what works wellbeing

the relationship between engagement in sport or physical activity and subjective wellbeing among young healthy adults

secondary analysis

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This report explores the relationship between subjective wellbeing (SWB) and participation in sport or physical activity among healthy people aged 16 to 25. This relationship is studied by analysing data from four large samples: 1) a UK sample from the British Household Panel Survey and Understanding Society; 2) an English sample from the Active People Survey and the Taking Part survey; 3) a European sample of residents in Berlin, London and Paris from a study conducted at the London School of Economics; and 4) an American sample from the American Time Use Survey. Overall, the analysis reveals positive associations with various measures of SWB. In particular, the young, healthy adults who do sport or physical activity are usually more satisfied with their life, happier on the whole, and also find their life more worthwhile, especially if they exercise on a weekly basis. Moreover, they normally feel happier, less stressed, and a greater sense of purpose during sport or physical activity, compared to how they feel on average during other daily activities. It is further observed, however, that life satisfaction does not vary as people increase or decrease their participation over time, while moving from exercise to other activities during a typical day (and vice versa) is strongly linked to changes in mood. These findings indicate that sport and physical activity have little direct impact on how people feel overall, but they can significantly affect how they feel moment to moment. Implications for sporting policies are delineated.

Index

Executive summary

This report considers the relationship between subjective wellbeing (SWB) and engagement in sport or physical activity amongst healthy people aged 16 to 25. Previous studies have shown positive associations with evaluative measures of SWB (such as life satisfaction), but they have rarely focused on young, healthy populations. Moreover, there has been limited investigation of experience-based measures of SWB (how people feel during exercise).

This report fills these gaps by analysing four types of data: 1) a UK sample from the British Household Panel Survey and Understanding Society, to study life satisfaction; 2) an English sample from the Active People Survey and Taking Part, to study a range of evaluative measures of SWB; 3) a European sample of residents in Berlin, London and Paris from the LSE "Going for Gold" Study, to examine both evaluative and experiential measures; and 4) an American sample from the American Time Use Survey, to investigate experiential measures. All three samples are limited to healthy people aged 16 to 25. The analysis estimates associations by comparing SWB among those who do and do not participate in sport or physical activity. In addition, longitudinal analysis is performed on the largest samples (the UK and the American ones) by monitoring SWB upon changes in participation within person over time, so as to better infer causality.

From the English sample, positive associations with general happiness and life worthwhileness emerge among those who exercise at least once a week. Using 0-10 scales, the estimated increments in these measures linked to sport or physical activity are 0.17 and 0.18, respectively. (To place these number in context, the estimated differences in general happiness and life worthwhileness between the employed and the unemployed are 0.29 and 0.24, respectively).

Positive associations with evaluative SWB are also found in the European sample. On average, those who take part in sport or physical activity report being more satisfied with their life, being overall happier on a daily basis, and finding their life more worthwhile. On 0-10 scales, the estimated increments are 0.46, 0.39 and 0.57, respectively (while the differences in the same measures between the employed and the unemployed are 0.97, 0.50 and 0.67, respectively). Stronger associations are recorded for the young, healthy Europeans who take part in sport or physical activity on a weekly basis (0.56, 0.47 and 0.67, respectively).

The analysis of the UK sample shows a positive relationship between exercise and life satisfaction. The increment is estimated to be 0.18, using the same 0-10 scale (while the difference in life satisfaction between the employed and the unemployed is 0.48). Once again, the strongest association is found for the young, healthy adults who participate in sport or physical activity at least once a week (0.20). In spite of these results, the longitudinal analysis of the UK sample reveals that changes in participation over time do not predict changes in life satisfaction.

The analysis of the experience reports of the European sample reveals positive associations with experienced SWB. Specifically, people experience more happiness and more purpose during sport or physical activity as compared to how they feel when they spend their time in other ways. On 0-10 scales, the estimated increases in these measures linked to experiences of

exercise are 1.12 and 1.27, respectively (while the differences in experienced SWB between the employed and the unemployed is only significant for purpose: 0.59).

Positive relationships to experienced SWB are also found in the American sample. Young, healthy Americans feel happier, less stressed and a greater sense of meaning when they do sport or physical activity as opposed to when they perform other activities. On 0-10 scales, the estimated changes in these measures associated with exercising are 0.77, -0.40 1.27, respectively (while the difference in experienced SWB between the employed and the unemployed is 0.33 for experienced stressed, and insignificant for the other measures). In addition, from the longitudinal study of the American sample, it emerges that experiential SWB varies following shifts from experiences of exercise to other experiences within the same day, and vie versa. Interestingly, changes in experienced happiness are larger when people switch from exercising to other activities (-1.26) than vice versa (0.77), whereas changes in experienced meaning are similar in both cases (-1.84 and 1.82, respectively).

Bearing in mind the differences among samples, the above findings suggest that the measure matters in establishing what works for wellbeing among young, healthy adults. Although always positive, the associations between evaluative SWB and engagement in sport or physical activity are systematically weaker than those estimated with experience-based SWB. Moreover, the results of the longitudinal study cast doubts on the causal impact of exercising on evaluative SWB. In contrast, taking part in sport or physical activity seems to have direct repercussions on experienced SWB. Policymakers should properly consider these findings when designing interventions to improve SWB among young, healthy adults. Future research should better appraise causality via randomised control trials.

1. Introduction

Promoting participation in sport and physical activity has become a chief policy goal in the UK, in view of improving health and wellbeing throughout the population. In 2015, the Government launched *Sporting Future*, an initiative to leverage and support participation in the country, with particular attention to socio-demographic groups that have been traditionally less likely to participate.[1] In parallel, Sport England has recently committed to work on raising the number of citizens that play sport and exercise by 2021, through its *Towards an Active Nation* strategy.[2]

Young adults are one of the main targets of current sporting policies. As per the figures laid out by Sport England, 55% of people aged 16 to 25 took part in sport or physical activity on a weekly basis in England in 2016 (about 3.8 million people). Although this number has slightly increased compared to the year before, the trend has been declining on the whole over the last decade, after reaching a peak of 58% in 2008.[3] These statistics call for interventions as to get more young people to exercise.

The aim of this report is to advise on how engagement in sport and physical activity is related to wellbeing among people aged 16 to 25. In particular, the report focuses on the population of young, *healthy* adults, so as to shed light on how sport and physical activity are related to wellbeing regardless of their health benefits.

In this report, wellbeing is understood as subjective wellbeing (SWB), in the wake of recent developments in academic research and policy practices. SWB is an account that conceives individual wellbeing in terms of mental states and feelings (see Dolan et al., 2011; Kahneman et al., 1997). Depending on their type, mental states and feelings can be classified as either hedonic (e.g., happiness, anxiety) or eudemonic (e.g., worthwhileness, meaning, futility).

Building on previous research (for a review, see the Appendix), this report presents new evidence on the association between SWB and exercise among healthy adults aged 16-25. The evidence comes from the analysis of large datasets, covering samples of young, healthy people from the UK, Europe and the United States. It is important to note that the data are observational in nature, whereby care should be taken when interpreting the causal nature of the observed relationships. Nonetheless, the analysis is conducted so as to get at causality as close as it can be done in observational studies.

The analysis is conducted with three research questions in mind.

1. **How is engagement in sport or physical activity related to *evaluative* SWB among young, healthy adults?**

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/590578/Sporting_Future_-_first_annual_report_final.pdf
[2] https://www.sportengland.org/media/10629/sport-england-towards-an-active-nation.pdf
[3] See technical reports at https://www.sportengland.org/news-and-features/news/2016/december/8/record-numbers-of-women-getting-active/

Evaluative measures of SWB consist of people's summary assessments of how they feel overall. These measures are normally collected by having people answer questions eliciting such summary evaluations. Examples of evaluative measures of SWB include: life satisfaction (*Overall, how satisfied are you with your life nowadays?*), which is deemed to capture both hedonic and eudemonic aspects of SWB (e.g., Layard, 2011); general happiness (*How happy are you these days, all things considered?*), which is meant to capture hedonic aspects (e.g., Waldron, 2010); and worthwhileness of life (*How worthwhile are the things that you do in your life?*), which captures eudemonic aspects. Evaluative measures can also assess how people feel overall on a daily basis (e.g., *How happy/anxious did you feel yesterday/do you feel today?*). The measures of SWB used in the Annual Population Survey by the UK Office for National Statistics are all instances of evaluative SWB.

Assessing the relationship between evaluative SWB and engagement in sport or physical activity means comparing SWB among people who exercise and people who do not exercise. Previous research has extensively investigated these associations, but it did not focus on young, healthy populations. Moreover, it left unclear how different frequencies of participation in sport or physical activity are related to evaluative SWB. This report will shed light on this aspect.

2. **How is engagement in sport or physical activity related to *experiential* SWB among young, healthy adults?**

Experiential measures of SWB capture how people feel over time based on what they are doing moment to moment (i.e., the flow of feelings; Dolan, 2014). Measuring experience-based SWB requires a direct assessment of people's experiences, which normally involves asking them to report how they spend their time and how they feel meanwhile (ideally, capturing both hedonic and eudemonic aspects of SWB). The most widely used techniques for assessing experiential SWB are: ecological momentary assessment (Shiffmann et al., 2008), which requires people to write a diary of their daily activities and their associated feelings over a period of time; experience sampling (Stone et al., 1999), which involves asking people to report what they are doing and how they are feeling at random moments in a day; and day reconstruction (DRM; Kahneman et al., 2004), which requires people to divide a given day into episodes and to state how they felt in each.

Assessing the relationship between experiential SWB and engagement in sport or physical activity entails gauging how people feel during exercise as opposed to how they feel when they spend their time in other activities. Previous research sparsely investigated associations with experience-based SWB, even less so for young, healthy adults specifically. This report seeks to fill this important gap.

3. **Which are the socio-demographic correlates of engagement in sport and physical activity among young, healthy people?**

Different socio-demographic groups within the population of young, healthy people might exhibit different tendencies to participate in sport or physical activity. This issue is worth exploring so as to understand which groups are more likely to engage

therein, and identify groups to whom potential policy interventions should be addressed. Previous research did explore some of the socio-demographic correlates of engagement, but it overlooked important ones (such as employment status and income). Moreover, it merely focused on the correlates of overall participation, without discerning how socio-demographic background influences frequency of participation. This report will attempt to clarify this.

The following section describes the data and methodology used for the analysis (2). Next, the results are presented (3) and discussed in terms of their policy implications (4). Limitations of the present analysis and avenues for future research are delineated in the final section (5). An Appendix follows at the end, with a review of the relevant literature, a description of the data sources, the analysis outputs and references.

2. Methodology

2.1. Data

The analysis is conducted on four samples, obtained by using data from six sources.[4]

1. A **UK sample**, taken from the British Household Panel Survey (Waves 1996-97, 1998-99, 2000-01, 2002-03, 2004-05, 2006-07, 2008-09) and Understanding Society (Waves 2010, 2013).
2. An **English sample**, taken from the Active People Survey (2010-11, 2011-12) and the Taking Part survey (Waves 2013-14, 2014-15, 2015-16).
3. A **European sample** of residents in Berlin, London and Paris, taken from the LSE 'Going for Gold' study (Waves 2011, 2012, 2013).
4. An **American sample**, taken from the American Time Use Survey (Waves 2010, 2012, 2013).

All samples contain observations over multiple time periods (panels) for at least some respondents. The table below summarises the characteristics of each sample.[5]

Sample	Size	SWB measures	Sport or physical activity
UK sample	20,792 observations 12,474 respondents 4,658 panels (over different years	Evaluative SWB: • Life satisfaction	17,274 observations: • 4,772 less than weekly • 12,502 weekly or more
English sample	5,798 observations 5,462 respondents 243 panels	Evaluative SWB: • Life satisfaction • General happiness • Daily anxiety • Life worthwhileness	3,920 observations: • 591 less than weekly • 3,329 weekly or more
European sample	2,664 observations 2,124 respondents 435 panels	Evaluative SWB: • Life satisfaction • Daily happiness • Daily anxiety • Life worthwhileness Experiential SWB: • Experienced happiness • Experienced anxiety • Experienced purpose	2,454 observations: • 771 less than weekly • 1,683 weekly or more 97 experience reports
American sample	9,324 observations 3,143 people 3,135 panels	Experiential SWB: • Experienced happiness • Experienced stress • Experienced meaning	191 experience reports

[4] The data sources have been chosen based on the quality and quantity of the available data. Some sources, such as other waves of the Active People Survey, Taking Part or Understanding Society, have been excluded because they do not capture SWB or engagement in sport or physical activity, or have too many missing observations on socio-demographic controls.

