

Increasing access to physical activity

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An economic appraisal of equipping non-selective, state-run, secondary schools with gym equipment

**ECOM184 -
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Would providing access to a gym in non-selective, state-run, secondary schools, beyond standard physical education curriculum, be considered cost-effective according to NICE's evaluation methodology?

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Non-Executive Summary:

This appraisal assesses whether providing small bundles of gym equipment to non-selective, state-run secondary (NSSRS) schools in England would represent good value for public money. The aim of the intervention is to improve access to structured physical activity (PA) for adolescents, particularly those facing financial or social barriers to using commercial gyms. The proposal offers two additional supervised hours of voluntary gym access each school day, delivered using existing school staff.

To estimate whether this would be cost-effective, the appraisal considers both the costs of purchasing and installing the equipment, alongside the ongoing costs of supervision and running the sessions. Cost estimates are deliberately conservative: market prices for equipment, installation, electricity, insurance and teacher time are used, and higher-end assumptions are chosen where uncertainty exists. The expected health benefits are based on evidence cited by NICE showing that regular additional PA can improve health-related quality of life. These health improvements are expressed in quality-adjusted life years (QALYs), a standard measure used in health and public policy appraisals. Because only regular users are likely to experience health benefits, the model assumes that a participating student must complete 38 hours of additional exercise across the school year (one extra hour per week). Participation is not assumed to be universal. Instead, the number of students who can realistically benefit is constrained by two practical limits: the number of machines available and the number of supervised hours offered. Under these operational constraints, each piece of equipment can support approximately 1% of all students nationally each year in achieving the required 38 hours.

The appraisal follows guidance from HM Treasury's Green Book and NICE's Technology Appraisal Manual. Both costs and health benefits are discounted at 3.5% per year over a 10-year horizon. The results indicate that the intervention would cost £8,555 per QALY gained under central assumptions. This is well below NICE's current cost-effectiveness threshold of £25,000 per QALY, meaning that the intervention would be considered cost-effective using standard public-sector decision rules. Sensitivity analysis shows that the results are stable across different cost and benefit dimensions. Equipment cost has a minor effect on the effectiveness. The largest influence on cost-effectiveness is the number of students who can participate regularly enough to achieve measurable health improvements. Even when the estimated health benefits per student is reduced, or when higher-end cost assumptions are applied, the intervention remains cost-effective in most plausible scenarios. Only in extreme cases- where students would need higher amounts of supervised exercise exposure time to generate a health impact – does the intervention cease to be cost-effective.

Overall, the analysis suggests that providing supervised access to gym equipment in NSSRS schools could be a cost-effective way to increase PA among adolescents and improve equity of access. While the appraisal is indicative, not definitive, and subject to uncertainty, particularly around long-term behaviour and participation levels, the results support the view that the intervention offers good value for money under reasonable, reproducible and conservative assumptions.

Introduction:

According to Sport England (2025), PA among adolescents has significant implications for both physical and mental wellbeing and plays a crucial role in their development. Furthermore, the Physical Activity Guidelines (DHSC, 2019) acknowledge the compelling evidence between regular PA and improved learning and attainment, mental health and cardiovascular fitness. Whilst schools play a central role in delivering physical education (PE), often twice a week, access to structured exercise opportunities, outside the formal statutory curriculum, remains patchy; evidence suggests that stubborn inequalities persist (DfE *et al*, 2023). Commercial gyms may be inaccessible to many students due to financial, geographic or social barriers, potentially reinforcing inequalities in health-related behaviours during adolescence. NSSRS schools represent a potential setting through which access could be expanded in a more equitable manner. Providing supervised access to small bundles of gym equipment outside of standard teaching hours may offer a low-cost method of enhancing opportunities for regular exercise among students who would not otherwise engage due to the barriers.

This appraisal undertakes a cost-utility analysis (CUA) of a policy that provides access to gym equipment in NSSRS schools in England. In line with coursework constraints, earlier stages of a full appraisal – such as long-listing against critical success factors or formal multi-criteria decision analysis – are not replicated here. The intervention is compared against a do-nothing (business-as-usual) comparator over a 10-year time horizon, with both costs and health outcomes discounted at a social rate (SDR) of 3.5%. The SDR is consistent with HM Treasury’s Green Book (HMT, 2025) and NICE reference case guidance (NICE, 2022) for public appraisals over a 10-year horizon (see Annex C). The analysis adopts a national-level perspective and focuses on incremental costs and quality-adjusted life years (QALYs).

Accepting data limitations, coursework constraints, proportionality and the scope of the appraisal, a population-level model is employed. Physical activity (NICE, 2013) is defined “... as any bodily movement produced by skeletal muscles that requires energy expenditure...”. Regular use is modelled in our scenario as a minimum of 38 hours and is required, and sufficiently plausible, to generate a health benefit (see Annex A). Our model accounts for the capacity constraints associated with limited equipment availability and supervision. Whilst cost-benefit analysis is traditionally grounded in the Hicks-Kaldor compensation principle, the appraisal recognises that social policy interventions are not always designed to generate compensable gains across all individuals. Instead, the intervention is motivated by distributional considerations, particularly the potential to improve access to PA among students who may otherwise face financial or structural barriers.

Rationale:

The table below conveys the difference between the proposed intervention and the business-as-usual (BAU) scenario and their respective key features. The intervention extends access to gym equipment beyond the statutory physical education (PE) curriculum by providing voluntary, supervised sessions, before and after the school day, in NSSRS schools. In contrast, BAU represents the continuation of existing statutory provisions only, with no additional facilities (capital expenditure), supervision or structured access out scheduled PE lessons. Explicitly defining these differences is essential, as the appraisal adopts an incremental cost-utility framework in which only additional costs and additional health benefits, relative to BAU, are considered in the calculation of the incremental cost-effectiveness ratio (ICER).

Feature	Intervention	BAU (Do-nothing)
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Hours of access.	1 hour before + 1 hour after.	Standard PE lessons only (statutory curriculum)
Supervision.	PE staff / trained personnel (DBS-cleared).	None beyond existing (contracted) hours.
Equipment.	Small gym equipment bundles per school.	None beyond existing (legacy) facilities.
Target population.	Students in NSSRS schools.	All students (no additional access).
Participation.	Constrained by equipment capacity and supervision.	Not applicable.

The BAU represents a baseline in which students continue to receive statutory PE provision only, without the additional access to gym facilities during the school day. While some students may engage in PA outside school through commercial gyms, clubs or informal exercise, these opportunities are unevenly distributed and subject to financial (resource), geographic and social barriers (Green, 2022). These activities are treated as exogenous to the appraisal, although, the results segment consider the risk of overstated QALYs from activity displacement. BAU provides a counterfactual for identifying incremental costs and incremental QALYs attributable solely to the intervention, holding other factors constant (*ceteris paribus*).

The intervention targets students who may face barriers to accessing structured PA outside of school, particularly in comparison with students attending selective, private or fee-paying schools where facilities may be more readily available. By providing supervised access to equipment beyond curriculum-mandated PE, the intervention generates a clearly defined increment: additional capital equipment, supervision and operating expenses, alongside the potential for additional health-related quality-of-life (QoL) gains.

Participation is modelled, at a population level, to reflect realistic constraints associated with limited equipment availability – a fixed supply of hours under the proposed scenario – and supervision capacity rather than assuming universal uptake. Only students who use the facilities regularly, as in, the full additional 38 hours, plausibly generate a health benefit. This approach embeds operational realism into the appraisal with a conservative approach that actively avoids overstating health benefits by recognising that access, staffing and time availability bind achievable participation rates. For further information, refer to Annex A.

The appraisal focuses on a single, illustrative intervention rather than a full long-listing exercise; this is a deliberate choice rather than an omission. While a full appraisal would consider a broader set of alternatives and delivery models subject to critical success factors, the selected intervention provides a transparent and policy-relevant case study through which to explore cost-effectiveness, capacity constraints and key drivers of value for money. The results are indicative rather than definitive.

