the lack of quantitative evidence on the effectiveness of play provision on children's outcomes, the results provide an indication of the potential benefits associated with staffed play provision on children's outcomes. Future research efforts should aim at collecting and measuring data that can be employed to generate more robust estimates of the economic benefits generated by play interventions.

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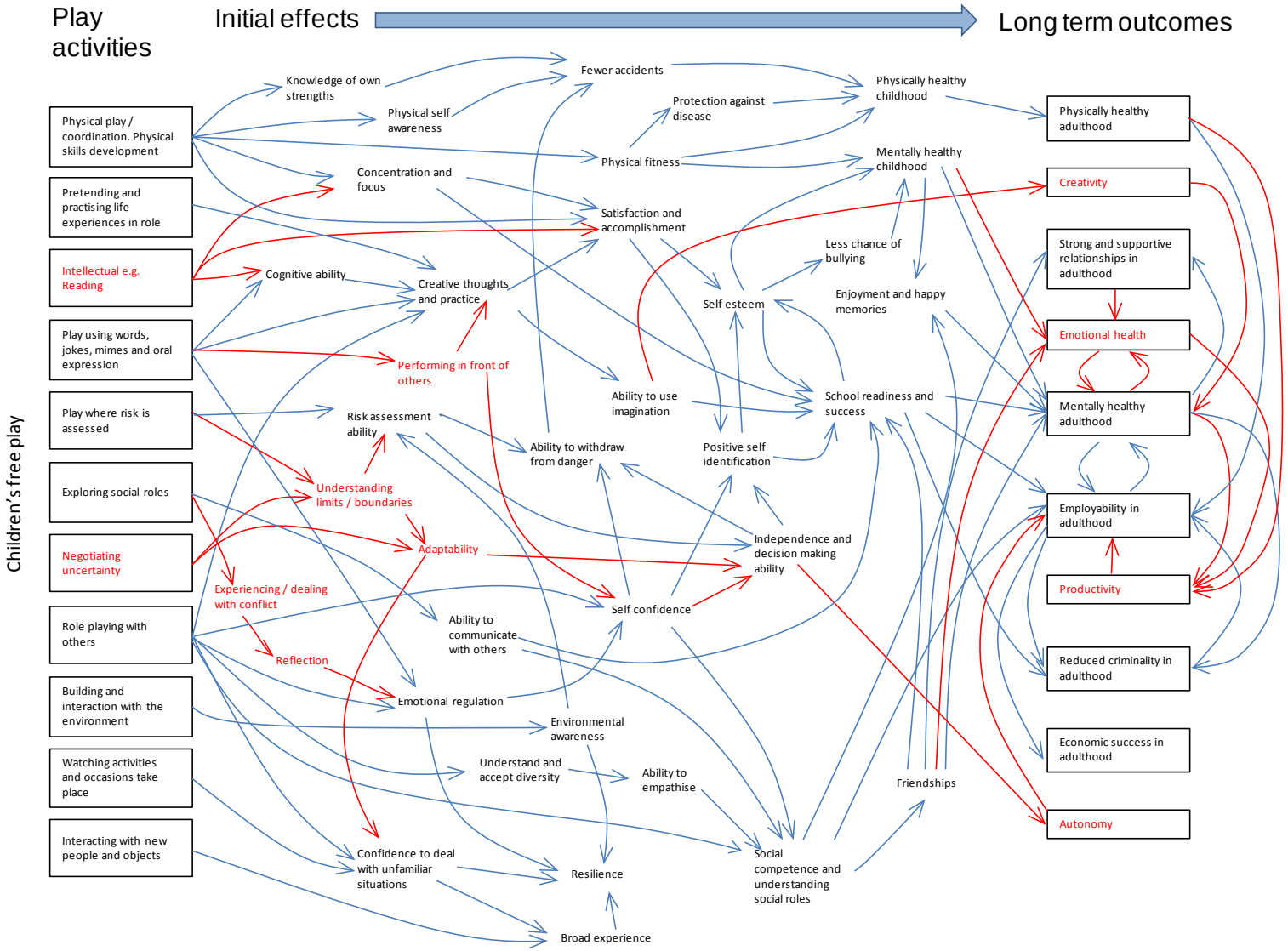
Appendix 1: conceptual model



Appendix 2: search terms

Tables A2.1 and A2.2 provide details on the search strategy used for adventure playground and afterschool play clubs respectively.

Table A2.1. Search terms used for each database: adventure playgrounds

Database	Search terms
Science Direct	("playground" AND "physical activity") OR ("playground" AND emotional*) OR ("playground" AND "social skill") OR ("playground" AND behaviour*) OR ("playground" AND learning*) OR ("playground" AND activity*)OR ("playground" AND skill*) AND LIMIT-TO(topics, "child, physical activity, relational aggression, early childhood, teacher, child care, bullying, childhood obesity, public health")
Pub Med	("playground" AND emotional*) OR ("playground" AND "social skill") OR ("playground" AND behaviour*) OR ("playground" AND learning*) OR ("playground" AND skill*)
ERIC	(Keywords: playground) and (Keywords: emotion*) or (Keywords: playground) and (Keywords: skill*) or (Keywords: playground) and (Keywords: behaviour*) or (Keywords: playground) and (Keywords: learn*))
Google Scholar	("playground" AND "learning", with at least one word: "playground", search only" in Social sciences, Arts and Humanities"); in the title of the article; anywhere in the article. (" playground" AND "behaviour", with at least one word: "playground", search only" in Social sciences, Arts and Humanities"); anywhere in the article ("adventure playground" AND "learning", with at least one word: "playground", search only" in Social sciences, Arts and Humanities"); anywhere in the article
Childata	playgrounds & emotional*; playgrounds & skill*; playgrounds & behaviour; playgrounds & learning; playgrounds & activity; playgrounds & evaluation; adventure playgrounds
National Children's Bureau	Playground; play ranges; children's outcome; school readiness; physical activity
NFER	Playground; play ranges
National Literacy Trust	Playground

