# Stand Out in Class

## Supplementary File 2 – Economic Analyses

### Within Trial Analysis

**Table 1**. Healthcare resource use costing sources

| Survey Item | Price (2016 £) | Source (Assumptions) |
|---|---|---|
| General practitioner (GP) Surgery visit | £27.00 | PSSRU 2016 |
| General practitioner (GP) Home visit | £103.94 | PSSRU 2010 |
| General practitioner (GP) phone call | £14.40 | PSSRU 2016 |
| GP Nurse Surgery visit | £12.58 | PSSRU 2015 |
| GP Nurse Home visit | £14.37 | PSSRU 2010 |
| GP Nurse phone call | £6.10 | PSSRU 2016 |
| Other doctor | £39.18 | PSSRU 2012 *(Assumed 50% case mix admitted/non-admitted)* |
| Health visitor | £40.91 | PSSRU 2010 *(per home visit)* |
| District nurse | £26.54 | PSSRU 2010 *(per home visit)* |
| Social worker office visit | £49.50 | PSSRU 2016 *(55 min appointment assumed)* |
| Social worker home visit | £59.40 | PSSRU 2016 *(12 minutes travel time assumed)* |
| Psychiatrist | £236.44 | NHS Reference Costs 2016 *(Child and adolescent psychiatry – outpatient attendance)* |
| Psychologist | £144.70 | NHS Reference Costs 2016 *(Clinical psychology – outpatient attendance )* |
| Other counsellor/therapist | £59.96 | PSSRU 2013 *(GP Counsellor, 55min appointment)* |
| Mental health nurse | £62.24 | PSSRU 2015 *(55 min appointment assumed)* |
| Accident and Emergency Visit | £137.74 | NHS Reference Costs 2016 |
| Hospital Outpatient appointment | £116.92 | NHS Reference Costs 2016 |
| Inpatient Stay (per day) | £389.10 | NHS Reference Costs 2016 *(Average hospital costs per day)* |

## Missing Data

**Table 2**. Missing data by outcome source

| Missing Data (% missing) | Baseline | | Follow-up | |
|---|---|---|---|---|
| | Control Group (n=90) | Intervention Group (n=86) | Control Group (n=90) | Intervention Group (n=86) |
| Healthcare Resource Use | 49% | 37% | 52% | 38% |
| EQ-5D-Y | 2% | 9% | 7% | 3% |
| PEDS-QL | 17% | 17% | 9% | 5% |
| Education Resource Use | 0% | 0% | 0% | 0% |
| Strengths & Difficulties Questionnaire | 9% | 9% | 7% | 3% |
| Activity Levels (Weekday & Weekend) | 18% | 19% | 34% | 28% |

**Table 2**. Missing data by outcome source

## Table 3. Complete case analysis

### Health Resource Use

| Total Healthcare Resource Use | Baseline | | Follow-up | |
|---|---|---|---|---|
| | Control Group (n=46) | Intervention Group (n=54) | Control Group (n=43) | Intervention Group (n=53) |
| Primary Care | 20.5 | 47 | 18.5 | 21 |
| Hospital Care | 8 | 9 | 9 | 17 |
| Psychological Care | 2 | 2 | 15 | 0 |
| Community Care | 0 | 1 | 3 | 0 |

| Healthcare resource use (mean cost) | Baseline | | Follow-up | |
|---|---|---|---|---|
| | Control Group (n=46) | Intervention Group (n=54) | Control Group (n=43) | Intervention Group (n=53) |
| Primary Care | £11.97 | £22.89 | £11.21 | £9.63 |
| Hospital Care | £38.99 | £20.64 | £24.96 | £114.93 |
| Psychological Care | £10.28 | £5.36 | £22.94 | £0.00 |
| Community Care | £0.00 | £0.49 | £4.14 | £0.00 |
| Mean Cost (all categories) | £61.24 | £49.38 | £63.25 | £124.56 |
| Intervention cost | | | | £7.58 |
| **Mean Cost (per patient)** | **£61.24** | **£49.38** | **£63.25** | **£132.14** |