[5] The table entries refer to: the size of each sample (total number of observations, total number of respondents, and number of respondents with at least two observations); the SWB measures considered for each sample (distinguished based on whether they are evaluative or experiential); and the number of observations relevant to engagement in sport or physical activity in each sample (distinguished based on whether they are people or.

All samples are limited to people aged 16 to 25 who are healthy, where health is measured according to respondents' self-assessment. All measures of SWB considered are on a 0-10 scale. See the Appendix for further details on the data sources and on how SWB, participation in sport or physical activity and health are measured in each dataset.

The following socio-demographics are accounted for in the analysis:

- **Gender** (male; female).
- **Age** (16-25).
- **Geographical region** (England; London; Wales; Scotland; Northern Ireland; Berlin; Paris; United States).
- **Education** (high-school diploma or below; qualification below degree level; degree or above).[6]
- **Marital status** (single or never married; married, living as a couple, or in a civil partnership; other).[7]
- **Children in household** (no; yes).[8]
- **Employment status** (employed; unemployed; inactive).
- **Income** (below or equal to year sample median; above year sample median).[9]
- **House tenure** (house not owned; house owned).[10]
- **Self-rated health** (excellent or very good; very good or good; good or fair).[11]
- **Survey wave** (the survey wave a particular observation is associated with).

Although the samples are made up of healthy individuals, health is included among the controls so as to capture differences in healthy status.

2.2. Analysis

Three types of analysis are conducted so as to reflect the three research questions above. All three types are based on linear regression modelling. For further details on the statistical methods, see the Appendix.

1. **The relationship between evaluation-based SWB and engagement in sport or physical activity**.

[6] In the UK sample, 'high-school diploma or below' stands for 'GCSE or below', and 'qualification below degree level' stands for 'A levels or qualification below degree level'.
[7] Information on marital status is not available in the English sample.
[8] Children refer to individuals aged 16 or less. They refer to the respondents' own children only in the UK sample. In all other samples, this variable captures the presence of children in the respondents' household (e.g., respondents' younger siblings).
[9] The median is taken with respect to the income levels observed within a particular sample in each year. Therefore, whether a respondent is below or above the median depends on the survey wave as well. Income is annual in all samples expect for the UK one, where income is measured monthly. It refers to household income in all samples a part from the English one, where it is only measured as personal income.
[10] House tenure refers to respondents' household.
[11] This is based on people's self-evaluations. The labelling of each health level varies depending on the sample, but in all samples health is measured on a similar 1-3 scale. The exception is the European sample, where health is measured on a 0-5 satisfaction scale. This measure is adapted to the 1-3 scale.

Cross-sectional analysis is performed on the English sample, the European sample and the UK sample, but not on the American sample, as this does not comprise the data relevant to this type of analysis. The goal is to compare levels of evaluative SWB among the young, healthy adults who do and do not exercise. Separate analyses are performed to study both overall participation in sport or physical activity (whether or not respondents exercise) and frequency of participation (measured on three levels: never or almost never; less than weekly; once a week or more). The associations with sport and physical activity are compared to those observed for employment (relatively to unemployment), in order to have a benchmark for their strength. The socio-demographics listed above are used as control variables.

In addition to the cross-sectional analysis, longitudinal analysis is conducted so as to monitor evaluative SWB upon changes in participation in sport or physical activity within individual over time. Specifically, the longitudinal analysis studies changes in evaluative SWB from one time period to the next relatively to changes in (frequency of) participation over the same time interval. While the cross-sectional analysis will merely return associations, the longitudinal analysis will serve to better understand whether exercise has a causal impact on evaluative SWB. If this were the case indeed, one would expect that increases or decreases in (frequency of) participation be accompanied by a change in evaluative SWB.

The longitudinal study is only performed on panel observations of the UK sample.[12] In this sample, changes over time refer to changes over years, as observations for the same respondent are collected in different years. Because of how the UK sample has been selected (see the Appendix for details), the interval between one observation and the next for the same respondent in is 2 years on average, which means that the longitudinal analysis will generally examine changes in SWB and participation in sport or physical activity over 2 years (this can vary if an individual skipped a survey wave and returned at a later stage). Among the above socio-demographics, those that are also subject to change over time (age, education, marital status, having children, employment status, income, house tenure and health) are used as controls in the longitudinal analysis.

2. **The relationship between experiential SWB and engagement in sport or physical activity**.

Cross-sectional analysis is performed on the European and American samples only, as they are the only ones to incorporate experience reports. The objective is to assess whether young, healthy people report significantly different levels of experiential SWB when they exercise as compared to when they are engaged in other activities. The associations with sport or physical activity are compared to those with employment (relatively to unemployment), in order to have a benchmark for their strength. The socio-demographics listed above are used as control variables; in addition, the analysis controls for whether or not people are alone during an experience, and for where they are during the experience.

[12] This is because the UK sample is the only one to have a sufficiently large number of panels to allow for reliable results (see table above).

Besides the cross-sectional analysis, longitudinal analysis is conducted so as to monitor experiential SWB upon changes in participation in sport or physical activity within individual over time. Note, however, that in this case changes in participation denote changes in time use from experiences of exercise to other kinds of experiences unrelated to sport or physical activity, or vice versa. (This is because the object of analysis is experienced SWB). The purpose of the longitudinal analysis is to better get at causality: if exercise had a causal impact on experiential SWB, one would expect to observe a change in SWB as people switch from sport or physical activity to other activities, or vice versa.

The longitudinal study is performed on the American sample only, because only this sample collects multiple experience reports for the same person close enough in time to understand how experienced SWB changes as people alter the way they use their time moment after moment.[13]As the experience reports all refer to the same day, none of the above socio-demographics will change over time. Nonetheless, such variables as where people are during an experience and whether they are alone will probably vary as people switch from one experience to another, and these changes are used as controls in the longitudinal analysis.

3. **The relationship between socio-demographics and engagement in sport or physical activity**.

This type of analysis is performed on the UK sample only.[14] The objective is to examine whether and how frequency of participation in sport or physical activity varies across socio-demographic groups. The socio-demographics used are all those listed above.

[13] If experiences were collected over different days, longitudinal analysis would not be as reliable, since changes in experiential SWB might be due to factors other than the change experiences.

[14] The American sample only contains experiences of sport or physical activity. Since experience reports are random, it is not possible to determine whether the people who do not report such experiences do or do not engage in sport or physical activity. The other samples do not have enough observations

3. Summary of results

3.1. Evaluative SWB and engagement in sport or physical activity

The analysis of the **English sample** produces the following results (see Tables A1-A4 in the Appendix):

- Positive association with general happiness.
- Positive association with life worthwhileness.

The estimated increment in these measures associated with exercising is 0.15 for both measures. The associations are only significant for those who take part in sport or physical activity on a weekly basis (0.17 and 0.18, respectively). These associations compare to increments of 0.29 and 0.24 associated with employment. No associations with life satisfaction and with daily anxiety are recorded.

The analysis of the **European sample** produces the following results (see Tables A5-A8 in the Appendix):

- Positive association with life satisfaction.
- Positive association with daily happiness.
- Positive association with life worthwhileness.

The estimated increments in these measures associated with sport or physical activity are 0.46, 0.39 and 0.57, respectively. The associations are significant for both those who take part in sport or physical activity less than weekly (0.33, 0.29 and 0.44, respectively) and those who take part on a weekly basis (0.56, 0.47 and 0.67, respectively). These relationships compare to increments of 0.97, 0.50 and 0.67 associated with employment. No association with daily anxiety is recorded.

The analysis of the **UK sample** produces the following results (see Tables A9 in the Appendix):

- Positive association with life satisfaction.

The estimated increment in this measure associated with exercise is 0.18. The association is significant for both the people who engage in sport or physical activity less than weekly (0.12) and those who engage therein at least once a week (0.20). This association compare to an increment of 0.48 associated with employment.

The longitudinal analysis of the UK sample (Table A10 in the Appendix) reveals:

- No association between changes in (frequency of) participation in sport or physical activity and changes in life satisfaction.

This result holds whether the change considered is an increase or a decrease in (frequency of) participation.

3.2. Experiential SWB and engagement in sport or physical activity

The analysis of the **European sample** produces the following results (see Table A11 in the Appendix):

- Positive association with experienced happiness.
- Positive association with experienced purpose.

The estimated increments in these measures associated with sport or physical activity are 1.12 and 1.27, respectively. These associations compare to a change associated with employment that is not significantly different from zero for experienced happiness, and to an increment of 0.59 associated with employment for experienced purpose. No association with experienced anxiety is recorded.

The analysis of the **American sample** produces the following results (see Table A12 in the Appendix):

- Positive association with experienced happiness.
- Positive association with experienced meaning.
- Negative association with experienced stress.

The estimated increments in experienced happiness and experienced meaning associated with sport or physical activity are 0.77 and 1.24, respectively. The estimated decrement in experienced stress is instead -0.41. These associations compare to the changes associated with employment that are not significantly different from zero for experienced happiness and experienced meaning, and to a decrement of -0.33 associated with employment for experienced stress.

The longitudinal analysis of the American sample (Table A13 in the Appendix) reveals:

- Positive associations between switching from other experiences to experiences of sport or physical activity and experienced happiness.
- Positive associations between switching from other experiences to experiences of sport or physical activity and experienced meaning.

The estimated increments in these measures are estimated to be 0.76 and 1.82. The analysis further reveals:

- Negative association between switching from experiences of sport or physical activity to other experiences and experienced happiness.
- Negative association between switching from experiences of sport or physical activity to other experiences and experienced happiness.

- Positive association between switching from experiences of sport or physical activity to other experiences and experienced happiness.

The estimated decrements in experienced happiness and in experienced meaning are -1.26 and -1.84, respectively. The estimated increment in experienced stress is 0.53. No association is observed between switching from other experiences to experiences of exercise and experienced stress.

3.3. Socio-demographic correlates of engagement in sport or physical activity

The analysis of the **UK sample** produces the following results (Table A14 in the Appendix):

- Males are more likely than females to exercise weekly, but not on a less regular basis.
- Participation declines with age similarly across frequencies of participation.
- Participation is less common in Wales and in Northern Ireland than in the rest of the UK, especially on a non-weekly basis.
- Participation increases with education steadily.
- Participation is less common in presence of own children in the household.
- The unemployed are less likely to participate than the employed, and the inactive ones are more likely to participate than the employed, especially on a weekly basis.
- Those with household income above the median are more likely to engage than those with household income below the median, but only at a frequency less than weekly.
- Being part of a household that owns a house increases participation, especially weekly participation.
- Better health is associated with increased weekly participation, but being in relatively worse health is associated with increased participation less than weekly.

4. Discussion and policy implications

The findings presented above are a step forward towards understanding how sport and physical activity are related to SWB. The following conclusions and policy implications can be drawn.

1. **There is evidence of some positive relationship between engagement in sport or physical activity and evaluative SWB among young, healthy adults, but this relationship seems to imply little or no causality**.

As also shown by previous research, the above findings demonstrate that exercise is linked to higher levels of evaluative SWB, based on a variety of measures. Although differences across samples have been recorded, the available evidence consistently suggests that the healthy adults aged 16-25 who take part in sport or physical activity are more satisfied with their life, happier on the whole, and also find their life more worthwhile, compared to their peers who do not exercise. The strength of these relationships increases with frequency of participation, and the strongest associations are found for those who exercise at least once a week. Furthermore, the evidence seems to imply no link between engagement in sport or physical activity and overall anxiety levels, however frequently people engage therein.