Table A2.2: Search terms used for each database: after school clubs

Database	Search terms
Science Direct	(“effect” OR “evaluation”) AND (“after school” OR “extended school” OR “playgroups” OR “play scheme” OR “play range”)
Pub Med	(“effect” OR “evaluation”) AND (“after school” OR “extended school” OR “playgroups” OR “play scheme” OR “play range”)
ERIC	(“effect” OR “evaluation”) AND (“after school” OR “extended school” OR “playgroups” OR “play scheme” OR “play range”)
Inter Science	(“effect” OR “evaluation”) AND (“after school” OR “extended school” OR “playgroups” OR “play scheme” OR “play range”)
Childata	Extended schools, after school care, play benefits, play schemes, play groups, play value
NFER	After school

Appendix 3: key stage 1 to GCSE's transition probabilities

Table A3.1 and A3.2 outlines the transition probabilities used to predict performance on GCSE's from key stage 1 performance (DCSF, 2003).

Table A3.1 Transitions probabilities: adventure playground model

Transitions probabilities	Value
Probability if KS1 is Incomplete --> KS2 L4	0.00
Probability if KS1 is Incomplete --> KS2 L5+	0.00
Probability if KS1 is Incomplete --> KS2 < L4	1.00
Probability if KS1 is L1 --> KS2 L4	0.37
Probability if KS1 is L1 --> KS2 L5+	0.04
Probability if KS1 is L1 --> KS2 < L4	0.59
Probability if KS1 is L2C --> KS2 L4	0.63
Probability if KS1 is L2C --> KS2 L5+	0.10
Probability if KS1 is L2C --> KS2 < L4	0.26
Probability if KS1 is L2B --> KS2 L4	0.66
Probability if KS1 is L2B --> KS2 L5+	0.25
Probability if KS1 is L2B --> KS2 < L4	0.10
Probability if KS1 is L2A --> KS2 L4	0.50
Probability if KS1 is L2A --> KS2 L5+	0.48
Probability if KS1 is L2A --> KS2 < L4	0.02
Probability if KS1 is L3 --> KS2 L4	0.23
Probability if KS1 is L3 --> KS2 L5+	0.77
Probability if KS1 is L3--> KS2 < L4	0.00
Probability if KS2 L4 --> KS3 L5	0.45
Probability if KS2 L4 --> KS3 L6+	0.36
Probability if KS2 L4 --> KS3 < L5	0.19
Probability if KS2 L5+ --> KS3 L5	0.13
Probability if KS2 L5+ --> KS3 L6+	0.85
Probability if KS2 L5+ --> KS3 < L5	0.01
Probability if KS2 < L4 --> KS3 L5	0.12
Probability if KS2 < L4 --> KS3 L6+	0.01
Probability if KS2 < L4 --> KS3 < L5	0.86
Probability if KS3 L5 --> 5 GCSE's A*-C	0.51
Probability if KS3 L5 --> NO 5 GCSE's A*-C	0.49
Probability if KS3 L6+ --> 5 GCSE's A*-C	0.97
Probability if KS3 L6+ --> NO 5 GCSE's A*-C	0.03
Probability if KS3 < L5 --> 5 GCSE's A*-C	0.03
Probability if KS3 < L5 --> NO 5 GCSE's A*-C	0.97

Table A3.2 Transitions probabilities: after school club model

Transition Probabilities	Value
Probability if KS2 INCOMPLETE --> KS3 L5	0.00
Probability if KS2 INCOMPLETE --> KS3 L6+	0.00
Probability if KS2 INCOMPLETE --> KS3 < L5	1.00
Probability if KS2 L2 --> KS3 L5	0.00
Probability if KS2 L2 --> KS3 L6+	0.00
Probability if KS2 L2 --> KS3 < L5	0.00
Probability if KS2 L3 --> KS3 L5	0.22
Probability if KS2 L3 --> KS3 L6+	0.02
Probability if KS2 L3 --> KS3 < L5	0.75
Probability if KS2 L4 --> KS3 L5	0.45
Probability if KS2 L4 --> KS3 L6+	0.36
Probability if KS2 L4 --> KS3 < L5	0.19
Probability if KS2 L5 --> KS3 L5	0.13
Probability if KS2 L5 --> KS3 L6+	0.85
Probability if KS2 L5 --> KS3 < L5	0.01
Probability if KS3 L5 --> 5 GCSE's A*-C	0.51
Probability if KS3 L5 --> NO 5 GCSE's A*-C	0.49
Probability if KS3 L6+ --> 5 GCSE's A*-C	0.97
Probability if KS3 L6+ --> NO 5 GCSE's A*-C	0.03
Probability if KS3 < L5 --> 5 GCSE's A*-C	0.03
Probability if KS3 < L5 --> NO 5 GCSE's A*-C	0.97

Appendix 4: economic models – adventure playground

Education model

Figure A4.1. A decision model for the impact of adventure playground on educational attainment – intervention arm

