

## Appendix D: Health economic analysis methods and theory overview

### Cost-benefit analysis framework

A cost-benefit analysis (CBA) methodology was used to test the practical feasibility of applying an economic perspective to a complex social intervention. Using CBA meant wider impacts, such as spill-over effects, positive and negative, where the costs and outcomes may stretch beyond the project, and effects over time could be included. Standard appraisal indicators were calculated in MS Excel.

$$NPV = \sum_{t=1}^T \frac{C_t}{(1-r)^t} - C_0$$

$$BCR = \frac{\textit{Present value of Benefits}}{\textit{Present value of costs}}$$

#### Key

NPV - net present value

BCR - benefit cost ratio

PVC - present value costs

PVB - present value benefits

Value placed was estimated using economic costs and benefits and the principle of opportunity cost underpinned valuations – essentially the value of the next best option that you give up when you use resources. It is the case that there are challenges with regard to the valuation of complex interventions because the costs and benefits of early intervention are not easily measured and generally not measurable in the short term. It was also anticipated that difficulties could be experienced identifying appropriate and accessible data sources for some costs (or benefits). Lack of (accessible) information was anticipated to be a constraint – in this circumstance the relevant cost (or benefit) was listed and comment made about the potential magnitude of impact of the cost (or benefit) on evaluation conclusions.

The benefits anticipated by Big Noise Govanhill are expected to manifest themselves over the participating individual's lifetime as a consequence of involvement in the project. The current participants in Big Noise Govanhill are aged between three and eight years of age (nursery to Primary 4 at October 2014). It is the case that benefits delivered are likely to be limited in the short term (0-5 years) as the anticipated impacts for the programme are of a nature that a medium (6-15 years) to long term (15+ years) horizon would be required to provide enough

time for outcomes (benefits) to manifest. A timescale for the CBA of 0-15 years has been identified as this is the maximum time that an individual child could be involved (age 3 to age 18). The impact of time horizons is explored through sensitivity analysis, specifically 0-6 years (budgetary forecast period), 0-9 years (full nursery plus primary school stages involved) and 0-70 years (predicted lifetime effects).

In addition, the presence of other community-based projects may dilute the impact of Big Noise Govanhill for those children participating in the community activity also. Predicted benefits for participants will be delivered through other routes and so it is difficult to attribute causation, although a longitudinal study may reveal correlational evidence. Sistema Scotland asserts that other community-based projects are unlikely to be of the same quality, duration of intensity in nature. There is an active 'music in schools' programme in Scotland and an emphasis on lifelong learning skills through Curriculum for Excellence pedagogy in schools, which has overlap in terms of predicted outcomes. This means attributable benefits may be smaller in magnitude of impact than predicted. This implication was explored using sensitivity analysis.

## Counterfactual

In order to appraise Big Noise Govanhill it was necessary to set out the assumed counterfactual. The counterfactual sets out what happens if the intervention was not undertaken and serves as a baseline case against which the project will be compared. Consideration was given to implicit assumptions about the economy if the project did not go ahead, such as that another project will fulfill the need. For example, National Youth Orchestras of Scotland (NYS) and the Royal Conservatoire of Scotland (RCS) both offer a number of long- and short-term music programmes for children and young people. Unlike Big Noise Govanhill, which is free at the point of consumption, NYS and RCS programmes are generally accessed through competitive application and require payment of fees of ranging between around £750 to £1,900 per year, depending on the programme of study chosen<sup>1</sup>. Given that Govanhill is within the lowest 15% of SIMD (rankings of relative measure of deprivation) in Scotland, this would indicate that movement of demand to private sector provision is highly unlikely in the absence of Big Noise Govanhill.

It was concluded that it is reasonable to assume that another project with similar aims and coverage would not occur and so the counterfactual was taken as a 'Do Nothing' scenario, i.e. the project ceases to exist and no other investment is made in its place.

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<sup>1</sup> From published fees for session 2014-2015, accessed at [www.rcs.ac.uk](http://www.rcs.ac.uk) and [www.nyos.co.uk](http://www.nyos.co.uk) in July 2014.

## Costs: measurement and valuation

The main costs examined in the analysis comprised eight categories in total: four financial costs; three economic costs; and one predicted reduction in future public service costs.