Scenario:

The scenario assumes two additional, voluntary hours of access, to a small package of gym equipment, each school day, for the length of the school year, over the appraisal period. The school year is estimated to be 39 weeks (Essex County Council, 2026) or 195 days. Although, 5 of the 195 days are inset days, therefore, leaving 190 days available or 38 weeks. Furthermore, there are 2,872 NSSRS (English) schools (DfE, 2026). In total, there are approximately 1.1 million hours of accessibility to the additional gym equipment. Participating adolescents (Year 7 – Year 11) must complete an additional hour of exercise, each week, for the school year to achieve the marginal change in QALY. The total students able to use a single piece of equipment is limited to the total hours of accessibility (approximately 1.1 million hours) divided by the number of hours necessary to achieve a QALY change (38hrs). This provides us with 28,720 eligible children across all NSSRS schools in England; however, this linearly increases with the number of equipment provided (refer to Annex A for calculation). Taking the total

number of eligible children per piece of equipment (28,720) as a ratio of the total headcount of students in NSSRS schools, calculates that each piece of equipment, distributed to each school, is approximately ~0.9%, or simplified to ~1% participation. Therefore, each unit of equipment distributed to the designated schools enables approximately ~1% participation; a package of ten units would enable approximately ~10% participation of the student population.

Determining the optimal number of gym equipment units for distribution is essential for analysis and underpins the central scenario. Sport England (2025) reports that PA levels among students in Years 7-8 and Years 9-11 stand at 53% and 49%, respectively. Averaging these figures and rounding to one-significant figure, suggests that approximately 50% of students complete an average of 60+ minutes of daily exercise. Furthermore, the UK Chief Medical Officers recommend a minimum of 60 minutes of exercise a day (DHSC, 2019). In contrast, this appraisal adopts a deliberately conservative assumption: only 10% of students would complete an additional hour of exercise per week if gym equipment were made accessible. The estimated total student population in NSSRS schools is 3,153,487 (DfE, 2026). When distributed across 2,872 schools, an average enrolment of approximately 1,098 students per school is estimated, rounded to 1,000 for simplicity. Under a conservative assumption, we assume only 10% of students would complete an additional hour per week (100 students). This reduces the total number of students in each day to 20 that would demand an additional hour. Given two hours of availability per day, this equates to approximately 10 students per hour. To meet the estimated demand, each school would require a least 10 pieces of equipment, forming the basis of our central scenario.

Methodology:

The appraisal uses a cost-utility analysis (CUA) framework to assess whether the scenario represents good value for money relative to the BAU. Health outcomes are measured in quality-adjusted life years (QALYs), enabling comparison with NICE's cost effectiveness thresholds (NICE, 2025). The analysis follows the NICE Reference Case principles where practicable, subject to proportionality and coursework constraints (NICE, 2022).

The analysis adopts a public-sector perspective, capturing costs incurred including capital equipment, supervision and operating costs. The intervention is assessed against the “do-nothing” BAU comparator, defined earlier, as the continuation of statutory PE provision only. Although longer horizons could offer a suitable alternative due to unmodelled additional health benefits and the expected useful life of equipment, the Green Book (HMT, 2024), as a guideline, suggests a time horizon of 10 years is a suitable working assumption for many interventions; the NICE Reference Case recommends a horizon “long enough to reflect all important differences in cost or outcomes”. As a result, the appraisal is conducted over a 10-year time horizon.

Benefits:

QALYs:

When conducting health-related appraisals, quality of life (QoL) is a key dimension to consider; QoL is often measured using instruments such as questionnaires (HMT, 2024): for instance, the UK's EQ-5D-5L (EuroQol, 2025). QALYs combine the dimension of longevity and QoL. Our appraisal expresses health benefits in QALYs, derived from the estimated marginal improvement in health-related QoL (HRQoL) associated with regular physical activity. Given limited adolescent-specific evidence, utility values are informed by NICE-cited literature and extrapolated proportionally to reflect the additional activity, or required exposure, approximately 38 hours across the school year, delivered through the intervention. Annual QALY gains are adjusted to reflect the fact that the intervention operates during the school year rather than continuously across the calendar year. Total annual QALYs equal the

adjusted per-participant gain multiplied by the number of participating students, which itself is determined by capacity. Further detail on the derivation and confidence of the utility value see Annex F.

Consistent with guidelines from the Office for Health, Improvement and Disparities (2020), the intervention is assessed against the ‘do nothing’, representing continuation of the existing statutory physical education curriculum. The analysis adopts a broad, national perspective, reflecting societal costs and health benefits. The calculation for QALYs follow a formula:

$$QALY = Life\ Value \times Utility\ Value$$

The Utility Value used in the intervention is obtained from Beale *et al* (2007, as cited in NICE, 2008) which reported that 30 minutes of additional PA once per month, for one year is associated with a QALY gain of approximately 0.0026692 (equivalent to 6 hours annually). As the original York Health Economics Consortium report by Beale *et al* (2007) is not publicly available, the estimated QALY gain was obtained from NICE cost-effectiveness evidence that cites and summarises the original modelling results. To align with the scenario requirements – 38 hours of additional PA per year – the QALY gain was extrapolated linearly, producing an estimated value of approximately ~0.0169.

The life-year component of the QALY calculation reflects the proportion of a full calendar year over which health gains are plausibly accrued. In this appraisal, the intervention operates during the academic year, rather than calendar year. As previously mentioned, the school year is 38 weeks, equivalent to ~72% of a calendar year. Accordingly, the annual utility gain attributable to regular participation in supervised gym access is scaled by a factor of 0.72 to reflect the shorter exposure period: the unadjusted utility gain of 0.0169 per eligible student is therefore multiplied by 0.72, yielding an adjusted per-participant QALY gain of approximately ~0.0123 per year. The total annual QALYs generated for a given year are calculated by multiplying the adjusted per-participant QALY gain (0.0123) by the estimated number of participating, eligible students nationally, this corresponds to approximately:

$$Total\ QALY\ (Annual) = (0.72 \times 0.0169) \times 28,720 = 341\ QALYs\ (undiscounted)$$

**Assuming only one item is distributed to each school.*

This figure also linearly scaled with the number of machines as the number of eligible students increases proportionally per item. As a result, the QALYs scale proportionally with the number of items. For ten items, the number of QALYs are approximately:

$$\begin{aligned} Total\ QALY\ (Annual) &= ((0.72 \times 0.0169) \times 28,720) \times 10 \\ &= 3410\ QALYs\ (undiscounted) \end{aligned}$$

Costs:

Costs are split within the model between capital (one-off) and recurrent components. Capital includes the purchase and installation of gym equipment, whereas recurrent costs comprise supervision, electricity consumption and insurance (including maintenance). Unit costs are informed by UK market research and public sector wage data. Where uncertainty exists, conservative assumptions are applied. Detailed cost calculations and unit cost sources are presented below; they are also implemented in the spreadsheet model and are available on request.

Machines (Prices, Installation and Delivery):

According to the UK Chief Medical Officer’s guidelines on activity (DHSC, 2019), children should exercise using a range of activities and intensities; furthermore, the NHS (2024) outline that students

should do aerobic exercise and exercises to strengthen bone and muscle. As a result, the intervention provides an assortment of cardiovascular equipment including a treadmill, a rowing machine, a stationary bike, an air bike and an elliptical machine. These items are stationary, with varied resistance levels, requiring minimal supervision or instruction on optimal use – in that they offer a lower chance of injury relative to hand-held or machine weights.

For each machine, market research explored brands, prices, power, horsepower, delivery and installation fees. Clusters were identified regarding price and horsepower; the latter underpins the electricity cost modelling. For delivery, often tied to a minimum threshold, it is assumed to be negligible although installation costs were estimated to be £150; installation fees are applied across all cardiovascular equipment homogenously. This analysis does not account for bulk-order discounts (ignoring economies of scale); it assumes installation expense scale linearly with the quantity of machines supplied rather than being optimised by regional delivery hubs. These assumptions are simplifying and intentional, designed to overstate costs and introduce a conservative bias to mitigate optimism bias. The table below summarises the conditions stated above. For further information see Annex B.

Machine	Price (£ / per unit)	Delivery & Installation (£/ per unit)	Energy Consumption (kWh)
Treadmill	3,500	150	1
Rowing Machine	1,000	150	Self-Powered
Air bike	1,000	150	Self-Powered
Stationary bike	1,000	150	1
Elliptical Machine	1,250	150	1

Insurance, Repair and Maintenance:

In practice, UK schools have established insurance for capital assets through local-authority insurance arrangements, commercial education insurance or the Department for Education’s Risk Protection Arrangement (DfE, 2024). It is plausible to assume that additional gym equipment would be incorporated into existing cover; however, this appraisal adopts a cautious approach by forecasting ongoing insurance cost using a simple formula:

$$\text{Insurance} = (\text{Fixed Percentage} * \text{Asset Price}) * \text{Quantity of Asset} * \text{Number of Schools}$$

The cost to insure a single asset is assumed to be 2% of its value. Under this assumption, insurance cost can be scaled linearly relative to quantity of equipment distributed. Importantly, insurance is not a significant cost driver for ICER; it does not distort the results but captures the conservative nature of the modelling. Furthermore, it is unlikely that insurance, at the national level, would be calculated on a per-item basis or in isolation. The model ignores the benefits from pooling or per-school bundling; a simplification to capture underestimation or optimism. Explicitly, it is assumed that the insurance cost includes the cost of maintenance, replacement and general insurance. See Annex C for further details.