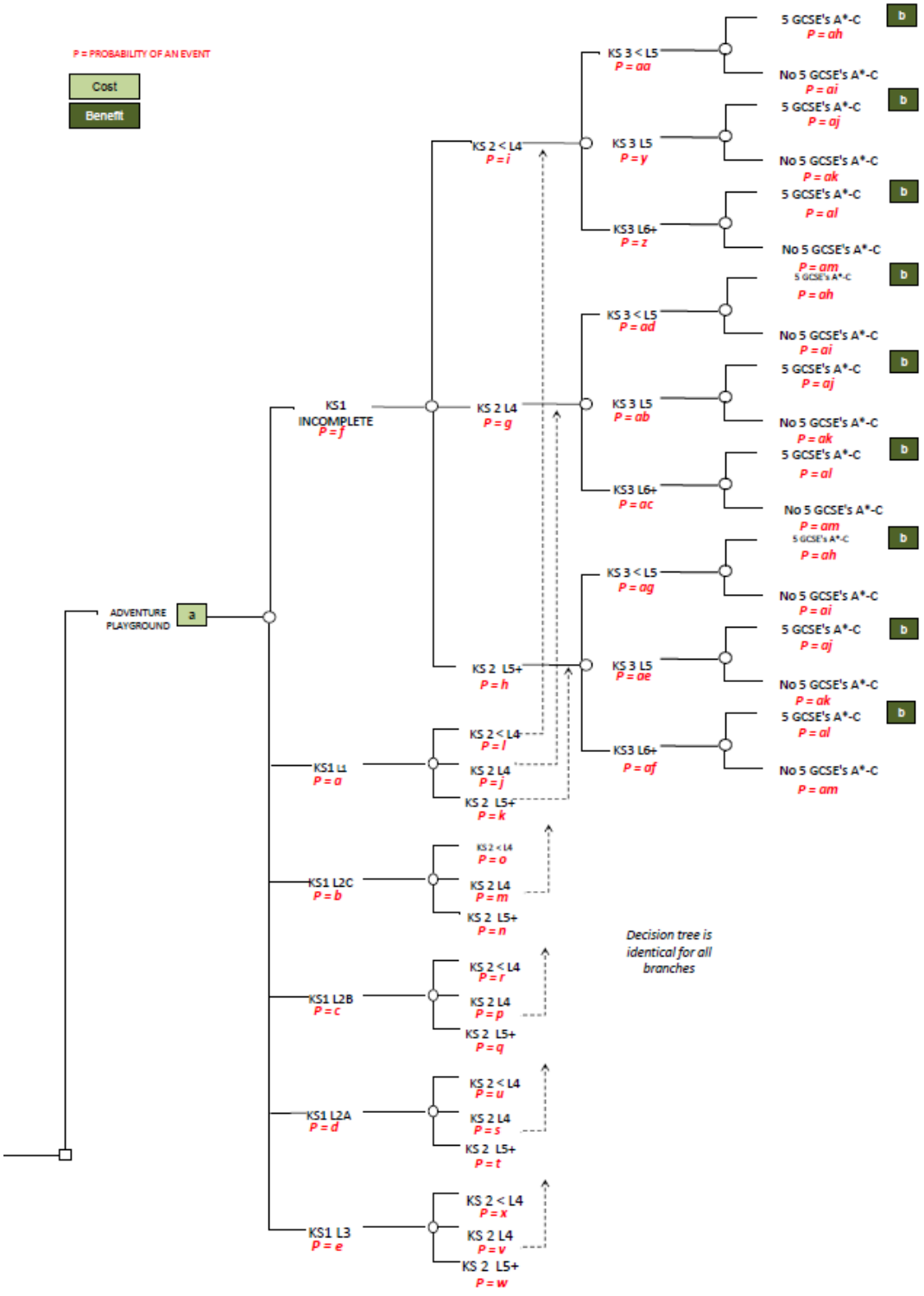


Figure A4.1. A decision model for the impact of adventure on educational attainment – counterfactual arm