Financial costs were derived from Sistema Scotland's Govanhill budgetary forecasts and were annualised. Economic costs (for office/accommodation, volunteer and schools) were based on discussion with the GCPH and the principle of opportunity cost of resource use, as follows:

- capital costs – this includes capital investment to make venues suitable for operation and to make venues suitable for storage and strategic costs for project initiation. In line with HM Treasury Green Book guidance for undertaking an economic analysis *in media res*, these are 'sunk costs' that have already been incurred and are irrevocable, and as such they have been given a value of zero at baseline.
- office and related accommodation costs – taking into account in-kind donation of the main site for Big Noise Govanhill this includes the opportunity cost of Forsyth House (i.e. the potential rental income that is forgone) and opportunity cost of spaces used within school venues. These were separated from operating costs because of future considerations of alternative sites for after-school orchestra element of intervention. This may increase the opportunity cost of community spaces – even if financial cost remains zero due to in-kind donation.
- operating costs – including resource costs such as staffing and direct programme costs. Excludes costs for 'once in a lifetime' trips and special events because specific fundraising is undertaken for these, distinct from general project running costs, and so they do not form part of the current evaluation.
- volunteer costs – comprising both financial expenses and economic cost. It is recognised that volunteers generally give their time because they gain utility from doing so, and that there are different perspectives about the rationale for presuming that the opportunity cost for the volunteer is loss of income as a result of choosing not to undertake paid work. The economic cost was determined using a shadow price for volunteer time as follows:

$$\text{Shadow price (volunteer time)} = \sum \text{volunteers} \times (\text{av.time p/wk} \times \text{p/volunteer} \times \text{NMW}^3)$$

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<sup>2</sup> Based on average time regular formal volunteers spent volunteering = average of 2.8 hours a week. [source: [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/314432/2012-2013-giving-time-and-money-report.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/314432/2012-2013-giving-time-and-money-report.pdf)]

<sup>3</sup> NMW (2013) = £6.31 per hour. [source: <https://www.gov.uk/government/news/national-minimum-wage-to-rise-from-1-october-2013>]

It is recognised that there are alternatives to using NMW such as the Glasgow City Council 'living wage' rate or the Scottish national average wage rate. The number of volunteers involved with Big Noise Govanhill was set at 24, and time spent was based on the average time regular formal volunteers spent volunteering = average of 2.8 hours a week<sup>4</sup>.

- translating costs – an overhead cost for translation and interpretation services, separated from operating (overhead) costs because of the significant challenges faced in Govanhill which has more than 50 languages spoken on a daily basis
- direct school costs – consideration was given to the economic cost of Big Noise Govanhill's partnership with schools, specifically the economic value of teacher and other school staff time spent on Big Noise activities. Consideration was given to opportunity costs for schools of teachers involved who might otherwise be engaged in other productive teaching activities. Big Noise Govanhill is delivered in classrooms during normal school operation, and so there is not a demand for additional inputs outwith the working day. In Scotland the Curriculum for Excellence opens up the curriculum for teachers to be more creative and innovative in the way they deliver learning opportunities for children and so it is unlikely that Big Noise Govanhill is displacing teaching activity. In addition, although individual schools may choose to scale back their use of peripatetic specialist music teachers for P1 and P2, it is not expected that there is a reduced demand for those specialist teachers in aggregate as a consequence of Big Noise Govanhill.
- Project close down costs – included as a category for completeness but valued at zero with the assumption that staff redundancy or redeployment liabilities are offset by the residual value of the assets.
- Society: 'avoided costs' – the Big Logic Model indicates that a long-term outcome (*Big Logic Model – Communities (long-term)*) could be reduced expenditure on social work support, possibly due to a combination of more effective contact and/or reduced need for contact which results in more appropriate and efficient service use and delivery. This would be particularly important if being involved in Big Noise could deliver increased trust and contact with services and agencies for hard to reach families. There is also a possibility of avoided costs to public services of antisocial behaviour should Big Noise Govanhill provide a focal point for positive activity and so result in a reduction of negative behaviours as a consequence of actively participating in Big Noise Govanhill, relative to counterfactual. Often both social work and justice involvement relate (at least initially) to conduct problems.

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<sup>4</sup>Source: [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/314432/2012-2013-giving-time-and-money-report.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/314432/2012-2013-giving-time-and-money-report.pdf)

Beecham et al (2011: p9) evaluated a school-based intervention that promotes social and emotional learning to prevent conduct problems in childhood and comment that “without [the intervention], approximately 46% of children have few conduct problems throughout their life-course; 24% have conduct problems in childhood that do not persist; 20% develop conduct problems in adolescence; and approximately 11% have life-course persistent conduct problems”. Applying the same proportions to the current study school population for counterfactual, it is assumed that Big Noise Govanhill is effective at impacting on the 11% of annual participants, preventing the development of lifecourse persistent conduct problems and avoiding the concurrent cost of anti-social behaviour.

