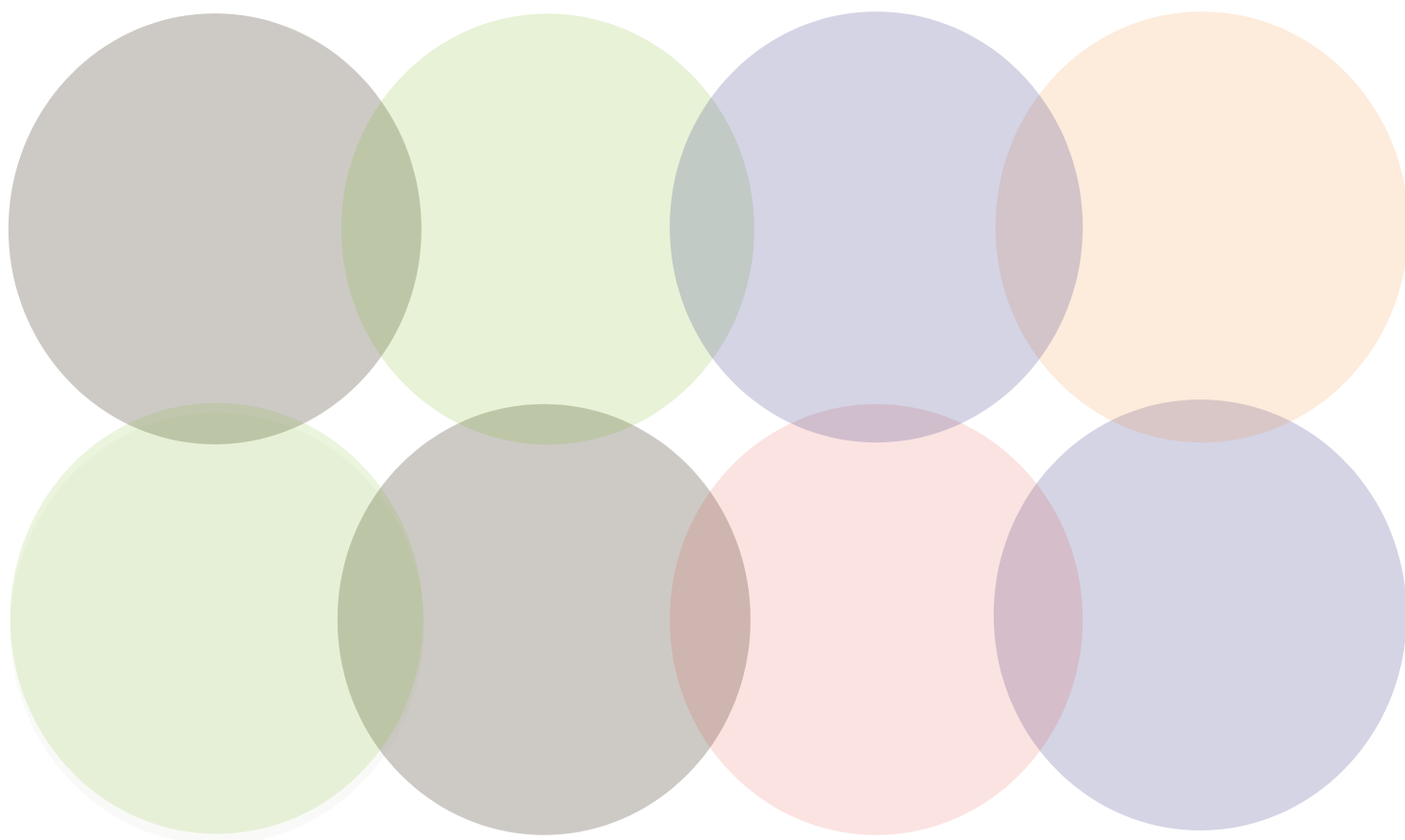


spear

centre for sport, physical education
& activity research

Value for Money & Return on Investment of Change4Life Sports Clubs



Updated June 2016

Change4Life Sports Clubs 2016 Research:

Part Two Report

About *spear*

The Centre for Sport, Physical Education & Activity Research (*spear*) is located within the School of Human & Life Sciences at Canterbury Christ Church University. *spear* undertakes a range of theoretically-informed analyses, from critical commentaries and reflections on current policy and practice, to commissioned research, evaluation and consultancy.

