Journal of Physical Activity and Health, 2014, 11, 396-403
http://dx.doi.org/10.1123/jpah.2012-0001

JOURNAL OF
Physical Activity & Health
Official Journal of ISPAH
www.JPAH-Journal.com
ORIGINAL RESEARCH

Sport Participation and Subjective Well-Being: Instrumental Variable Results From German Survey Data

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***Background*:** A major policy goal of many ministries of sport and health is increased participation in sport to promote health. A growing literature is emerging about the benefits of sport participation on happiness. A challenge in establishing a link between sport participation and happiness is controlling for endogeneity of sport participation in the happiness equation. ***Methods*:** This study seeks to establish causal evidence of a relationship between sport participation and self reported happiness using instrumental variables (IV). ***Results*:** IV estimates based on data from a 2009 population survey living in Rheinberg, Germany indicate that individuals who participate in sport have higher life happiness. The results suggest a U-shaped relationship between age and self-reported happiness. Higher income is associated with greater self-reported happiness, males are less happy than females, and single individuals are less happy than nonsingles. ***Conclusions*:** Since the results are IV, this finding is interpreted as a causal relationship between sport participation and subjective well-being (SWB). This broader impact of sport participation on general happiness lends support to the policy priority of many governments to increase sport participation at all levels of the general population.

***Keywords*:** physical activity, happiness

Many ministries of sport and health cite increased participation in sport and physical activity at all levels of the population as a major policy goal. This policy objective is rooted in statistics showing that most countries' citizens are not sufficiently physically active to obtain health benefits.[1] The benefits of regular physical activity are well documented in the clinical and public health literature and include reduced risk of many chronic diseases, reduced stress and depression, and increased emotional well-being, energy level, self-confidence, and satisfaction with social activity.[2] Government interest in promoting sport participation extends beyond promoting health to achieving other important societal goals like reducing obesity, deterring crime, and imparting important life skills on youth.[3]

The nearly global policy priority of promoting physical activity has motivated a number of studies in epidemiology, public health and, more recently, economics that examine physical activity and sport participation. A common factor motivating this body of research is a desire to improve the understanding of how participation in physical activity and sport benefits society and highlights the importance of sport participation in everyday life. A growing literature is emerging about the benefits of physical activity and sport participation on happiness or SWB. This relatively small literature is part of a larger area of research on the social and economic determinants of happiness (for reviews of this literature see[4–6]). Fox's survey[4] of prior research finds a positive correlation between sport participation and self-reported quality of life. However, the interpretation of correlative relationships between SWB and physical activity/ sport participation is not straightforward making it difficult to ascertain the underlying causal mechanisms and direction of causality. This factor together with the policy relevance of the relationship between sport participation and happiness makes advancing the understanding of this relationship an important area of research.

The objective of this study is to develop evidence of a causal link between sport participation and happiness (or SWB) using an instrumental variables (IV) approach. Sport participation may be an endogenous regressor in an equation with SWB as the dependent variable due to unobservable individual heterogeneity affecting both sport participation and well-being. Individuals who choose to participate in sport may be genetically healthier or otherwise predisposed toward social activities and, therefore, happier even without sport participation. Establishing a causal link between sport participation and SWB is difficult using cross-sectional data. One approach to overcoming this challenge is to use information about an

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individual's attitudes or beliefs and proximal surrounding environment to identify sport participation. This approach is taken in this paper by combining data from a population survey in the German city of Rheinberg with information about the location of sports facilities in the city. The environmental factor exploited is proximity to a sports facility. The belief factor exploited is the strength of individuals' beliefs that physical activity is important. It is posited that differences in these factors are exogenous to individuals' tendency to sport participation and SWB; thus they can be used as instruments to explain observed participation in sport and to analyze the causal relationship between sport participation and SWB. Evidence is found that individuals who practice sport report higher levels of life happiness. Since the results are IV results, this finding is interpreted as a causal relationship between sport participation and SWB.

An overview of the current state of literature about sport participation and happiness is provided next. This is followed by a description of the data and empirical methods. The paper finishes with a discussion of the results from the empirical analysis and some directions for future research.