## Benefits: measurement and valuation

Pathways of impact in education, society and health and wellbeing spheres have been identified using the Big Logic Model<sup>5</sup> (as it was, in draft format at June 2014). Logic models are useful to elicit key drivers and potential pathways of influence that an intervention may have and to inform perspectives about the timescales that evidence of impact, or no evidence of impact, should become available. Economic evaluation can inform this process by indicating what outcomes measures might be useful and whether they are directly measurable or, in absence of directly measurable outcome, what output measures could act as a proxy variable that allows for indirect monitoring of effectiveness. For the economic evaluation of Big Noise Govanhill, specific attention was paid to the outcomes in Table 1.

**Table 1. Big Logic Model outcomes considered in economic evaluation.**

Outcome	Logic model	Term
Improved employment outcomes	Communities	Medium
Improved engagement with education	Communities	Medium
Increased social skills	Children	Short
Stronger social support mechanisms	Children +families +communities	Long
Reduced expenditure on social work support	Communities	Long
Increased health and wellbeing	Children +communities	Short

<sup>5</sup> Big Logic Model (DRAFT) supplied to GCU by GCPH in June 2014.

Improved health outcomes	Children +families +communities	Long
Impact on health and premature death	Children +families	Long

From this, four benefit categories (income / education / society / health and wellbeing) were included and benefits were identified in discussion with the GCPH and consideration of relevant academic literature. All benefits have been forecast (i.e. predicted impact of the intervention) and, where possible, monetary values were identified using a benefits transfer approach, specifically drawing on wider research to identify reasonable values. The benefit categories were:

- Income – includes a proportion of Sistema Scotland’s charitable works income plus the economic value of concerts (always free of charge). Community-based orchestral concerts are a stated key output for Big Noise Govanhill and a focus of effort for the participants in the project. Concerts are free of charge. However there is a market value for leisure entertainment. The opportunity cost of attendance is valued at equivalence to purchasing a ticket for the cinema (industry average, 2013 prices). Over the course of a year an estimated 1,000 adults attend Big Noise Govanhill concerts.
- Education – consideration was given to the likely short- and medium-term pathways of impact that the Big Logic Model indicated for increased educational achievement and attainment. The underlying assumption is that the intervention has a positive impact from involvement in music/arts programmes. Specifically, two logic model outcomes were identified and explored to assign potential monetary values to the benefits:

*(1) Increased social skills: Logic model short-term outcomes (children).*

Specifically, increased social skills leading to medium and long-term employment outcomes and community behaviours. It is claimed that children who become involved in a musical group or ensemble learn important life skills, such as how to relate to others, how to work as a team and appreciate the rewards that come from working together, and the development of leadership skills and discipline (Pavlicevic *et al.*, 2009). The theory is that this ‘sense of belonging’ and improved team-working and cooperation skills then impact upon academic engagement and attainment, which thereafter influences employment outcomes and community behaviours such as voting, and so on.

*(2) Improved engagement with education: Logic model medium-term outcome (communities )*

Exposure to Big Noise Govanhill as a positive learning experience is assumed to lead to improved engagement with education. There is also an assumption that this should translate into improved post school destination and employment outcomes. Measurement by estimating the expected change in lifetime earnings caused by a change in the human capital variables of years of education completed and qualification level gained.

NOTE: The underlying assumption is that the intervention has a positive impact of involvement in music/arts programmes once controlled for general ability.

- Society – the value of living in a community with a Big Noise project, an increased level of aspiration amongst children and families, and with the (predicted) benefits of lower incidence of antisocial behaviour. However, there is a difficulty in valuing community life. No available measure could be identified and this benefit was not quantifiable for this study.
- Health and wellbeing – the value of better individual health outcomes is being measured using the proxy measure of increased utility (‘happiness/enjoyment’) of participation in Big Noise Govanhill. Leadbetter & O’Connor (2013) report that “there is consistent evidence that people who participate in culture and sport or attend cultural places or events are more likely to report that their health is good and they are satisfied with their life than those who do not participate. This finding remains true even when other factors such as age, economic status; income; area deprivation, education qualification, disability/or long standing illness and smoking are accounted for.” The value of better individual health outcomes is being measured using the proxy measure of increased utility (‘happiness/enjoyment’) of participation in Big Noise Govanhill. Fujiwara (2013: p27) reports that people value participation in the arts at about £1,500 per annum. This is comparable to the lower estimate of the economic value of participating in sport (£1,750) estimated by the CASE programme (DCMS, 2010). A second element was to seek to monetise predicted improved health outcomes, presuming full participation until age 18 resulted in a change in life-course trajectory that could close the gap in life expectancy (at birth) rates between Govanhill and Scotland. This would gain 5.5 years (presuming gained years are in full health) for males and 2.8 years for females. Assuming 50% male 50% female participants, an average QALY gain per participant of 4.15 years has been used in calculations, obtained at age 60.

