Sport NZ – wellbeing value methodology note

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1 Introduction

Simetrica has been commissioned by Sport NZ to produce wellbeing values for outcomes relevant to play, active recreation and sport interventions in New Zealand. This analysis provides insight on the value of the contribution that play, active recreation and sport has towards the wellbeing of all New Zealanders – ensuring full consistency with its Outcomes Framework. This, in turn, implies that the analysis is aligned with the wider NZ Treasury Living Standards Framework, which formed the basis for the Sport NZ Outcomes Framework.

This technical note sets out the theory behind wellbeing valuation, as well as the data and methodology used to derive values for Sport NZ. We then set out some guidelines for interpreting and using the values, and end with a short discussion of caveats. In addition to describing the general approach used to value all outcomes from data collected by Sport NZ, this note provides more detail on the following outcomes:

- Moderate and vigorous physical activity per week (30-150 minutes)[1]
- Moderate and vigorous physical activity per week (150-300 minutes)
- Moderate and vigorous physical activity per week (300+ minutes)
- Meeting physical activity guidelines (for youth and adults)
- Doing an individual activity (for adults)
- Doing a group activity (for adults)
- Weekly volunteering
- Sports club membership

The values for these outcomes and the activities included under 'group activity, individual activity, team sport and individual sport' can be found in Annex A.

[1] 1 minute of vigorous activity is assumed to be worth 2 minutes of moderate activity.

2 Wellbeing valuation

Wellbeing valuation is a well-established method in the field of social impact assessment. Grounded in extensive academic research (Dolan and Fujiwara, 2016), it is endorsed as a best-practice method for policy evaluation by many organisations internationally, including the OECD (2013) and the NZ Government, and the UK Government (Fujiwara and Campbell, 2011).

Wellbeing valuation (WV) estimates social impact in monetary terms. This acts as a 'common currency unit' to allow for cost-benefit analysis of various aspects of projects. Consequently, the financial impacts of the project can be reliably compared with social impacts. Using this in the cost-benefit analysis allows for impacts of different kinds to easily be summed up across outcomes, beneficiaries and stakeholders, or projects.

2.1 Valuation Theory

Given the objective of monetising the overall impact of outcomes on individuals, economic valuation prescribes looking at how individual utility changes as a result of experiencing outcomes. The monetary equivalent of this change can be measured as Equivalent Surplus (ES) or Compensating Surplus (CS). ES is the amount of additional income that the individual should be given, in absence of the outcome, to achieve the (higher) level of utility experienced in the presence of the outcome:

$$u_{it}(O^1, X_{it}, M_{it}) = u_{it}(O^0, X_{it}, M_{it} + ES_{it}) \tag{2.1}$$

Where u_{it} denotes the utility of individual i at time t, O refers to the outcome (with the superscript 0 denoting its absence and 1 its presence), M is income and X are other factors that affect utility besides income and the outcome. On the other hand, CS is the amount of income that would need to be taken away from an individual that benefits from the outcome to achieve the (lower) level of utility they would experience in absence of the outcome:

$$u_{it}(O^0, X_{it}, M_{it}) = u_{it}(O^1, X_{it}, M_{it} - CS_{it}) \tag{2.2}$$

Outcomes that have a positive change in wellbeing (welfare gain), the compensating surplus (or variation) corresponds to the willingness to pay (WTP) to undertake the outcome (hence, to experience the higher level of wellbeing associated with the outcome). Conversely, the equivalent surplus (or variation) corresponds to the willingness to accept (WTA) to stop experiencing an outcome (hence, to stop experiencing wellbeing associated with the outcome). Cost-benefit analysis usually measures positive changes in outcomes in terms of WTP using CS.

2.2 Wellbeing Valuation Approach

Wellbeing Valuation compares the change in wellbeing induced by an outcome (or any other non-market good for that matter) with the change in wellbeing induced by income. It estimates the value of the non-market good as the marginal rate of substitution (MRS) between income and the good itself, expressed in monetary terms.

In practice, wellbeing is usually measured in terms of life satisfaction, which represents "the closest measure to the economist's notion of utility" (Fujiwara and Campbell, 2011). Life satisfaction questions are commonly found in national statistics. For example, the British Household Panel Survey asks respondents how satisfied they feel with their lives on a scale from 1 (not at all satisfied) to 7 (completely satisfied). Similar questions can be found in Active NZ and Active NZ Young People.