The Centre's research is funded by a range of national and international funders such as the International Olympic Committee, World Health Organisation, Terres des Hommes, Department of Health, Department for Education, English Federation for Disability Sport, Mencap, Access Sport, Youth Sport Trust, UK Sport, Sports Coach UK, Sport England and Sport Wales. Recent work has focused on sport, physical activity, health and wellbeing in schools and communities.

Research conducted by *spear* has helped guide and inform public policy by contributing to the wider evidence base used by policy makers, providing a rationale for government and commercial investment, and steering programme improvements that enhance the experience of practitioners and participants.

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Headlines

Unit Outcome and Unit Cost Analyses

- Change4Life Sports Clubs have a cost of £305 for every new child meeting CMO physical activity guidelines, for which cost an additional 0.2 children were lifted out of inactivity and a further 2.2 children were lifted out of low activity, with each of these children experiencing an average increase in reported wellbeing and individual development outcomes of 71%.
 - In comparison to the control condition counterfactual, Change4Life Sports Clubs delivered the following NET outcomes per £1,000 of expenditure:
 - 41 participants
 - 0.8 sustained clubs
 - 3.9 Young Leaders
 - 2.8 new children meeting CMO physical activity guidelines
 - 8.4 children lifted out of low activity
 - 1.3 children lifted out of inactivity
 - 0.1 children newly eating 5-a-day
 - 0.6 children reporting increased wellbeing and individual development outcomes
 - 5.1 children starting with low activity levels reporting increased wellbeing and individual development outcomes.
-

Quality Adjusted Life Year (QALY) Analysis

- The cost per QALY generated for the GROSS outcomes of Change4Life Sports Clubs is £3,385 (range: £3,036 to £3,806).
 - In comparison to the control condition counterfactual, the cost per QALY generated for the NET outcomes of Change4Life Sports Clubs is £3,791 (range: £3,413 to £4,245).
 - The cost per QALY generated for Change4Life Sports Clubs is significantly below NICE's threshold for value for money per QALY of £20,000.
 - The cost per QALY generated for the GROSS outcomes of Change4Life Sports Clubs compares favourably to GROSS outcomes estimated for walking buses (£4,008 per QALY), dance classes (£27,570 per QALY), free swimming (£40,462 per QALY) and community sports (£71,456 per QALY).
 - The cost per QALY generated by the NET outcomes of exercise referral interventions in adulthood is approximately five and a half times greater than that of Change4Life Sports Clubs.
-

Analysis of Future Health at Ages 13-15

- The Change4Life Sports Clubs cohort are predicted to do around an hour more physical activity per week at ages 13-15 than that predicted for the control condition counterfactual, and than today's 13-15 year olds.
 - The estimated additional physical activity of the Change4Life Sports Clubs cohort up to ages 13-15 will generate one additional QALY for every five children that took part in Change4Life Sports Clubs.
 - In comparison to the control counterfactual, the cost per QALY generated by the estimated future NET outcomes of Change4Life Sports Clubs up to ages 13-15 is £120.
 - Across the Health Survey for England, the Millennium Cohort Study and the Understanding Society Survey, no data is available to support a robust estimation of likely health and wellbeing status associated with physical activity levels at ages 13-15.
-

Unit Outcome and Unit Cost Analysis

Unit Outcome

This analysis reports the cost per unit of outcome delivered for the lifetime impact (to December 2015) of the Change4Life Sports Clubs. To undertake this analysis it is usual to identify a particular outcome as the primary goal of the programme, and to identify the cost per unit of that outcome if all programme costs are assumed to be directed towards achieving that outcome. Three potential primary outcomes are identified, these being: number of new children meeting CMO guidelines; number of children lifted out of *low activity*;¹ number of children lifted out of *inactivity*.² These outcomes are measured at follow-up – that is, 12 weeks after children left the Change4Life Sports Clubs – and are shown in table 1.

Table 1. Physical Activity Outcomes for Change4Life Sports Clubs

Number of...	On entry to clubs	12 weeks after leaving clubs	Change
Children meeting CMO guidelines	61,693	90,057	28,364
Children with low activity levels	164,159	103,176	-60,983*
Inactive children	15,246	9,218	-6,028*

* negative figures indicate a positive outcome in that they represent a decrease in the number of children with low activity levels or that are inactive.