It is worth highlighting that it was decided to exclude the following potential outcomes in order to avoid double-counting. Specifically:

Social and group cohesion is particularly relevant in Govanhill because perceived separation and marginalisation between immigrant populations is an issue, with different cultural group selections apparent within schools. Participation in organised music leads to social support opportunities – developing ‘social capital’ for individuals. This crosses over with both income

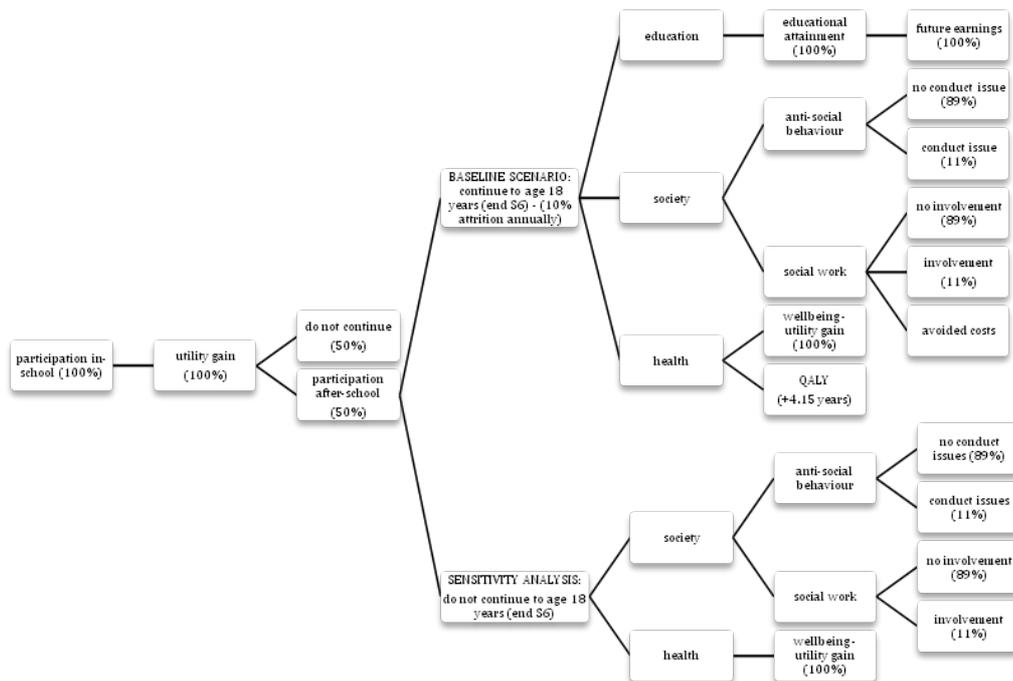
and education benefits above.

And

The value of avoided health care costs as a result of better public health outcomes. Specifically, if involvement in Big Noise Govanhill develops children’s resilience such that there are positive spill-over impacts on future ability to cope with life events, then there could be a resultant reduced demand for mental health services, reduced demand for treatment for cardiovascular disease, reduced alcohol-related hospital visits and drug-related hospital visits.

Figure 1 provides a mapping of the benefits outlined above that may be achieved by participants and indicates which benefits are accessible for those who continue to engage in Big Noise Govanhill until the end of S6, and which benefits are accessible for those who do not continue with Big Noise Govanhill.

**Figure 1: map of outcomes (%participants).**



## Model assumptions

Uncertainty about values has been a barrier during this study and in seeking to overcome this, expert opinion has been sought and the principle of considering whether a population effect is proportionate to the number of participants in Big Noise Govanhill applied.

The following assumptions underpin the economic model:

- presumption of the efficacy of the intervention to deliver the stated benefits such as improvements in cognitive development, behaviour and social competence, and educational attainment.
- presumption that claims for pathways of impact are reasonable.
- atrophy of impact from participation is assumed to be zero.
- magnitude of benefits is correlated with the degree of engagement of participants with Big Noise Govanhill.
- all participants experience an equal increase in utility from participation.
- baseline model assumes 50% conversion rate from in-school provision to after-school orchestra with 90% participation thereafter, year on year (i.e. 10% attrition).

Assumptions informing the monetisation of costs and benefits are as follows:

### Financial costs

The analysis assumes that Sistema Scotland will meet 100% of financial costs each year. Sensitivity analysis was conducted to determine the impact of a rise in financial costs to £1,000,000 per annum.