### Education Resource Use

| Total Education Resource Use | Baseline | | Follow-up | |
|---|---|---|---|---|
| | Control Group (n=90) | Intervention Group (n=86) | Control Group (n=90) | Intervention Group (n=86) |
| Pupils receiving additional tutoring | 1% | 12% | 9% | 12% |
| Disciplinary events | 3% | 13% | 8% | 13% |
| Pupils receiving learning support | 8% | 13% | 7% | 13% |

### Health Outcomes

| EQ5D-Y Dimension | Baseline | | Follow-up | |
|---|---|---|---|---|
| | Control Group (n=88) | Intervention Group (n=78) | Control Group (n=84) | Intervention Group (n=83) |
| **Mobility** | | | | |
| No problems | 89% | 90% | 83% | 82% |
| Some problems | 9% | 10% | 15% | 17% |
| A lot of problems | 2% | 0% | 1% | 1% |
| **Looking after myself** | | | | |

| | | | | |
|---|---|---|---|---|
| *No problems* | 97% | 94% | 95% | 92% |
| *Some problems* | 2% | 6% | 5% | 8% |
| *A lot of problems* | 1% | 0% | 0% | 0% |
| **Doing usual activities** | | | | |
| *No problems* | 80% | 88% | 85% | 83% |
| *Some problems* | 19% | 10% | 14% | 17% |
| *A lot of problems* | 1% | 1% | 1% | 0% |
| **Having pain or discomfort** | | | | |
| *No problems* | 64% | 58% | 55% | 59% |
| *Some problems* | 31% | 38% | 43% | 39% |
| *A lot of problems* | 6% | 4% | 2% | 2% |
| **Feeling worried, sad or unhappy** | | | | |
| *Not worried, sad…* | 77% | 69% | 75% | 72% |
| *A bit worried, sad…* | 23% | 29% | 25% | 28% |
| *Very worried, sad…* | 0% | 1% | 0% | 0% |

| **PEDS-QL Mean Scores** | **Baseline** | | **Follow-up** | |
|---|---|---|---|---|
| | Control Group (n=75) | Intervention Group (n=71) | Control Group (n=82) | Intervention Group (n=82) |
| Physical Function | 71.71 | 69.32 | 68.10 | 68.14 |
| Emotional Function | 82.13 | 74.15 | 78.60 | 75.85 |
| Social Function | 83.53 | 78.94 | 81.71 | 79.70 |
| School Function | 80.47 | 71.76 | 72.56 | 69.76 |

**Education Outcomes**

| **SDQ profiles** | **Baseline** | | **Follow-up** | |
|---|---|---|---|---|
| | *Control Group (n=82)* | *Intervention Group (n=78)* | *Control Group (n=84)* | *Intervention Group (n=83)* |
| SDQ (normal) | 79% | 68% | 80% | 75% |
| SDQ (slightly raised) | 10% | 15% | 13% | 12% |
| SDQ (High) | 7% | 6% | 4% | 6% |
| SDQ (Very High) | 4% | 10% | 4% | 7% |

**Table 4**. Cost-effectiveness scenario analysis (CCA)

| Complete Case Analysis | Base Case | |
|---|---|---|
| | Unadjusted | Adjusted for Baseline METs |
| Predicted Change in HRQoL (30y) | 0.00011 | -0.00001 |
| Predicted Change in Health Cost | -£0.22 | £0.02 |
| Predicted Change in Total Cost | £7.36 | £7.60 |
| **Mean Cost Effectiveness Ratio** | **£69,412 per QALY** | **Dominated** |
| p (Cost-Effective): £20,000 per QALY | 17.70% | 6.43% |
| p (Cost-Effective): £30,000 per QALY | 29.59% | 12.80% |

## Scoping Review

Database: Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>

**Search Strategy 1:**

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1    association.m_titl. (210023)

2    sedentary.m_titl. (4481)