The costs of delivering Change4Life Sports Clubs in primary schools between 2011 and 2015 was £8,650,204 (see appendix A). Consequently, depending on which of the above outcomes are chosen as the primary goal of the Change4Life Sports Clubs, the unit cost can be expressed as:

- £305 for every new child meeting CMO physical activity guidelines
- OR* • £142 for every child lifted out of low activity
- OR* • £1,435 for every child lifted out of inactivity

However, it is also possible to attribute reported wellbeing and individual development outcomes³ to these costs, as these can be isolated for those children achieving the above three physical activity outcomes (see table 2)

¹ *Low activity*, as defined by the Health Survey for England, is that children do not achieve 30 minutes of physical activity every day.

² *Inactivity*, as defined by the Department for Culture, Media and Sport, is that children do not achieve 30 minutes of physical activity a week.

³ Wellbeing and individual development outcomes comprise dimensions for creativity, aspiration, resilience, empathy, sociability, happiness and confidence – see Change4Life Sports Clubs Research 2016: Part One Report - for details.

Table 2. Percentage of Children Reporting Wellbeing and Individual Development Outcomes “every day” for each Physical Activity Outcome

	On entry to clubs	12 weeks after leaving clubs	Percentage Increase
Children meeting CMO guidelines at follow-up	51%	63%	26%
Children with low activity levels on entry to clubs	18%	34%	95%
Children that were inactive on entry to clubs	12%	17%	39%

This allows wellbeing and individual development outcomes to be reported for each of the three identified physical activity outcomes. Thus, depending on which physical activity outcome is chosen as the primary goal of the Change4Life Sports Clubs, the unit cost can be expressed as:

- £305 for every new child meeting CMO physical activity guidelines, each experiencing an average increase in reported wellbeing and individual development outcomes of 26%
- OR** • £142 for every child lifted out of low activity, each experiencing an average increase in reported wellbeing and individual development outcomes of 95%
- OR** • £1,435 for every child lifted out of inactivity, each experiencing an average increase in reported wellbeing and individual development outcomes of 39%.

What the above analysis shows is that while Change4Life Sports Clubs have been successful in delivering physical activity and wellbeing and individual development outcomes for each of the three physical activity outcomes, its greatest success has been in lifting children out of low activity, for which there is the lowest cost per physical activity outcome and the greatest increase in reported wellbeing and individual development outcomes.

One of the disadvantages with the analysis above is that it requires that the full costs of the programme are attributed to only one physical activity outcome. However, it is possible to provide an overall summary which states a primary physical activity outcome, but notes increases in the other outcomes, and also notes an overall average wellbeing and individual development outcome. For the purposes of this overall summary, the number of new children meeting CMO physical activity guidelines has been used as the primary outcome, as this is the most recognisable outcome in the wider physical activity community. Consequently, the overall summary of the unit outcome analysis is that:

*Change4Life Sports Clubs have a cost of
£305 for every new child meeting CMO physical activity guidelines,
for which cost an additional 0.2 children were lifted out of inactivity
and a further 2.2 children were lifted out of low activity,
with each of these children experiencing an average increase in
reported wellbeing and individual development outcomes of 71%.*

Unit Cost

This analysis reports the profile of outcomes delivered by unit of cost, in this case £1,000, for the lifetime impact (to December 2015) of the Change4Life Sports Clubs. It draws on the same basic data as the unit outcome analysis above, but is able to report on a wider profile of outcomes across the programme. For this analysis, it is also possible to set the outcomes per unit cost against the counterfactual provided for the control condition.

Table 3 shows the overall outcomes for the programme and outcomes for the control counterfactual. The control counterfactual has been built by grossing the control outcomes to the size of the actual programme (354,556 participants).

Table 3. GROSS and NET Overall Outcomes and Outcomes per £1,000 for the Change4Life Sports Clubs and the Control Condition Counterfactual

	GROSS Programme Outcomes	GROSS Outcomes per £1,000	Control Counterfactual Outcomes (per 354,556 children)	NET Programme Outcomes (vs control)	NET Outcomes per £1,000 (vs control)
Children participating	354,556	41.0	n/a	354,556	41.0
Number of sustained clubs (i.e. those that remain as of 2015)	7,211	0.8	*	*	*
Young Leaders developed	33,496	3.9	*	*	*
New children meeting CMO guidelines	28,364	3.3	3,717	24,648	2.8
Children lifted out of low activity	60,984	7.0	-12,081	73,065	8.4
Children lifted out of inactivity	6,027	0.7	-5,203	11,231	1.3
Children newly eating 5-a-day	42,901	5.0	42,101	800	0.1
Children reporting increased wellbeing & individual development outcomes	17,373	2.0	12,055	5,318	0.6
Children starting with low activity reporting increased wellbeing & individual development outcomes	41,508	4.8	-2,545	44,053	5.1

* no counterfactual data is available for these outcomes.