The table below summarises the calculations across the select cardiovascular machines.

Machine	Price (£) / per unit	Percentage	Insurance per unit (£)	Quantity	Schools	Total Insurance (£)
Treadmill	3,500	2%	70	1	2872	201040
Rowing Machine	1,000	2%	20	1	2872	57440
Air bike	1,000	2%	20	1	2872	57440
Stationary bike	1,000	2%	20	1	2872	57440
Elliptical Machine	1,250	2%	25	1	2872	71800

Average	1,550	2%	31	1	2872	89032
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Electricity:

Two of the five machines in the gym package are self-powered: for the rowing machine and air bike, no electrical cost is incurred. Conversely, the remaining three machines – the treadmill, stationary bike and elliptical trainer – require mains regarding power sourcing. The mean maximum HP is approximately 3 HP (3.075 HP) although it is assumed that all powered machines operate a half capacity. A single unit of HP is equivalent to 0.746 kW. As electricity consumption is a function of time, a treadmill operating at half capacity (1.5 HP) consumes 1.119 kWh. For simplicity, the appraisal assumes an average consumption of 1 kWh per house of use. Subsequently, the availability of a single piece of gym equipment for use is approximately ~1.1 million hours across all schools. Hence, a single piece of gym equipment corresponds to approximately ~1.1 million kWh of annual electricity consumption at the nation level.

Smart Meter (2026) reports that the electricity unit rate is 27.69p per kilowatt-hour (kWh). Analysis of Ofgem's (2026) forward delivery indicates no clear long-term trend. As a result, the model uses a central estimate of 30p per kilowatt-hour (kWh); a conservative assumption incorporating headroom for volatility, optimism bias and biases energy cost against the intervention. For simplicity, avoiding energy-cost underestimation, treadmills, ellipticals and bikes are assumed to be comparable regarding energy consumption. In practice, they likely consume less electricity.

Machine	Average Electricity Use per Hour (kWh)	Available hours for all schools per year (hours)	Total Energy Consumption (kWh)	Central Estimate (£)	Annual Electricity Cost (£)
Treadmill	1	1,120,080.00	1,120,080.00	0.30	336024
Rowing Machine	0	1,120,080.00	0	0.30	0
Air bike	0	1,120,080.00	0	0.30	0
Stationary bike	1	1,120,080.00	1,120,080.00	0.30	336024
Elliptical Machine	1	1,120,080.00	1,120,080.00	0.30	336024

**Electricity costs are shown at the national aggregate level for one unit of each machine type per school.*

The annual cost of electricity is linearly scaled by the quantity of items included in the gym package. Under the constraints of the coursework, it is considered a proportional approach to estimating a non-driver of cost; the cost of electricity will have a negligible effect on the ICER. See Annex C for more information.

Teaching:

As noted on the 'Get Into Teaching' webpage (DfE, 2025), the minimum salaries for primary and secondary teachers range subject to location; however, the minimum salary is £32,916, excluding London. Including the London fringe, Outer London and Inner London produces an average salary of ~£36,375. The central estimate, taking the average of the minimum salaries across the various geographies, produces hourly earnings of ~£20 (£20.48). Further details on teaching are in Annex D.

Area	Minimum Salary (£)	Monthly Earning (£)	Weekly Earning (£)	Day Earning (£)	Hourly Earnings (£)
England (excluding London)	£32,916.00	£2,743.00	£685.75	£137.15	£18.53
London fringe	£34,398.00	£2,866.50	£716.63	£143.33	£19.37
Outer London	£37,870.00	£3,155.83	£788.96	£157.79	£21.32
Inner London	£40,317.00	£3,359.75	£839.94	£167.99	£22.70

Average	£36,375.25	£3,031.27	£757.82	£151.56	£20.48
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Furthermore, no additional non-wage on-cost uplift is applied. This reflects the assumption that supervision is delivered by existing teaching staff under existing employment contracts: national insurance, pensions, safeguard training and administrative overheads area already sunk. Application of a non-wage uplift could risk double-counting costs.

The average hourly earnings (£20) are multiplied by the total available hours for all schools per year (1,091,360) to produce an annual recurrent cost of approximately ~£22,000,000. The wage cost of the supervision directly impacts the ICER. Given constraints, this is considered a proportional estimate of wage cost; however, availability of PE staff is a constraint on the success of the intervention, further analysis should explore whether this assumption holds in practice or if there are inequalities geographically.

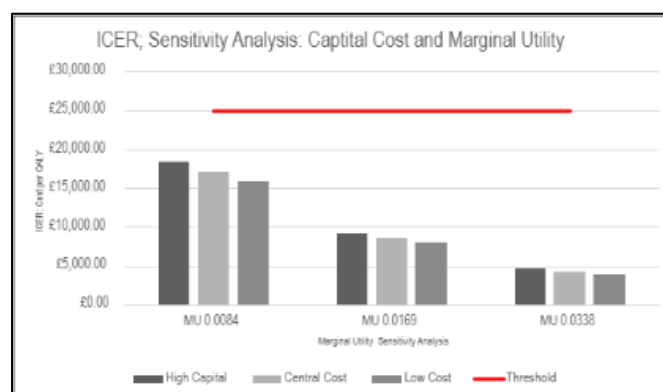
Discounting:

Discounting in the public sector allows costs and benefits with different time spans to be compared on common present-value basis. The public sector discount rate adjusts for social time preference or the value that society attaches to present rather than future consumption. The Green Book (HMT, 2024) discount rate, known as the Social Time Preference Rate, is set a 3.5% in real terms. The green book states that the recommended discount rate for risk to health and life values is 1.5% - the wealth effect (2%) is excluded; however, the Green Book explicitly frames this, in Annex 1: Life and Health, as risks to life and health. Whereas the NICE Technology Appraisal Guidance (NICE, 2022) outlines in the reference case that the “same annual rate for both costs and health effects (currently 3.5%)” should be administered when discounting. Consistent with the NICE reference case, we discount both costs and QALYs at 3.5% in the base case. This aligns with our comparator (statutory PE only). However, alternative figures, discounted at 1.5% for QALYs, are included in Annex J.

Results:

Results are presented across several dimensions: capital cost, marginal utility gains (QALYs per participant) and participation constraints (proxied by required annual hours of activity). Across all scenarios, variation in capital has a limited effect on cost-effectiveness, whereas assumptions relating to utility gains and participation materially influence ICERs.

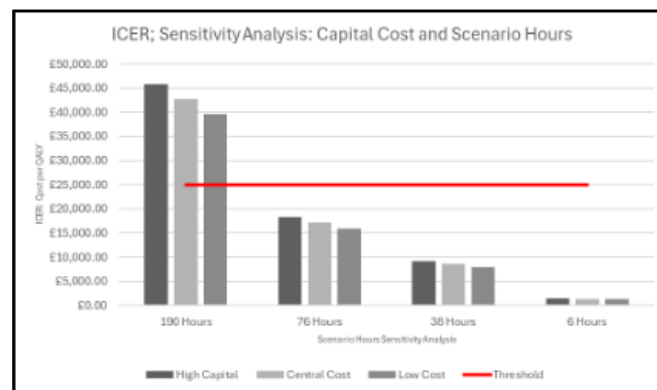
The graph below reports ICERs (£/QALY) for three capital-cost scenarios (High/Central/Low) across marginal utility assumptions (Central/Halved/Doubled), holding participation constant at 38 hours per year and 10 items of equipment per school. The corresponding tables are included in Annex J; furthermore, the central estimate’s PV for costs and QALYs are included in Annex H.



For a given marginal-utility assumption (e.g. MU = 0.0169), changes in capital cost shift the ICER modestly. Under the central MU estimate, all capital-cost scenarios sit below NICE’s conventional

thresholds (formerly £20,000 / QALY and currently £25,000 / QALY), indicating cost-effectiveness in each case. This reflects the comparatively small share of capital within total discounted costs, with recurrent supervision costs dominating. Assumptions about additional QALYs per participant exert a proportional effect on ICER: halving MU worsens ICERs; doubling MU improves them. Even under the high-cost / low-utility combination, ICERs remain below threshold (e.g. £18,345 / QALY), supporting the robustness of cost-effectiveness to plausible utility variation. Importantly, the central MU (0.0169) would need to fall by a factor of 2.7 (to ~0.0063) before the high-capital-cost case breaches the threshold.