3    1 and 2 (171)

4    exp child/ (1880426)

5    Adolescent/ (1982092)

6    (child or children or childhood or infant$ or infancy or boy or boys or girl or girls or schoolchild$ or schoolboy$ or schoolgirl$ or teen or teens or teenager$ or adolescen$ or youth or young people or pediatric or paediatric).ti,ab. (1923601)

7    4 or 5 or 6 (3671655)

8    3 and 7 (78)

78 records were identified

**Search Strategy 2:**

----------------------------------------

1    association.m_titl. (210023)

2    sedentary.m_titl. (4481)

3    1 and 2 (171)

4    exp child/ (1880426)

5    Adolescent/ (1982092)

6    (child or children or childhood or infant$ or infancy or boy or boys or girl or girls or schoolchild$ or schoolboy$ or schoolgirl$ or teen or teens or teenager$ or adolescen$ or youth or young people or pediatric or paediatric).ti,ab. (1923601)

7    4 or 5 or 6 (3671655)

8    3 and 7 (78)

9    sedentary lifestyle/ (7073)

10    7 and 9 (2774)

11    *sedentary lifestyle/ (3762)

12    7 and 11 (1540)

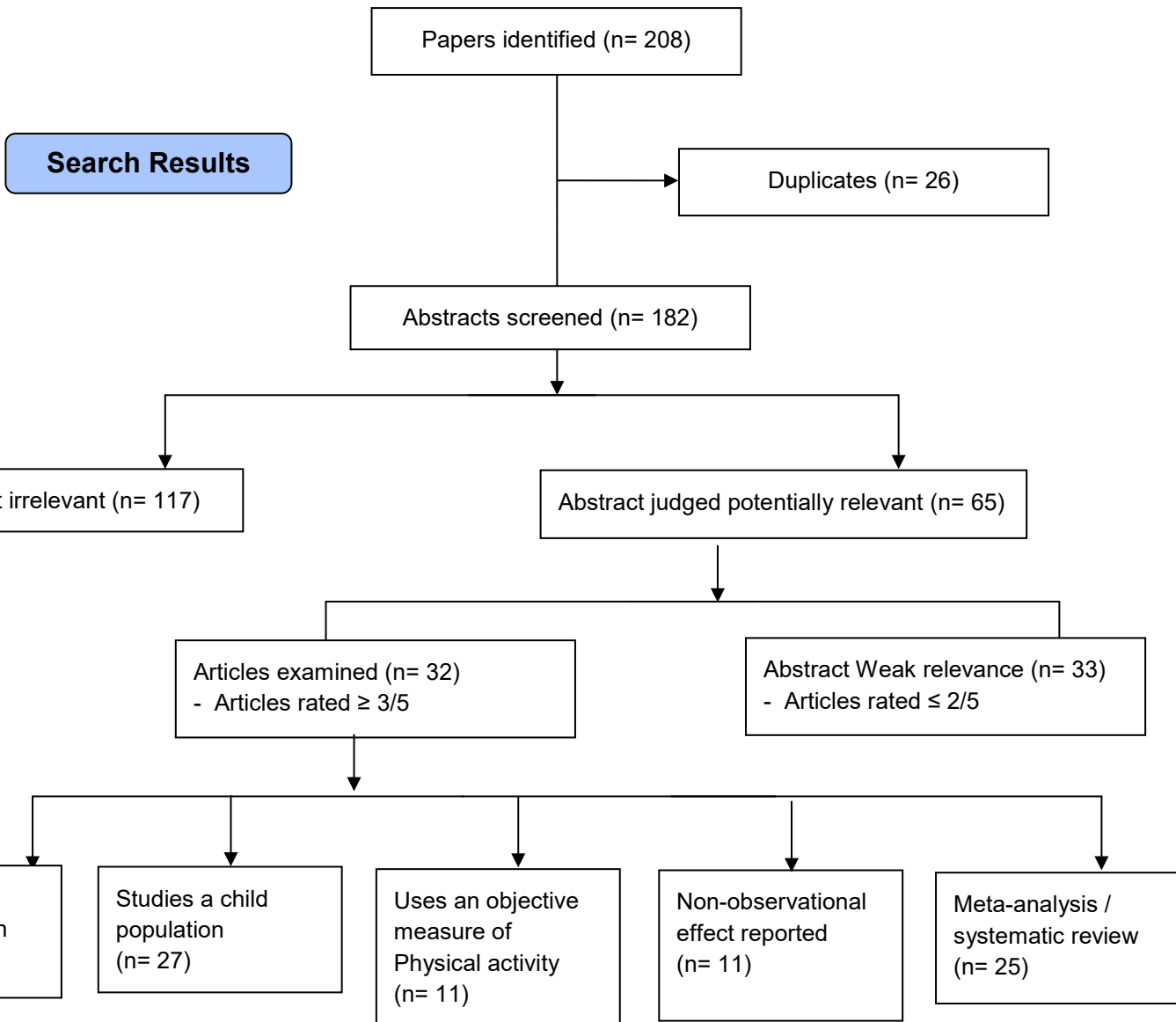1540 records were identified

**Figure 1**. Search Strategy

Papers identified (n= 208)

Search Results

Duplicates (n= 26)

Abstracts screened (n= 182)

Abstract irrelevant (n= 117)

Abstract judged potentially relevant (n= 65)

Articles examined (n= 32)
- Articles rated ≥ 3/5

Abstract Weak relevance (n= 33)
- Articles rated ≤ 2/5

Examined a quantified health effect (n= 31)

Studies a child population (n= 27)

Uses an objective measure of Physical activity (n= 11)

Non-observational effect reported (n= 11)

Meta-analysis / systematic review (n= 25)

**Figure 2**. Scoping review results

**Table 5**. Full evidence summary

| First author (year) | Analysis type | Objective measure of sedentary behaviour reported | Accounts for Physical Activity levels | Reported outcomes | Study conclusions |
|---|---|---|---|---|---|