Although there are positive associations, they often appear quite weak in relation to how evaluative SWB is associated with other important policy outcomes, such as employment. The difference in evaluative SWB between those who do and do not engage in sport or physical activity is systematically smaller, or at best not greater, than the difference between the employed and the unemployed, even when weekly engagement is considered.

Nonetheless, however weak or strong the associations might appear, the longitudinal analysis reveals that changes in participation over time do not predict any change in evaluative SWB, at least based on a life satisfaction measure. This result cast doubts on the causal impact of exercise on evaluative SWB. If sport and physical activity indeed entailed any effect thereon, it would be reasonable to expect increases or decreases in frequency of participation to be accompanied by some variation in evaluative SWB. Since this is not the case based on the current study, the most obvious conclusion to draw is that exercise does not directly affect how young, healthy people feel overall. The observed associations are probably due to self-selection effects: those who decide to take part in sport or physical activity might already exhibit higher evaluative SWB in the first place.

Clearly, other explanations for the results of the longitudinal study are plausible. It is still possible, for example, that life satisfaction has not responded to changes in participation due to reasons that could not been accounted for, given that the data on which the study is based on are observational. However, the relatively large sample size and the statistical methods used to conduct the study (which should account for unobserved factors to an extent) make it unlikely that such unobserved reasons have played a determinant role. A more reasonable explanation might be that any effect of

changes in frequency of exercising on life satisfaction is delayed in time. Specifically, it is possible that the impact of sport and physical activity on evaluative SWB only emerges after prolonged engagement over time, further ahead than the average 2-year interval that has been considered in the present longitudinal study.

What are the policy implications? An obvious recommendation to policy-makers is to be aware that, based on evaluative measures of SWB, interventions promoting engagement in sport or physical activity might not be worth pursuing. First, the association between evaluative SWB and exercise is weaker, or anyhow not any stronger, than the association between evaluative SWB and other policy outcomes, such as employment. Hence, were policy decisions to be based only on such associations, sporting interventions might not yield higher benefits in comparison to alternative policies, other conditions being equal.

Most importantly, sport and physical activity are unlikely to have a direct effect on how young, healthy adults feel overall. Thus, if the policy goal were to improve evaluative SWB among young, healthy adults, sporting interventions by themselves would hardly succeed. Even if it were believed, as hypothesised above, that the effects of exercise on life satisfaction and other global feelings were delayed in time, relevant interventions would have to be appraised taking account of the time lag that separates their implementation and the emergence of their benefits. This lag makes these policies less attractive compared to interventions that increase evaluative SWB in the short term. In sum, policies to leverage participation in sport or physical activity have little potential to significantly and promptly improve how young, healthy adults feel on the whole.

2. **There is evidence of strong positive relationship between engagement in sport or physical activity and experiential SWB among young, healthy adults, and this relationship appears to be causal in character**.

The above findings indicate strong and positive associations between exercise and various measures of experiential SWB among healthy individuals aged 16 to 25. Bearing in mind that the magnitude of such associations may vary depending on other characteristics of the population (as shown by the differences between European and Americans), young, healthy adults consistently feel happier and a greater sense of purpose when they spend their time in sport or physical activity, as compared to when they spend their time in other activities. There is also moderate evidence that experiences of exercise are linked to lower levels of stress, at least for some people. It is worth underscoring that these results refer to the 'average' experience of participation in sport or physical activity, regardless of whether this is expression of regular engagement or an isolated episode of exercise.

The estimated relationships between exercise and experienced SWB are stronger than those estimated with evaluative SWB, which is indicative of the fact that exercise is a more important predictor of the former than it is of the latter. The relationships to experiential SWB are also stronger than the associations between experienced feelings and other policy outcomes, such as employment, which in fact seems to be little related to how people feel as they go about their life. Furthermore, the stronger

associations found with experienced purpose as opposed to experienced happiness suggest that participation in sport or physical activity is an important correlate of the eudemonic aspects of SWB.

All the more, the longitudinal analysis suggests that changes in participation in sport or physical activity predict changes in the feelings young, healthy adults experience during their daily life. Specifically, when they spend their time exercising after they have been engaged in other, unrelated activities, their reports of experienced happiness and experienced meaning increase. Conversely, when they move from doing sport or physical activity to doing something else, their reported feelings deteriorate. Bearing in mind the observational nature of the data this research is based on, these trends are strongly indicative of a causal impact of exercise on experiential SWB.

It is interesting to observe that changes in how young, healthy people allocate their time on sport or physical activity are not symmetrical, and they do not always reflect the difference between how they feel on average during exercise and during other activities. For example, increases in experienced happiness when individuals switch to exercise (which reflect how relatively happier they feel on average during exercise) tend to be smaller than the decreases in happiness when they move from exercising to other activities. This may suggest that, after exercising, individuals tend to engage in activities that make them less happy than they have been before and during exercising. Similarly, changes in experienced purpose when switching from and to sport or physical activity are larger than the difference in how much meaning people feel when they exercise and when they spend their time in other ways. This might indicate that people engage in sport or physical activity after they have done something relatively more futile than usual, and that they seek again a relatively more futile activity after exercising. These trends might have to do with how young, healthy adults trade off their experiences over time based on the feelings they associated with them and on the balance between hedonic and eudemonic feelings they desire to accomplish.

What are the policy implications? On the grounds of experiential measures, sporting interventions can be put forward as valuable instruments to successfully enhance SWB among young healthy adults. Considering the strong associations between exercise and experienced SWB in relation to those found with other policy outcomes, sporting policies look relatively more appealing in terms of their benefits than other kinds of interventions, such as those tackling unemployment.

Crucially, what makes sporting interventions worth pursuing is their high potential to affect how young, healthy adults feel moment to moment, given the causal impact that sport and physical activity seem to have on experiential SWB. It is worth noting that, given the relatively stronger association found with experienced purpose or meaning as opposed to experienced happiness, promoting participation in sport or physical activity is especially appealing if the policy goal is to act on the eudemonic aspects of experiential SWB.

The differences in the figures on how exercise is related to evaluative and experiential SWB demonstrate that the measure of SWB matters in establishing what works for young, healthy individuals. Therefore, a side message to policymakers is to pay due regard to experiential measures when appraising interventions promoting engagement in sport or physical activity. Not considering them in cost-benefit analysis could signify that important opportunities to improve SWB be overlooked.

3. **There is evidence that engagement in sport or physical activity differs across some socio-demographic groups of young, healthy adults, and the effects can vary for different frequencies of engagement.**

The above findings on the relationship between socio-demographics and participation in sport and physical activity in the UK reveal that, among healthy adults aged 16 to 25 in the UK, participation in sport or physical activity is more common among males than among females; it slightly declines with age (i.e., the 16-year-old are more likely to participate than the 25-year-old); it is less common in Wales and in Northern Ireland than in the rest of the UK; it increases with education; it is less widespread among the unemployed and more among those outside the labour force; and it is more common among the wealthier and the relatively healthier.

Nonetheless, being in a given socio-demographic group does not always have the same effect on different frequencies of exercising. For example, males are more likely than females to engage in sport or physical activity only on a weekly basis. The people in Wales and Northern Ireland are less likely to exercise on a non-weekly basis, but the odds that they exercise at least once a week are the same as those of people living in other parts of the UK. Young, healthy adults outside the labour force are more likely to take part in sport or physical activity, but more so if frequent exercise is considered. Higher income is only associated with more sporadic exercise, but not with more frequent exercise. The people who are in relatively worse health status tend to exercise more sporadically than the people in relatively better health.

What are the policy implications? These findings are relevant to policy for a number of reasons. Knowing who tends to engage more in sport or physical activity allows, first, targeting socio-demographic groups who are less likely to participate and design interventions specifically addressed to them. By knowing that the unemployed are less likely to exercise, for instance, policymakers can design interventions specifically targeted to that group and not to others. Information on how frequency of exercising varies across socio-demographic groups is also important and allows identifying whether or not a given group necessitates some kind of sporting intervention. Increasing weekly participation in sport or physical activity only in the bottom 50% of the income distribution, for example, might not be as due as one can think, as there is a similar chance of finding people who exercise regularly both below and above the median.

The findings can also be used to identify those groups that are likely to 'self-select' into sport or physical activity interventions and those that require greater investment of resources to assure they are reached by the intervention. For example, in interventions directed to both males and females, the finding that males are more

likely to participate than women suggests that the former will also be more likely to enrol in sporting interventions spontaneously, and thus to require less encouragement to sign up to the intervention, than the latter.

5. Future research

The current evidence on how sport and physical activity are related to SWB among young, healthy adults is far from conclusive, and it is limited in many respects. The following recommendations for future research can be made.

1. **Future research should seek to further investigate how engagement in sport and physical activity is associated with SWB among young, healthy people, and in particular with experiential measures of SWB; future studies should also focus on specific forms of sports and physical activity.**

This report is one of the first endeavours in the literature to focus on young people. As such, more studies on this particular population are necessary. One of the tasks for future research is to replicate the findings presented above. For instance, more studies are needed to validate whether different insights arise based on evaluative and experiential measures of SWB. New data on how young people feel in the moment they do sport or physical activity need to be collected and analysed (covering a wide range of both hedonic and eudemonic feelings), so as to compensate for the current unbalance of the evidence available in the literature in favour of studies that looked at evaluative measures.

In addition, while the focus of the report was on engagement in any form of exercising, it also attempted to study more specific instances of sport and exercising. The current literature does not encompass many studies of this kind, especially using experienced SWB measures. It is crucial that future research enlarge the spectrum of sports to examine and collect new data on how young, healthy people feel when they are playing. It would also be interesting to investigate differences between team as opposed to individual sports, and between engagement in sport and physical activity outdoors as opposed to indoors.

2. **Future research should seek to investigate how socio-demographics moderate the relationship between SWB and sport or physical activity among young, healthy adults, and also how socio-demographics predict engagement.**

This report did not explore the moderating role of socio-demographics, while the scarcity of studies of this sort in the literature calls for more research. This is particularly of interest since the targets of current strategies to leverage sport and physical activity in the UK are often specific socio-demographic groups, such as ethnic minorities and women. Hence, it is crucial that future studies be concerned with how exercise is related to SWB within these groups, in order to assure that targeted sporting policies are designed properly.

This report is a step forward towards establishing which socio-demographic groups of young, health people are more likely to engage in sport or physical activity, also exploring how the socio-demographic background affects frequency of engagement.

Yet the findings presented above need replication, and more correlates of engagement need investigation. There are plenty of factors that remain to be accounted for: particularly worth exploring are such factors as personality traits, contingent life circumstances, cultural influences, social norms and the role of parents' engagement in sport or physical activity.

3. **Future research should seek to establish the extent to which sport and physical activity have causal impacts on SWB among young, healthy people**.

This report has sought to establish causal relationships between exercise and SWB among young, healthy people via longitudinal analysis. This approach is relatively new in the literature that used observational data to study the effect of exercise on SWB. As such, the findings presented above require endorsement by similar longitudinal studies, which should investigate both evaluative and experiential measures of SWB.

While longitudinal research using observational data is useful, however, it is not enough to ascertain causality. For that purpose, future research should make recourse on randomised controlled trials, which, in spite of their many problems, remain are the most effective method for determining causality to date. The medical literature features many examples of experimental research. Nevertheless, most studies did not use SWB measures of wellbeing and were mainly concerned with the impacts of sport and physical activity on health. There are some controlled experiments that studied SWB, but they mostly focused on evaluative measures (see the Appendix for a short review), while much fewer studies were concerned on the causal impacts of sport and physical activity on how people feel in the moment. Importantly, few experiments examined young, healthy populations in particular. New randomised controlled trials are required to remedy against these pitfalls.

A1. Literature review

A1.1. Evaluative SWB and engagement in sport or physical activity

Over the last two decades, a wealth of studies using observational data found positive associations between exercising and evaluative measures of SWB. Most of these studies were cross-sectional, while there has been limited longitudinal research to try and infer causality. Rasciute and Downward (2010), and Downward and Rasciute (2011) analysed an English sample from the Taking Part survey and found a positive association with general happiness. Kavetsos (2011) observed a positive correlation with general happiness based on a worldwide sample from the International Social Survey Programme.