To illustrate sensitivity to sustained participation, ICERs are reported for alternative annual hour requirements (6, 38, 76 and 190 hours), across the same capital-cost tiers (High/Central/Low), fixing MU at 0.0169 and equipment at 10 items per school.



Re-expressing participation requirements has a first-order effect on ICERs. Using Beale’s 6-hour annual equivalence markedly improves value for money (ICERS ~£1.25k-£1.45k / QALY), whereas progressively higher hour requirements deteriorate ICERs, eventually breaching NICE thresholds at 190 hours. This is consistent with the intervention’s supply-side constraint: access is bounded by supervised and limited equipment, so the plausible, required exposure per participant directly determines the number of participants able to realise benefits. See Annex A regarding the scenario and its calculations.

Under Beale’s scenario of an additional 30 minutes a month, the participation rate shifts from ~28,720 students to ~181,893 students per item per year; doubling hours to 76 reduced capacity to ~14,340 students per item. With 10 items per school and 76 required, ICERs remain below threshold across capital-cost variations; at 190 hours, ICERs become non-cost-effective, reflecting a scenario in which only two pupils per school, per item, per year could meet the requirements.

These results suggest that: capital costs have a minor influence on cost-effectiveness, marginal utility gains are a source of significant uncertainty and drive the ICER proportionally, participation is a consequential constraint that governs how many students can generate health benefits (QALYs) within the fixed supervised hours. Under conservative, NICE-aligned assumptions, the intervention remains cost-effective across a wide range of plausible parameter values, breaching thresholds under intensive participation requirements that restrict the number of students able to benefit.

The analysis is underpinned by an assumption that the gym package will be utilised within two additional, supervised hours of access per school day. Reducing available hours down to a single hour per day, would lower supervision costs (a dominant variable in the cost profile) but also the total number of students able to reach the minimum required hours to generate health benefits. While reducing staffing (linked endogenously to hours open) could partially offset cost reduction, fewer available hours

would tighten participation constraints and are therefore expected to deteriorate cost-effectiveness, all else equal. A brief formal model of the effect is included in the table below.

Sensitivity: Scenario Hours Open	ICER
ICER given: 38hrs; 0.0169MU; 10 equipment; central capital cost	
High: 4 hours.	£7,630.56 / QALY
Central: 2 hours.	£8,555.38 / QALY*
Low: 1 hour.	£10,405.03 / QALY

Reducing access hours raises the ICER because supervision costs fall roughly in proportion to hours, but the tighter capacity constraints reduce the number of pupils that can achieve the 38-hour requirement of regular exercise a school year. Amongst this, fixed capital costs remain unchanged.

A classical bias could be the displacement effect: students use the additional availability created by the free provision of gym equipment to displace their usual commitments. The table below adds a simple sensitivity that reduces marginal utility by a 25% to account for the effects of displacement:

Sensitivity: Displacement	Sensitivity: Marginal Utility	
	ICER given: 38hrs; 0.0169MU; 10 equipment; central capital cost	ICER given: 38hrs; 0.00845MU; 10 equipment; central capital cost
Displacement	£11,407.17 / QALY	£22,814.35 / QALY
Without displacement	£8,555.38 / QALY*	£17,110.76 / QALY

The ICER remains under NICE's new threshold with displacement, given that conservative estimates are applied and central costing is used. A discussion on the impact of wages is in Annex I.

Conclusion:

This appraisal provides indicative evidence on the cost-effectiveness of a policy intervention offering two additional hours, per school day, of supervised, voluntary access to small bundles of gym equipment in NSSRS schools. Under conservative assumptions and a proportion modelling approach, consistent with HM Treasury's Green book and NICE's Technology Appraisal Guidance, the central case ICER falls well below both the former and current NICE cost-effectiveness thresholds. Sensitivity analysis suggest that results are robust to plausible with variations in capital costs, with cost-effectiveness primarily driven by assumptions regarding sustained participation and marginal health gains (QALYs). While uncertainty remains, particularly around behavioural persistence, participation rates and marginal utility, the analysis indicates that, under realistic delivery assumptions, the intervention would be considered cost-effective and aligns with the policy objective of improving equitable access to PA among adolescents.

Discussion:

Our approach followed a national perspective; however, implementation towards schools or areas with higher baseline inactivity may improve cost-effectiveness by increasing marginal utility gains or participation due to lower hours necessary for health gains. The modelling assumed capacity and motivation regarding PE teachers; however, in their absence, personal trainers with enhanced DBS checks and training could offer an alternative, although the ICER would be significantly impacted due to the increased wage cost, from private sector profit incentives, alongside the non-wage uplift (see Annex I). Furthermore, our intervention assumes that each piece of equipment provides homogenous marginal utility gains; it is likely individuals prefer one machine type to another which could impact their motivation, participation and health gains from use. Likewise, some equipment may be difficult to use over a sustained period: an hour on the treadmill against the rowing machine may be an unfair

equivalence. Thereby, we implicitly assume students act rationally and use a variety of machinery over the period.

Unplanned equipment downtime – repairs or servicing – would reduce available hours and the number of pupils reaching the 38 hours of exposure; this would worsen the ICER relative to our central case. Additionally, our model assumes those eligible for participation, will continue to regularly participate; an unfair assumption in the face of natural human stochastic shocks: illnesses, unexpected deaths in the family, unavailability of staff, strikes, external uncontrollable factors and other points of contest undermine the strength of this assumption. An attrition rate could be included to capture the uncertainty in participation pushing the ICER upwards. Time horizon is a crux; whilst the Green Book agrees that a 10-year horizon is a suitable guideline, we exclude from analysis the long-term health benefits attributed to habit-forming behaviour at a young age; we also proportionately choose to forego the direct health benefits attributable from exercise to disease prevention in the long-term. Moreover, space availability feeds into practicality constraints; we assume that schools have access to a gymnasium, at minimum, which could host ten additional machines – it is likely that 10 equipment pieces may be infeasible due to estate constraints pushing the ICER upwards as participation is decreased in select schools. Likewise, using the national average headcount omits the heterogeneity of schools: small schools, rural settings or schools outside of England – if scope were expanded – would prove challenging to external validity.

Notably, our central prices are estimated from provisional market research, it is likely that the small pool of items surveyed, for each product, is unrepresentative of the entire market; for robust estimates, future research should utilise web scraping to develop a database of equipment with their respective prices and specifications. Additionally, we argue that the use of cardiovascular equipment is suitable on the grounds that it requires minimal instruction and supervision and is compliant with the NHS and CMO's guidance; however, introducing MCDA analysis, with NSSRS schools as stakeholders, with a focus on several criterion (possibly informed by an administrative, school-wide survey), could specialise the selection and distribution of equipment across England: this methodology would sensibly acknowledge the variation in needs across schools which our intervention has omitted. Arguably, it is analytically tenuous to utilise linear extrapolation to derive our estimate from Beale's study: the extrapolation will be unrealistic causing the estimated QALY gain to be over-simplified, most likely, inflated. Future research should utilise non-linear estimation to model diminishing marginal returns from participation in exercise. In conjunction with non-linear estimation, to capture the uncertainty around Beale's estimate – notably, that it was conducted on sedentary adults, not children – a more robust approach would involve representing the marginal utility parameter as a probability distribution within a probabilistic sensitivity analysis. Utilising this methodology could capture (pseudo) realistic variation in QALY gains – assuming Beale's estimate is a reliable proxy. Using a normal distribution with high variation and left skew could incorporate the parametric uncertainty, strengthening the robustness of the cost-effectiveness estimates and better reflect the wide-berth of heterogeneity of the target population: secondary-school-age children.

See Annex K for more detail.

Annex A – Scenario:

The scenario assumes two additional, voluntary hours of access, to a small package of gym equipment, each school day, for the length of the school year, over the appraisal period. The school year is estimated to be 39 weeks (Essex County Council, 2026) or 195 days. Although, five of the 195 days are inset days, therefore, leaving 190 days available or 38 weeks. Furthermore, there are 2,872 NSSRS schools (DfE, 2026). The table below summarises the information.