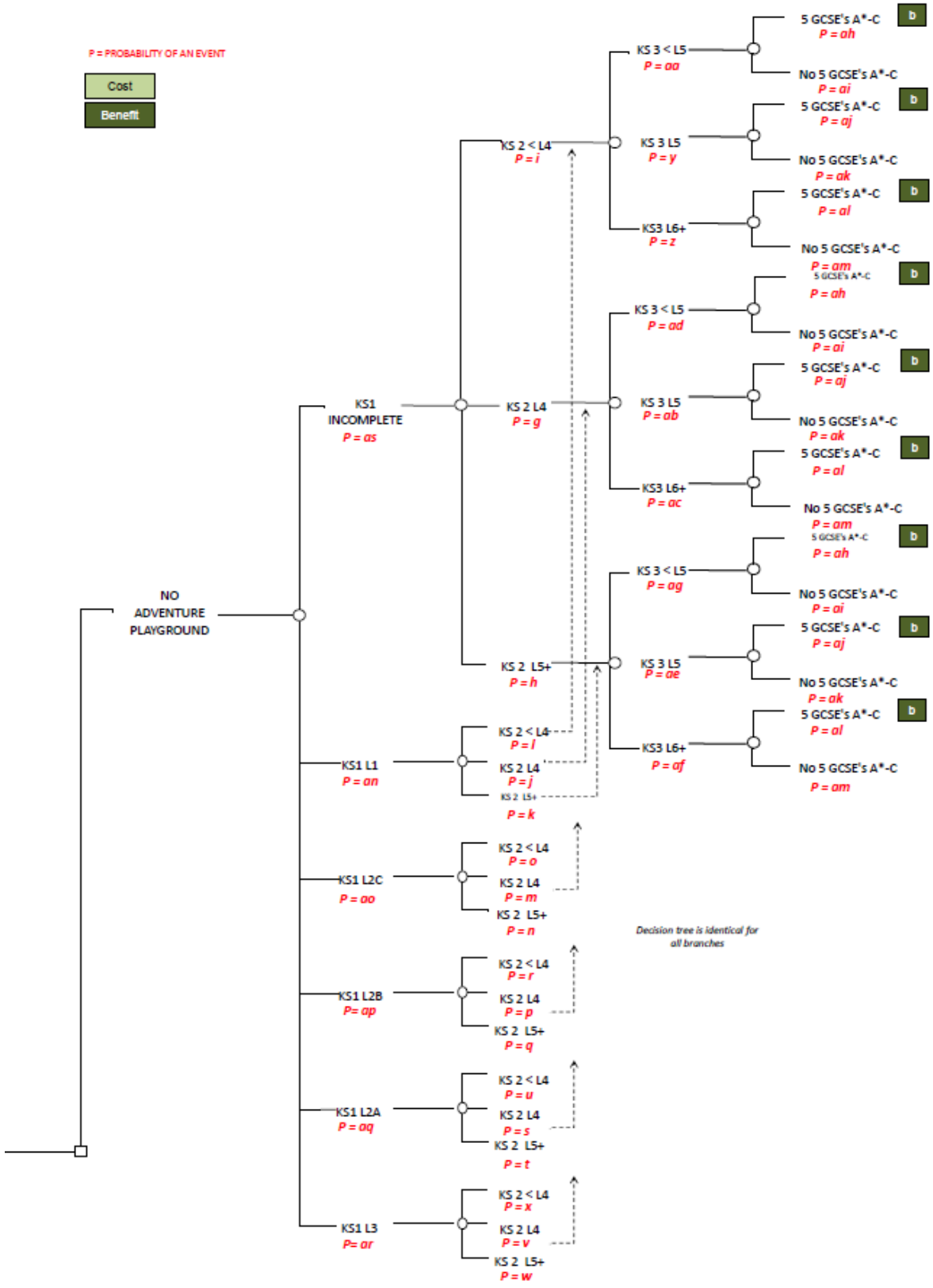


Table A4.1. Parameters used to populate adventure playground education model

Ref	Description	Value	Calculation and Sources
a	Cost of an adventure playground (AP)	a. Set up costs = £800,000 b. Running costs = £100,000 c. Reinvestment = 10% of set up costs annually from year 10 to year 20.	Costs provided by Play England. Costs were amortized over 20 years and discounted at 3.5%
a	Probability of attaining KS1 L1 with access to an AP	0.042	Education effect size = 5.09% (refer section 3.1) Minimum points required for KS1 L1 = 9 points (Table 7). Applying education effect size children achieving a score of 8.56 would shift from incomplete to KS1 L1= $\frac{9}{1.059} = 8.56$ Assume at baseline KS1 scores are distributed evenly - i.e. at baseline 12% of students achieve an "incomplete" (Table 7), using 0.20 point increments = $12\%/[(9-1)/0.20] = 0.30\%$ students at each point increment. Per cent of students who shift from "incomplete" to KS1 L1 = $\frac{9-8.56}{0.20} * 0.30\% = 0.65\ \%$ Total per cent of students attaining KS1 L1 = $(\%\ \text{baseline} + \%\ \text{shift from incomplete} - \%\ \text{sift from KS1 L1 to KS1 L2C}) = 4\% + 0.65\% - 0.63\% = 4.02\%$ The same logic is applied to reference b to e below.
b	Probability of attaining KS1 L2C with access to an AP	0.097	Per cent of students who shift from KS1 L1 to KS1 L2C = $\frac{4\%}{\frac{(13-9)}{0.20}} * \frac{13 - \frac{13}{1.059}}{0.20} = 0.63\%$ Total percent of students attaining KS1 L2C = 13.25% + 0.63% - 4.81% = 9.7%

Table A4.1. Parameters used to populate adventure playground education model

Ref	Description	Value	Calculation and Sources
c	Probability of attaining KS1 L2B with access to an AP	0.228	Per cent of students who shift from KS1 L2C to KS1 L2B = $\frac{\frac{13.25\%}{(15-13)}}{0.20} * \frac{15-\frac{15}{1.059}}{0.20} = 4.81\%$ Total percent of students attaining KS1 L2C = 30.50% + 4.81% - 12.55% = 22.76%
d	Probability of attaining KS1 L2A with access to an AP	0.247	Per cent of students who shift from KS1 L2B to KS1 L2A = $\frac{\frac{30.50\%}{(17-15)}}{0.20} * \frac{15-\frac{15}{1.059}}{0.20} = 12.55\%$ Total percent of students attaining KS1 L2C = 16.25% + 12.55% - 4.13% = 24.67%
e	Probability of attaining KS1 L3 with access to an AP	0.281	Per cent of students who shift from KS1 L2A to KS1 L3 = $\frac{\frac{16.25\%}{(21-17)}}{0.20} * \frac{17-\frac{17}{1.059}}{0.20} = 4.13\%$ Total percent of students attaining KS1 L2C = 24.0% + 4.13% = 28.13% In baseline no children receive a KS1 L4 score, therefore assumed for KS1 L3 no children would shift to KS1 L4.
f	Probability of attaining KS1 incomplete with access to an AP	0.113	Calculation = 1 – above probabilities (a to e)
g	Probability if KS1 is Incomplete transition to KS2 L4	0.00	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
h	Probability if KS1 is Incomplete transition to KS2 L5+	0.00	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002

Table A4.1. Parameters used to populate adventure playground education model

Ref	Description	Value	Calculation and Sources
i	Probability if KS1 is Incomplete transition to KS2 < L4	1.00	Calculation: i = 1- (g+h)
j	Probability if KS1 is L1 transition to KS2 L4	0.37	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
k	Probability if KS1 is L1 transition to KS2 L5+	0.04	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
l	Probability if KS1 is L1 transition to KS2 < L4	0.59	Calculation: l = 1- (j+k)
m	Probability if KS1 is L2C transition to KS2 L4	0.63	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
n	Probability if KS1 is L2C transition to KS2 L5+	0.10	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
o	Probability if KS1 is L2C transition to KS2 < L4	0.26	Calculation: o = 1- (m+n)
p	Probability if KS1 is L2B transition to KS2 L4	0.66	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
q	Probability if KS1 is L2B transition to KS2 L5+	0.25	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
r	Probability if KS1 is L2B transition to KS2 < L4	0.10	Calculation: r = 1- (p+q)