Dolan et al. (2014) analysed a European sample from the Eurobarometer: using people's reasons for participation as instruments to better get at causality, they found a positive association with life satisfaction. Similarly, Fujiwara et al. (2014) observed a positive association with life satisfaction based on a UK sample from Understanding Society. Associations with general happiness or life satisfaction were also documented in Canada (Wang et al., 2012), in the Netherlands (Stubbe et al., 2007), in Germany (Becchetti et al., 2008), in Korea (Lee & Park, 2010), Sweden (Melin et al., 2003) and in the US (Huang & Humphreys, 2012).

Many studies from the medical literature investigated the effects of habitual exercise on overall mood and trait anxiety. McAuley and Rudolph (1995) conducted a qualitative review on older adults, showing long-term, positive effects on mood of programmes focused on physical activity, with longer programmes entailing the strongest effects. Similar results were reported in the meta-analysis of experimental research conducted by Arent et al. (2000). Dunn et al. (2001) conducted a review of experiments, showing that aerobics and resistance training led to reduced anxiety and symptoms of depression over time. Similarly, Salmon (2001) reviewed experiments showing reducing effects of habitual physical activity on trait stress over time.

Some evidence suggests that the observed associations are largely mediated by the improvements in health entailed by taking part in sport and physical activity over time. There is indeed widespread evidence that frequent participation in sport or physical activity is linked to better health, both physical and mental; and that these links are often causal in character.[15] In turn, health (both physical and mental) is positively related to evaluative measures of SWB: in fact, it is one of the most important correlates thereof.[16]

[15] See, for example: Batty (2002); Biddle et al. (2004); Cervero et al. (2003); Fox (1999); Dimeo et al. (2004); Paluska and Schwenk (2000); Peluso and Andrade (2005); Penedo and Dahn (2005); Rasciute and Downward (2010); Sari (2009); Teixeira et al. (2013); Wendel-Vos et al. (2004).

[16] See, for example: Blanchflower and Oswald (2008); De Mello and Tiongson (2009); Melin et al. (2003); Oswald and Powdthavee (2007, 2008); Roberts et al. (2000); Sabatini (2014); Sutzer and Meier (2015). For comprehensive reviews, see Dolan et al. (2008) and Rodriguez et al. (2011).

Berger and Motl (2000) reviewed studies showing enhancements in overall mood mainly for clinical populations. Netz et al. (2005) conducted a meta-analysis of studies on older, healthy people, which demonstrated no considerable effects of sport and physical activity on life satisfaction and trait anxiety. Stroehle (2009) reviewed experiments documenting that physical activity interventions successfully lowered trait anxiety mainly in the subjects who suffered from anxiety disorders prior to the interventions. Further, in a correlational study, Richards et al. (2015) analysed a European sample from the Eurobarometer (2002): controlling for respondents' health status, they reported minimal correlations between sport or physical activity and general happiness. Fujiwara et al., 2014, did control for health and found similarly weak associations with life satisfaction.

A1.2. Experiential SWB and engagement in sport or physical activity

The relationship between SWB and sport or physical activity can be also studied at the experience level, looking at how people feel during or right after sport or physical activity. Few observational studies in the literature explored this, but those few demonstrated positive relationships. Kanning and Schlicht (2010) conducted an ecological momentary assessment, having a small sample of subjects complete a diary of activities over ten weeks: they observed that subjects reported better mood after each experience of physical activity. Lathia et al. (2017) analysed a large dataset of mobile app reports of experiences of sport or physical activity and real data on physical activity coming from accelerometers on the subjects' phones: they found positive associations with positive affect in the moments in which the subjects were engaged in sport or physical activity.

More evidence comes from the medical literature, and it seems to suggest a causal impact of sport and physical activity on experienced SWB. Yeung (1996) surveyed controlled experiments showing that mood improved for both healthy and unhealthy subjects after a session of exercising. Ekkekakis and Petruzzello (1999) reviewed qualitative studies showing that subjects experienced less anxiety after each aerobics session. In an experiment, McAuley et al. (1999) demonstrated that moderately intense exercise reduced experienced anxiety among young women (see Marquez et al., 2002, for a similar study on older, sedentary women). In another experiment, Netz and Lidor (2003) recorded improvements in mood after a Feldenkrais session, swimming and yoga (but not after aerobics). In yet another experiment, Szabo (2003) did find positive effects on mood following aerobics.

It is worth noting that some neurological evidence implies a positive and causal relationship between experienced SWB and physical activity. Physical activity normally leads the brain to release endorphin and serotonin, which are associated with feelings of happiness and positive affect (Chaouloff, 1997; Hoffmann, 1997).

A1.3. Sport, physical activity, SWB and socio-demographics

Some research examined the moderating role of socio-demographics on the relationship between SWB and sport or physical activity, but mostly using evaluative measures. Lechner (2009) analysed a German samples from the Socio-Economic

Panel, finding positive associations with life satisfaction for males, but not for females. Pawlowski et al. (2011) analysed a worldwide sample from the International Social Survey Programme and reported that the associations with general happiness decreased in strength for older people. Huang and Humphreys (2012) observed significant gender differences in the associations with life satisfaction. Dolan et al. (2014) reported a similar result for a European sample. By contrast, Fujiwara et al. (2014) observed little differences in the associations with life satisfaction across men and women, age groups, income groups and geographical regions in the UK.

As for experienced SWB, the evidence is much sparser. Over three meta-analyses, Petruzzello et al. (1991) did not observe considerable differences across gender and age groups in the effects of aerobic physical activity on anxiety reduction. Jerome et al. (2002) found no differences in mood enhancements following exercise between White and Hispanic women.

There have been various investigations, instead, of the socio-demographic correlates of engagement in sport and physical activity. Widespread evidence (e.g., Breuer et al., 2010; Mechling & Netz, 2009) documents how participation declines with age. Based on samples from England and Spain, Kokolakakis et al. (2012) reported that participation is more common among males, the young, the highly educated and the employed. Using data from the Eurobarometer (2009), Downward et al. (2014; see also Downward & Rasciute, 2015) found that engagement declined among women with children and larger families. See Breuer et al. (2011) for an analysis of the correlates of participation in different sports.

Access to sport and leisure facility appears to be an important determinant of participation. Forrest and McHale (2009) found that, in the UK, those who lived in neighbourhood endowed with sport facilities are more likely to participate. Huang and Humphreys (2012) recorded similar patterns in the US. Downward and Rasciute (2010), furthermore, showed that engagement was conditional on the availability of other leisure facilities within one's neighbourhood, and it decreased when such facilities are easily accessible.

A1.4. Summary and limitations

There has been plenty of research on sport, physical activity and SWB. Nonetheless, such research has rarely focused on people aged 16 to 25, who are the population of interest in this report. Rather, it has generally considered aggregate data covering all age groups. Moreover, there have been very few explorations of specific forms of sport and physical activity.

While investigations of evaluative measures of SWB abound and systematically show positive associations with sport or physical activity, investigations of experiential measures are more limited in number and have used poor and heterogeneous measures to assess how people feel during sport or physical activity (although they have also shown positive associations). Moreover, there has been no formal comparison between evaluative and experiential measures. This is a significant

limitation that needs to be addressed, as the two types of measures might give rise to different insights into how sport and physical activity relate to SWB.

Evidence on the moderating role of socio-demographics is available and it typically demonstrates significant differences across socio-demographic groups in the relationships between SWB and sport or physical activity. However, these studies have been chiefly concerned with evaluative measures of SWB, and less with experiential measures. Further, they have extensively examined some socio-demographics (e.g., gender, age), but others remain largely unexplored to date (e.g., ethnicity, education, employment status, income). There has been extensive research on the socio-demographic determinants of engagement in sport and physical activity, but many key variables, such as ethnicity and income, have not been widely studied yet. These voids in the literature require further research.

A2. Data sources

A2.1. Active People Survey

The Active People Survey (APS) was a cross-sectional study of engagement in sport among people in England. This survey was carried out by Sport England from 2005-2006 until 2015-2016, in collaboration with Arts Council England, Public Health England and the Department for Transport (it has recently been replaced by the Active Lives Survey). The data are publicly accessible through the UK Data Service.

The main goal of APS was to track participation in sport or physical activity and to estimate the number of people in England who are active in a wide range of sports. The survey also assessed respondents' attitudes towards sport, frequency of participation, reasons for taking part (e.g., leisure, work, etc.), and so forth. Questions assessing respondents' SWB had been included since the 2010-2011.

This dataset is used for the analysis of evaluation-based SWB only. The analysis focuses on the 2010-2011 and 2011-2012 waves, because earlier waves did not measure SWB and later waves have too many missing observations for variables that are crucial to the present analysis.

The only evaluative measure of SWB that is taken from APS is life satisfaction. This is expressed on a 1-7 scale, where 1 means 'completely dissatisfied' and 7 means 'completely satisfied'. This measure is converted to a 0-10 scale.

Engagement in sport or physical activity is determined as follows. Respondents are asked to report how many days they have taken part in any form of recreational sport or physical activity in the four weeks preceding the survey. If they report that they have done sport or physical activity for 1 to 3 days, they are considered engaged in sport or physical activity less than weekly. If they report more days, they are considered engaged at least once a week. Conversely, if they report zero days, they are not considered engaged.

Health is measured as follows. Respondents are asked to rate their health status on a scale from 1 to 5, where 1 means 'Very good', 2 'Good', 3 'Fair', 4 'Bad' and 5 means 'Very bad'. Only those who rate their health with a score from 1 to 3 are deemed healthy and included in the sample.

A2.2. American Time Use Survey

The American Time Use Survey (ATUS) is a cross-sectional study of how American people allocate their time in a typical day of their life. The survey is sponsored by the US Bureau of Labor Statistics, and it has been conducted by the US Census Bureau on a yearly basis since 2003. The ATUS data are publicly available for download from the survey website.[17]

[17] http://www.bls.gov/tus/datafiles_0315.htm

The core of the ATUS consists of a Day Reconstruction Method type of study. Respondents were asked to report, in an open-ended format, the main activities they had engaged in throughout the day prior to the interview, as well as, for each activity reported, where they had been, with whom they had been, and the duration of the experience.[18] The activities reported include many of the usual daily activities people do: from commuting to working, from relaxing to socialising, from doing sport to attending museums. For the complete list of activities reported, see the survey website.[19]

In addition to surveying time use, the 2010, 2012 and 2013 waves subsume the 'Well-being Modules', which measures the feelings each respondent experienced during three activities randomly selected from the set of activities he or she reported in the DRM (thus, experiential SWB is not measured for all the activities each respondent reported).

This dataset is used for the analysis of experience-based SWB only. The analysis is restricted to the data of the 2010, 2012 and 2013 waves, since they are the only ones to comprise SWB measures. All activity reports with no experiential SWB assessment are excluded from the analysis.

Three experiential measures of SWB are considered in this report, among all those available in the ATUS data: experienced happiness, experienced stress and experienced meaning.[20] All these feelings are measured on a 0-6 scale, where 0 means 'not at all' and 6 means 'very'. All these measures are converted into a 0-10 scale.

ATUS contains reports of participation in various forms of sport or physical activity (e.g., basketball, jogging or running, tennis). These reports are combined so as to create a measure of participation in sport or physical activity.

Health is measured as follows. Respondents are asked to rate their health status on a scale from 1 to 5, where 1 means 'Excellent', 2 'Very good, 3 'Good, 4 'Fair and 5 means 'Bad'. Only those who rate their health with a score from 1 to 3 are deemed healthy and included in the sample.

A2.3. British Household Panel Survey

The British Household Panel Survey (BHPS) was a longitudinal study monitoring UK households over time. The study had run for 18 years from 1991 to 2009, when it was replaced by Understanding Society (the old participants to the BHPS were linked to the new survey). The survey was funded by the Economic and Social Research

[18] People submitted their reports via telephone, and interviewers thereafter coded them according to the type of activity reported.
[19] http://www.bls.gov/tus/lexiconnoex0314.pdf
[20] The data also include measures of experienced sadness, experienced pain and experienced tiredness, but these measures were not considered in this report.