Scenario	Units	Input (Central)	Description
School Year	Days	190	Number of days in a school year.
School Year	Weeks	38.00	Number of weeks in a school year.
Scenario hours	Hours per day	2.00	An hour in the morning, before the start of school; an hour in the afternoon, after the end of the school day.
Available hours for a given school	Hours a year	380.00	Total number of hours the gym equipment is accessible for a given school and year.
Total NSSRS schools in England	Number of schools	2,872.00	Total number of NSSRS schools in England.
Available hours for all schools each year	Hours a year (aggregated across schools)	1,091,360.00	Total number of hours during the school year, across all schools, available for use.
Assumed price for power (kWh) (rounded)	kWh	£0.30	Assumed price of a unit of kWh. Rounded up to account for uncertainty over the appraisal period. There is volatility with electricity prices; however, generic exploratory analysis of growth rates shows elements of stationarity. Therefore, we have taken an overestimated price to account for possible underestimation.
Example of electricity cost: running a treadmill, at half power, in each school for two hours consecutively.	£	£327,408.00	Assuming there is only one single treadmill being run this would be the provisional benchmark cost of running a single treadmill for a school year.

In total, there are approximately 1.1 million hours of accessibility to the additional gym equipment. However, to achieve a change in QALY, regular and consistent exercise is necessary; under our scenario, participating adolescents (Year 7 – Year 11), must regularly complete an additional hour of exercise each week for the school year to achieve the marginal change in QALY. This creates a constraint per exercise equipment delivered.

If each student must complete an hour a week, for the full school year, then the total number of students that could use a single piece of equipment, for instance a treadmill, is limited to the total hours of accessibility divided by the number of hours necessary to achieve a QALY change (38hrs). **This provides us with 28,720 eligible children across all NSSRS schools in England; however, this linearly increases with the number of equipment provided.**

Interestingly, if we take the total number of eligible children per piece of equipment (28,720) and take this a fraction of the total headcount of students in NSSRS schools, we calculate that each piece of equipment, distributed to each school, is approximately 0.9%, or simplified to ~1% participation. **Therefore, each unit of equipment distributed to the designated schools enables approximately ~1% participation; a package of ten units would enable approximately ~10% participation of the student population.**

Determining the optimal number of gym equipment units for distribution is essential for analysis and underpins the central scenario. Sport England (2025) reports that physical activity levels among students in Years 7-8 and Years 9-11 stand at 53% and 49%, respectively. Averaging these figures and rounding to one-significant figure, suggests that approximately 50% of students complete an average of 60+ minutes of daily exercise. Furthermore, the UK Chief Medical Officers recommend a minimum of 60 minutes of exercise a day (DHSC, 2019). **In contrast, this appraisal adopts a deliberately conservative assumption: only 10% of students would complete an additional hour of exercise per day if gym equipment were made accessible.**

This underestimation accounts for uncertainties related to adolescent motivation, existing participation in extracurricular activities, and other influencing factors.

The estimated total student population in NSSRS schools is 3,153,487 (DfE, 2026). When distributed across 2,872 schools, an average enrolment of approximately 1,098 students per school is estimated, rounded to 1,000 for simplicity. Assuming five school days per week, around 200 students could access the equipment each day. However, under our conservative assumption, we assume only 10% of students would complete an additional hour. This reduces the total number of students in each day to 20 that would demand an additional hour. Given two hours of availability per day, this equates to approximately 10 students per hour. **To meet the estimated demand, each school would require a least 10 pieces of equipment, forming the basis of our central scenario.**

In entirety, our scenario assumes that 10 pieces of equipment – at minimum – would be distributed to NSSRS schools across England. In each school, it is assumed – under a conservative approach – that only 20 students per school demand an additional hour of exercise: equivalent to 10 students per hour. This assumption holds under the demand and supply constraint as a single machine can provide 28,720 students the full 38 hours required to achieve a change in QALY; this is approximately ~1% (0.92%) of students across England, given that each school receives that same singular piece of equipment. Therefore, sending a minimum of 10 exercise machines approximates a 10% participation rate (or demand for an additional hour of exercise).

Annex B – Machines (Price, Installation and Delivery):

According to the UK Chief Medical Officers' guidelines on activity (DHSC, 2019), children should exercise for a minimum of 60 minutes a day and “children should engage in a variety of types and intensities of physical activity across the week to develop movement skills, muscular fitness and bone strength”: from this evidence it is inferred that a variety of exercise equipment should be included in the gym package distributed to described schools. Furthermore, the NHS (2024) outlines that students should do two types of physical activity each week: aerobic exercise and exercises to strengthen muscle and bone. Aerobic exercise can include walking to school, walking the dog, jumping, running, catching, football, tennis, swimming, skipping, dancing and cycling; exercises to strengthen muscle and bone include sit-ups, press-ups, resistance exercises with bands, weight machines, or hand-held weights. Neither list is comprehensive, but they provide guidelines for what machines would be desirable to include in a gym package.

The packages to be distributed across the UK include five pieces of cardiovascular equipment: a treadmill, a rowing machine, a stationary bike, an air bike and an elliptical machine. Each item has a range of resistance settings which can afford the individual user an assortment of intensities; furthermore, these items are stationary and require minimal supervision or instruction on optimal use – in that they offer a lower chance of injury relative to hand-held or machine weights. Furthermore, as outlined previously, muscle- and bone-building exercises are not limited to free-weights; press-ups, sit-ups and other similar exercises are suitable, complementary exercises which adhere the NHS and CMO guidelines. These can be done in conjunction with the use of cardiovascular equipment.

Analysis of observed market prices was conducted to inform the assumption surrounding central pricing for each item; for example, treadmills included a range of brands, prices, powering options, horsepower, delivery and installation costs. In continuation, analysis then looked at the trend in prices for our sample and determined whether there were clustering around price levels.

Using treadmills as an example, the analysis drew on market research conducted over brands, prices, power sources, maximum motor horsepower, delivery and installation costs. Price data examined determined clustering patterns around £3,000, with outliers and extreme values removed to establish a central estimate. A similar process was applied to horsepower data, excluding anomalies to ensure consistency. Based on this approach, prices below £1,000 and above £8,000 were excluded, resulting in a central estimate of approximately ~£3,500 (£3,445.32). Under the same criteria, the average maximum motor horsepower was calculated at ~3HP (3.075HP). These two estimates form the basis for calculating acquisition costs and electricity consumption, the latter detailed below.

Most UK suppliers offer free delivery when orders exceed a minimum threshold – typically, from our analysis, approximately £99 – making delivery costs negligible for each cardiovascular item. Installation, however, is treated separately. Two UK suppliers, Fitshop and Fitness Superstore, list installation fees ranging from £0 to £200, with premium brands such as Matrix or Life Fitness including installation in the purchase price. For other brands, installation costs commonly fall between £135 and £200. After reviewing multiple scenarios (excluding premium brands), the average installation cost clustered around ~£150 (e.g., £156.43, £156.39, £156.68). Including premium brands lowers the average to £88.78, which likely underestimates true cost. Therefore, £150 is adopted as the central estimate for installation, assuming delivery remains negligible. This figure is applied consistently across all cardiovascular equipment in the proposed package. The table below summarises the conditions stated above.

This analysis does not account for bulk-order discounts that reduce costs through economies of scale. Additionally, it assumes installation expenses scale linearly with the number of machines rather than being optimised by regional delivery hubs. These assumptions are intentional, designed to overstate costs and introduce a conservative bias to mitigate optimism bias.

Machine	Price (£ / per unit)	Delivery & Installation (£/ per unit)	Energy Consumption (kWh)
Treadmill	3,500	150	1
Rowing Machine	1,000	150	Self-Powered
Air bike	1,000	150	Self-Powered
Stationary bike	1,000	150	0.25
Elliptical Machine	1,250	150	1

Annex C – Insurance, Repair and Maintenance:

In practice, UK schools already insure capital assets such as IT equipment through local-authority insurance arrangements, commercial education insurance, or Department for Education’s Risk Protection Arrangement (DfE, 2024). The RPA is a government-backed alternative to commercial insurance and covers risks normally included in standard school insurance policies, including material damage to property and contents. It would therefore be plausible, arguably justifiable, to assume that the additional gym equipment delivered would be incorporated into existing cover at minimal or zero marginal cost. However, this appraisal adopts a cautious approach by forecasting an ongoing insurance cost using a simple formula:

$$\text{Insurance} = (\text{Fixed Percentage} * \text{Asset Price}) * \text{Quantity of Asset} * \text{Number of Schools}$$

For modelling purposes, the cost to insure a single asset is assumed to be 2% of its value. The table below summarises the calculations across the select cardiovascular machines.