Relevant Literature

A number of studies explore the economic, social, political, and health- and sport-related determinants of happiness or SWB.[7–12] Since the focus of this study is on the relationship between physical activity and SWB, the review of the relevant literature is limited to studies that investigate the relationship between happiness and sport and happiness and health.

The research community and public policy makers often do not make a clear distinction between health and well-being or happiness and SWB implying that health, happiness and SWB are interrelated.[12,13] While health is often described as a state of complete physical mental and social well-being, some argue that this description corresponds more to happiness than to health.[14] Both terms, health and happiness, designate distinct life experiences, whose relationship is neither fixed nor constant. It is difficult to distinguish between health and happiness because any disturbance in happiness is often indicated as a health problem.[15] Health is a very important determinant of happiness and increases it significantly.[9,16] Borooah[17] identifies good health as the most important source of happiness, where health is determined either through self-assessment or in terms of the absence of any health problems.

Although there are a lot of studies investigating the factors influencing happiness, few studies examine the relationship between sport participation and happiness.[10–12,18] In recent studies, Downward et al.[18,19] find that sport engagement contributes directly to SWB. This applies as well to duration and frequency of sports; thereby 67 sports were included in the analysis,[19] though not as single sports but aggregated. Further research examines the influence of sport participation and active forms of transport, like walking and cycling, on self-reported health and SWB.[12] The results suggest that sport participation has a statistically significant and positive effect on both health and happiness. Moreover, other studies find that the availability of public sports facilities in close proximity of individual's homes positively influences SWB[10] and the accessibility of sport facilities increases sport participation and simultaneously fosters an increase in reported happiness.[11] Regarding gender effects in this context, a study in the UK finds that women who participated in sport report higher well-being than women with similar characteristics who were not physically active.[20] However, not only women, but both gender gain happiness from physical activity, but men appear to benefit more.[11] Kavetsos and Szymanski[21] investigate the interplay between SWB and sport events. Based on a multinational survey, they conclude that hosting sport events leads to a short-term "feel-good effect."[21] However, they stress that there is no evidence of a long-term effect.

The handful of papers reviewed here show that research on the relationship between sport and happiness is emerging. All of the studies, with the exception of Huang and Humphreys[11] use data from Europe. The key issue for empirical analysis of sport participation and SWB or happiness is the econometric identification of sport participation to correct for the potential endogeneity between happiness and sport participation. This study adds to this literature by developing further evidence about the relationship between sport participation and happiness using IV and data for a different population than those in the existing studies.

Data and Methods

Data Source

The relationship between sport participation and SWB is analyzed using data from a population survey conducted in Rheinberg, Germany. The questionnaire was developed to get information about sport participation, happiness, attitudes about sport participation and parental or peer influence on sport participation. The questionnaire contained questions about sport participation, like "Do you practice sport in your free-time?", and questions about the kind of sports that were performed. Questions about the first- and second-most often practiced sports within a week were asked. In addition to detailed questions about sport participation, the respondents were asked for their time spent in many activities like work, childcare, and care of relatives; monetary costs of participation; and nonmonetary costs of time spent getting to sporting facilities. Self-reported happiness is measured by asking respondents how happy they are with their lives in general. In addition, data to construct factors that have been repeatedly documented as associated with sport participation like age, income, educational attainment, gender, and nationality were available in the survey.

The survey was conducted by means of a Computer Assisted Telephone Interview (CATI) in the city of Rheinberg from September 3, 2009 to October 6, 2009. Rheinberg is situated in the federal state of North Rhine Westfalia in Germany and is a small town with a population of 32,556 inhabitants at the time of the survey. Rheinberg was chosen as the city of Rheinberg was interested in collecting data about their inhabitant's sport participation.

The selection of the sample was carried out using the Gabler-Häder approach to include also persons that cannot be found in the telephone book[22] as well as the last-birthday method as second quality measure. As a third quality measure, every household was called up to 10 times to get reached. It was possible to generate a total of 7333 telephone numbers. After controlling for invalid numbers and business numbers, 6547 numbers remained. Some of those numbers were not easy to get to as they represented fax only or voice mail only numbers, resulting in a clean sample of 2733 numbers. A total of n = 1526 interviews were conducted, which implies a response rate of 55.8%. The questionnaire also included questions for children which were answered by their parents. Hence, 408 cases of 3- to 17-year-old children were added so that the overall sample is 1934. Table 1 contains the descriptive statistics from the sample of adults for variables that are used in the empirical analysis.