Council and designed by the Institute of Social and Economic Research at the University of Essex. The data are available through the UK Data Service.
The BHPS asked a number of questions appraising people's socio-economic status, health, and various attitudes, habits and life circumstances. Since Wave 6 (1996-1997), it had measured life satisfaction. Questions on participation in sport or physical activity were asked in the even waves.

This dataset was used for the analysis of evaluative SWB only. The analysis was limited to the even waves from the sixth (6, 8, 10, 12, 14, 16, 18), which were those assessing the variables of interest.

The measure of evaluative SWB contained in the BHPS is life satisfaction, measured on a 1-7 scale, where 1 means 'completely dissatisfied' and 7 means 'completely satisfied'. This measure is converted into a 0-10 scale.

Engagement in sport or physical activity is measured as follows. Respondents were asked whether they played any sport, done exercise or swam in their free time, and how often they did so. They could choose among: at least once a week; at least once a month; several times a year; 1-2 times a year, never or almost never. If respondents selected 'at least once a week', they are considered engaged on a weekly basis. If they selected 'at least once a month' or 'several times a year', they are considered engaged less than weekly. Otherwise, they are not considered engaged in sport or physical activity.

Health is measured as follows. Respondents are asked to rate their health status on a scale from 1 to 5, where 1 means 'Excellent', 2 'Very good, 3 'Good, 4 'Fair and 5 means 'Bad'. Only those who rate their health with a score from 1 to 3 are deemed healthy and included in the sample.

A2.4. Going for Gold

The LSE "Going for Gold" study (GfG; a.k.a. Olympics Study) was a survey designed to investigate the impact of the London 2012 Olympic Games on engagement in sport, on health, and on SWB among people living in Berlin, London, and Paris. It was a longitudinal survey embracing three waves (2011, 2012, and 2013), which was conducted by researchers at the LSE in collaboration with Ipsos MORI. The data are not publicly available.

GfG consisted of a number of questions assessing sport participation, health, and evaluation-based SWB, and it also involve a hybrid of a Day Reconstruction Method and an Experience Sampling Method study. Specifically, in each wave, respondents were asked to report the activity they had done at a random time on the day prior to the survey and how they had felt in that moment (as well as where and with whom they had been), but without reconstructing the whole day. In practice, each respondent reported one experience per wave. When reporting their experiences, respondents had to choose from a list of fifteen different activities: 1) getting ready, washing, bathing; 2) cooking, preparing, eating food; 3) commuting; 4) walking,

cycling, driving to get to/from somewhere; 5) working; 6) doing housework; 7) doing voluntary work; 8) exercising, doing sport; 9) attending a sports event or match; 10) relaxing, napping; 11) watching TV; 12) listening to music; 13) using the internet; 14) socialising; 15) other.

This dataset is used for the analysis of both evaluative and experience-based SWB only. Four evaluative measures are included in the data: life satisfaction, daily happiness, daily anxiety, and life worthwhileness. Three experiential measures are considered: experienced happiness, experienced anxiety[21] and experienced purpose[22]. All these measures are on a 0-10 scale, where 0 means 'not at all' and 10 means 'completely'.

Participation in sport or physical activity is measured as follows. Respondents have to state how often they usually play sport, exercise or do any physical activity, choosing one of six options: 5+ times a week, 3-4 times a week, 1-2 times a week, 1-2 times a month, less often, or never. If respondents report that they exercise at least 1-2 times a week, they are considered engaged in sport or physical activity on a weekly basis. If they state that they never take part, they are not considered engaged. Otherwise, they are considered engaged less often than once a week.

GfG also includes reports of experiences of sport or physical activity, but these reports refer to any form of exercise, without distinguishing among specific forms.

Health is measured as follows. Respondents are asked to rate their satisfaction with their health status on a scale from 0 to 10, where 0 means 'Completely dissatisfied' and 10 means 'Completely satisfied'. Only those who are satisfied with their health with at least a score of 5 are considered healthy and thus included in the analysis.

A2.5. Taking Part

The Taking Part survey (TP) is a face-to-face, partly cross-sectional and partly longitudinal study of engagement in culture and sport among English households. This survey is commissioned by the Department of Culture, Media and Sport of the UK Government, by Arts Council England, by Historic England, and by Sport England, and it has been running on a quarterly basis since 2005-2006 (with the longitudinal waves starting in 2011-2012). The data are publicly accessible through the UK Data Service.

TP covers a wide range of detailed assessments of people's attitudes towards culture and sport, participation patterns in cultural and physical activities, frequency of participation, reasons for taking part (e.g., leisure, work, etc.), whether participation

[21] In the 2011 wave, half of the people were asked about their experienced anxiety, and the other half about their experienced worry. In the 2012 wave, half of the people were asked about their experienced anxiety, and the other half about their experienced 'stress. In the 2013 wave, everyone was asked about their experienced anxiety. Wording was not controlled for in the data analysis.

[22] Half of the people in the 2012 and 2013 were asked about their experienced worthwhileness, whereas the other half about their experienced purpose. Wording was not controlled for in the analysis.

was in group or solo, and so forth. Since 2011-2012, moreover, the survey has been measuring life satisfaction and other, evaluation-based measures of SWB.

This dataset is used for the analysis of evaluation-based SWB only. The analysis is restricted to the waves from 2013-2014 to 2015-2016, for earlier waves do not contain enough observations for relevant variables.

The measures of SWB that are taken from TP are: life satisfaction, daily anxiety and life worthwhileness, all expressed on a 0-10 scale, where 0 means 'not at all' and 10 means 'completely'; and general happiness, on a 1-10 scale, where 1 means 'not at all' and 10 means 'completely.

Engagement in sport or physical activity is determined as follows. Respondents are asked to report how often they have taken part in any form of sport or physical activity in the four weeks preceding the survey. If they report that they have engaged for more than 4 days, they are considered engaged in sport or physical activity on a weekly basis. If they state a number of days between 1 and 3, they are considered engaged less often than weekly. Otherwise, they are not considered engaged.

Health is measured as follows. Respondents are asked to rate their health status on a scale from 1 to 5, where 1 means 'Very good', 2 'Good', 3 'Fair', 4 'Bad' and 5 means 'Very bad'. Only those who rate their health with a score from 1 to 3 are deemed healthy and included in the sample.

A2.6. Understanding Society

Understanding Society (USoc) is the largest longitudinal study in the UK, aiming at monitoring citizens' living conditions over time. This survey, which has taken place since 2009 on an annual basis replacing the BHPS, is funded by the Economic and Social Research Council and designed by the Institute of Social and Economic Research at the University of Essex. The data are available through the UK Data Service.

USoc asks a number of questions appraising people's socio-economic status, health, life satisfaction, and various attitudes, habits and life circumstances. Wave 2 and Wave 5, in particular, subsumed the 'Leisure, Culture and Sport' module, which assessed people's participation in activities pertaining to these domains (including music activities) through some of the questions included in TP.

This datasets is used for the analysis of evaluation-based SWB only. The analysis focuses on Wave 2 (2010) and Wave 5 (2013).

The evaluative measure of SWB taken from USoc is life satisfaction. This is measured on a 1-7 scale, where 1 means 'completely dissatisfied' and 7 means 'completely satisfied'. This measure is converted into a 0-10 scale.

Engagement in sport or physical activity is determined as follows. Respondents are presented with a list of sports and have to state, for each sport, whether they have participated at least once in the twelve months preceding the survey. Afterwards, they are asked via a single question to report how often they usually engage in the sports they have reported to take part in. They could choose between: 3+ times a week; 1-3 times a week; at least once a month; at least 3-4 times a year; twice in past year; or once in past year. If respondents do not declare they have taken part in any sport in the list, they are not considered engaged in sport or physical activity. If they select at least one and they state that they participate at least 1-3 times a week, they are considered engaged weekly. Conversely, if they state they participate at least 3-4 times a year, they are considered engaged less than weekly. The other frequencies (once or twice a year) are considered as no participation.

Health is measured as follows. Respondents are asked to rate their health status on a scale from 1 to 5, where 1 means ‘Excellent’, 2 ‘Very good, 3 ‘Good, 4 ‘Fair and 5 means ‘Bad’. Only those who rate their health with a score from 1 to 3 are deemed healthy and included in the sample.

A3. Statistical analysis

The data analysis is based on linear regression modelling, which is regular practice in SWB research. Three types of models are estimated so as to reflect the three research questions that motivated this report. All models use sets of socio-demographic and other types of control variables, as appropriate to the analysis being conducted.

All models are also endowed with normally distributed random effects.[23] The reason for using random effects is to control for correlations within the data due to repeated observations for the same respondent and the same type of experience. The function of random effects is also to control for unobserved differences among respondents and experiences so as to obtain better estimates for the regression coefficients, while also accounting for the random nature of the samples of respondents and of experiences at hand (i.e., these are random samples from populations of respondents and of experiences). One could also employ fixed effects for the same purposes (and this is normally the standard practice), but fixed effects do not account for the random nature of the samples considered: they only account for unobserved differences within the particular samples at hand. In general, random effects are more appropriate for statistical inference at the population level than fixed effects, provided that the assumptions for using them are met (see Ferrer-i-Carbonell & Frijters, 2004).[24]

The following equation describes the model for the analysis of the relationship between evaluation-based SWB and engagement in sport or physical activity. Each observation refers to respondent *i* at time *t* (time is to be accounted for because the data are longitudinal).

(1) $$eval.SWB_{i,t} = \alpha_0 + \boldsymbol{\alpha}_1 \boldsymbol{S}_{i,t} + \boldsymbol{\alpha}_2 \boldsymbol{X}_{i,t} + \boldsymbol{\alpha}_3 \boldsymbol{W}_t + \pi_i + \epsilon_{i,t},$$

where $eval.SWB_{i,t}$ is evaluative SWB; α_0 is the grand intercept (measuring the average level of evaluative SWB across respondents); $\boldsymbol{S}_{i,t}$ is a vector of 0-1 indicators of participation in sport or physical activity, or in specific forms thereof; $\boldsymbol{\alpha}_1$ are the corresponding regression coefficients; $\boldsymbol{X}_{i,t}$ is the set of socio-demographic controls; $\boldsymbol{\alpha}_2$ is the vector of their coefficients; $\boldsymbol{W}_t$ is the vector of indicators of survey waves; $\boldsymbol{\alpha}_3$ is the vector of corresponding coefficients; π_i is a random intercept specific to respondent *i* (capturing unobserved factors related to the SWB of respondent *i*); and $\epsilon_{i,t}$ is the error term.

The model in (1) is estimated on the English sample, the European sample and the UK sample, all in separate instances. The models estimated for each sample are as many as the evaluative measures of SWB available in the sample.

[23] The normal distribution assumed for the random effects is just one of many possible choices for the distribution, but it is a good choice in that, if one tries to estimate the fixed effects in a separate model, their distribution closely resembles the normal distribution with a variance that is very close to the one estimated for the random effects.

[24] Unless the focus of the analysis is on the particular sample, and not on the population it comes from, random effects allow better inference at the population level than fixed effects when the number of clusters among which there might be unobserved differences is large enough (see Snijders, 2005; in this case, the clusters are respondents or experiences). Anyhow, using fixed effects does not change the results presented in this report.

When performing longitudinal analysis of evaluative SWB on the UK sample, the regression model is based on the one in (1), but the variables plugged into the equation are changes within person from one time period to the following one (i.e., over adjacent values of the index *t*). Only the variables that change with time are plugged into the equation.