Therefore, in summary, drawing from table 3, *in comparison to the control condition counterfactual, the Change4Life Sports Clubs delivered the following NET outcomes per £1,000 of expenditure:*

- *41 participants*
- *0.8 sustained clubs*
- *3.9 Young Leaders*
- *2.8 new children meeting CMO physical activity guidelines*
- *8.4 children lifted out of low activity*
- *1.3 children lifted out of inactivity*
- *0.1 children newly eating 5-a-day*
- *0.6 children reporting increased wellbeing and individual development outcomes*
- *5.1 children starting with low activity levels reporting increased wellbeing and individual development outcomes.*

Quality Adjusted Life Year (QALY) Analysis

GROSS and NET QALYS Generated

This analysis reports the impact of physical activity gains made through Change4Life Sports Clubs on health and wellbeing using the standardized QALY measure. The method adopted, which is outlined in detail in appendix B, is that used to inform NICE guidance PH17, Physical Activity for Children and Young People (which NICE assesses as still current). The analysis is based on health and wellbeing improvements derived from additional physical activity during the Change4Life Sports Clubs programme period and during the 12 weeks after leaving the programme (the follow-up period). While further additional physical activity is assumed to take place after the 12-week follow-up period, activity levels during this time were not measured, and so have not been included in the analysis.

The QALY analysis involves generating a measure of the overall number of additional minutes of physical activity undertaken by all participants across the lifetime of the programme, and in the 12 weeks after leaving the programme (follow-up), taking physical activity minutes upon entering the programme as the baseline. These number of additional minutes are then used to estimate the number of QALYs generated during participation in the programme, and in the follow-up period, using a ratio employed in the method that informed NICE guidance PH17.⁴ The outcomes of this analysis are shown in table 4.

Table 4. QALY analysis for the GROSS outcomes of Change4Life Sports Clubs

	During the programme	During the 12 week follow-up	GROSS Programme Outcomes (programme + follow-up)
Number of additional minutes of physical activity	137,787,553	206,840,879	344,628,432
Number of additional minutes of activity per child	389	583	972
Number of additional minutes of activity per child per week	32	49	81
Number of QALYs generated	1,022	1,533	2,555
Number of QALYs generated per 1,000 children	2.9	4.3	7.2

Given a programme cost of £8,650,204 (see appendix A), *the cost per QALY generated for the GROSS outcomes of Change4Life Sports Clubs is £3,385.*

However, using the control counterfactual, it is also possible to generate a cost per QALY based on NET outcomes. The control counterfactual has been built by grossing the control outcomes to the size of the

⁴ The ratio used is that every additional 30 minutes of physical activity generates 0.000222433333 QALYs (see appendix B for details).

actual programme (354,556 participants) and then applying these across two 12 week periods to represent the programme and the follow-up periods. Table 5 shows the gross programme outcomes, the control counterfactual outcomes, and total net outcomes for the programme compared to the control counterfactual.

Table 5. QALY analysis for the Control Condition Counterfactual and the NET outcomes of Change4Life Sports Clubs

	GROSS Programme Outcomes	Control Counterfactual Outcomes	NET Programme Outcomes (vs control)
Number of additional minutes of physical activity	344,628,432	36,927,342	307,701,090
Number of additional minutes of activity per child	972	104	868
Number of additional minutes of activity per child per week	41	4	37
Number of QALYs generated	2,555	274	2,281
Number of QALYs generated per 1,000 children	7.2	0.8	6.4

Given a programme cost of £8,650,204 (see appendix A), *in comparison to the control condition counterfactual, the cost per QALY generated by the NET outcomes of Change4Life Sports Clubs is £3,791.*

Sensitivity Analysis

A sensitivity analysis has been conducted for these findings, accounting for maximum margins of error at 95% confidence in the programme data of +/- 2.7%, in the control data of +/-6%, and in the ratio used to estimate QALYs of 8.6% (see appendix B for details). The sensitivity analysis gives a range for gross and net outcomes as follows:

- *Cost per QALY based on NET outcomes is in the range £3,413 to £4,245 (-12.0% to +10.0%)*
- *Cost per QALY based on GROSS outcomes is in the range £3,036 to 3,806 (-12.4% to +10.3%)*

The ranges for both of these figures are *significantly below NICE's threshold for value for money per QALY of £20,000.*

Comparative Analysis

The cost per QALY figures for Change4Life Sports Clubs compare favourably to those calculated for programmes as part of the work to inform NICE guidance PH17. Two such programmes were calculated (at 2008 prices) to have ranges for cost per QALY that overlapped NICE's £20,000 threshold.⁵ These were:

WALKING BUSES: *Cost per QALY based on GROSS outcomes of £4,008*
95% confidence range of £2,431 to £26,306 (-39% to +556%)

DANCE CLASSES: *Cost per QALY based on GROSS outcomes of £27,570*
95% confidence range of £15,545 to £150,794 (-44% to +447%)

In addition, *two further programmes, free swimming and community sports were calculated to have costs per QALY significantly above NICE's threshold of £40,462 and £71,456 respectively.* The much larger ranges for the Walking Buses and Dance Classes programmes is due to both the outcomes and the costs of these programmes being estimates rather than the measures that are available for the Change4Life Sports Clubs. The Walking Buses and Dance Classes estimates are also based on GROSS outcomes as no control counterfactual was available.

A final comparison can be made between the cost per QALY generated by Change4Life Sports Clubs and the estimated cost per QALY generated by physical activity interventions in adulthood. In a systematic review of randomised controlled trials conducted for the Health Technology Assessment programme of the National Institute for Health Research,⁶ the cost per QALY generated by exercise referral programmes for "sedentary" adults (those participating in less than 90 minutes of physical activity per week) was estimated to be £20,876. As this analysis compared exercise referral to a normal care comparator group, this estimate is based on NET outcomes. Consequently, *the cost per QALY generated by the NET outcomes of exercise referral interventions in adulthood is approximately five and a half times greater than that of Change4Life Sports Clubs.* Furthermore, this is likely to be a conservative estimate, as NICE guidance PH54 estimates a cost per QALY generated by exercise referral programmes in the range £31,009 to £113,931.

⁵ See Fordham, R. & Barton, G. (2008). Promotion of Physical Activity in Children Programme Guidance: A cost-effectiveness scenario analysis of four interventions to increase child and adolescent physical activity. Report to NICE.

⁶ Pavey, T.G. et al. (2011). The clinical effectiveness and cost-effectiveness of exercise referral schemes: a systematic review and economic evaluation. *Health Technology Assessment*, 2011: 15(44).

Analysis of Future Health at Ages 13-15

The purpose of this analysis is to track the health impact of participation at ages 7-9 in the Change4Life Sports Clubs into adolescence (circa ages 13-15). The first part of the analysis is to track the impact of physical activity at ages 7-9 on physical activity at ages 13-15 for Change4Life Sports Clubs participants and for a control counterfactual. The assumed physical activity of these two groups at ages 13-15 can also be compared with today's 13-15 year olds as measured by the Health Survey for England.⁷ The measure used is average minutes of physical activity per young person per week.

A meta-analysis of six studies with time-series designs that tracked physical activity from an age within the 7-9 range to an age within the 13-15 range showed that, on average, physical activity minutes decline between 5% and 7% per annum between these age groups (see appendix C for details).

Table 6 shows estimated physical activity at ages 13-15 by applying these declines to the Change4Life Sports Clubs cohort, using physical activity 12 weeks after leaving the programme as the baseline. The comparator counterfactual control case is modelled by applying the measured physical activity change in the control group across two 12 week periods to represent the programme and the follow-up periods. Table 6 illustrates these results, alongside physical activity levels of today's 13-15 year olds from the Health Survey for England.

Table 6. Predicted Physical Activity at Age 13-15 for the Change4Life Sports Clubs Cohort and the Control Counterfactual Cohort compared with Today's 13-15 year olds.