Regression analysis is used to estimate wellbeing as a function of the outcome (O), income (M) and other factors (X).The logarithmic transformation of income allows for diminishing returns of income on wellbeing – implying that the wellbeing impact of income is higher for those on lower incomes:

$$WB_{it} = \alpha + \beta_1 ln(M_{it}) + \beta_2 O_{it} + \beta_3 X_{it} + \varepsilon_{it} \qquad (2.3)$$

Combining equation 2.2 with the empirical wellbeing function in equation 2.3 yields:

$$\alpha + \beta_1 ln(M_{it}) + \beta_2 O_{it}^0 + \beta_3 X_{it} + \varepsilon_{it} = \alpha + \beta_1 ln(M_{it} - CS_{it}) + \beta_2 O_{it}^1 + \beta_3 X_{it} + \varepsilon_{it} \qquad (2.4)$$

It is possible to solve equation 2.4 for CS, which represents the monetary equivalent of the impact of an outcome on individual wellbeing:

$$CS_{it} = M_{it}\left[1 - e^{-\left(\frac{\beta_2(O^1 - O^0)}{\beta_1}\right)}\right] \qquad (2.5)$$

One difficulty the WV approach faces is accurately estimating the income coefficient (β_1). Fujiwara (2013) suggests using a three-stage wellbeing valuation strategy to produce robust estimates that are consistent with economic theory and can be used for cost-benefit analysis. This valuation strategy represents the latest development in WV methodology, in line with the UK's *HM Treasury Green Book* recommendations (2018) and the OECD's guidance on wellbeing (2013).

The three-stage valuation approach involves estimating two separate models for wellbeing: one for the impact of income and one for the impact of the outcome considered.

Stage I: Income Model

$$WB_{it} = f(ln(M_{it})) \qquad (2.6)$$

Stage II: Outcome Model

$$WB_{it} = g(P_{it}) \qquad (2.7)$$

The compensating surplus (willingness to pay) is then calculated using total derivatives from stages I and II.

Stage III: Monetary Equivalent Value

$$CS = M\left[1 - e^{-\left(\frac{g'_O(O^1 - O^0)}{f'_{ln(M_{it})}}\right)}\right] \qquad (2.8)$$

Empirically, the values of g'_P and $f'_{ln(M_{it})}$ in equation 2.8 are given by regression coefficients estimated in stages I and II. What distinguishes this strategy from the previous WV approach described in equation 2.5 is the fact that here the regression coefficients come from two different models rather than from a single one. Instead of β_1 we now use the impact of income estimated in stage I, and instead of β_2 we now use the impact of the outcome estimated in stage II, and M is the average household income in the sample.

3 Data and Methodology

3.1 Data sources

The wellbeing values produced for Sport NZ are derived from the following two sources:

- Active NZ, a pooled cross-sectional dataset collected by Sport New Zealand in 2017 and 2018, containing 52,188 observations of adults aged 18+.
- Young People Active NZ, a pooled cross-sectional dataset collected by Sport New Zealand in 2017 and 2018 containing 11,599 observations of young people aged 5-17.

3.2 Life Satisfaction measures

To estimate the wellbeing as described in equation 2.3, we used life satisfaction as our measure of wellbeing in line with the OECD Guidelines on Measuring Subjective Well-being (OECD, 2013). More specifically, we used question 68 from Active NZ, that asked: *"How do you feel about your life as a whole? Please answer on a scale where zero is completely dissatisfied and ten is completely satisfied"*.

The complementary question in Active NZ Young People is question 48: *On a scale from 1 to 10, where 1 is very unhappy and 10 is very happy, in general how happy are you?"*. In the absence of a question about life satisfaction directly, this happiness question is used to estimate wellbeing for the values derived from Active NZ Young People. This is important to account for when using the Adult and Youth values together, which are broadly comparable but not derived from the exact same wellbeing measure.

3.3 Main outcomes

The main outcomes in our analysis derived from Active NZ data include, but are not limited to:

- Moderate[2] + vigorous[3] physical activity per week (30-150 minutes)
- Moderate + vigorous physical activity per week (150-300 minutes)
- Moderate + vigorous physical activity per week (300+ minutes)
- Meeting physical activity guidelines[4]
- Doing individual activity weekly[5]
- Doing group activity weekly
- Weekly volunteering

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[2] Moderate activity is 'any activity that caused a slight, but noticeable, increase in breath'. One could still have a conversation while doing this activity.