| Biddle et al. (2017) | Narrative Review | Yes | No | **Adiposity**<br>*Objective measurement*<br>"Studies using objective accelerometer measures of sedentary behaviour yielded null associations"<br>*Reported screen time*<br>"Small associations… from cross-sectional evidence"<br>*Behavioural interventions*<br>"Modest effects for weight status and adiposity" | "Analysis of causality guided by the classic Bradford Hill criteria concluded that there is no evidence for a causal association between sedentary behaviour and adiposity in youth, although a small dose-response association exists." |
| Carson et al. (2016) | Narrative Review<br><br>*Update of Tremblay 2011* | Yes | No | **Adiposity**<br>*Reported screen time*<br>"Associated with unfavourable body composition"<br>**Cardiovascular**<br>*Reported screen time*<br>"Associated with higher clustered cardiometabolic risk scores" | "Based on very low to moderate quality evidence … across the majority of health indicators examined, higher duration of TV viewing and/or screen time was associated with unfavourable health. A gradient was observed across health indicators, indicating that less sedentary behaviour, especially screen time, was associated with better health." |
| Cliff et al. (2016) | Meta-analysis | Yes | Yes | **Adiposity**<br>*Adjusted for MVPA*<br>(r = −0.00, 95% CI −0.07 to 0.076)<br>*Not adjusted for MVPA*<br>(r = 0.10, 95% CI 0.02 to 0.18)<br>**Glucose/Insulin**<br>*Adjusted for MVPA*<br>(r = −0.12, 95% CI −0.29 - 0.06)<br>*Not adjusted for MVPA*<br>(r = 0.09, 95% CI 0.04 - 0.13)<br>**HDL-Cholesterol**<br>*Adjusted for MVPA*<br>(r= −0.29, 95% CI −0.45 - −0.12) | "There is limited available evidence that the total volume or patterns of sedentary behaviour are associated with health in children and adolescents when accounting for moderate-intensity to vigorous-intensity physical activity or focusing on studies with low risk of bias" |