### Cost – society

A number of assumptions underlie the valuation of the ‘Cost – society’ aspect of the current evaluation. It has been necessary to make presumptions about the population involved in Big Noise Govanhill which are both highly stylised and generalised due to the (appropriate) absence of specific data about the children involved. CBAs such as Heckmann, *et al.* (2010) highlight the persistent difficulty of balancing the recognition of the significant costs to society of antisocial behaviours, particularly when that behaviour escalates into criminal behaviour, with a proportional assessment of both the likelihood of an intervention influencing an individual’s behaviour (because it may be more likely that it is a package of influences together that make a difference) and also the recognition of the potential rate of behaviour. In the case of Govanhill, the population has a high degree of flux as people move into and out of the area and is not clear which proportions of types of crimes are committed by people who have been in Govanhill for a long time, or have recently moved into Govanhill. It is also possible that the main influence for criminal activity is the systemic overcrowding in Govanhill and this is not something that it is possible or feasible for Big Noise Govanhill to influence.

As such, a general approach has been taken to monetising value. Beecham *et al.* (2011: p9) suggest that approximately 46% of children have few conduct problems, 24% have conduct problems in childhood that do not persist; 20% develop conduct problems in adolescence; and 11% of children have life-course persistent conduct problems. For the purposes of the CBA it was assumed that 11% of the children participating in Big Noise Govanhill could have life-course persistent problems. It was assumed that Big Noise is effective at impacting on this 11% of the children, delivering annual savings<sup>6</sup> (relative to counterfactual) from avoided antisocial behaviour. In addition, it was assumed that improved relations within and across the community as a result of involvement with Big Noise Govanhill could result in more effective interactions with Social Work services and that there could be a saving<sup>7</sup> (relative to counterfactual).

Costs of employability support were not included as this risks double counting with the inclusion of benefits of future salary resulting from achieving positive destinations.

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<sup>6</sup> Knapp M, Scott S, Davies J. (1999) “The cost of antisocial behaviour in younger children”. *Clinical Child Psychology & Psychiatry* 4:457–473 [NB. converted to 2013 prices]

<sup>7</sup> Scott & Knapp (2001)

### **Benefit – education**

Gains from increasing numbers of children moving on to positive destinations after school was calculated using the following assumptions:

- 20% lowest SIMD enter 86% positive destinations was assumed as proxy for Govanhill versus Glasgow City 89.2% versus Scotland 91.4%<sup>8</sup>. It was assumed that Big Noise Govanhill ‘closed the gap’ between Govanhill and Scotland (5.4%).
- positive destination “Highest qualification is an A Level or equivalent qualification (excluding apprenticeships)” – using average salary over lifetime<sup>9</sup> (marginal gain compared with National Minimum Wage, 2013)
- the movement of life-course trajectory due to involvement in Big Noise Govanhill is attainable as a result of involvement in Big Noise Govanhill until end S6 (age 18).

### **Benefit – health and wellbeing**

It was assumed that all participants in Big Noise Govanhill (in-school and after school) gained utility from participation. Benefits transfer was used (Fujiwara (2013) reported people value participation in the arts at about £1,500 per annum). It was assumed that utility gain ceases when an individual no longer participates in Big Noise.

For participants completing involvement with Big Noise Govanhill at age 18, it was assumed that there is a spillover effect from duration and intensity of the programme which delivers QALY (quality adjusted life years) – specifically, it generates health which ‘closes the gap’ between Govanhill and Scotland life expectancy rates (at birth). QALY gain begins at age 60 for 4.15 years.

### **Weighting for poverty**

No weighting of consumption benefits was undertaken.

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<sup>8</sup> Skills Development Scotland “School Leaver Destinations Initial Follow up 2012/13 – National”, p22.

<sup>9</sup> ONS Graduates in the labour market 2013 report, data worksheet 'pay progression'

## Detailed sensitivity analysis results

### SA1, SA2 and SA3: time horizons

Different time horizons for project appraisal periods have been calculated and reported at all stages.

SA1: 0-6y

SA2: 0-9y

SA3: 0-70y

### SA4: Participation

Attrition is unknown and has been exceptionally low in Raploch at less than 10% year-on-year and so the baseline model assumes 50% conversion rate from in-school provision to after-school orchestra with 90% participation thereafter, year-on-year (i.e. 10% attrition). It is the case that Govanhill is estimated to have up to 35% of people moving into and out of the area each year and so other rates were explored as part of sensitivity analysis to reflect the potential for percentage loss of participants from a cohort involved in the after-school programme, year-on-year as they progress through school/move out of the area.

Adjusting the underlying assumption about continuing after-school participation rates (baseline 90% continuing net participation, recognising that some children may drop out and reengage in later years), to test the range from 50% to 100% in ten percent increments, revealed a sharp drop-off in numbers of participants continuing until the end of S6.