Table A4.1. Parameters used to populate adventure playground education model

Ref	Description	Value	Calculation and Sources
s	Probability if KS1 is L2A transition to KS2 L4	0.50	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
t	Probability if KS1 is L2A transition to KS2 L5+	0.48	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
u	Probability if KS1 is L2A transition to KS2 < L4	0.02	Calculation: u = 1- (s+t)
v	Probability if KS1 is L3 transition to KS2 L4	0.23	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
w	Probability if KS1 is L3 transition to KS2 L5+	0.77	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
x	Probability if KS1 is L3transition to KS2 < L4	0.00	Calculation: x = 1- (v+w)
y	Probability if KS2 L4 transition to KS3 L5	0.45	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
z	Probability if KS2 L4 transition to KS3 L6+	0.36	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
aa	Probability if KS2 L4 transition to KS3 < L5	0.19	Calculation: aa = 1- (y+z)
ab	Probability if KS2 L5+ transition to KS3 L5	0.13	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002

Table A4.1. Parameters used to populate adventure playground education model

Ref	Description	Value	Calculation and Sources
ac	Probability if KS2 L5+ transition to KS3 L6+	0.12	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
ad	Probability if KS2 L5+ transition to KS3 < L5	0.01	Calculation: ad = 1- (ab+ac)
ae	Probability if KS2 < L4 transition to KS3 L5	0.86	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
af	Probability if KS2 < L4 transition to KS3 L6+	0.85	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
ag	Probability if KS2 < L4 transition to KS3 < L5	0.01	Calculation: ag = 1- (ae+af)
ah	Probability if KS3 L5 transition to 5 GCSE's A*-C	0.51	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
ai	Probability if KS3 L5 transition to NO 5 GCSE's A*-C	0.49	Calculation: aj = (1 – ah)
aj	Probability if KS3 L6+ transition to 5 GCSE's A*-C	0.97	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
ak	Probability if KS3 L6+ transition to NO 5 GCSE's A*-C	0.03	Calculation: ak = (1 – aj)
al	Probability if KS3 < L5 transition to 5 GCSE's A*-C	0.03	Table A3.1: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002

Table A4.1. Parameters used to populate adventure playground education model

Ref	Description	Value	Calculation and Sources
am	Probability if KS3 < L5 transition to NO 5 GCSE's A*-C	0.97	Calculation: am =(1 – al)
b	Increase in adult earnings due to achieving 5 GCSE's A*-C compared to none.	£156,863	Cummings et al (2007) - average increase in adult earnings for a boy and girl in 2005/6 = £144,098. 2005/6 prices converted to 2010 using HM Treasury GDP inflator = £144,098 * 1.088 = £156,863.
an	Probability of attaining KS1 L1 without access to an AP	0.12	DCFS (2001) – Key Stage 1 National Results
ao	Probability of attaining KS1 L2C without access to an AP	0.14	DCFS (2001) – Key Stage 1 National Results
ap	Probability of attaining KS1 L2B without access to an AP	0.133	DCFS (2001) – Key Stage 1 National Results
aq	Probability of attaining KS1 L2A without access to an AP	0.305	DCFS (2001) – Key Stage 1 National Results
ar	Probability of attaining KS1 L3 without access to an AP	0.163	DCFS (2001) – Key Stage 1 National Results
as	Probability of attaining KS1 incomplete without access to an AP	0.24	DCFS (2001) – Key Stage 1 National Results