	Change4Life Sports Clubs cohort	Control counterfactual cohort	Today's 13-15 year olds
12 weeks after leaving the programme (mins/week)	705 minutes	618 minutes	n/a
Aged 13-15 (mins/week)	488 minutes	428 minutes	434 minutes

Table 6 shows that *the Change4Life Sports Clubs cohort are predicted to do an average of 60 minutes more physical activity (14%) per week at age 13-15 than that predicted for the control counterfactual, and 54 minutes more (13%) than today's 13-15 year olds.*

This analysis can be extended to calculate the QALY gains associated with the estimated increased physical activity levels of the Change4Life Sports Clubs cohort over seven years as they move from ages 7-9 to ages 13-15 as compared to the estimated physical activity levels of the control counterfactual cohort over this same period. This analysis estimates that the Change4Life Sports Clubs cohort as a whole will undertake over 9.4 billion additional minutes of physical activity than the control counterfactual cohort up to ages 13-15. ***This estimated additional activity will generate 69,842 additional QALYs, or one additional QALY for every five children in the Change4Life Sports Clubs cohort.*** If this estimated additional physical activity is added to the actual measured additional physical activity reported for the programme and 12 week follow up (2,281 QALYs), then, given a programme cost of £8,650,204 (see appendix A), ***in comparison to the control counterfactual, the cost per QALY generated by the estimated future NET outcomes of Change4Life Sports Clubs up to ages 13-15 is £120.***

⁷ Although the term "today's 13-15 year olds" is used, the latest data available for physical activity from the Health Survey for England is for 13-15 year olds in the 2012 survey.

The second part of this analysis was to use Health Survey for England data to estimate likely health status associated with these activity levels for markers such as obesity, sedentariness, long-term conditions, acute illness, and various wellbeing indicators (such as “feeling reasonably happy” and “able to face problems”). However, while the Health Survey for England has an overall sample size of circa 15,000, the sample size for ages 13-15 is less than 100 at each year of age, and sub-groups (such as those meeting physical activity recommendations) are significantly lower than that, sometimes in single figures. Therefore, although there are some, albeit weak, associations between the enhanced physical activity levels of the Change4Life Sports Clubs cohort and some health markers (e.g. long-lasting illness), the sample sizes involved are not large enough to detect these associations as significantly different from those for the control counterfactual cohort or today’s 13-15 year olds.

As a consequence of the inconclusive data available in the Health Survey for England, the analysis was extended to the Understanding Society Survey (which has a sample size of 40,000 households) and the Millennium Cohort Study (which studies children born in the year 2000). Unfortunately, however, although children in the Millennium Cohort Study will now be 15 or 16, at the time of writing (June 2016) the latest published information only covers their activities up to age 11.

Data from the Understanding Society Survey on the predictors of wellbeing for young people shows that a complex range of social factors and social relations, particularly at school, are the key determinants of wellbeing for young people aged 11-15, but that there is no evidence that physical activity either enhances or diminishes these determinants. In fact, this is true for a wider range of healthy behaviours, including healthy eating and sedentariness. Consequently, the Understanding Society Survey provides no evidence for a link between physical activity and wellbeing at ages 13-15. However, analysis by the National Centre for Social Research (NatCen) does suggest that healthy behaviours, including physical activity, can be predictors of wellbeing in later life.⁸ As such, this provides evidence that implies that the promotion of physical activity in young people may be a stepping stone to wellbeing outcomes in adulthood.

Unfortunately, however, *across the Health Survey for England, the Millennium Cohort Study and the Understanding Society Survey, no data is available to support a robust estimation of the likely health and wellbeing status associated with physical activity levels at ages 13-15.*

⁸ NatCen. (2013). Predictors of Wellbeing. Report to Department of Health.

Appendix A

Costs of Delivering the Change4Life Sports Clubs in Primary Schools (2011-2015)

	Overall Costs of Delivery	Costs of Delivery Attributable to Primary School Clubs
Change4Life Primary Sports Clubs Delivery	£5,700,000	£5,700,000
Change4Life Secondary Sports Clubs Delivery	£1,705,000	£0
Youth Sport Trust Management Costs	£719,000	£553,450
Change4Life Support Workforce (e.g. champions, mentors, etc.)	£1,747,000	£1,344,754
Health & Wellbeing Schools to support Primary Change4Life Sports Clubs	£1,052,000	£1,052,000
TOTALS	£10,923,000	£8,650,204

Appendix B

Methodological Note for the Quality Adjusted Life Years Analysis

A) Calculating GROSS and NET QALYs generated

The method used for estimating QALYs in this report was that used to inform NICE guidance PH17, Physical Activity for Children and Young People, undertaken by Fordham and Barton⁹ in the Health Economics Group at the University of East Anglia. The key ratio used by Fordham and Barton, derived from previous work for NICE by Beale et al,¹⁰ calculated from Health Survey for England data from 1999, 2003 and 2004, and informed by previous work on estimating QALY gains for children for NICE by Bond et al,¹¹ is that each additional 30 minutes of physical activity results in a gain of 0.000222433333 QALYs.