| First author (year) | Analysis type | Objective measure of sedentary behaviour reported | Accounts for Physical Activity levels | Reported outcomes | Study conclusions |
|---|---|---|---|---|---|
| | | | | *Not adjusted for MVPA*<br>(r = −0.02, 95% CI −0.13 - 0.09) | |
| de Rezende et al. (2014) | Narrative review<br><br>*Observational evidence only* | No | No | **Adiposity**<br>*(TV viewing & screen-time)* <u>Strong Evidence</u><br>**Cardiovascular**<br>*(TV viewing & screen-time)*<br><u>Moderate evidence</u> for association with Blood pressure and total cholesterol.<br><u>Insufficient evidence</u> of an association with HbA1, fasting insulin or insulin resistance<br>**Other**<br>*(TV viewing & screen-time)*<br>Moderate evidence for association with self-esteem, social behaviour problems, physical fitness & academic achievement | "Sedentary behaviour may be an important determinant of health, independently of physical activity. However, the relationship is complex because it depends on the type of sedentary behaviour and the age group studied." |
| Tremblay et al. (2011) | Meta-analysis and narrative review | No | No | **Adiposity**<br>*Unspecified sedentary time reduction, observed in 4 RCTs*<br>(r=−0.81, 95% CI −1.44 - −0.17)<br>**Cardiovascular**<br>"Increased screen time is associated with increased risk for markers of metabolic syndrome and cardiovascular disease. Risk increases in a dose-response manner" | "Sedentary behaviour (assessed primarily through increased TV viewing) for more than 2 hours per day was associated with unfavourable body composition, decreased fitness, lowered scores for self-esteem and pro-social behaviour and decreased academic achievement" |
| van Ekris et al. (2016) | Meta-analysis and narrative review.<br><br>*Evidence synthesis stratified by sedentary behaviour* | Yes | Yes | **Adiposity**<br>*Objective measurement*<br><u>No evidence of effect</u><br>*1h additional reported TV viewing*<br>(β = 0.01, 95% CI −0.002 - 0.02, I²= 89%)<br>*Adjusted for diet/physical activity*<br>(β = 0.01, 95% CI − 0.03 - 0.05, I² = 55%)<br>*Unadjusted for MVPA, >1y follow-up*<br>(β = 0.12, 95% CI 0.01 - 0.22, I² = 88%) | "The evidence for a prospective relationship between childhood sedentary behaviour and biomedical health is in general unconvincing … For objectively assessed total sedentary time, we found no convincing evidence for a relationship with biomedical health indicators, which is consistent with a |

| First author (year) | Analysis type | Objective measure of sedentary behaviour reported | Accounts for Physical Activity levels | Reported outcomes | Study conclusions |
|---|---|---|---|---|---|
| | *type. Prospective studies only.* | | | *Adjusted for MVPA, >1y follow-up*<br>(β = 0.07, 95% CI −0.04 - 0.18, $I^2$ = 64%)<br><br>*1h additional reported computer use*<br>(β = 0.00, 95% CI −0.004 - 0.01, $I^2$ = 72%)<br>*Adjusted for diet/physical activity*<br>(β = −0.03, 95% CI −0.11 - 0.05, $I^2$ = 64%)<br>**Cardiovascular**<br><u>Triglycerides and glucose</u><br>*TV viewing time*<br>Insufficient evidence found<br><u>HDL-Cholesterol</u><br>*All measures*<br>"Strong evidence for an inverse relationship with HDL-cholesterol (based on two high-quality studies)."<br><u>Blood Pressure</u><br>*All measures*<br>No evidence found | previous review and a previous meta-analysis" |

\* 2 reviews, Hoare 2016, Suchert 2015, focus specifically on Psychosocial/Mental health measures. These outcomes were perhaps insufficiently considered in the six reviews considered, given the prominence of these outcomes in the gathered literature. Heterogeneity in collection methods and reported outcomes limited the quality of evidence available and made it difficult to assess whether there was an observable effect. Suchert et al. concluded an indeterminate effect, and both authors call for more prospective evidence for this outcome. Both were scored 3/5 for relevance and thus were not included in this summary table of presented evidence.