Machine	Price (£ / per unit)	Percentage	Insurance per unit (£)	Quantity	Schools	Total Insurance (£)
Treadmill	3,500	2%	70	1	2872	201040
Rowing Machine	1,000	2%	20	1	2872	57440
Air bike	1,000	2%	20	1	2872	57440
Stationary bike	1,000	2%	20	1	2872	57440
Elliptical Machine	1,250	2%	25	1	2872	71800
Average	1,550	2%	31	1	2872	89032

Under this assumption, insurance costs can be scaled linearly based on the quantity of equipment distributed. However, insurance is not a significant cost driver for the ICER and therefore does not distort the results; it captures the conservative nature of our modelling and is a proportional addition. Insurance is treated as a small recurrent cost and is likely unnecessary. Furthermore, it is unlikely that insurance would be calculated on a per-item basis or in isolation; our approach ignores the benefits of pooling or per-school bundling and in effect it is biased against the intervention – a deliberate simplification to capture underestimation or optimism. Explicitly, it is assumed that the insurance cost, estimated from the two percent (2%) asset valuation, outlined in the table, includes the cost of maintenance, replacement and general insurance.

Annex D – Electricity:

Two of the five machines in the gym package are self-powered, whereby the user’s mechanical work drives the resistance system and supplies the minimal electricity required for onboard displays and sensors. Examples include the Concept2 rowing machine and the Assault Fitness air bike which relies on the same mechanism to provide real-time feedback to the user. For the rowing machine and air bike, no electrical cost is incurred and therefore is not calculated.

Conversely, the remaining three machines – the treadmill, stationary bike and elliptical trainer – require mains regarding power sourcing. As a result, they incur an ongoing electricity charge when used. To estimate these costs, a proportional approach was adopted, using the average maximum motor horsepower of a treadmill as the baseline for the calculation. The mean horsepower, previously derived, was approximately 3 HP (3.075 HP). Given that one horsepower is equivalent to 0.746 kW, electricity consumption is a function of time (hours). For example, a 3 HP treadmill, operating for one hour at half capacity (1.5 HP) consumes 1.119 kWh. For modelling simplicity and transparency, this appraisal assumes an average consumption of 1 kWh per hour use.

Based on prior calculations, the total availability of gym equipment each year for a school is ~1.1 million hours (1,091,360); when a single powered machine, for example, a treadmill, is distributed to each eligible school, the aggregate national availability totals ~1.1 million hours per year. Under the assumption of 1 kWh per hour of use, this corresponds to approximately ~1.1 million kWh of annual electricity consumption at the national level.

Smart Meter (2026) reports that the electricity unit rate for customers on default tariffs between January and March 2026 is 27.69p per kilowatt-hour (kWh). While this figure provides a short-term benchmark, analysis of Ofgem's (2026) forward delivery contract data indicates no clear long-term trend, with prices fluctuating within relatively stable bounds rather than exhibiting violent volatility. As a result, this appraisal adopts a rounded, central estimate of 30p per kilowatt-hour (kWh). This conservative assumption incorporates headroom for volatility, mitigates optimism bias, and biases energy costs against the intervention. Furthermore, electricity cost is not a primary driver of cost and is unlikely to materially influence the ICER. For simplicity and to avoid under-estimating energy costs, the energy consumption of the stationary bikes and the elliptical trainers are assumed to be comparable to that of a treadmill, noting that in practice, these machines are likely to consume less electricity: particularly, the stationary bike which is linked to Reps Per Minute (RPM).

Machine	Average Electricity Use per Hour (kWh)	Available hours for all schools per year (hours)	Total Energy Consumption (kWh)	Central Estimate (£)	Annual Electricity Cost (£)
Treadmill	1	1,120,080.00	1,120,080.00	0.30	336024
Rowing Machine	0	1,120,080.00	0	0.30	0
Air bike	0	1,120,080.00	0	0.30	0
Stationary bike	1	1,120,080.00	1,120,080.00	0.30	336024
Elliptical Machine	1	1,120,080.00	1,120,080.00	0.30	336024

**Electricity costs are shown at the national aggregate level for one unit of each machine type per school.*

The annual cost of electricity is linearly scaled by the quantity of items included in the gym package. Under the constraints of the coursework, it is considered a proportional approach to estimating a non-driver of cost; the cost of electricity will have a negligible effect on the ICER.

Annex E – Teaching:

According to the NEU (2024), most schools and college recruitment processes will require an enhanced disclosure certificate from the Disclosure and Barring Service (DBS). A paper document which includes information from local police records. There are several checks including a basic check, standard check, enhanced check and an enhanced check against the barred list(s). In addition to DBS clearance, effective supervision of children (aged 11 to 16 in our scenario) require familiarity with safeguarding procedures, behavioural management, and institutional accountability frameworks. Within this appraisal, supervision is treated as a non-negotiable requirement rather than a discretionary design choice. Existing teaching staff – particularly PE teachers – are identified as the least-cost and most operationally feasible supervisory option.

Teachers are already DBS-cleared, safeguarding-trained (with additional SEND Teaching Assistants on site), and contractually accountable to the school; the additional resource requirement is limited to marginal working hours rather than associated with recruitment, vetting training and oversight: for example, hiring a private personal trainer (PT) locally, for each school, nationally, with additional costs for enhanced DBS checks. While alternative supervisors could theoretically be employed, these options

introduce transaction costs, including DBS checks, inductions, safeguard training, and contractual arrangements, monitoring and liability risks. Subsequently, deploying existing teaching staff minimises administrative complexity. As a result, the use of teachers represents a conservative and economically rationale assumption for costing supervision with the appraisal.

As noted on the ‘Get Into Teaching’ webpage (DfE, 2025), the minimum salaries for primary and secondary teachers range subject to location; however, the minimum salary is £32,916, excluding London. Including the London fringe, Outer London and Inner London produces an average salary of ~£36,375. In the interest of being conservative in the central estimate, taking the average of the minimum salaries across the various geographies produces hourly earnings of ~£20 (£20.48).

Area	Minimum Salary (£)	Monthly Earning (£)	Weekly Earning (£)	Day Earning (£)	Hourly Earnings (£)
England (excluding London)	£32,916.00	£2,743.00	£685.75	£137.15	£18.53
London fringe	£34,398.00	£2,866.50	£716.63	£143.33	£19.37
Outer London	£37,870.00	£3,155.83	£788.96	£157.79	£21.32
Inner London	£40,317.00	£3,359.75	£839.94	£167.99	£22.70
Average	£36,375.25	£3,031.27	£757.82	£151.56	£20.48

The valuation of supervising time reflects the opportunity cost of teachers’ labour. Supervision, under the scenario, occurs outside of core teaching hours; implying that this time does not displace statutory classroom teaching. Supervision may substitute for other activities (preparation or pastoral duties: break/lunch time supervision), valuing this time at the hourly wage provides a conservative approximation of the resource cost to the school. This assumption is likely to overstate, rather than understate, the true marginal costs. Furthermore, no additional non-wage on-cost uplift is applied. This reflects the assumption that supervision is delivered by existing teaching staff under existing employment contracts: national insurance, pensions, safeguard training and administrative overheads area already sunk. Application of a non-wage uplift could risk double-counting costs.

The average hourly earnings (£20) are multiplied by the total available hours for all schools per year (1,091,360) to produce an annual recurrent cost of approximately ~£22,000,000. The wage cost of the supervising staff is a significant cost that directly impacts the ICER. Given constraints, this is considered a proportional estimate of wage cost; however, the availability of PE staff is a significant constraint on the success of the intervention, further analysis should explore whether this assumption holds in practice or if they are inequalities geographically.

Annex F – Quality Adjusted Life Years (QALYs):

... continuing from QALYs in the main body of the report.

The Office for National Statistics (ONS, 2022) published the UK Recreation Health Benefit Account, drawing on complementary methodology that cites Beale *et al* (2007). However, these estimates are designated as experimental statistics, a classification the ONS (2023) applies where outputs remain subject to ongoing evaluation regarding quality, volatility and their capacity to meet user needs. This designation signals substantial underlying uncertainty, which has important implications for downstream economic evaluations: for instance, our appraisal. The central challenge in estimating the ICER from the proposed physical activity – 38 hours of regular activity once a week – lies in limited availability of studies that isolate the incremental effect of having a clearly defined physical activity intervention. Much of the existing evidence estimates associations between activity levels and health outcomes within specific health/disease context, rather than the causal impact of a specific intervention

relative to a comparator. QALY estimates from these studies risk imperfect proxies for true marginal utility gains, thereby increasing parametric uncertainty with our ICER modelling. For example, Sun K *et al* (2014) report that, relative to inactive individuals, median two-year QALYs were 0.112 higher among those meeting the US Department of Health and Human Services (DHHS) 2008 Physical Activity Guidelines (150 minutes of moderate-to-vigorous activity per week), and 0.058 higher among those classified as insufficiently inactive, controlling for socioeconomic and health factors. However, this prospective study focuses on individuals with osteoarthritis (or are at risk of developing it) and predominantly included middle-aged and older adults (aged 49 years and above). The findings are disease-specific, age-restricted and bound to the US's guidelines, not the UK CMO's guidelines. Extrapolating these results to an adolescent population, aged 11 to 16, risks overstating (or understating) and misrepresenting marginal utility gain associated with physical activity in the school population. Similarly, the lower utility change estimates produced by Beale *et al* may inadequately capture the contextual and demographic characteristics of secondary-school-aged children. Reliance on such context-dependent evidence limits external validity and compounds the structural and parameter uncertainty with our ICER modelling.