In order to apply the ratio used by Fordham & Barton, it is necessary to calculate the number of additional 30 minute blocks of physical activity generated by the Change4Life Sports Clubs over the baseline activity levels reported in week 1. The key assumptions underpinning this calculation were:

- A reported move from less than 30 minutes to more than 30 minutes, and from less than 60 minutes to more than 60 minutes, represented an additional 30 minute block of physical activity for the number of days in the week for which the move was reported.
- “Never” was assumed to be zero days; “Some Days” was assumed to be 1-3 days; “Most Days” was assumed to be 4-6 days (with the respective mid-points of 2 and 5 days used for the purposes of the calculations); “Every Day” was assumed to be 7 days.
- Reported increases were assumed to have taken place evenly over the reporting period which, for the purposes of the calculation, meant increases were applied half way through the period. For example, an increase of, say, 600,000 minutes over the week one baseline reported across the cohort between weeks 7 and 12 would be applied to weeks 10-12 in the time period. Mathematically, this would be the same as applying an even increase each week. Given the size of the sample (n=3,300), variations can be assumed to even-out across the sample as a whole.

Calculations were undertaken for the number of additional 30 minute blocks generated from those moving from below to above 30 minutes for a given number of days, and for those moving from below to above 60 minutes for a given number of days. The calculation was therefore:

$[(\text{New children @ } >30\text{mins some days}) \times 2] + [(\text{New children @ } >30\text{mins most days}) \times 5] + [(\text{New children @ } >30\text{mins every day}) \times 7]$

PLUS

$[(\text{New children @ } >60\text{mins some days}) \times 2] + [(\text{New children @ } >60\text{mins most days}) \times 5] + [(\text{New children @ } >60\text{mins every day}) \times 7]$

This calculation was repeated for the data for the time periods between weeks 1-6, weeks 7-12, and for the 12 week follow-up period. To estimate the control condition counterfactual, calculations were undertaken for the number of additional 30 minute blocks generated from those moving from below to above 30 minutes for a given number of days, and for those moving from below to above 60 minutes for a given

⁹ Fordham, R. & Barton, G. (2008). Promotion of Physical Activity in Children Programme Guidance: A cost-effectiveness scenario analysis of four interventions to increase child and adolescent physical activity. Report to NICE.

¹⁰ Beale, S., Bending, M. & Trueman, P. (2007). An Economic Analysis of Environmental Interventions that Promote Physical Activity: NICE PDG Report. York Health Economics Consortium: University of York.

¹¹ Bond, M., Mealing, S., Anderson, R., Elston, J., Weiner, G., Taylor, R.S., Hoyle, M., Liu, Price, A. & Stein, A. (2008). The effectiveness and cost-effectiveness of cochlear implants for severe profound deafness in children and adults: A systematic review and economic model. Report commissioned by NHS R&D HTA Programme on behalf of NICE.

number of days, between weeks 1-12 in the control condition, and these were applied twice to represent the programme and the follow-up periods. The results are summarised in the table below:

	Change4Life Sports Clubs Cohort			Control Counterfactual Cohort	
	Weeks 1-6	Weeks 7-12	12 week follow-up	Weeks 1-12 x 1	Weeks 1-12 x 2
Additional 30mins blocks attributable to moving from below 30 minutes to above 30 minutes	607,354	1,452,970	2,922,960	-66,897	-200,692
Additional 30mins blocks attributable to moving from below 60 minutes to above 60 minutes	732,867	1,799,726	3,971,736	374,625	1,123,876
TOTAL 30mins blocks		11,487,614		1,230,911	
TOTAL minutes		344,628,432		36,927,342	
QALYs gained		2,555		274	
NET QALYs gained			2,281		

B) Sensitivity Analysis

To calculate a range within which the estimate for QALYs gained will fall with 95% confidence, the known maximum margins of error (MME) for the programme data and the control samples were used,¹² together with the MME for the QALY ratio per 30 minutes of activity.¹³ These MMEs were:

Programme data =	2.7% MME <i>(+/-1% MME from monitoring data PLUS +/-1.7% MME from survey sample)</i>
Control data =	6% MME <i>(+/-1% MME from monitoring data PLUS +/-5% MME from control sample)</i>
QALY ratio =	8.6% MME

¹² Please see Change4Life Sports Clubs Research 2016 Part One Report for details of these margins of errors.