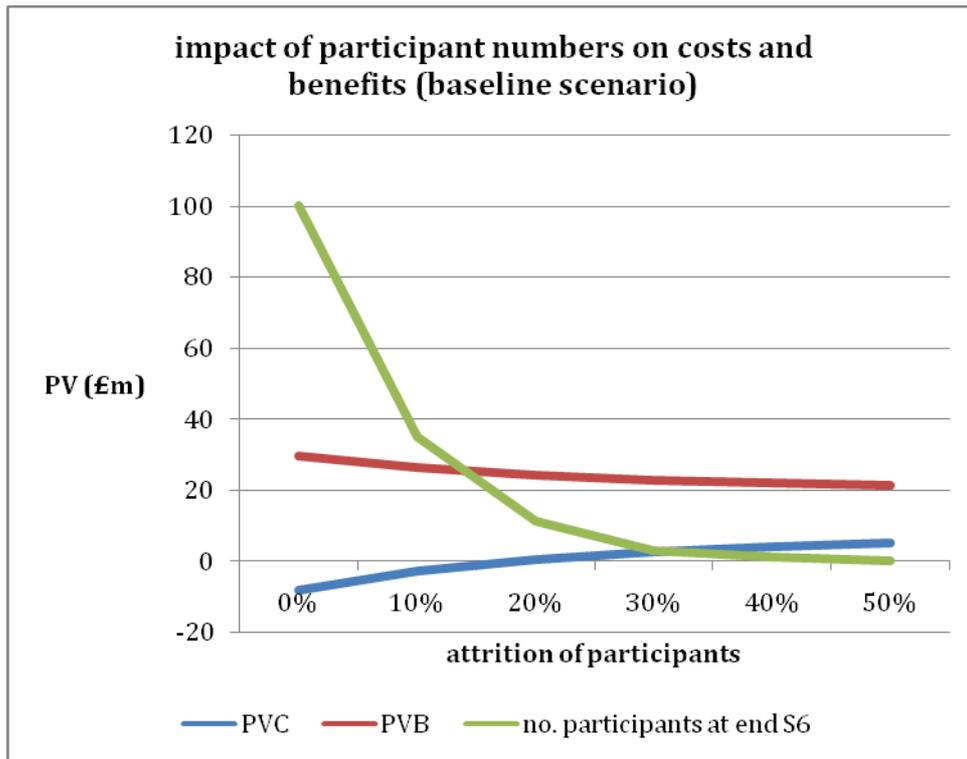
Sensitivity analysis results show that, assuming 50% of eligible children moving from P2 to P3 engaged with the after-school programme, if attrition thereafter reached 50% for the after-school orchestra delivery (possible given the high inflow and outflow of population in Govanhill each year) then there would be no child involved in Big Noise Govanhill beyond S3 (age 14) – see Table 7. This has implications in particular for the underlying assumption that it is only with full involvement until S6 that a participant will access QALY gain (B4) and educational attainment (measured as future income gain) (B2).

**Table 2. Sensitivity analysis: participation – results.**

stage	baseline (10%)	attrition rate				
		0%	20%	30%	40%	50%
P3	100	100	100	100	100	100
P4	90	100	80	70	60	50
P5	81	100	64	49	36	25
P6	73	100	51	34	22	13
P7	66	100	41	24	13	6
S1	59	100	33	17	8	3
S2	53	100	26	12	5	2
S3	48	100	21	8	3	1
S4	43	100	17	6	2	0
S5	39	100	13	4	1	0
S6	35	100	11	3	1	0
<b>TOTAL participants in after- school orchestras per year</b>	<b>687</b>	<b>1,100</b>	<b>457</b>	<b>327</b>	<b>251</b>	<b>200</b>

Attrition of participants is a significant risk to the project because economies of scale can only be achieved with large numbers of participants due to the high fixed costs of the project. Figure 2 shows that there is a steady decline in PVB as participant attrition rates increase and there is a narrowing of the gap between PVB and PVC as participation rates decline.

**Figure 2: Sensitivity analysis: attrition of participants – effect on PVC and PVB.**



The results of sensitivity analysis, varying the participation parameter, are at Table 3.

**Table 3. appraisal results adjusted for participation rates (after-school).**

<b>Participa tion</b>	<b>Attriti on</b>	<b>NPV</b>	<b>BCR</b>	<b>PVC</b>	<b>PVB</b>	<b>B1</b>	<b>B2</b>	<b>B3</b>	<b>B4</b>	<b>no. partici pants at end S6</b>
100%	0%	37.5 5	-3.68	-8.02	29.5 4	7.53	0.06	0.00	21.9 5	100
90%	10%	28.9 1	-9.07	-2.70	26.2 1	7.53	0.02	0.00	18.6 7	35
80%	20%	23.5 8	41.4 8	0.58	24.1 7	7.53	0.01	0.00	16.6 3	11
70%	30%	20.1 9	8.53	2.68	22.8 6	7.53	0.00	0.00	15.3 4	3
60%	40%	17.9 3	5.40	4.07	22.0 0	7.53	0.00	0.00	14.4 7	1
50%	50%	16.3 5	4.24	5.05	21.4 0	7.53	0.00	0.00	13.8 7	0

Given the largely fixed costs of Big Noise Govanhill this had the effect of dampening the potential NPV for lower levels of participation (range 16.35 to 37.55). This is in part driven by the assumption that social 'avoided costs' (C8) is only obtained while actively participating in Big Noise Govanhill, and that education impact (positive destination – B2) is only probable following full involvement until end S6.