The sample used in the empirical analysis contains 1238 adults between the ages of 18–70 who responded to the question about happiness. Sport participation and self-reported happiness are the key variables of interest. The sport participation variable is an aggregate measure of participation in any sport. It is based on responses to the questions: "Do you practice sport in your free-time" and "How many minutes per week do you spend doing your most frequently practiced sport." Individuals who responded yes to the first question and have a positive number of minutes spent per week are treated as participating in sports. Based on this definition, nearly 70% of the sample participates in sports. This finding is consistent with previous research on sport participation in other communities in Germany.[23,24] It is possible that the influence of sport participation on happiness varies by sport. However, given the sample size (1238), it is not desirable to separately analyze the relationship between happiness and individual sports since the number of individuals participating in any 1 sport is small.

Table 1 Summary Statistics (n = 1238)

Variable	Mean	SD
Sport participation	0.699	0.149
Self-reported happiness	4.140	0.823
Distance from nearest facility (km)	0.33	0.31
Believes physical activity is important	0.778	0.416
Age	46.091	14.380
Male	0.467	0.499
Household income	35,045	28,646
Employed	0.671	0.470
Hours worked	26.694	22.527
Higher education	0.149	0.357
Secondary education	0812	0.391
Children age 3–17	0.325	0.468
Children age <3	0.022	0.146
Single	0.111	0.315
Native German	0.940	0.237
Disabled	0.098	0.297

The other key variable, self-reported happiness, is measured on a 5-point scale. The survey question is: "Please indicate how happy you are with your life in general." Respondents choose 1 of 5 responses ranging from very unsatisfied (1) to very satisfied (5). The average response is 4.1 indicating that the residents of Rheinberg are generally satisfied with their lives.

The covariates used in the statistical analysis reflect those commonly used in happiness research. The economic variables include household income, employment status and hours worked. Respondents were asked to report both their personal and household net income on a monthly and annual basis. Annual household income is used as the measure of income in this study, unless the individual is single. In this case, annual personal net income is used. Respondents were asked several questions about time use, including the number of hours worked per week. Both the hours worked and employment status variables are generated from this question. An individual is considered employed if he reports working a positive number of hours per week. Average household income is 35,045€ per year. A majority of the sample (67%) is employed and reported working just under 27 hours per week.

The sociodemographic variables included in the analysis are age, gender, education, number of children, single, and native German. Age is allowed to enter nonlinearly by including age and age-squared. The average age of the sample is 46 years. Less than one-half (47%) of the sample is male. The majority of the sample is either married or living with a significant other as only 11% of the sample reported being single. Only 2.2% of the sample has children under the age of 3 in the household and 32.5% of the respondents have children between the ages of 3 and 17 living in the household. With regard to education, respondents were asked to report the highest level of education attained. The variable was used to construct 2 discrete measures of education: 1) higher education is equal to 1 if the respondent has a university education or an advanced technical diploma and equal to 0 otherwise; and 2) secondary education is equal to 1 if the respondent completed high school or equivalent and equal to 0 otherwise. The omitted category is respondents with less than a high school or equivalent education. 81.2% of the sample completed high school

or its equivalent and 14.9% has a university education or an advanced technical degree. The majority of the sample is native German (94%).

Survey participants were asked if they have a physical handicap. The variable 'disabled' is equal to 1 if the response to this question is yes and 0 otherwise. This variable plays a potentially important role in the empirical analysis of the effect of sport participation on self-reported happiness because it contains some information about an individual's health status. As discussed in Section 2, health, happiness and SWB are interrelated. 9.8% of the sample reported being disabled.

Methods

A 2-stage IV approach to estimate the relationship between participation in physical activity and self-reported happiness is used. The IV approach is employed to identify participation in physical activity using environmental factors exogenous to unobservable individual-specific factors affecting participation. Specifically, the predicted probability of participation in physical activity is used based on estimates from a linear probability model relating an indicator variable for participation in physical activity, the dependent variable, to a vector of explanatory variables that includes both factors known to affect participation in physical activity and 2 instruments that are correlated with the decision to participate in physical activity and uncorrelated with the unobservable factors affecting self-reported happiness. The estimated coefficient on the predicted probability of participating in physical activity in the second stage can be interpreted as reflecting the effect of participation in physical activity on well-being. The consistency of this estimate hinges on 2 factors: the exogenous environmental factors cannot affect the unobservable factors determining well-being; and must affect individuals' participation in physical activity.