The following equation describes the linear model for the analysis of the relationship between experience-based SWB and engagement in sport or physical activity. Each observation refers to respondent *i* and experience *j* at time *t*.

$$(2) \quad w_{i,j,t}(exp.SWB_{i,j,t}) = w_{i,j,t}(\beta_0 + \boldsymbol{\beta}_1\boldsymbol{S}_j + \boldsymbol{\beta}_2\boldsymbol{E}_j + \boldsymbol{\beta}_3\boldsymbol{X}_{i,t} + \boldsymbol{\beta}_4\boldsymbol{W}_t + \rho_i + \sigma_{i,j} + \eta_{i,t}),$$

where $exp.SWB_{i,j,t}$ is experiential SWB; $w_{i,j,t}$ is a regression weight indicating how long respondent *i* had engaged in activity *j* at time *t* for;[25] β_0 is the grand intercept (measuring how all respondents felt on average across all experiences other than sport or physical activity); $\boldsymbol{S}_j$ is a vector of 0-1 indicators of whether experience *j* is a sport or physical activity experience, or an experience of a particular form of sport or physical activity; $\boldsymbol{\beta}_1$ are the corresponding coefficients; $\boldsymbol{E}_j$ is a vector of 0-1 indicators of where respondent *i* was when engaged in experience *j* at time *t*, and whether he or she was alone or with other people; $\boldsymbol{\beta}_2$ are the corresponding coefficients; ρ_i is a random intercept specific to respondent *i*; $\sigma_{i,j}$ is another random intercept specific to respondent *i* and to experience *j* (capturing unobserved factors related to the SWB of respondent *i* when engaged in experience *j*); and $\eta_{i,t}$ is the error term. All other terms are as in (1), except for the change in how their coefficients are labelled.

The model in (2) is estimated based on the European sample and the American sample separately. The models estimated for each sample are as many as the evaluative measures of SWB available in the samples.

When performing longitudinal analysis of experiential SWB on the American sample, the regression model is based on the one in (2), but the variables plugged into the equation are changes within person from one time period to the following one (i.e., over adjacent values of the index *t*). Only the variables that change with time are plugged into the equation. Since respondents' multiple observations are collected on their experiences in a single day, the only variables that change are the indicators of where the respondent was during an experience and whether or not they were alone.

The following equation describes the multinomial logit model for the analysis of the relationship between frequency of engagement in sport or physical activity and socio-demographics. Each observation refers to person *i* at time *t*.

$$(3) \quad S_{i,t} = \gamma_0 + \boldsymbol{\gamma}_1\boldsymbol{X}_{i,t} + \boldsymbol{\gamma}_2\boldsymbol{W}_t + \tau_i + \upsilon_{i,t},$$

[25] Weighting by duration reflects the assumption that experiential SWB depends on both the intensity and the duration of the feelings experienced (Kahneman et al., 1997; Kahneman & Krueger, 2006). Hence, observations related to longer experiences are given more importance when estimating regression coefficients.

where $S_{i,t}$ is an indicator of a given frequency of participation in sport or physical activity (never or almost never; less than weekly, at least once a week); γ_0 is the grand intercept (measuring the average likelihood of engagement across all respondents); and $\upsilon_{i,t}$ is the error term. All the other terms are as above, except for the different labels for their coefficients.

The model in (3) is estimated on the UK sample only. Only one model was estimated.

A4. Analysis outputs

Table A1. English sample

Dependent variable: life satisfaction	Overall participation	Frequency of participation
Sport or physical activity (ref: no participation)		
Participation	0.0239 (0.0429)	
Frequency of participation in sport or physical activity (ref: never or almost never)		
Less than weekly		-0.0516 (0.0691)
Once a week or more		0.0403 (0.0445)
Gender (ref: male)		
Female	0.0136 (0.0412)	0.0174 (0.0412)
Age	-0.0458*** (0.0084)	-0.0457*** (0.0084)
Region (ref: England)		
London	-0.1726** (0.0616)	-0.1718** (0.0616)
Education (ref: GCSE, other or no qualification)		
A-levels or professional qualification	0.0103 (0.0465)	0.0089 (0.0465)
University degree or higher	-0.0134 (0.0632)	-0.015 (0.0632)
Children in household (ref: no)		
Yes	0.1556*** (0.0441)	0.1562*** (0.0441)
Labour force status (ref: employed)		
Unemployed	-0.3676*** (0.0686)	-0.3673*** (0.0686)
Inactive	-0.0753 (0.0487)	-0.0752 (0.0487)
Yearly personal income (ref: below or equal to year sample median)		
Above year sample median	0.1049* (0.0424)	0.103* (0.0424)
House tenure (ref: house not owned)		
House owned	0.0417 (0.0433)	0.0412 (0.0433)
Health (ref: very good)		
Good	-0.4342*** (0.0423)	-0.4314*** (0.0423)
Fair	-1.0061*** (0.0634)	-0.9974*** (0.0637)
Survey (ref: APS 2010-11)		
APS 2011-12	-0.1646*** (0.049)	-0.1661*** (0.049)
TP 2013-14	-0.1816** (0.0649)	-0.181** (0.0649)
TP 2014-15	-0.1282 (0.0676)	-0.1269 (0.0675)
TP 2015-16	-0.1981** (0.0667)	-0.1963** (0.0667)
Intercept	9.276*** (0.1922)	9.2696*** (0.1923)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 5,798 Resp: 5,462	Obs: 5,798 Resp: 5,462

Table A2. English sample

Dependent variable: general happiness	Overall participation	Frequency of participation
Sport or physical activity (ref: no participation)		
Participation	0.1545* (0.0695)	
Frequency of participation in sport or physical activity (ref: never or almost never)		
Less than weekly		0.11 (0.108)
Once a week or more		0.1662* (0.0729)
Gender (ref: male)		
Female	-0.0069 (0.0702)	-0.0033 (0.0706)
Age	-0.0403** (0.0149)	-0.0401** (0.0149)
Region (ref: England)		
London	-0.2693** (0.1025)	-0.2705** (0.1026)
Education (ref: GCSE, other or no qualification)		
A-levels or professional qualification	-0.0582 (0.0751)	-0.0595 (0.0751)
University degree or higher	-0.1573 (0.1141)	-0.1588 (0.1142)
Children in household (ref: no)		
Yes	0.2978*** (0.074)	0.2983*** (0.074)
Labour force status (ref: employed)		
Unemployed	-0.2858* (0.1178)	-0.2852* (0.1178)
Inactive	-0.0493 (0.0805)	-0.0481 (0.0805)
Yearly personal income (ref: below or equal to year sample median)		
Above year sample median	0.1831* (0.0823)	0.1829* (0.0823)
House tenure (ref: house not owned)		
House owned	0.0585 (0.0712)	0.0571 (0.0713)
Health (ref: very good)		
Good	-0.5319*** (0.0694)	-0.5305*** (0.0694)
Fair	-1.3107*** (0.1134)	-1.3069*** (0.1136)
Survey (ref: TP 2013-14)		
TP 2014-15	-0.0096 (0.0741)	-0.0093 (0.0741)
TP 2015-16	-0.1242 (0.0742)	-0.1236 (0.0743)
Intercept	8.9754*** (0.3078)	8.9684*** (0.3082)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 2,080 Resp: 1,744	Obs: 2,080 Resp: 1,744

Table A3. English sample

Dependent variable: daily anxiety	Overall participation	Frequency of participation
Sport or physical activity (ref: no participation)		
Participation	-0.0609 (0.1332)	
Frequency of participation in sport or physical activity (ref: never or almost never)		
Less than weekly		-0.3154 (0.2077)
Once a week or more		0.0043 (0.1393)
Gender (ref: male)		
Female	0.5117*** (0.1322)	0.5323*** (0.1328)
Age	0.0695* (0.0283)	0.0704* (0.0283)
Region (ref: England)		
London	0.0361 (0.1932)	0.0291 (0.1933)
Education (ref: GCSE, other or no qualification)		
A-levels or professional qualification	0.014 (0.1437)	0.0069 (0.1437)
University degree or higher	0.2412 (0.2174)	0.2321 (0.2174)
Children in household (ref: no)		
Yes	-0.2399 (0.1399)	-0.237 (0.1399)
Labour force status (ref: employed)		
Unemployed	0.3003 (0.2255)	0.3027 (0.2254)
Inactive	0.2568 (0.1538)	0.2629 (0.1538)
Yearly personal income (ref: below or equal to year sample median)		
Above year sample median	-0.2314 (0.1575)	-0.233 (0.1574)
House tenure (ref: house not owned)		
House owned	-0.0197 (0.1356)	-0.0281 (0.1356)
Health (ref: very good)		
Good	0.3608** (0.1328)	0.3684** (0.1329)
Fair	1.2649*** (0.2165)	1.2848*** (0.2169)
Survey (ref: TP 2013-14)		
TP 2014-15	-0.0391 (0.1442)	-0.0375 (0.1441)
TP 2015-16	0.0304 (0.1436)	0.034 (0.1435)
Intercept	0.6687 (0.5834)	0.631 (0.5838)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 2,080 Resp: 1,744	Obs: 2,080 Resp: 1,744

Table A4. English sample

Dependent variable: life worthwhileness	Overall participation	Frequency of participation
Sport or physical activity (ref: no participation)		
Participation	0.1517* (0.0696)	
Frequency of participation in sport or physical activity (ref: never or almost never)		
Less than weekly		0.0377 (0.1078)
Once a week or more		0.1824* (0.0731)
Gender (ref: male)		
Female	0.2138** (0.0716)	0.2233** (0.072)
Age	-0.0337* (0.0151)	-0.0333* (0.0151)
Region (ref: England)		
London	-0.3132** (0.1046)	-0.3163** (0.1046)
Education (ref: GCSE, other or no qualification)		
A-levels or professional qualification	-0.0667 (0.0753)	-0.07 (0.0754)
University degree or higher	-0.0491 (0.1151)	-0.053 (0.1151)
Children in household (ref: no)		
Yes	0.3325*** (0.0752)	0.3341*** (0.0752)
Labour force status (ref: employed)		
Unemployed	-0.2421* (0.1182)	-0.2402* (0.1181)
Inactive	-0.1204 (0.0809)	-0.1171 (0.0809)
Yearly personal income (ref: below or equal to year sample median)		
Above year sample median	0.064 (0.0826)	0.0638 (0.0826)
House tenure (ref: house not owned)		
House owned	-0.0391 (0.0718)	-0.0427 (0.0718)
Health (ref: very good)		
Good	-0.3222*** (0.0696)	-0.3184*** (0.0696)
Fair	-0.7372*** (0.114)	-0.7275*** (0.1142)
Survey (ref: TP 2013-14)		
TP 2014-15	0.0587 (0.0731)	0.0596 (0.0731)
TP 2015-16	0.0412 (0.0738)	0.043 (0.0738)
Intercept	8.6183*** (0.3121)	8.5992*** (0.3124)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 2,080 Resp: 1,744	Obs: 2,080 Resp: 1,744

Table A5. European sample

Dependent variable: life satisfaction	Overall participation	Frequency of participation
Sport or physical activity (ref: no participation)		
Participation	0.4625*** (0.1165)	
Frequency of participation in sport or physical activity (ref: never or almost never)		
Less than weekly		0.333** (0.1231)
Once a week or more		0.5596*** (0.1202)
Gender (ref: male)		
Female	0.0074 (0.0688)	0.0333 (0.0692)
Age	-0.0571*** (0.0161)	-0.0537*** (0.0161)
Region (ref: London)		
Paris	-0.2485** (0.0865)	-0.2207* (0.0868)
Berlin	0.0087 (0.0927)	-0.0071 (0.0927)
Education (ref: GCSE, high-school diploma, other or no qualification)		
A-levels or professional qualification	0.1055 (0.0812)	0.1022 (0.0811)
University degree or higher	0.3823*** (0.097)	0.3699*** (0.0969)
Marital status (ref: single or never married)		
Married or living as a couple	0.1954* (0.0762)	0.2006** (0.0761)
Other	0.5948 (0.4924)	0.6259 (0.4917)
Children in household (ref: no)		
Yes	0.0262 (0.0778)	0.0344 (0.0777)
Labour force status (ref: employed)		
Unemployed	-0.9803*** (0.1321)	-0.9675*** (0.1319)
Inactive	0.0371 (0.0759)	0.0337 (0.0758)
Yearly household income (ref: below or equal to year sample median)		
Above year sample median	0.2019** (0.066)	0.1867** (0.066)
House tenure (ref: house not owned)		
House owned	0.1908* (0.0952)	0.1906* (0.095)
Health satisfaction (ref: 9-10/10)		
7-8/10	-0.5715*** (0.0756)	-0.5579*** (0.0756)
5-6/10	-1.1914*** (0.0867)	-1.1642*** (0.087)
Year (ref: 2011)		
2012	-0.072 (0.0736)	-0.0706 (0.0735)
2013	-0.0429 (0.0989)	-0.041 (0.0987)
Intercept	8.2674*** (0.3872)	8.1396*** (0.3887)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 2,664 Resp: 2,124	Obs: 2,664 Resp: 2,124