## SA5: Programme costs

It has been difficult to extrapolate if there are threshold effects regarding capacity (such as physical space, number of musicians, impact of increasing numbers of children on possible staff working patterns) for Big Noise Govanhill given the newness of the project, and the limited experience of Raploch to date where it is only recently that Sistema Scotland are looking at alternative delivery options such as older children mentoring younger children. Sistema Scotland are clear that their emphasis is on 'cutting the cloth' as project's are reconfigured to gain most benefit for financial costs. This sensitivity analysis considered the impact of an annual financial cost of £1m per year from 2018-2019 (i.e. a 15% increase on current financial budget forecasting).

**Table 4. Sensitivity analysis: programme costs – results.**

	Baseline	SA1	SA2	SA3
	£m	£m	£m	£m
PV costs	-1.88	0.85	0.33	-6.35
PV benefits	26.21	9.94	15.54	79.89
NPV	28.09	9.09	15.22	86.24
BCR	-13.94	11.66	47.50	-12.59
participation (in-school)	600	600	600	600
participation (after)	686	410	570	686
timescale	0-15y	0-6y	0-9y	0-70y

Analysis revealed a small change in NPV at baseline. This is due to the effect of discounting.

## SA6: Direct school costs

This sensitivity test assumes that the opportunity cost is £500 per school (4), per calendar month (10.5 months) of school year, for staff time and in-kind provision of space.

(Total = £21,000 pa).

**Table 5. Sensitivity analysis: direct school costs – results.**

	Baseline	SA1	SA2	SA3
	£m	£m	£m	£m
PV costs	-2.45	0.87	0.13	-8.89
PV benefits	26.21	9.94	15.54	79.89
NPV	28.66	9.07	15.41	88.78
BCR	-10.68	11.43	115.66	-8.99
participation (in-school)	600	600	600	600
participation (after)	686	410	570	686
timescale	0-15y	0-6y	0-9y	0-70y

Analysis revealed a small change in NPV at baseline reflecting the small increase in project costs.

### SA7: Education – positive destination

This is one of the key expected pathways of impact for participants. Baseline calculated on average lifetime earnings marginal gain moving from ‘employed, no qualifications’ to ‘employed, GCSE-equivalent qualification’. Sensitivity analysis tested marginal gain from ‘employed, no qualifications’ to ‘employed, HE qualification’ (NB. this retains the baseline assumptions about participation and so counts 35 participants who have completed S6 and still been involved with Big Noise Govanhill each year from 2023-2024 (year 12)).

**Table 6. Sensitivity analysis: positive destination – results.**

	Baseline	SA1	SA2	SA3
	£m	£m	£m	£m
PV costs	-2.70	0.76	-0.03	-9.47
PV benefits	26.27	9.94	15.54	80.54
NPV	28.97	9.18	15.57	90.01
BCR	-9.72	13.06	-608.93	-8.50
participation (in-school)	600	600	600	600
participation (after)	686	410	570	686
timescale	0-15y	0-6y	0-9y	0-70y

Analysis revealed a small change in NPV at baseline. The dampening impact of the assumption that only involvement until end S6 gains benefit is evident.

## SA8: Benefit threshold assumption

The baseline assumption is that involvement is required until end S6 to achieve benefit, specifically life-course trajectory (education – revealed in positive destination) and health and wellbeing (QALY gain). Sensitivity analysis tested a change in threshold to seven years of involvement (P3 to S2).

**Table 7. Sensitivity analysis: benefits threshold – results.**

	Baseline	SA1	SA2	SA3
	£m	£m	£m	£m
PV costs	-2.70	0.76	-0.03	-9.47
PV benefits	26.28	9.94	15.57	84.79
NPV	28.98	9.18	15.59	94.26
BCR	-9.73	13.06	-609.84	-8.95
participation (in-school)	600	600	600	600
participation (after)	686	410	570	686
timescale	0-15y	0-6y	0-9y	0-70y

Analysis revealed a small change in NPV at baseline. However, as the appraisal period was extended to the lifetime horizon of 0-70 years, NPV increased. This indicates both the impact of thresholds assumptions and the challenge that public health projects have in measuring impacts that may emerge over a lifetime and so indicate inter-generational benefits.