The first stage model explains observed participation in physical activity:

$$G_i = a_0 + a_1 X_i + bZ_i + e_i \quad (1)$$

where G_i is an indicator variable equal to 1 if individual *i* participates in physical activity and equal to 0 if the individual is a nonparticipant, X_i is a vector of explanatory variables that affect both participation in physical activity and happiness, Z_i is a vector of instruments—variables that affect participation in physical activity but are unrelated to unobservable factors that affect happiness—e_i is an unobservable, mean 0, constant variance random variable capturing unobservable and omitted factors that affect participation in physical activity, and α_0, α_1, and β are unknown parameters to be estimated.

The parameters of Equation (1) are estimated using a linear probability model, as opposed to a probit model, because it is planned to use the predicted probability of participation as an instrument in the second stage equation. The literature on IV does not recommend using the predicted probability from a nonlinear probit or logit model as an instrument in the second stage regression because the danger of misspecification of a nonlinear first stage regression is high (eg,[25]). Following Angrist and Krueger,[25] the OLS estimator is used to generate the first-stage estimated probability of participation in physical activity, since the consistency of the estimates in the second stage IV equation does not require the first stage functional form to be correctly specified. A linear probability model is often criticized for generating predictions outside the 0 and 1 range. In the sample, this is not a problem, as all of the predicted probabilities from the first stage linear model fall in the (0, 1) interval.

For the IV estimates to reflect the relationship between participation in physical activity, the first stage equation must contain 1 or more variables related to participation in physical activity and unrelated to unobservable factors affecting happiness. These instruments statistically identify participation in physical activity. Two instruments are used in the first stage of the regression equation: the distance between an individuals' home and the nearest sports facility and the answer to a survey question that asked if individuals believed that participating in physical activity was important. The data on the distance to the nearest sport facility are based on geo-coded data of the respondent's street address and the detailed addresses of all available sport facilities in the city of Rheinberg, which was provided by the municipality. Based on the longitude and latitude of each street address and the location of each facility, we calculated the minimum straight line distance between each home address in the sample and each sports facility in Rheinberg.

With regard to the question about physical activity being important, 1.6% of the sample strongly disagreed with the statement, 3.3% disagreed, 17.1% neither agreed nor disagreed, 23.5% agreed, and 54.3% strongly agreed. An indicator variable was created that was equal to 1 if the individual agreed or strongly agreed with the statement and was used as an instrument in the first stage regression. Since opinions about the importance of participation in physical activity should be uncorrelated with unobservable factors affecting happiness, this should be an ideal instrument. The distance to the nearest sports facility serves as a proxy for access to these facilities. Similar instruments have been used by Forrest and McHale[26] and Huang and Humphreys[11] to identify participation in physical activity in happiness regressions using IV. Following Stock and Yogo,[27] an F-test from an OLS regression with P_i as the dependent variable and only the vector Z_i as explanatory variables is used to assess the strength of the instruments. The F-statistic from this regression is 55.48. This F-statistic is commonly used as a diagnostic to determine the strength of the instruments, and values greater than 10 indicate good instruments.[28] The Sargan-Hansen test of overidentifying restrictions for the IV model is 0.104, with a p-value of 0.75. The null that the instruments are uncorrelated with the error term on the second stage regression model, Equation (2), is not rejected.

The second stage regression model explains observed variation in self-reported satisfaction using only the

vector of explanatory variables, X_i, from the first stage regression model, equation (1) and the predicted value from equation (1), $\hat{G}_i$,

$$H_i = f_0 + f_1 X_i + f_2 \hat{G}_i + u_i (2)$$

where the fitted values from the first stage regression comes from Equation (1), the vector of explanatory variables X_i contains demographic and personal characteristics known to affect self reported happiness including age, gender, marital status, educational, income, racial/ethnicity, employment status, and an indicator variable for disability, and u_i is an unobservable mean 0, constant variance random variable capturing all other factors that affect self-reported happiness. By assumption u_i is uncorrelated with e_i, the unobservable factors affecting participation in physical activity. An indicator variable for disability is included because activity limitations arising from physical disabilities likely affect sport participation and possibly self-reported happiness.