Annex G – Discounting:

Discounting in the public sector allows costs and benefits with different time spans to be compared on common present-value basis. The public sector discount rate adjusts for social time preference or the value that society attaches to present rather than future consumption. The Green Book (HMT, 2024) discount rate, known as the Social Time Preference Rate, is set at 3.5% in real terms. The green book states that the recommended discount rate for risk to health and life values is 1.5% - the wealth effect (2%) is excluded; however, the Green Book explicitly frames this, in Annex 1: Life and Health, as risks to life and health. Whereas the NICE Technology Appraisal Guidance (NICE, 2022) outlines in the reference case that the “same annual rate for both costs and health effects (currently 3.5%)” should be administered when discounting.

Consistent with the NICE reference case and because this intervention does not model risk-of-death outcomes (nor estimate mortality risk reductions), we discount both costs and QALYs at 3.5% in the base case. This aligns with our comparator (statutory PE only) and with the appraisal's focus on quality-of-life gains rather than mortality. However, in Annex J, the alternative results have been provided for comparison – switching from 3.5% to 1.5% SDR regarding QALYs improves the ICER as expected.

Annex H – Present Values:

For completeness, the central case produces an approximate PV cost of £261m and PV QALYs of 30,500; discounted at the 3.5% level for both costs and health benefits yielding an ICER of £8,555 per QALY.

Year	Period	Discount Factor	Capital Cost (£)	Recurrent Cost (£)	Discounted Costs (£)	QALYS	Discounted QALYS
2026	0	1.000	£48,824,000	£24,681,968	£73,505,968	3547.96	3547.96
2027	1	0.966	£0	£24,681,968	£23,847,312	3547.96	3427.98
2028	2	0.934	£0	£24,681,968	£23,040,881	3547.96	3312.05
2029	3	0.902	£0	£24,681,968	£22,261,721	3547.96	3200.05
2030	4	0.871	£0	£24,681,968	£21,508,909	3547.96	3091.84
2031	5	0.842	£0	£24,681,968	£20,781,555	3547.96	2987.28
2032	6	0.814	£0	£24,681,968	£20,078,797	3547.96	2886.26
2033	7	0.786	£0	£24,681,968	£19,399,804	3547.96	2788.66

2034	8	0.759	£0	£24,681,968	£18,743,772	3547.96	2694.36
2035	9	0.734	£0	£24,681,968	£18,109,924	3547.96	2603.24
Total	10	8.608	£48,824,000	£246,819,680	£261,278,643	35479.55	30539.69

Annex I – Wage:

As raised in the appraisal, the model values the teacher's additional hours spent supervising the participating children at the opportunity cost which is estimated to be approximately £20 an hour; however, two situations arise from this uncertainty. What happens to the central case if a 20% - 30% uplift is applied to the wage cost of a contracted teacher and what happens if the wage cost increases substantially under a personal trainer. The first table below indicates the central case with a 20% and 30% uplift. The second table indicates the central case with a wage cost of £40 an hour and £60 an hour.

Sensitivity: Wages	ICER
ICER given: 38hrs; 0.0169MU; 10 equipment; central capital cost	
Sensitivity Two: 30% Uplift (£26)	£10,401.00 / QALY
Sensitivity One: 20% Uplift (£24)	£9,785.79 / QALY
Central:	£8,555.38 / QALY

The wage uplift when applied to supervision costs (wages) raises total recurrent costs but leaves the central ICER below threshold, confirming robustness to plausible staffing cost variation. Alternatively, the effects of using an external supervisor have significantly more impact on the ICER.

Sensitivity: Wages	ICER
ICER given: 38hrs; 0.0169MU; 10 equipment; central capital cost	
Sensitivity Two: Wage (20% uplift) = £66	£22,705.10 / QALY
Sensitivity Two: Wage = £60	£20,859.48 / QALY
Sensitivity One (20% uplift): Wage = £44	£15,937.84 / QALY
Sensitivity One (no uplift): Wage = £40	£14,707.43 / QALY
Central: Wage = £20	£8,555.38 / QALY

Utilising Sensitivity One, the ICER increases from £8,555 to £14,707 per QALY, although compared against the NICE thresholds it is still considered cost-effective; when an uplift of 20% is applied, the ICER increase to £15,938 which would be considered cost-effective. However, Sensitivity Two, under the old NICE threshold, is considered cost ineffective as the ICER is £20,859 per QALY against the £20,000 threshold; against the new threshold it would be considered cost-effective. With an additional uplift, the ICER rises proportionally to £22,705 which is cost ineffective against the old threshold but cost-effective against the new threshold.

Annex J – Results Tables for Report:

- Tables presented below use a social discount rate of 3.5% to discount both costs and benefits.

The table below presents the results for scenarios varying marginal utility and capital cost.

Sensitivity: Capital Cost		Sensitivity: Marginal Utility		
		ICER given: 38hrs; 0.0169MU; 10 equipment	ICER given: 38hrs; 0.00845MU; 10 equipment	ICER given: 38hrs; 0.0338MU; 10 equipment
	High	£9,172.67 / QALY	£18,345.35 / QALY	£4,586.34 / QALY
	Central	£8,555.38 / QALY*	£17,110.76 / QALY	£4,277.60 / QALY

	Low	£7,938.09 / QALY	£15,876.17 / QALY	£3,969.04 / QALY
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**For completeness, the central case produces an approximate PV cost of £261m and PV QALYs of 30,500; discounted at the 3.5% level for both costs and health benefits yielding an ICER of £8,555 per QALY.*

The results suggest that the ICER is insensitive to changes in capital cost; however, variation in marginal utility directly influences the result. As presented under 0.00854MU, half of the central scenario's marginal change, the results scale proportionally, effectively doubling. The key takeaway is that uncertainties regarding marginal utility change will have dire consequences on the validity of the intervention. To bolster the reliability and robustness of the results, a full literature review should be conducted for marginal utility change derived from engagement in physical activity. The use of a single homogenous figure, applied across all eligible participants, fails to capture the true heterogeneity present in student ability, baseline fitness, motivation and determination and inherent talent and predisposition to sports.

A more robust approach would involve representing the marginal utility parameter as a probability distribution within a probabilistic sensitivity analysis. This would allow the model to capture (pseudo) realistic variation in QALY gains – assuming the central estimate is a valid proxy. Using a normal distribution with high variation and left skew could incorporate the parametric uncertainty, strengthening the reliability of the cost-effectiveness estimates and better reflect the heterogeneity of the target population.

Sensitivity: Capital Cost		Sensitivity: Scenario Hours			
		ICER given: 38hrs; 0.0169MU; 10 equipment	ICER given: 6hrs; 0.0169MU; 10 equipment	ICER given: 76hrs; 0.0169MU; 10 equipment	ICER given: 190hrs; 0.0169MU; 10 equipment
	High	£9,172.67 / QALY	£1,448.32 / QALY	£18,345.35 / QALY	£45,863.37 / QALY
	Central	£8,555.38 / QALY*	£1,350.86 / QALY	£17,110.76 / QALY	£42,776.90 / QALY
	Low	£7,938.09 / QALY	£1,253.38 / QALY	£15,876.17 / QALY	£39,690.43 / QALY

As identified in the main report, the number of hours tangibly impacts the ICER. Under Beale's estimates, the ICER is favourable and cost-effective, according to NICE's methodology and thresholds; however, Beale's estimate alongside the central scenario's requirements for a plausible health gain warrant caution. It is an unlikely assumption that inactive adults engaging in minimal activity (30 minutes a month), sourced from Beale's study, should prove representative and a valid proxy for young students between the ages of 11-16.

Furthermore, there remains substantial quality problems regarding literature on HRQoL from physical activity. Evidence is most likely cross-sectional rather than causal, failing to capture the full range of variables and facets that are feeding into the estimates. Combined with our linear extrapolation of marginal utility, which is certainly unrealistic, the QALY gain is over-simplified, most likely, inflated. The linear extrapolation fails to capture the diminishing returns from higher dosages (exposure) to the treatment or intervention. The returns from activity are likely to have a non-linear relationship with exposure.