Physical activity model

Figure A4.2. A decision model for the impact of adventure on physical activity

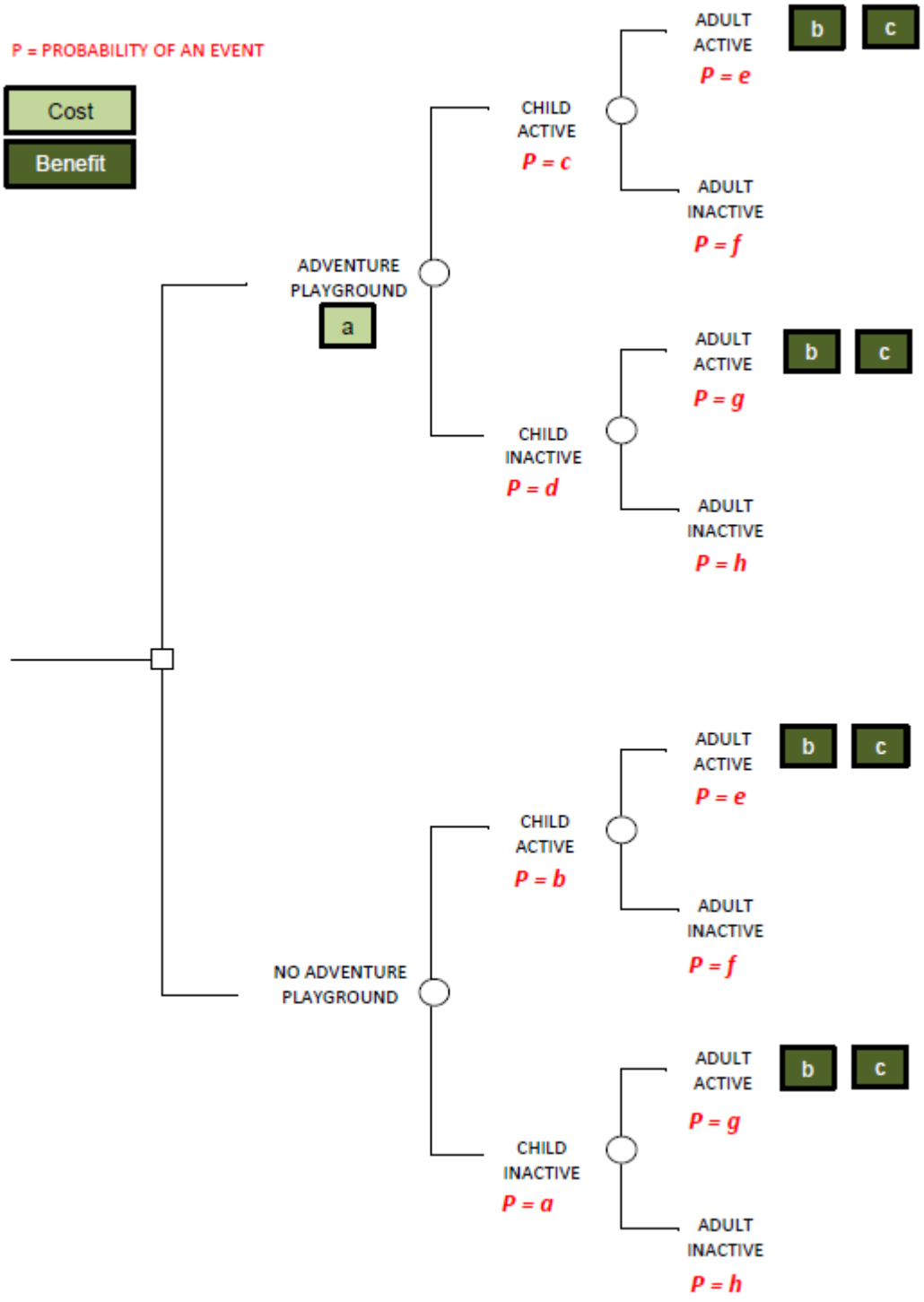


Table A4.2. Parameters used to populate adventure playground physical activity model

Ref	Description	Value	Calculation and Sources
a	Cost of an adventure playground (AP)	Set up costs = £800,000 Running costs = £100,000 Reinvestment = 10% of set up costs annually from year 10 to year 20.	Costs provided by Play England. Costs were amortized over 20 years and discounted at 3.5%
a	Probability child is in active without access to an adventure playground	0.4270	Proportion of girls aged 4-10 inactive in childhood = .34, proportion of boys aged 4-10 inactive in childhood = .51 (Health Survey for England – 2008). Proportion of boys aged 5-9 = 0.5115. Average = $(0.51 * 0.5115) + (0.34 * (1 - 0.5115) = 0.4270$
b	Probability child is active without access to an adventure playground	0.5730	Calculation: b = (1 - a)
c	Probability child is active with access to an adventure playground	0.6197	Physical activity effect size = .0815 (refer to section 3.1) Applying effect size to baseline children active = 0.5730 * 1.0815 = 0.6197
d	Probability child is inactive with access to an adventure playground	0.3803	Calculation: d = (1 – b)
e	Probability active in adulthood given active in childhood	0.487	Calculation = ref g * odds ratio of being a physically active adult if physically active child compared to a physically active adult if physically inactive child = 3.6 (Telama, 2005) = 0.135 * 3.6 = 0.487

Table A4.2. Parameters used to populate adventure playground physical activity model

Ref	Description	Value	Calculation and Sources
f	Probability inactive in adulthood given active in childhood	0.513	Calculation = f = (1 - 0.513)
g	Probability active in adulthood given inactive in childhood	0.135	Baseline likelihood of being a physically active adult = 0.34 (Taking Part, 2008). Baseline children active = 0.4270 (ref a) Odds ratio of being a physically active adult if physically active child compared to a physically active adult if physically inactive child = 3.6 (Telama, 2005) Probability active in adult hood given inactive in childhood = $0.34/[(0.4270 + 3.6(1 - 0.4270)] = 0.135$
h	Probability inactive in adulthood given inactive in childhood	0.865	Calculation = h = (1 – g)
b	Decrease in health care costs due to decreased incidence of – type II diabetes, stroke, colon cancer, and CHD	£2,110	Matrix (2006), Physical activity – economic modelling report.
c	QALY gained due to decreased incidence of – type II diabetes, stroke, colon cancer, and CHD	1.31	Matrix (2006), Physical activity – economic modelling report.

Appendix 5: economic model – after school club

Figure A5.1: A decision model for the impact of after school club on educational attainment – intervention arm