**Table 6**. Candidate economic models considered

| Model (funder) | Strengths | Limitations |
|---|---|---|
| NICE Physical Activity ROI tool<br><br>*(National Institute for Clinical Excellence, UK department of Health)* | • Considers a child population<br>• Evidence can be tailored to local area | • Opaque and unadaptable<br>• Does not allow input of individual activity values<br>• Best suited for population level analysis - binary distinction between % population meeting physical activity requirements & % "physically inactive" |
| EConDA<br><br>*(European Union Health Programme)* | • Produces output in Costs and QALYs across a range of obesity-related health outcomes<br>• Up to lifetime time horizon | • Opaque with limited adaptability<br>• Does not allow input of individual activity values<br>• Considers an adult population (≥ 18y)<br>• Limits causal pathway to obesity-mediated only<br>• Best suited for population level analysis - binary distinction between % population at healthy & unhealthy weight. |
| MOVES v.2<br><br>*(Sport England, UK department for Digital, Culture, Media and Sport)* | • Transparent assumptions and easily adaptable<br>• Widest range of health areas considered<br>• Produces output in costs and QALYs in each health area<br>• Allows input of individual-level data of activity values (METs) | • Considers an adult population (≥ 16y)<br>• Time horizon only up to 30y |

## Extrapolated model analysis
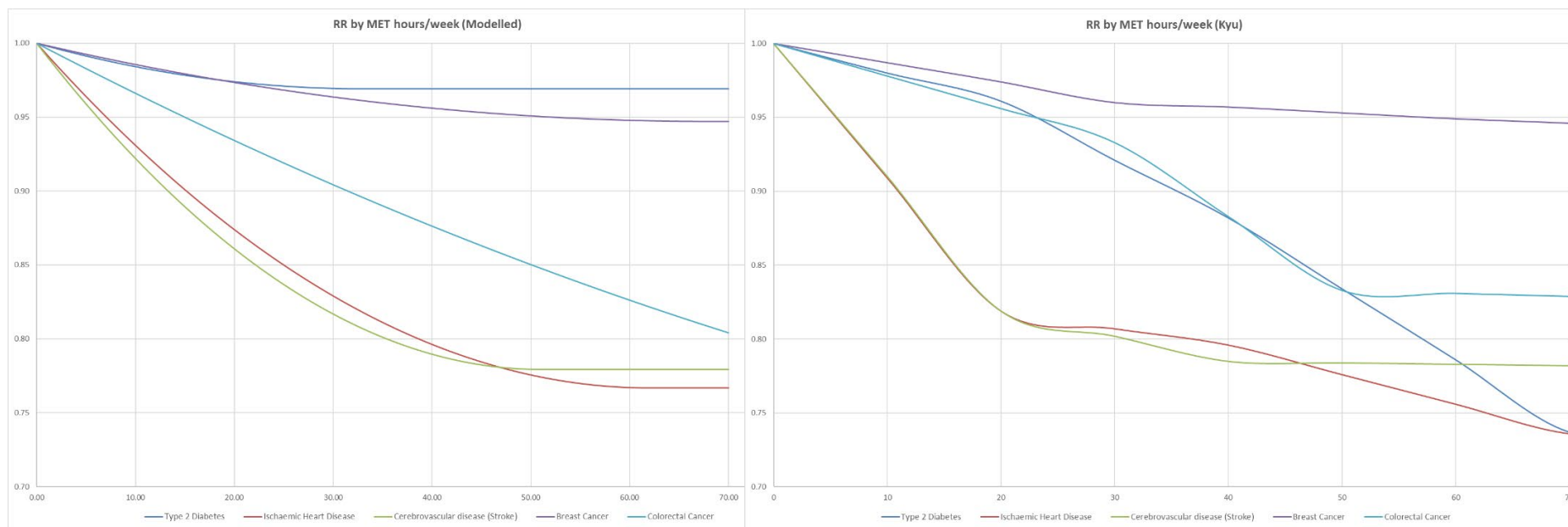


**Figure 3**. Comparison of modelled and raw health outcomes

| Adjustments made to MOVES model |
| --- |
| - Rounding removed, with METs/Week precise to 2dp |
| - Model defaults to not show negative health effect removed |
| - Starting age in model set to 16 years old |
| - Time horizon increased to 30 years |
| - Correction of rate to probability formula in dropout parameter [cite] |

| Probabilistic Values | Non Probabilistic values |
| --- | --- |
| Baseline Activity & Intervention Effect | Intervention cost |
| Disease Incidence and Prevalance | Dropout parameter |
| Δ Disease specific RR | |
| Disease specific Survival | |
| Cost of Prevalent and Incident Cases | |
| National Population Mortality | |
| Baseline Utility | |
| Condition Specific Utility | |