[3] Vigorous activity is 'any activity that had you out of breath'. One could not have a conversation while doing this activity.

[4] The New Zealand Physical Activity Guidelines outline the minimum levels of physical activity required to gain health benefits, the guidelines recommend that:

- Adults do at least 30 mins of moderate or 15 mins vigorous activity, at least 5 days a week.
- Young people and children (5-17) years do at least 1 hour a day of moderate to vigorous physical activity (incorporating vigorous physical activities and activities that strengthen muscles and bones, at least 3 days a week)

[5] See Appendix for definition of group and individual activity.

- Sports club membership

The main outcomes in our analysis derived from Active NZ Young People data include, but are not limited to:

- Meeting physical activity guidelines

3.4 Control variables

Each regression model includes control variables that account for some of the main determinants of life satisfaction as set out in Fujiwara and Campbell (2011). The controls used in all of the regressions are as follows:

- Age
- Gender
- Income
- Employment status
- Number of children
- Highest qualification
- Ethnicity
- Deprivation
- Smoker
- Region
- Survey wave

Housing satisfaction, marital status, social connections, religion, carer status, living in an urban or rural area, and personality traits – typical control variables used by the wellbeing literature - were not present in the data and so were omitted. These variables were accounted for using an adjustment explained in section 3.8. Furthermore, health was omitted, as it is an important vehicle through which sport affects wellbeing. Controlling for health would lead to an underestimation of the true impact of sport. Smoking was included as a control, to account for the potential difference in wellbeing impacts of sport for smokers and from non-smokers.

3.5 Regression models used

We estimate the income coefficient of Stage I (β_1), as displayed in equation 2.6, by regressing wellbeing on income and the standard control variables (see section 3.4) for New Zealand data. Stage II coefficients are also derived from a separate regression for each outcome using Active NZ and Active NZ Young People. These coefficients are derived using the life satisfaction variables and outcome variables available in the data (see section 3.1-3.3).

All estimations in this study have undergone rigorous diagnostic and specification tests. Unless explicitly stated otherwise, all estimations were derived from cross-sectional OLS regression analysis with heteroskedasticity-robust standard errors.

3.6 Splits across demographic groups

The models described thus far only study the value of outcomes estimated using the entire sample. However, to account for heterogeneous treatment effects and get a clearer picture of the wellbeing value of outcomes for specific target demographics, we included models with interaction terms between outcomes and demographic characteristics. Consequently, we can compare the effect of, for example, physical activity on females to the effect of the same outcome on males. The interpretation of the interaction term is then the wellbeing benefit of the outcome for the interacted group (e.g. male) if it is statistically different from the other groups (e.g. female). These *splits* provide a clearer picture of how projects affect separate demographic groups differently.

It was not possible to split the values by more than two demographic groups (e.g. simultaneously understanding the how value varies according to age, region, and deprivation) due to sample size issues. As a result, we separately analysed heterogeneous treatment effects for gender, two measures of deprivation (one based on the NZDep index income,[6] and the other derived from income[7]), age, and ethnicity to be able to prioritise the right splits. For each outcome, we ran five additional regressions which interacted the demographic group with the outcome. Gender and income deprivation produced the highest proportion of significant interactive terms. As a result, we produced separate values by gender and levels of socio-economic deprivation. Another interaction term is added to be able to investigate the intersection between the two splits. This allows for analysing the effect of a given outcome on, for example, someone who is both male *and* deprived, as well as on the other three possible combinations of the splits.

We only used interaction terms which were statistically significant and covered more than a hundred observations in the dataset. In the absence of this, the coefficient for the outcome derived using the whole sample was used. When these two conditions are satisfied, however, a coefficient is used for the split. These values were bounded to ensure that they do not deviate too much from the full sample valuations, which are the least prone to bias. The upper bound was calculated as an average of the distances between the upper bound of the 90% confidence interval and the central estimate for all full-sample estimations. The full sample values are the least likely to be affected by statistical outlier observations, and so provide a more robust basis for the upper bound. This provides us with an estimate for the average upper bound for the 90% confidence interval and is consequently used as an upper bound for the splits. The lower bound is set to 0, as in the worst case, there is no effect, making 0 the lowest a coefficient can go.