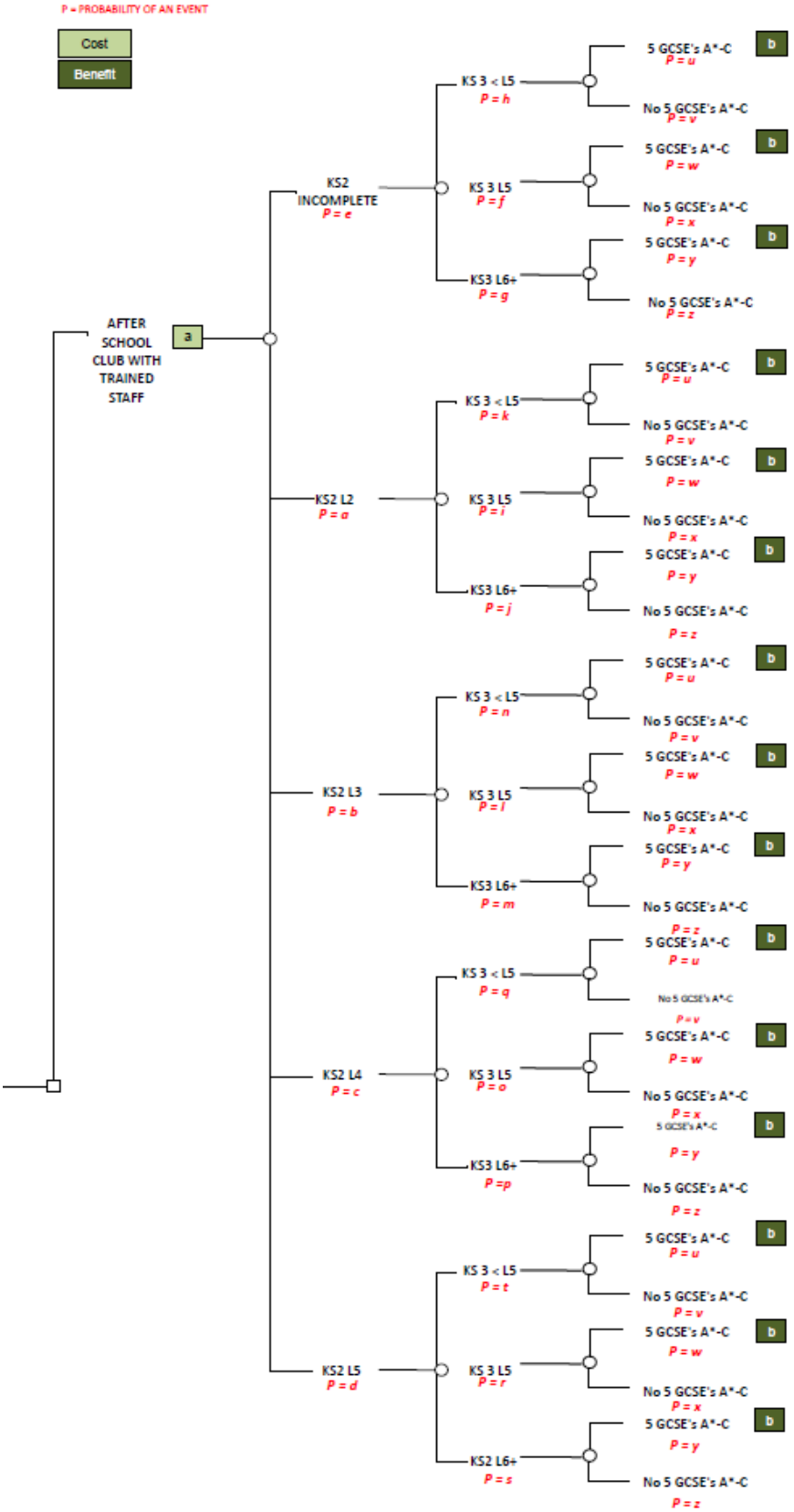


Figure A5.1: A decision model for the impact of after school club on educational attainment – counterfactual arm