**Figure 4**. Adjustments to the Moves v.2 model

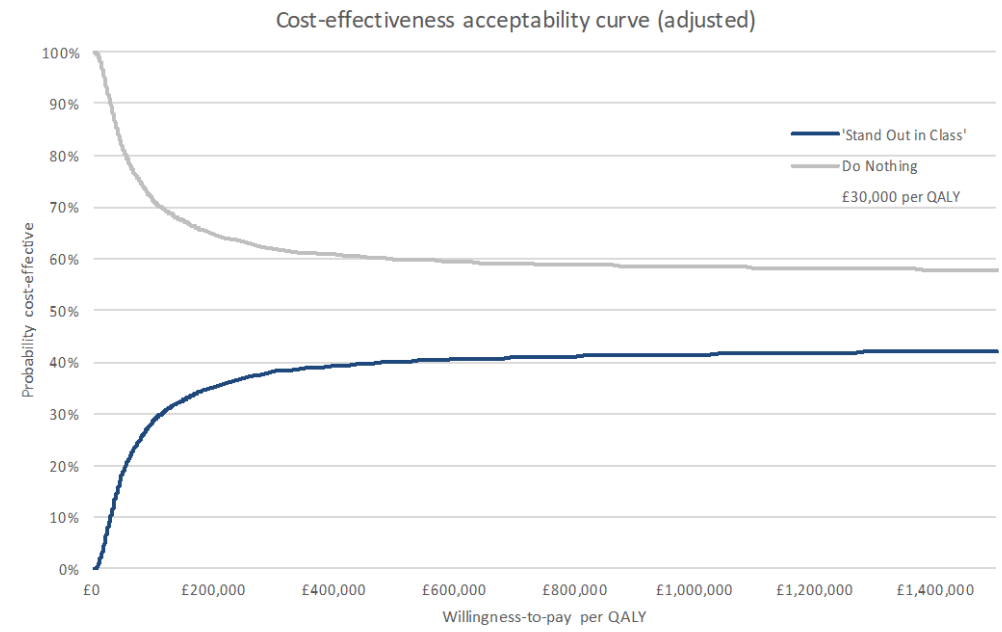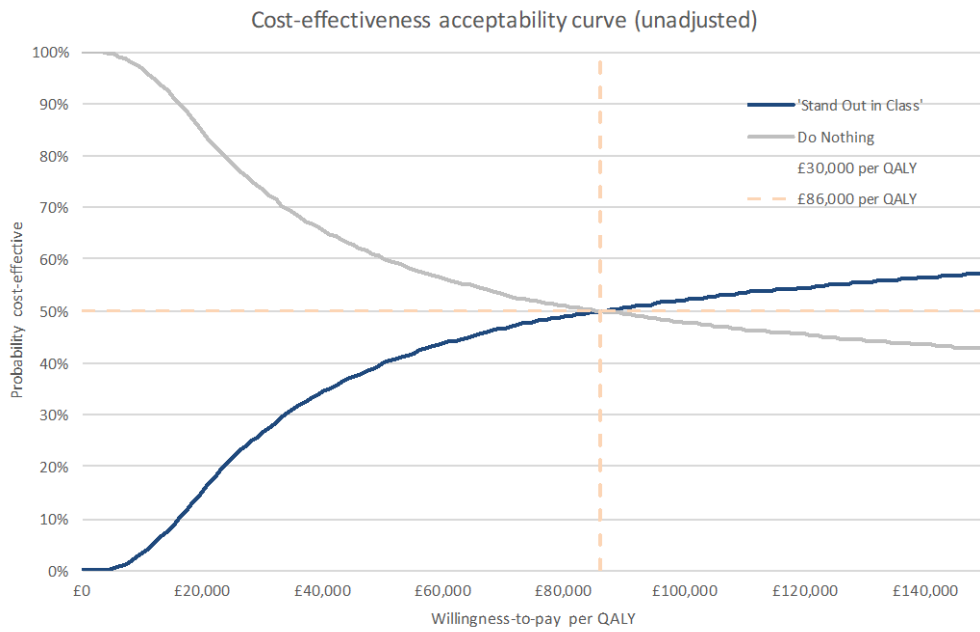