Table A6. European sample

Dependent variable: daily happiness	Overall participation	Frequency of participation
Sport or physical activity (ref: no participation)		
Participation	0.3919** (0.1357)	
Frequency of participation in sport or physical activity (ref: never or almost never)		
Less than weekly		0.2855* (0.1436)
Once a week or more		0.4704*** (0.14)
Gender (ref: male)		
Female	-0.0384 (0.0795)	-0.0174 (0.08)
Age	-0.0115 (0.0187)	-0.0087 (0.0187)
Region (ref: London)		
Paris	-0.0107 (0.1001)	0.0119 (0.1005)
Berlin	-0.0666 (0.1073)	-0.0796 (0.1074)
Education (ref: GCSE, high-school diploma, other or no qualification)		
A-levels or professional qualification	0.0434 (0.0947)	0.0404 (0.0947)
University degree or higher	0.2432* (0.113)	0.2327* (0.113)
Marital status (ref: single or never married)		
Married or living as a couple	0.3323*** (0.0885)	0.3366*** (0.0885)
Other	0.0693 (0.5705)	0.0948 (0.5703)
Children in household (ref: no)		
Yes	-0.1321 (0.0903)	-0.1255 (0.0903)
Labour force status (ref: employed)		
Unemployed	-0.5128** (0.1543)	-0.5022** (0.1542)
Inactive	0.1004 (0.0883)	0.0978 (0.0882)
Yearly household income (ref: below or equal to year sample median)		
Above year sample median	0.2541** (0.0768)	0.2416** (0.077)
House tenure (ref: house not owned)		
House owned	0.0881 (0.1108)	0.0881 (0.1107)
Health satisfaction (ref: 9-10/10)		
7-8/10	-0.6264*** (0.0882)	-0.6153*** (0.0883)
5-6/10	-1.3557*** (0.1011)	-1.3333*** (0.1015)
Year (ref: 2011)		
2012	0.0277 (0.0868)	0.0289 (0.0867)
2013	-0.0331 (0.1166)	-0.0315 (0.1164)
Intercept	7.2139*** (0.4493)	7.1104*** (0.4514)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 2,664 Resp: 2,124	Obs: 2,664 Resp: 2,124

Table A7. European sample

Dependent variable: daily anxiety	Overall participation	Frequency of participation
Sport or physical activity (ref: no participation)		
Participation	-0.0414 (0.1896)	
Frequency of participation in sport or physical activity (ref: never or almost never)		
Less than weekly		0.0593 (0.2007)
Once a week or more		-0.1167 (0.1959)
Gender (ref: male)		
Female	0.3017** (0.1118)	0.2817* (0.1125)
Age	0.0259 (0.0262)	0.0232 (0.0262)
Region (ref: London)		
Paris	0.0788 (0.1406)	0.0572 (0.1412)
Berlin	-0.2409 (0.1507)	-0.2287 (0.1508)
Education (ref: GCSE, high-school diploma, other or no qualification)		
A-levels or professional qualification	0.0536 (0.1323)	0.0562 (0.1322)
University degree or higher	-0.1655 (0.1578)	-0.1558 (0.1579)
Marital status (ref: single or never married)		
Married or living as a couple	-0.072 (0.1239)	-0.0759 (0.1239)
Other	1.874* (0.8005)	1.8499* (0.8004)
Children in household (ref: no)		
Yes	0.352** (0.1265)	0.3458** (0.1266)
Labour force status (ref: employed)		
Unemployed	0.291 (0.2151)	0.2812 (0.2152)
Inactive	0.0075 (0.1235)	0.0102 (0.1235)
Yearly household income (ref: below or equal to year sample median)		
Above year sample median	-0.4359*** (0.1074)	-0.4241*** (0.1077)
House tenure (ref: house not owned)		
House owned	-0.0252 (0.1549)	-0.0251 (0.1549)
Health satisfaction (ref: 9-10/10)		
7-8/10	0.5298*** (0.1231)	0.5194*** (0.1233)
5-6/10	1.1487*** (0.1412)	1.1279*** (0.1418)
Year (ref: 2011)		
2012	0.2394* (0.1202)	0.2385* (0.1202)
2013	0.4004* (0.1613)	0.3991* (0.1613)
Intercept	3.1369*** (0.6297)	3.2354*** (0.6329)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 2,664 Resp: 2,124	Obs: 2,664 Resp: 2,124

Table A8. European sample

Dependent variable: life worthwhileness	Overall participation	Frequency of participation
Sport or physical activity (ref: no participation)		
Participation	0.5691*** (0.1244)	
Frequency of participation in sport or physical activity (ref: never or almost never)		
Less than weekly		0.4411*** (0.1314)
Once a week or more		0.6651*** (0.1284)
Gender (ref: male)		
Female	0.2214** (0.0739)	0.2467*** (0.0742)
Age	0.0277 (0.0173)	0.0311 (0.0173)
Region (ref: London)		
Paris	-0.5171*** (0.0929)	-0.4895*** (0.0931)
Berlin	0.0937 (0.0995)	0.0784 (0.0994)
Education (ref: GCSE, high-school diploma, other or no qualification)		
A-levels or professional qualification	0.0882 (0.0867)	0.0858 (0.0866)
University degree or higher	0.1987 (0.1035)	0.1876 (0.1035)
Marital status (ref: single or never married)		
Married or living as a couple	0.0312 (0.0815)	0.036 (0.0813)
Other	0.2311 (0.5283)	0.2608 (0.527)
Children in household (ref: no)		
Yes	0.1863* (0.0833)	0.194* (0.0832)
Labour force status (ref: employed)		
Unemployed	-0.6262*** (0.1407)	-0.6157*** (0.1406)
Inactive	-0.0193 (0.0811)	-0.0225 (0.081)
Yearly household income (ref: below or equal to year sample median)		
Above year sample median	-0.0065 (0.0705)	-0.0215 (0.0705)
House tenure (ref: house not owned)		
House owned	-0.0987 (0.1017)	-0.0988 (0.1015)
Health satisfaction (ref: 9-10/10)		
7-8/10	-0.6029*** (0.0806)	-0.5903*** (0.0806)
5-6/10	-1.2037*** (0.0925)	-1.1788*** (0.0928)
Year (ref: 2011)		
2012	-0.1521 (0.0777)	-0.1515 (0.0778)
2013	-0.3445** (0.1044)	-0.3445** (0.1045)
Intercept	6.5702*** (0.4148)	6.445*** (0.4161)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 2,664 Resp: 2,124	Obs: 2,664 Resp: 2,124

Table A9. UK sample

Dependent variable: life satisfaction	Overall participation	Frequency of participation
Sport or physical activity (ref: no participation)		
Participation	0.1752***	
	(0.0454)	
Frequency of participation in sport or physical activity (ref: never or almost never)		
Less than weekly		0.1244*
		(0.0505)
Once a week or more		0.2022***
		(0.0469)
Gender (ref: male)		
Female	-0.0229	-0.015
	(0.033)	(0.0331)
Age	-0.0625***	-0.0622***
	(0.0067)	(0.0067)
Region (ref: England)		
London	-0.2077***	-0.2081***
	(0.0568)	(0.0568)
Wales	-0.0319	-0.0338
	(0.0522)	(0.0522)
Scotland	-0.023	-0.0258
	(0.05)	(0.05)
Northern Ireland	0.1257*	0.1224*
	(0.0619)	(0.0619)
Education (ref: GCSE, other or no qualification)		
A-levels or professional qualification	0.0571	0.0581
	(0.0335)	(0.0335)
University degree or higher	0.0927	0.0931
	(0.0561)	(0.0561)
Marital status (ref: single or never married)		
Married or in a civil partnership	0.3377***	0.3387***
	(0.0698)	(0.0698)
Other	-0.7458***	-0.7506***
	(0.209)	(0.2089)
Own children in household (ref: no)		
Yes	0.187***	0.1855***
	(0.0547)	(0.0546)
Labour force status (ref: employed)		
Unemployed	-0.4868***	-0.4881***
	(0.0558)	(0.0558)
Inactive	0.0211	0.0182
	(0.0343)	(0.0343)
Monthly household income (ref: below or equal to year sample median)		
Above year sample median	0.169***	0.1697***
	(0.0311)	(0.031)
House tenure (ref: house not owned)		
House owned	0.1381***	0.1368***
	(0.0334)	(0.0334)
Health (ref: excellent)		
Very good	-0.5096***	-0.507***
	(0.0328)	(0.0329)
Good	-1.0337***	-1.027***
	(0.0408)	(0.0409)
Survey (ref: BHPS 6)		
BHPS 8	0.1389*	0.1382*
	(0.0636)	(0.0636)
BHPS 10	-0.1079	-0.1099
	(0.0618)	(0.0618)
BHPS 12	-0.0416	-0.0437
	(0.064)	(0.064)

BHPS 14	-0.0361 (0.0653)	-0.0371 (0.0653)
BHPS 16	-0.0928 (0.0676)	-0.0979 (0.0676)
BHPS 18	0.1736* (0.0779)	0.1799* (0.078)
USoc 2	0.4085*** (0.0586)	0.408*** (0.0586)
USoc 5	0.0771 (0.0599)	0.0747 (0.0599)
Intercept	8.5488*** (0.1577)	8.5352*** (0.1578)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 20,792 Resp: 12,474	Obs: 20,792 Resp: 12,474

Table A10. UK sample

Dependent variable: change in life satisfaction	Overall participation	Frequency of participation
Change in participation in sport or physical activity (ref: no participation – no participation)		
Participation – no participation	0.0326	
	(0.1251)	
No participation – participation	0.0227	
	(0.1316)	
Participation – participation	-0.0042	
	(0.1126)	
Change in frequency of participation in sport or physical activity (ref: never or almost never – never or almost never)		
Once a week or more – never or almost never		0.0668
		(0.1318)
Once a week or more – less than weekly		-0.0395
		(0.1316)
Less than weekly – never or almost never		-0.0449
		(0.1576)
Never or almost never – less than weekly		0.159
		(0.1673)
Less than weekly – once a week or more		0.0224
		(0.1341)
Never or almost never – weekly or more		-0.049
		(0.1425)
Less than weekly – less than weekly		-0.0458
		(0.1394)
Once a week or more – once a week or more		0.0094
		(0.1158)
Change in age	-0.1608***	-0.16***
	(0.03)	(0.03)
Change in education (ref: no change)		
GCSE or no qual. – A-levels or prof. title	0.0544	0.0528
	(0.0694)	(0.0695)
A-levels or prof. title – degree or higher	-0.1702	-0.1753
	(0.0965)	(0.0966)
GCSE or no qual. – degree or higher	-0.0704	-0.0825
	(0.2884)	(0.2886)
Change in marital status (ref: no change)		
Single – other	-1.9575**	-1.9654**
	(0.6313)	(0.6315)
Married – other	-0.4604	-0.4777
	(0.4693)	(0.4695)
Single - married	0.1723	0.178
	(0.1337)	(0.1338)
Other – married	0.8334	0.8092
	(1.6059)	(1.6063)
Change in own children in household (ref: no change)		
Own children in household – no own children in household	-0.429	-0.4173
	(0.5278)	(0.5281)
No own children in household – own children in household	0.2192*	0.2229*
	(0.1117)	(0.1119)
Change in employment status (ref: no change)		
Inactive – unemployed	-0.4844***	-0.4796***
	(0.1275)	(0.1276)
Employed – inactive	0.2606*	0.2635*
	(0.123)	(0.123)
Employed – unemployed	-0.299	-0.3004
	(0.1973)	(0.1974)
Unemployed – employed	-0.0176	-0.0184
	(0.1466)	(0.1466)
Inactive – employed	-0.0887	-0.0874