However, caution is noted about the degree to which benefits that are claimed to be a result of the intervention can be causally attributed. For example, maturation of individuals could be presumptively allocated to Big Noise Govanhill when it may be that normal development and exogenous factors, or the impact of multiple interventions, are responsible or partially responsible for positive changes.

## SA9: Society – social work costs

Estimating avoided costs are exacerbated by the difficulty of measuring, or taking into account sufficiently, potential increased demand on other services. For example, if engagement with social work (C8) and other community services becomes more effective then this could result in increased pressure in the short-term on services as children and families in Govanhill become more confident to seek assistance and become more aware of the assistance that is available.

GCPH have suggested that social work costs in Govanhill are £10m per year and are 150% of those in Glasgow. This sensitivity test replaces the current estimates with a global figure of £3m per year (2013 prices) of avoided costs, impacting from year 12 when Big Noise Govanhill will be involving the full range of school stages (nursery to S6). Prices are assumed to increase in line with inflation.

**Table 8. Sensitivity analysis: resource reductions (social work) – results.**

	Baseline	SA1	SA2	SA3
	£m	£m	£m	£m
PV costs	-35.86	-13.09	-21.02	-89.60
PV benefits	26.21	9.94	15.54	79.89
NPV	62.07	23.03	36.56	169.50
BCR	-0.73	-0.76	-0.74	-0.89
participation (in-school)	600	600	600	600
participation (after)	686	410	570	686
timescale	0-15y	0-6y	0-9y	0-70y

Analysis revealed a large change in NPV at baseline, for each time horizon, resulting in negative PV costs at all time points.

## SA10: Society – avoided cost of offending

For key life-course groups such as children and young people, Big Noise Govanhill could act as a focal point for positive activity during adolescence, increasing the opportunity cost of engaging in risky behaviours and so leading to less negative behaviours among those involved.

Scotland has an imprisonment rate of 139 per 100,000 population<sup>10</sup> (0.00139%). Assuming participation rates of around 700 children in Big Noise Govanhill’s after-school programme, potentially one child could be imprisoned during their lifetime.

This sensitivity test adds the avoided cost of offending<sup>11</sup> of one child every seven years (given inflow is predicted to be 100 children per year into after-school programme), retaining the baseline assumption that Big Noise Govanhill may impact upon 11% of children who would otherwise have life-course persistent conduct problems.

**Table 9. Sensitivity analysis: resource reductions (justice) – results.**

	Baseline	SA1	SA2	SA3
	£m	£m	£m	£m
PV costs	-3.14	0.60	-0.29	-10.61
PV benefits	26.21	9.94	15.54	79.89
NPV	29.35	9.34	15.83	90.50
BCR	-8.34	16.46	-54.05	-7.53
participation (in-school)	600	600	600	600
participation (after)	686	410	570	686
timescale	0-15y	0-6y	0-9y	0-70y

Analysis revealed a change in NPV at baseline, for each time horizon, with more benefit realised in the longer term.

<sup>10</sup> Prison population rate of 139 (per 100,000 of national population), based on an estimated national population of 5.35 million at beginning of 2015 (from National Records of Scotland figures). Source: <http://www.prisonstudies.org/country/united-kingdom-scotland>.

<sup>11</sup> Lifetime cost of a young offender, from New Philanthropy Capital (February 2010) “Trial and Error: Children and Young People in Trouble with the Law, a guide for Charities and Funders.” Matthew va Poorvliet, Iano Joy and Camilla Nevill, reported in “Evaluation of Big Noise, Sistema Scotland” [available at: <http://www.scotland.gov.uk/Publications/2011/03/16082812/15>]

## SA11: Health and wellbeing – atrophy

The baseline model assumes that, with full involvement until the end of S6, the life-course trajectory of individuals will be changed and participants will gain QALY. This sensitivity analysis tests the effect of atrophy over time of intervention effects which would result in zero impact on life expectancy (and so zero QALYs).

**Table 10. Sensitivity analysis: atrophy of impact – results.**

	Baseline	SA1	SA2	SA3
	£m	£m	£m	£m
PV costs	-2.70	0.76	-0.03	-9.47
PV benefits	26.21	9.94	15.54	70.89
NPV	28.91	9.18	15.57	80.36
BCR	-9.70	13.06	-608.93	-7.48
participation (in-school)	600	600	600	600
participation (after)	686	410	570	686
timescale	0-15y	0-6y	0-9y	0-70y

Analysis shows a change at for SA3 (0-70y), as NPV is lowered due to the absence of long-term health benefit.