¹³ This was provided by Fordham & Barton (2008), derived from Beale, et al (2007).

The calculation of the sensitivity analysis is shown in the table below:

	30mins blocks	QALY ratio	QALYs gained	Cost/QALY
GROSS PROGRAMME OUTCOMES				
LOW	11,177,449 (-2.7%)	0.000203340000 (-8.6%)	2,273	£3,806
CENTRAL	11,487,614	0.000222433333	2,555	£3,385
HIGH	11,797,780 (+2.7%)	0.000241526666 (+8.6%)	2,849	£3,035
CONTROL COUNTERFACTUAL CASE				
LOW	1,157,057 (-6%)	0.000203340000 (-8.6%)	235	n/a
CENTRAL	1,230,911	0.000222433333	274	n/a
HIGH	1,304,766 (+6%)	0.000241526666 (+8.6%)	315	n/a
NET PROGRAMME OUTCOMES				
LOW	n/a	n/a	2,037	£4,245
CENTRAL	n/a	n/a	2,281	£3,791
HIGH	n/a	n/a	2,534	£3,413

Appendix C

Methodological Note for the Analysis of Future Health at Ages 13-15

A systematic review and pooled analysis conducted by Dumith et al (2011)¹⁴ identified 26 studies that tracked physical activity change during adolescence. For the analysis of future health at ages 13-15, six studies with time series designs that tracked physical activity among a cohort with an age at baseline that overlapped with the 7-9 years age range and an age at the end of the study that overlapped with the 13-15 years age range were extracted from the systematic review. These studies had sample sizes ranging from 110 to 2,014 young people and provided a pooled sample of 5,635. The studies all showed that physical activity declined between the ages of 7-9 and 13-15, with the declines shown ranging from 5% to 7% per annum. A meta-analysis of these studies, accounting for sample size and age-range, estimated an average annual decline in physical activity minutes across the pooled sample of 5.9% per annum. This average decline was used to estimate minutes of physical activity per week per person for the Change4Life Sports Clubs cohort and the control counterfactual cohort for each of the seven years between ages 7-9 and ages 13-15, using measured physical activity levels 12 weeks after leaving the programme. The results are summarised in the table below:

	7-9 yrs	8-10 yrs	9-11 yrs	10-12 yrs	11-13 yrs	12-14 yrs	13-15 yrs
Change4Life Sports Clubs cohort (mins per week per person)	705	663	624	587	552	519	488
Control counterfactual cohort (mins per week per person)	618	581	547	514	484	455	428

To calculate the QALY gains associated with these estimated physical activity levels, the difference between the weekly minutes of the Change4Life Sports Clubs cohort and the control counterfactual cohort was calculated and grossed up to an annual figure. The annual difference per person was then grossed up to the size of the Change4Life Sports Clubs cohort to give the NET gain in physical activity minutes per annum over the control counterfactual cohort. This figure was then converted to the number of 30 minute blocks of activity, from which the NET QALY gain per annum was generated. The sum of the annual QALY gains gave the total QALYs generated by the estimated NET future outcomes of the Change4Life Sports Clubs. These calculations and results are summarised in the table overleaf:

¹⁴ Dumith, S.C., Gigante, D.P., Domingues, M.R. & Kohl, H.W. (2011) Physical activity change during adolescence: a systematic review and pooled analysis. *International Journal of Epidemiology*, 40, 685-698.

	7-9 yrs	8-10 yrs	9-11 yrs	10-12 yrs	11-13 yrs	12-14 yrs	13-15 yrs
Difference in mins per week per person between C4L Sports Clubs & control counterfactual	87	82	77	72	68	64	60
Difference in mins per annum per person	4,525	4,257	4,005	3,767	3,544	3,334	3,136
Gross up to C4L Sports Clubs cohort size (000s minutes per annum)	1,604,374	1,509,289	1,419,839	1,335,691	1,256,529	1,182,060	1,112,003
Additional 30 minute blocks per annum	53,479,148	50,309,640	47,327,978	44,523,027	41,884,315	39,401,990	37,066,782
QALYs gained per annum	11,896	11,191	10,527	9,903	9,316	8,764	8,245
TOTAL QALYs gained	69,842						