3.7 Adjustments to the income coefficient

We have estimated an income coefficient (β_1 in equation 2.5) from New Zealand data rather than using the UK-based income coefficient presented in the literature, to approximate the true New Zealand income coefficient as closely as possible. To increase robustness, we have applied a transformation to the income coefficient, to account for some of the data constraints we faced in the New Zealand data.

Firstly, as the New Zealand estimate of β_1 relies on an OLS model, it is likely that it is biased downwards. If unresolved for, this would result in higher valuations (see equation 2.5). As reported by the wider wellbeing valuation literature (Fujiwara 2013), the sources of this bias are:

- Simultaneity – being more satisfied with one's life can lead to higher earnings, whilst higher earnings can also lead to higher life satisfaction

[6] Defined as equivalised household income being below the 15th percentile of the income distribution in a given year. This threshold was selected to correspond with the poverty line definition used in the New Zealand's geographic area-based deprivation index, NZDep 2015

[7] https://www.otago.ac.nz/wellington/departments/publichealth/research/hirp/otago020194.html

- Omitted variable bias – other factors which we are not able to control for which are correlated with income and life satisfaction
- Measurement error – responses to the income question will not always be correct.

We measure the extent of this bias by comparing the causal estimate of β_2 derived in Fujiwara (2013) to an OLS regression which uses the same data. We find that the causal estimate is 14.9 times the OLS estimate, and so scale the NZ OLS coefficient accordingly. This is founded on the assumption that the factors that bias the income coefficient in an OLS model of life satisfaction do not differ materially between the New Zealand and UK populations. This approach has shown to have been robust using Australian data and ensures that wellbeing values are conservative.

Secondly, as Active NZ and Active NZ Young People do not contain continuous income variables, and we account for this by applying a transformation on the coefficient estimated using income bands. This transformation is based on the ratio of two similar regressions run with UK data: the first regresses life satisfaction on the standard controls and a continuous income variable derived from income bands, and the second does the same except for using a continuous income variable directly stated by the respondent. By taking the ratio of the two, we approximate the impact that deriving a continuous income variable from income bands has on the income coefficient, and we adjust our income coefficient for New Zealand accordingly.

3.8 Adjustments to outcome coefficients

In light of the data constraints mentioned in section 3.7, we also applied a post-estimation adjustment to the outcome coefficients to increase the robustness of the estimates. In the absence of panel data, important time-invariant effects such as personality and genetics, are not corrected for in the model. The same applies to some of the controls recommended by the literature (Fujiwara and Campbell 2011). The adjustment is derived from UK data using two types of models: (i) a fixed effects regression of life satisfaction on the outcome of interest and all control variables recommended in the literature (see section 3.4), and (ii) an OLS regression of life satisfaction on the outcome of interest using the same controls as used for the analysis of New Zealand data. The controls added to the FE model but absent from the OLS model are:

- Marital status
- Religion
- Carer status
- Urban vs. rural
- House owned
- Wants to move house

By estimating similar models with UK data, we calculate a ratio between a fixed-effects model with extra controls and an OLS model that is just like the model used for the analysis on New Zealand data. This way, we have an estimation of the magnitude of the bias that follows from the absence of panel data. We multiply the coefficient obtained by the OLS regressions using data from New Zealand with this coefficient, to estimate the unbiased segment of the coefficient. The impacts of these adjustments have been cross-checked with the regression results of a similar analysis using UK data, to verify the robustness of the results. Similar to the assumption made in section

3.7 above, we assume that the factors that bias the outcomes coefficient in an OLS model of life satisfaction do not differ materially between the New Zealand and UK populations.

3.9 Reference income used

To estimate the wellbeing values, we used the New Zealand adult minimum wage, this value corresponds to M in equation 2.8. This figure, $39,312 NZ Dollars, is provided by Employment New Zealand[8]. New Zealand minimum wage was used to estimate the values to ensure that the estimates are conservative.