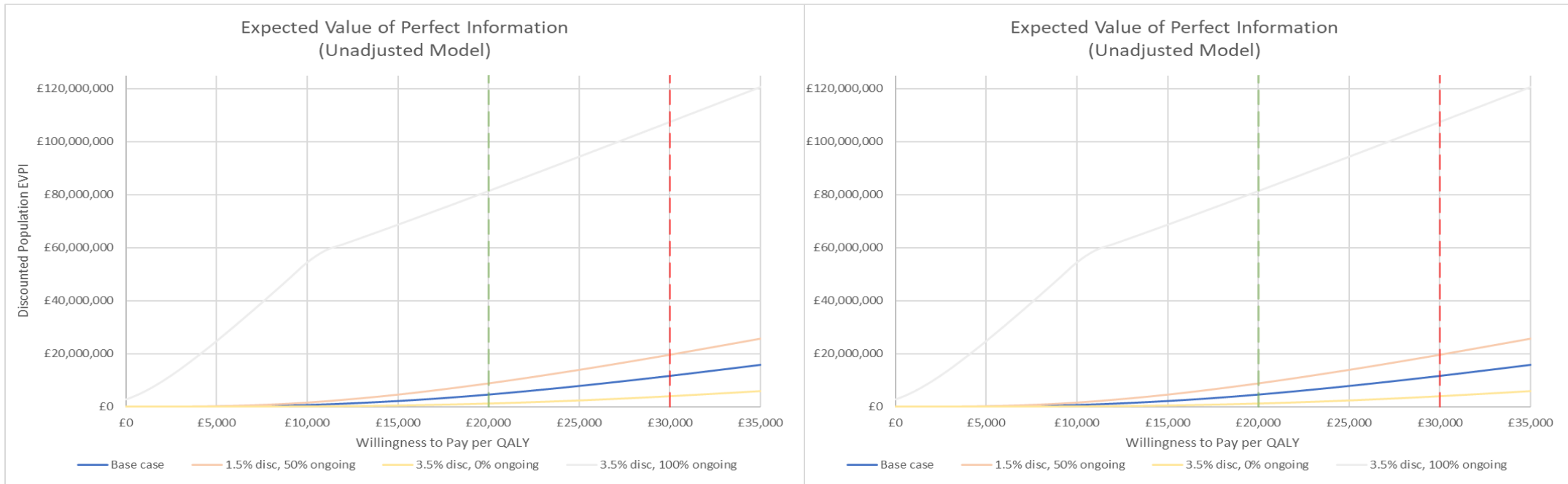**Figure 5**. Cost Effectiveness Acceptability Curves (Base case)

**Figure 6**. EVPI plot (unadjusted scenarios)