	(0.0622)	(0.0623)
Unemployed – inactive	-0.2996	-0.2939
	(0.2267)	(0.2268)
Change in monthly household income (ref: no change)		
Above year sample median – below or equal to year sample median	-0.2045**	-0.206**
	(0.0764)	(0.0764)
Below or equal to year sample median – above year sample median	0.1514*	0.1506*
	(0.074)	(0.074)
Change in house tenure (ref: no change)		
House owned – house not owned	0.1241	0.1272
	(0.0926)	(0.0927)
House not owned – house owned	0.1446	0.1414
	(0.1064)	(0.1065)
Change in health (ref: no change)		
Good– excellent	0.503**	0.5026**
	(0.1841)	(0.1842)
Good– very good / very good – excellent	0.2782***	0.2798***
	(0.0645)	(0.0645)
Excellent – very good / very good - good	-0.2646***	-0.2653***
	(0.0648)	(0.0649)
Excellent – good	-0.8071***	-0.8101***
	(0.1625)	(0.1626)
Intercept	0.2126	0.2099
	(0.1327)	(0.1328)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 8,318 Resp: 4,658	Obs: 8,318 Resp: 4,658

Table A11. European sample

Dependent variable: experienced SWB	Experienced happiness	Experienced anxiety	Experienced purpose
Sport or physical activity (ref: no participation)			
Participation	1.121***	-0.1063	1.2743***
	(0.248)	(0.2979)	(0.3294)
Gender (ref: male)			
Female	-0.1304	0.1711	0.1112
	(0.0933)	(0.1125)	(0.1246)
Age	-0.0327	-0.0061	0.0327
	(0.0219)	(0.0264)	(0.0292)
Region (ref: London)			
Paris	-0.2256	-0.2296	-1.593***
	(0.1189)	(0.1434)	(0.1587)
Berlin	-0.172	-0.2412	0.127
	(0.1267)	(0.1527)	(0.1691)
Education (ref: GCSE, high-school diploma, other or no qualification)			
A-levels or professional qualification	-0.0112	0.154	-0.1073
	(0.1084)	(0.1307)	(0.1443)
University degree or higher	-0.0212	0.0915	-0.1215
	(0.1284)	(0.1552)	(0.171)
Marital status (ref: single or never married)			
Married or living as a couple	0.0356	0.3042*	0.1976
	(0.0991)	(0.1203)	(0.1322)
Other	0.1459	1.7784*	1.4037
	(0.6709)	(0.8011)	(0.8926)
Children in household (ref: no)			
Yes	-0.0807	0.2807*	0.1019
	(0.1076)	(0.1299)	(0.1436)
Labour force status (ref: employed)			
Unemployed	-0.0337	0.1381	-0.5923*
	(0.1964)	(0.2356)	(0.2612)
Inactive	-0.1135	-0.0817	-0.1957
	(0.108)	(0.13)	(0.1439)
Yearly household income (ref: below or equal to year sample median)			
Above year sample median	0.2486**	-0.4648***	-0.0853
	(0.0874)	(0.1057)	(0.1164)
House tenure (ref: house not owned)			
House owned	-0.2482	-0.133	-0.0812
	(0.1273)	(0.1536)	(0.1695)
Health satisfaction (ref: 9-10/10)			
7-8/10	-0.5423***	0.6858***	-0.4594**
	(0.1023)	(0.1235)	(0.1362)
5-6/10	-1.1537***	1.0448***	-1.2338***
	(0.1171)	(0.1411)	(0.1559)
Year (ref: 2011)			
2012	0.1192	-0.0492	-0.0677
	(0.0962)	(0.1167)	(0.1277)
2013	0.1342	-0.2618	-0.2551
	(0.1223)	(0.1489)	(0.1626)
Where respondent is during an experience (ref: other)			
At home	0.7047***	-0.6322***	-0.0054
	(0.1257)	(0.1505)	(0.167)
At work	-0.6474***	0.7984***	0.8706***
	(0.1381)	(0.1654)	(0.1834)
At someone else's home	0.7525***	-0.5789**	0.6825**
	(0.1598)	(0.1913)	(0.2123)
Outdoors	0.7739***	-0.2567	0.8094***

	(0.1357)	(0.1626)	(0.1802)
In a restaurant or bar	0.9057***	-0.3366	0.688*
	(0.2189)	(0.2628)	(0.291)
Whether respondent is alone during an experience (ref: no)			
Yes	-0.6316***	0.2972*	-0.509***
	(0.094)	(0.1131)	(0.1249)
Intercept	8.1377***	2.2122***	6.6792***
	(0.513)	(0.6185)	(0.6843)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 2,664 Resp: 2,124	Obs: 2,664 Resp: 2,124	Obs: 2,664 Resp: 2,124

Table A12. American sample

Dependent variable: experienced SWB	Experienced happiness	Experienced stress	Experienced meaning
Sport or physical activity (ref: no participation)			
Participation	0.7694***	-0.4067*	1.2441***
	(0.1843)	(0.1953)	(0.2407)
Gender (ref: male)			
Female	0.1755**	0.3953***	0.0894
	(0.0555)	(0.0585)	(0.0721)
Age	0.0632***	0.03*	0.1978***
	(0.0131)	(0.0137)	(0.0169)
Education (ref: high-school diploma or no qualification)			
Professional qualification	-0.1161	0.2023*	-0.0949
	(0.0764)	(0.0804)	(0.0992)
University degree or higher	-0.6568***	0.3227**	-0.9047***
	(0.118)	(0.1246)	(0.1536)
Marital status (ref: single or never married)			
Married	0.4646***	-0.2837*	0.2495
	(0.1086)	(0.1138)	(0.1404)
Other	0.4417*	0.5562*	-0.4929
	(0.215)	(0.2254)	(0.2781)
Own children in household (ref: no)			
Yes	0.127	0.0394	0.4178***
	(0.072)	(0.0759)	(0.0936)
Labour force status (ref: employed)			
Unemployed	0.0548	0.3344***	0.1495
	(0.0847)	(0.0891)	(0.1099)
Inactive	0.0538	0.0815	0.0788
	(0.069)	(0.0725)	(0.0894)
Yearly household income (ref: below or equal to year sample median)			
Above year sample median	-0.1783**	0.1346*	-0.4711***
	(0.0632)	(0.0665)	(0.082)
House tenure (ref: house not owned)			
House owned	-0.1354*	-0.0657	-0.0026
	(0.0653)	(0.0687)	(0.0847)
Health (ref: excellent)			
Very good	-0.2878***	0.311***	-0.2214*
	(0.0665)	(0.07)	(0.0863)
Good	-0.6625***	0.5292***	-0.4133***
	(0.0723)	(0.0761)	(0.0938)
Year (ref: 2010)			
2012	0.2387***	-0.1238	0.0323
	(0.0675)	(0.0708)	(0.0873)
2013	0.3687***	-0.0687	0.2529**
	(0.0678)	(0.0712)	(0.0879)
Where respondent is during an experience (ref: other)			
At home	0.0033	-0.3865***	0.1729*
	(0.0601)	(0.0625)	(0.0772)
At work	-0.5332***	0.804***	0.4193**
	(0.1169)	(0.1226)	(0.1513)
At someone else's home	0.4768***	-0.6102***	0.5149***
	(0.1084)	(0.1121)	(0.1386)
Outdoors	0.5545***	-0.6623***	0.6286**
	(0.1545)	(0.1568)	(0.1943)
In a restaurant or bar	0.425*	-0.3857*	0.8547***
	(0.1804)	(0.1834)	(0.2272)
Whether respondent is alone during an experience (ref: no)			

Yes	-0.6979*** (0.0575)	0.3763*** (0.0591)	-1.0064*** (0.0731)
Intercept	6.3136*** (0.2864)	0.7743* (0.3008)	2.5289*** (0.371)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 9,324 Resp: 3,143	Obs: 9,324 Resp: 3,143	Obs: 9,324 Resp: 3,143

Table A13. American sample

Dependent variable: change in experienced SWB	Experienced happiness	Experienced stress	Experienced meaning
Change in participation in sport or physical activity (ref: no change)			
Participation – no participation	-1.2612***	0.5258*	-1.8412***
	(0.2501)	(0.241)	(0.3322)
No participation – participation	0.7621**	-0.1068	1.8229***
	(0.2382)	(0.2295)	(0.3165)
Change in where respondent is during an experience (ref: no change)			
At home – not at home	-0.1359	0.3108**	0.161
	(0.1001)	(0.0964)	(0.1329)
Not at home – at home	-0.036	-0.3206***	0.3019*
	(0.0889)	(0.0857)	(0.1181)
At work – not at work	0.9571***	-1.2194***	-0.0669
	(0.1476)	(0.1422)	(0.196)
Not at work – at work	-0.1049	1.066***	1.1075***
	(0.1693)	(0.1631)	(0.2249)
At someone else's home – not at someone else's home	-0.5574**	0.2781	-0.7766**
	(0.1769)	(0.1705)	(0.235)
Not at someone else's home – at someone else's home	0.6736***	-0.3423*	1.103***
	(0.1592)	(0.1534)	(0.2115)
At a restaurant or bar – not at a restaurant or bar	-0.2885	0.6097**	-0.7139**
	(0.206)	(0.1985)	(0.2736)
Not at a restaurant or bar – at a restaurant or bar	0.2466	-0.4867**	0.5181*
	(0.1874)	(0.1806)	(0.249)
Outdoors – not outdoors	-0.1766	0.1181	0.2577
	(0.2737)	(0.2637)	(0.3635)
Not outdoors – outdoors	0.342	-0.7416**	0.9049**
	(0.2609)	(0.2514)	(0.3466)
Change in whether respondent is alone during an experience (ref: no change)			
Alone – not alone	0.697***	-0.1907*	1.0126***
	(0.0882)	(0.085)	(0.1171)
Not alone – alone	-0.4986***	0.2997***	-1.273***
	(0.094)	(0.0906)	(0.1248)
Year (ref: 2010)			
2012	-0.0297	2e-04	-0.0633
	(0.0845)	(0.0814)	(0.1122)
2013	-0.063	-0.0679	-7e-04
	(0.0841)	(0.081)	(0.1117)
Intercept	-0.1025	-0.2714***	-0.2496*
	(0.075)	(0.0722)	(0.0996)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 6,181 Resp: 3,135	Obs: 6,181 Resp: 3,135	Obs: 6,181 Resp: 3,135

Table A14. UK sample

Dependent variable: odds of frequency of participation in sport or physical activity	Less than weekly (ref: never or almost never)	Once a week or more (ref: never or almost never)
Gender (ref: male)		
Female	-0.0476 (0.0472)	-0.6092*** (0.0406)
Age	-0.0177*** (0.0107)	-0.0392*** (0.0092)
Region (ref: England)		
London	-0.1842* (0.0841)	-0.1815 (0.0738)
Wales	-0.5233*** (0.0694)	-0.3439*** (0.0577)
Scotland	-0.2466*** (0.0703)	-0.008 (0.0601)
Northern Ireland	0.6994*** (0.085)	0.3821*** (0.0679)
Education (ref: GCSE, other or no qualification)		
A-levels or professional qualification	0.2749*** (0.0508)	0.2147*** (0.0436)
University degree or higher	0.6564*** (0.0892)	0.6570*** (0.0792)
Marital status (ref: single or never married)		
Married or in a civil partnership	-0.028 (0.0985)	-0.1731* (0.0868)
Other	-0.0839 (0.3407)	0.357 (0.2732)
Own children in household (ref: no)		
Yes	-0.42*** (0.0773)	-0.2913*** (0.0651)
Labour force status (ref: employed)		
Unemployed	-0.331*** (0.0865)	-0.2001** (0.0725)
Inactive	0.0281*** (0.0554)	0.2467*** (0.0482)
Monthly household income (ref: below or equal to year sample median)		
Above year sample median	0.1271* (0.0503)	0.068 (0.0437)
House tenure (ref: house not owned)		
House owned	0.1081** (0.0509)	0.2075** (0.0441)
Health (ref: excellent)		
Very good	0.1365* (0.0554)	-0.1069* (0.0467)
Good	0.2258*** (0.064)	-0.3165*** (0.0555)
Intercept	0.4918* (0.2347)	2.2426*** (0.202)
*: p-value < .05 **: p-value < .01 ***: p-value < .001	Obs: 20,792 Resp: 12,474	Obs: 20,792 Resp: 12,474

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