[8] Employment New Zealand, Current minimum wages rates. Current minimum wage rates » Employment New Zealand

4 Interpretation and instructions for use

The theory and model specifications explained above provide insight into how the values are to be interpreted and used. Further key points include:

- The values are per person per year and represent the average impact for that outcome definition and sub-group (where relevant).
- The values represent the experienced wellbeing benefits of the outcomes.
- These can be applied to any intervention in New Zealand which impacts on the outcomes which have been valued.
- The values can be broadly be interpreted as an annual willingness to pay (WTP) and therefore can be applied to beneficiaries in cost-benefit analysis (CBA) where robust estimates of impact on outcomes have been derived.
- To minimise double counting when multiple outcomes apply to the same individual, we make two assumptions. First, we assume that outcomes are independently distributed, and second, we assume that, for certain combinations of outcomes, the impacts are non-additive. The independence assumption means that the likelihood of achieving one outcome is not affected by whether an individual has achieved the other outcome. The non-additive assumption implies that if an individual achieves both, the overall wellbeing impact is only equivalent to the more valuable outcome. As a result, we recommend using the most valuable outcome when an individual has achieved multiple outcomes.
- The only exceptions are the group and individual activity values. These values are calculated in the same regression and therefore can be applied to the same beneficiaries.

5 Caveats

These values have been designed to provide a measure of the value created by play, active recreation and sport interventions in New Zealand. They will form the basis for a tool which automates the valuation process based on entered information on interventions. Inputting accurate and complete data will increase precision of the value estimates produced by interventions.

However, even with the most accurate and complete input data, the comprehensiveness of the result may be limited by the selection of outcomes and the level of detail allowed by the tool – both of which have been selected so as to ensure balance between the accuracy of results and the user-friendliness of the tool.

Furthermore, the wellbeing values are for an average beneficiary (for example, the average value of gaining employment), which is not necessarily representative of the value experienced by any individual beneficiary (in the same way that the average height of a group of people may be different from the actual height of any individual member of that group). However, the more beneficiaries an intervention has, the more likely it is that the total social value will be a close approximation of the sum of values across all beneficiaries.

Finally, the wellbeing values can never be precise causal estimates of impact. The best way to ascertain the causality of the estimates would be to conduct a series of randomised experiments, one for each of the outcomes valued. In most cases this would not be practical due to difficulties in implementing randomisation and the best available option is to conduct quasi-experimental analysis. Such approaches require that we estimate the impacts associated with a given outcome (e.g. increase in wellbeing associated with moving from worklessness to employment) while controlling for a wide range of characteristics known to affect wellbeing (such as age, gender, income, etc.). We have employed the most rigorous quasi-experimental study based on available data to produce these values.

6 Annex A: Values

Outcome	Units	Annual Wellbeing value
Adult outcomes		
Moderate to vigorous physical activity per week (30-150 minutes) *	Category	$573
Moderate to vigorous physical activity per week (150-300 minutes) *	Category	$1,271
Moderate to vigorous physical activity per week (300+ minutes) *	Category	$2,113
Regular volunteering (weekly)	Binary	$562
Sports club membership**	Binary	$817
Individual activity (weekly)**	Binary	$926
Group activity (weekly)**	Binary	$715
Physically active at MOH guidelines	Binary	$1,312

Youth Outcomes		
Young People's PA (meeting guidelines) Leisure PA / guidelines	Binary	$921

* Compared to individuals that do less than 30 minutes of moderate activity per week; 1 minute of vigorous activity is assumed to be worth two minutes hours of moderate activity and the minutes in the outcome description reflect the amount of equivalent moderate activity.

** Values for Sports club membership, Individual activity (weekly) and Group activity (weekly) are derived from the same regression which also controls for physical activity.

6.1 Activities included in subjective wellbeing value variables

Individual activity: running, individual workout swimming, road cycling, mountain biking, bmx, tramping, mountaineering, canoeing, kayaking, surfing, body boarding, triathlon duathlons, athletics, gymnastics, horse riding, gym, paddle boarding, roller skating, water skiing, wake boarding, rock climbing, weight training, skateboarding, hiking tramping, orienteering, marine fishing, freshwater fishing, surfing body boarding, surf life saving, skiing, snowboarding, hunting, shooting, motorcycling, overnight tramp, gardening, exercising, motocross, archery, darts, motorsports, mountaineering, snorkelling, diving, fishing, yoga, pilates, walking

Group activity: football, rugby, touch rugby, rugby league, netball, basketball, cricket, hockey, softball, volleyball, kapa haka, ultimate frisbee, adventure racing, indoor bowls, outdoor bowls, rowing, yachting sailing, waka ama, playing games (with children), interacting with dog, croquet, scuba diving, petanque, tae kwon do, aikido, jiu jitsu, martial arts, karate, group fitness, aquafit, tennis, table tennis, badminton, squash, golf, boxing.

Activities were grouped by Sport NZ according to how people predominantly participate in them (e.g. people can participate in football on their own, but typically participate with others).

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