H_i is the response to the survey question about happiness. The 5-step response to this question is not a cardinal measure of happiness. But these responses are often treated as cardinal measures in empirical happiness research, implying that OLS methods can be used to explain observed variation in these variables. Examples of papers using this approach include Di Tella et al,[29] Ferrer-i-Carbonell and Frijters,[30] and Helliwell and Huang.[31] The parameters of Equation (2) are estimated using OLS, following the approach used by Oswald and Wu,[32] who analyze variation in a similar variable reflecting self-reported happiness using OLS.

The parameter of interest is the estimate of f_2, which shows the effect of participation in sport on self reported happiness, correcting for the possibility that participation in physical activity is likely correlated with the unobservable factors affecting self-reported happiness, u_i.

Results and Discussion

Table 2 contains results from an IV model for the relationship between sport participation and self-reported happiness, Equation (2). This model explained about 6.7% of the observed variation in self reported happiness in the sample. One star indicates that the parameter estimate is statistically significant at the 10% level; 2 stars indicate that the parameter estimate is statistically significant at the 5% level; and 3 stars indicate that the parameter estimate is statistically significant at the 1% level. The results from the first stage linear probability model are provided in the Appendix.

The main parameter of interest is the estimated parameter of $\hat{G}_i$, the predicted probability of sport participation from the first stage equation, Equation (1). This estimated parameter is positive and statistically significant at the 1% level. The contribution of sport participation to self-reported happiness is 0.82. In the sample of data from Rheinberg individuals who practice sport are happier than individuals who do not participate in physical activity, other things equal. Because an IV estimator is used, assuming that sport participation is identified, these results suggest that effect of practicing sport on self-reported happiness is a causal effect. Huang and Humphreys[33] and Forrest and McHale[26] also attempt to account for endogeneity of sport participation in the happiness equation. Both studies find that sport participation has a positive but smaller effect on self-reported happiness.

Table 2 IV Results, Happiness Regression

Variable	Parameter	*t*-statistic
Age	–0.055	–3.99***
Age Squared	0.001	4.17***
Male	–0.096	–1.81*
Log(income)	0.134	3.26***
Employed	–0.071	–0.74
Hours Worked	0.001	0.69
Higher Education	0.166	1.15
Secondary Education	0.293	2.26**
Children Age 3–17	–0.008	–0.13
Children Age <3	0.409	2.45**
Single	–0.164	–2.13**
Native German	0.117	1.18
Disabled	–0.125	–1.54
Participation in Physical Activity	0.824	4.73***
N		1238
R^2		0.067

*** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level.

It is possible that the parameter estimate on the sport participation variable is partially measuring a positive association between health and happiness. Some researchers,[12,33] suggest that health may be the mechanism by which sport participation affects happiness. If this is the case, then the parameter estimate on the sport participation variable in the happiness equation is reflecting this mechanism and is likely larger than it would otherwise be after adequately controlling for this transmitting mechanism. The variable 'disabled' can be viewed as a proxy for health status in this study. The variable is negative and significant in the first stage OLS regression identifying sport participation but is statistically insignificant in the 2nd stage IV happiness regression. Kavetsos[34] includes having a permanent disability in the happiness equation and finds that it has a negative effect on happiness.

The results for the other covariates presented in Table 2 are generally consistent with empirical results from the happiness literature (eg,[9,17,35,36]). The results suggest a U-shaped relationship between age and self-reported happiness, where happiness first falls with age and then rises. Like in other studies, the young and old are happier than the middle-aged. The estimates on Table 2 indicate that the lowest self-reported happiness occurs at about age 42 in this sample, other things equal.[1] Higher income is

associated with greater self-reported happiness, males are less happy than females, single individuals are less happy than nonsingles, and individuals with children under the age of 3 are happier than those without children and those with children aged 3–17. It is possible that the elder and married populations are over-sampled in the data. It is unlikely that any potential over-sampling of these populations will influence the statistical significance of the sport participation variable. It may have the effect of understanding the influence of sport participation on SWB since older and married people tend to be happier and less likely to engage in sport than younger and single people.