Although our table indicates that our intervention is cost-effective against NICE's thresholds; the degree of uncertainty that is interwoven in the foundations of our modelling suggest that it is analytically tenuous to use this analysis as anything other than indicative, rather than definitive.

- Tables presented below use a social discount rate of 3.5% to discount costs and a rate of 1.5% to discount benefits.

Generally, lowering the discount rate on benefits will deflate the ICER further, indicating greater cost-effectiveness against NICE's former and current thresholds (£20,000/QALY and £25,000/QALY). However, as stated above, the uncertainties persist and these results are indicative, not definitive. The table below evidence this statement by showing lower figures for all instances and sensitivities.

The intervention chose to use 3.5% as the social discount rate for costs and benefits as the intervention hinges on being scored against NICE's thresholds. However, the Green Book (HMT, 2024), states evidently that health-related benefits should use a discount factor of 1.5% rather than 3.5%. For completeness, please find the tables below as the shadow values (using 1.5% for benefits) for all tables included in the results section of the report.

Sensitivity: Capital Cost		Sensitivity: Marginal Utility		
		ICER given: 38hrs; 0.0169MU; 10 equipment	ICER given: 38hrs; 0.00845MU; 10 equipment	ICER given: 38hrs; 0.0338MU; 10 equipment
	High	£8,434.95 / QALY	£16,869.90 / QALY	£4,217.48 / QALY
	Central	£7,867.30 / QALY*	£15,734.61 / QALY	£3,933.65 / QALY
	Low	£7,299.66 / QALY	£14,599.31 / QALY	£3,649.83 / QALY

*Costs are discounted using 3.5%. Benefits are discounted using 1.5%.

Sensitivity: Capital Cost		Sensitivity: Scenario Hours			
		ICER given: 38hrs; 0.0169MU; 10 equipment	ICER given: 6hrs; 0.0169MU; 10 equipment	ICER given: 76hrs; 0.0169MU; 10 equipment	ICER given: 190hrs; 0.0169MU; 10 equipment
	High	£8,434.95 / QALY	£1,331.83 / QALY	£16,869.90 / QALY	£42,174.76 / QALY
	Central	£7,867.30 / QALY*	£1,242.21 / QALY	£15,734.61 / QALY	£39,336.52 / QALY
	Low	£7,299.66 / QALY	£1,152.58 / QALY	£14,599.31 / QALY	£36,498.28 / QALY

*Costs are discounted using 3.5%. Benefits are discounted using 1.5%.

Sensitivity: Scenario Hours Open	ICER
ICER given: 38hrs; 0.0169MU; 10 equipment; central capital cost	
High: 4 hours.	£7,016.86 / QALY
Central: 2 hours.	£7,867.30 / QALY*
Low: 1 hour.	£9,568.19 / QALY

*Costs are discounted using 3.5%. Benefits are discounted using 1.5%.

Sensitivity: Displacement	Sensitivity: Marginal Utility	
	ICER given: 38hrs; 0.0169MU; 10 equipment; central capital cost	ICER given: 38hrs; 0.00845MU; 10 equipment; central capital cost
Displacement	£10,489.74 / QALY	£20,979.48 / QALY
Without displacement	£7,867.30 / QALY*	£15,734.61 / QALY

*Costs are discounted using 3.5%. Benefits are discounted using 1.5%.

Annex K – Non-quantifiable:

The following non-quantifiable factors have fallen outside of the scope of the modelling framework but nonetheless material affect participation, costs and realised health benefits. These uncertainties, among many others, limit the extent to which the ICER should be interpreted as definitive; hence the need to emphasise its indicative nature.

The model assumes that only 10% of students will demand an additional hour of activity per week. However, this may be an underestimation. For instance, more students may value the novelty of a gym in their school which opens the possibility of access that was not previously there. Some of these schools may also have highly motivated PE departments; furthermore, these schools that suffer from inaccessibility to equipment could host future young athletes: the distribution of equipment could open doors to future careers and enable effective use of inherent talent. Additionally, the appraisal omits the social influence that training can have on uptake: young students are prone to positive and negative influence, seeing their friends training could motivate them to increase their own uptake.

Alternatively, insufficient equipment (or a lack thereof) could lead to queuing, waiting lists, frustration or even rationing of use, the latter would impact QALY gains and thus ICER. Our appraisal neglects the human element to staff: these individuals will face fatigue, have families, partners or social lives. These additional hours are not without consequence. Subsequently, there may be a fall in the quality of supervision. Moreso, staff may strike or demand higher wages in return for these overtime hours. The long-term consequences of brazenly expecting staff to willingly take on additional hours, for little return in wages, could open dialogues on the unsociable and unpaid hours of teaching. It would not be unreasonable to expect Unions to object to routine out-of-hours expectations: a discussion with the unions before implementation would be optimal to reduce the likelihood of strikes. Transparently, inequalities persist between schools, especially at the national level. Schools in deprived areas may experience staffing shortages; rural schools may have fewer students to utilise machines; high-performance schools may extract more benefit due to their organisation structure and rigour. These distributions concerns should be acknowledged as non-quantifying but nonetheless impactful.

Lower demand also offers a harmful reality to the ICER. Should students deem the gym equipment poor in quality or rationalise that it would be an inferior alternative to usual activities – spending time away from school, using their phones (although social media bans are sweeping across countries), socialising with friends – participation would fall beneath the maximum participation constraint of 28,720 students per machine. In effect, the QALY gain would fall and the ICER would rise.

Motivation, engagement and behavioural fatigue are not considered. Students may start strong but sustained engagement over a full academic year is uncertain. Consider exam seasons, the added stress and pressure to achieve a grade with long-lasting implications for their lives may have knock-on effects to participation for the full 38 hours required. Novelty may linger temporarily before fading; possibly seeing resurgence with the incoming Year 7 Cohort but faltering by transition to Year 8. Students are prone to influence; therefore, peer pressure dynamics can impact the ICER.

To note, an inevitable conflict between informal social use and health objectives will arise. Students may use the gym as a setting to socialise and prioritise social engagement rather than strict health regimen. On conflict, certain pupils may dominate the setting. Students with high fitness, confidence and general athleticism may overuse the equipment which would dominate and crowd out disadvantaged or less confident peers. Students with disabilities may find equipment inaccessible unless adapted for their sake; this policy assumes that all students are non-disabled and can use the same equipment without adjustments – this assumption is particularly strong and fails to capture needs of all students across the country. In this regard, the policy would fail its own litmus test. Furthermore, gender

differences may play a role in supervision dynamics for young children (adolescents), as a result, the supervision may require gender-sensitive arrangements.

Interestingly, the model assumes that every school must have space for 10 machines; however, some schools may have no spare rooms. Further, we have failed to consider the noise considerations. These items are particularly noisy and could restrict placement in the school. Although, one could argue that the scenario requires use before and after school, removing the likelihood of conflicting with learning. A key notion to wager is the implication to fire safety and estate compliance; bringing new equipment into the schools offers hazards. The mains powered machines will need to be unplugged and switched off each morning and each evening to reduce the risk of a fire.

Adolescent misuse of machines is inevitable, although the intervention has failed to consider its effects on the ICER. Whilst the intervention includes insurance (assuming it covers maintenance and repairs), it fails to consider downtime. Things are not instantly replaced and government is bureaucratic. These problems may delay repairs, thus impacting use, reducing the ICER and lowering the cost-effectiveness of the intervention of the appraisal period. Furthermore, one cannot be certain that maintenance across regions and local authorities will be homogenous; some machines may break more than others, sooner than others: factors of which impact the ICER.

Non-economic factors can play a role in usage patterns. A discussion should be conducted on cultural norms about mixed spaces and attire. Some students may not feel comfortable participating in these extra-curricular activities should they conflict with their beliefs. Importantly, students may be self-conscious, especially around body image; it is necessary that these factors be considered at a later point. Hypothetically, if supervision were to be poor, it could fail to capture overuse of the machine which could risk health and wellbeing. These may not impact the cost of the programme – albeit in the absence of a lawsuit – but they could reduce the benefits in ways not represented numerically, as in Beale’s point estimate.

As noted in the introduction, there is literature to suggest that increased PA can improve concentration, boost academic outcomes, enhance behaviour and influence absenteeism. These externalities are significant factors that have been omitted from analysis. These wider educational impacts could lead to the appraisal understating the benefits gained from participation.

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