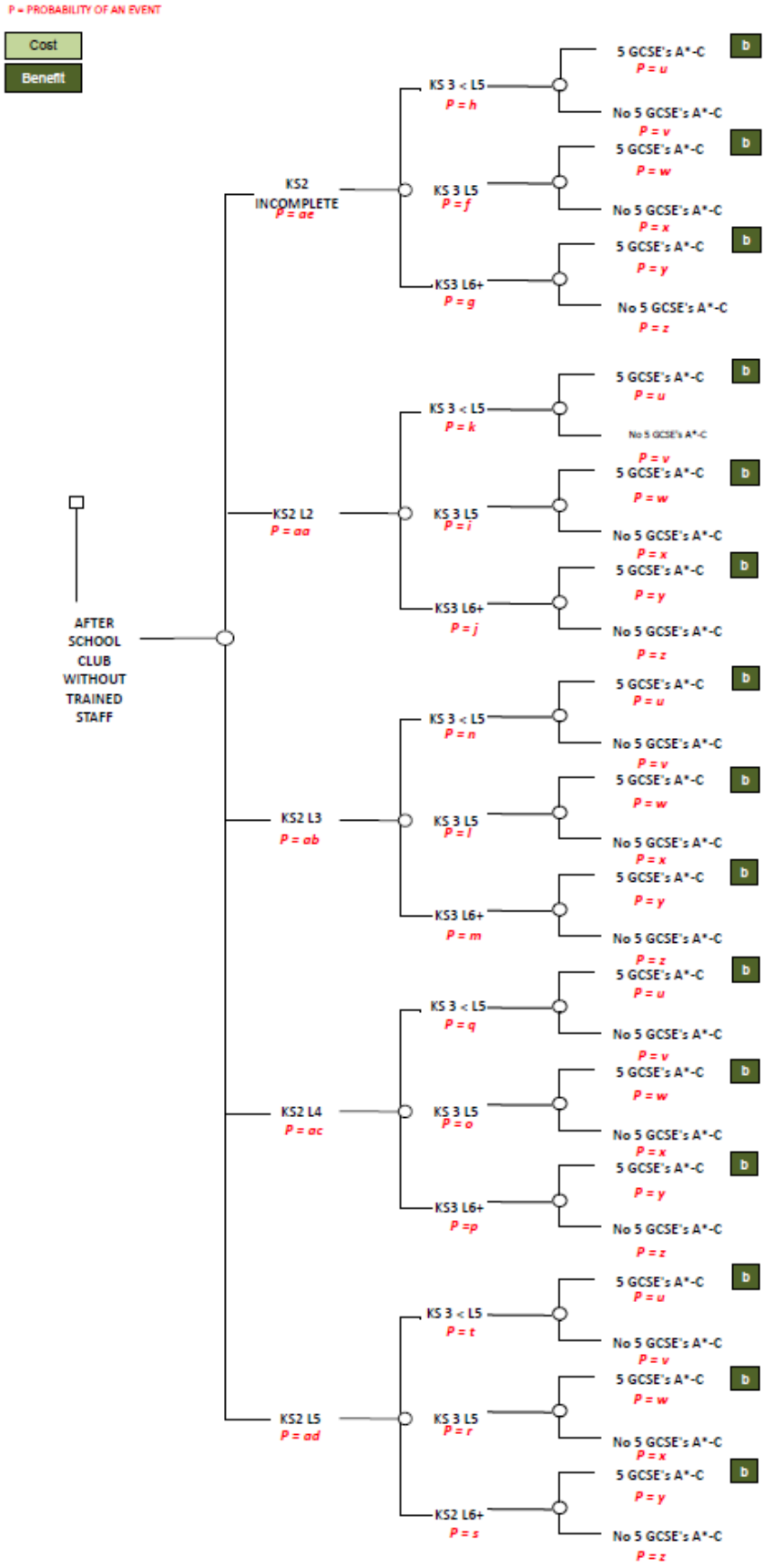


Table A5.1: Parameters used to populate after school club education model

Ref	Description	Value	Calculation and Sources
a	Cost of training for NVQ Level 2/3	£613 per staff member	Cost of NVQ 2 and NVQ 3 training obtained from training providers (table A6.1). Based on expert opinion each after school club has an average of 3 staff members, cost of training would be £1,915. Assume every 5 years 3 new staff is trained. Total cost of training is amortized over 20 years.
a	Probability of attaining KS2 L2 with access to an after school club with qualified personnel	0.90	Similar calculation to adventure playground model. Education effect size =8.33% estimated from interviews with after school club managers. Per cent of students who shift from KS2 Incomplete to KS2 L2 = $\frac{5\%}{\frac{(15-1)}{0.20}} * \frac{15-\frac{15}{1.083}}{0.20} = 0.41\%$ Total percent of students attaining KS2 L2 = 0.67% + 0.41% - 0.81% = 0.90%
b	Probability of attaining KS2 L3 with access to an after school club with qualified personnel	0.085	Per cent of students who shift from KS2 L2 to KS2 L3 = $\frac{0.67\%}{\frac{(21-15)}{0.20}} * \frac{21-\frac{21}{1.083}}{0.20} = 0.18\%$ Total percent of students attaining KS2 L2 = 12.67% + 0.18% - 4.38% = 8.46%
c	Probability of attaining KS2 L4 with access to an after school club with qualified personnel	0.30	Per cent of students who shift from KS2 L3 to KS2 L4 = $\frac{12.67\%}{\frac{(27-21)}{0.20}} * \frac{27-\frac{27}{1.083}}{0.20} = 4.38\%$ Total percent of students attaining KS2 L2 = 44.33% + 4.38% - 18.76% = 29.96%

Table A5.1: Parameters used to populate after school club education model

Ref	Description	Value	Calculation and Sources
d	Probability of attaining KS2 L5 with access to an after school club with qualified personnel	0.56	Per cent of students who shift from KS2 L4 to KS2 L5 = $\frac{44.33\%}{\frac{(33-27)}{0.20}} * \frac{33 - \frac{33}{1.083}}{0.20} = 18.76\%$ Total percent of students attaining KS2 L2 = 44.33% + 18.75% = 56.09% In baseline no children receive a KS2 L46 score, therefore assumed for KS2 L5 no children would shift to KS2 L6.
e	Probability of attaining KS2 incomplete with access to an after school club with qualified personnel	0.046	Calculation = 1 – (a to d)
f	Probability if KS2 INCOMPLETE transition to KS3 L5	0.00	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
g	Probability if KS2 INCOMPLETE transition to KS3 L6+	0.00	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
h	Probability if KS2 INCOMPLETE transition to KS3 < L5	1.00	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
i	Probability if KS2 L2 transition to KS3 L5	0.00	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
j	Probability if KS2 L2 transition to KS3 L6+	0.00	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
k	Probability if KS2 L2 transition to KS3 < L5	0.00	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
l	Probability if KS2 L3 transition to KS3 L5	0.22	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
m	Probability if KS2 L3 transition to KS3 L6+	0.02	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002

Table A5.1: Parameters used to populate after school club education model

Ref	Description	Value	Calculation and Sources
n	Probability if KS2 L3 transition to KS3 < L5	0.75	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
o	Probability if KS2 L4 transition to KS3 L5	0.45	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
p	Probability if KS2 L4 transition to KS3 L6+	0.36	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
q	Probability if KS2 L4 transition to KS3 < L5	0.19	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
r	Probability if KS2 L5 transition to KS3 L5	0.13	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
s	Probability if KS2 L5 transition to KS3 L6+	0.85	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
t	Probability if KS2 L5 transition to KS3 < L5	0.01	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
u	Probability if KS3 L5 transition to 5 GCSE's A*-C	0.51	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
v	Probability if KS3 L5 transition to NO 5 GCSE's A*-C	0.49	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
w	Probability if KS3 L6+ transition to 5 GCSE's A*-C	0.97	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
x	Probability if KS3 L6+ transition to NO 5 GCSE's A*-C	0.03	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
y	Probability if KS3 < L5 transition to 5 GCSE's A*-C	0.03	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002
z	Probability if KS3 < L5 transition to NO 5 GCSE's A*-C	0.97	Table A3.2: DCFS (2003) - Statistics of Education: Pupil Progress by Pupil Characteristics: 2002

Table A5.1: Parameters used to populate after school club education model

Ref	Description	Value	Calculation and Sources
aa	Probability of attaining KS2 L2 without access to an after school club with qualified personnel	0.0067	DCFS (2007) - KS2 National Results
ab	Probability of attaining KS2 L3 without access to an after school club with qualified personnel	0.1267	DCFS (2007) - KS2 National Results
ac	Probability of attaining KS2 L4 without access to an after school club with qualified personnel	0.4433	DCFS (2007) - KS2 National Results
ad	Probability of attaining KS2 L5 without access to an after school club with qualified personnel	0.3733	DCFS (2007) - KS2 National Results
ae	Probability of attaining KS2 incomplete without access to an after school club with qualified personnel	0.0500	DCFS (2007) - KS2 National Results

Appendix 6: cost of play work training

Estimates of the cost of play work training was calculated based on data provided by training providers. Due to recent changes in training structure, Skills Active was unable to provide an estimate on the cost of play work training. Therefore, various providers of training were contacted by phone and asked to provide a quote for NVQ 2 and NVQ 3 play work training. The variability in prices can be seen below in table A6.1. The average price of NVQ2 and NVQ3 was used for the purpose of the economic model.

Table A6.1 Cost of play work training for a selected number of providers

	NVQ Level 2		NVQ Level 3	
Source	**Fee**	**Duration/Hours**	**Fee**	**Hours**
East Riding College	£375	Flexible	£550	Flexible
Hopwood Hall College	N/A	N/A	£800	1 year, 3 hrs/week
Wakefield College	£500	6 months, 10 two hour session	£580	1 year, hours dependent on evidence requirements
Reading College	£680	1 year, hours dependent on evidence requirements	£900	18 months, hours dependent on evidence requirements
Average	**£518**		**£708**	