Educational attainment is allowed to have a nonlinear effect on happiness by including 2 indicator variables. The IV results indicate that only 1 of the 2 education variables, secondary education, is statistically significant and is positively associated with SWB. This finding is somewhat different from other studies. For example, prior research suggests that highly educated people tend to be happier on average.[16] In this study, the most highly educated citizens of Rheinberg are not any more or less happy than those with less than a secondary education. This result is not surprising considering that the majority of the sample falls into secondary education category (81%). In addition, the importance of education on happiness typically falls after controlling for other variables, such as income, that are correlated with education. Employment status, and hours worked are not associated with self reported happiness in this sample of Rheinberg individuals. These results also differ from those found in some other studies that find a negative relationship between unemployment and happiness.[8,37]

Conclusion

The question of whether participating in sport improves self-reported happiness in a sample of individuals from Rheinberg, Germany is addressed. The empirical challenge is to develop causal evidence about this relationship due to the potential endogeneity of sport participation in the happiness equation and reverse causality. If endogeneity is a problem, then simply regressing individuals' reported happiness on an indicator of sport participation in physical activity will result in biased estimates of the relationship. This econometric challenge is confronted by exploiting differences in proximal environmental factors that influence sport participation to statistically identify participation. Specifically the distance between an individuals' home and the nearest sports facility and beliefs about the importance of physical activity as instruments in an IV model of self-reported happiness and sport participation are included. The results of this IV estimation indicate that, after controlling for demographic and personal characteristics including age, gender, education, income, employment status, household structure and limitations on physical activity, individuals who practice sport report higher levels of happiness.

The results add to the emerging literature extending happiness research to sport participation. Prior research has developed evidence about the benefits of physical activity in reducing incidence of chronic disease, improving self-reported health status, reducing health care utilization and improving labor market outcomes. Finding evidence that sport participation increases happiness in individuals in Rheinberg, Germany adds to the recently developed evidence of this relationship in the other populations. This broader impact of sport participation on general happiness or SWB lends support to the policy priority of many governments to increase sport participation at all levels of the general population. Although not reported in the body of the paper, the results from the first stage regression indicate that believing that physical activity is important is a strong predictor of sport participation. This suggests that public information campaigns extolling the many benefits of sport participation, including improved happiness, might be an effective policy lever for increasing sport participation.

The question of the mechanism by which sport participation affects happiness is unsettled in the literature and is an important area for future research. If the mechanism is that engaging in sport promotes physical health or a feeling of health and this feeling of healthiness promotes happiness, then disentangling the separate effects of physical activity and health on happiness will advance our understanding of this complex relationship. Some studies of the effect of sport participation on happiness include self-reported health status as a covariate in the happiness equation.[10,19,26] In all cases, the coefficients are positive and significant. However, simply including some health status measure in the happiness equation without accounting for the endogeneity of health status is suggestive of only an association between health and happiness. Future research that attempts to establish causal evidence of the effect of physical activity and health on happiness is warranted.

Notes

[1] Note that the actual parameter on age squared is 0.00065 which was rounded to 0.001 on Table 2.

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Appendix

First Stage (Linear Probability Model) Results; Dependent Variable = Sport Participation

Variable	Parameter	*t*-statistic	*P*-value
Distance to nearest facility	0.0454	1.14	0.254
Thinks physical activity is important	0.3139	10.45	0.000
Age	0.0083	1.11	0.268
Age^2	–0.0001	–1.21	0.228
Male	–0.0570	–2.00	0.046
Log (income)	0.0152	0.67	0.500
Employed	–0.0323	–0.52	0.537
Hours worked	0.0003	0.29	0.771
Higher education	–0.0407	–0.52	0.605
Secondary education	–0.1102	–1.57	0.117
Children age 3–17	–0.0128	–0.38	0.704
Children age <3	–0.2609	–2.96	0.003
Single	–0.0386	–0.92	0.355
Native German	0.0800	1.50	0.134
Disabled	–0.0972	–2.24	0.026
Constant	0.3315	2.52	0.012
R^2	0.11		