Journal of Adolescent Health 55 (2014) 281–286

ELSEVIER

JOURNAL OF ADOLESCENT HEALTH

www.jahonline.org

Original article

The Association Between Adolescent Self-Reported Physical Activity and Wellness: The Missing Piece for Youth Wellness Programs

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Article history: Received October 26, 2013; Accepted January 19, 2014
Keywords: Cross-sectional studies; Exercise; Questionnaire; Teenager; Sedentary; Survey; Well-being

A B S T R A C T

Purpose: Potential positive associations between youth physical activity and wellness scores could emphasize the value of youth physical activity engagement and promotion interventions, beyond the many established physiological and psychological benefits of increased physical activity. The purpose of this study was to explore the associations between adolescents' self-reported physical activity and wellness.
Methods: This investigation included 493 adolescents (165 males and 328 females) aged between 12 and 15 years. The participants were recruited from six secondary schools of varying socio-economic status within a metropolitan area. Students were administered the Five-Factor Wellness Inventory and the International Physical Activity Questionnaire for Adolescents to assess both wellness and physical activity, respectively.
Results: Data indicated that significant associations between physical activity and wellness existed. Self-reported physical activity was shown to be positively associated with four dimensions including friendship, gender identity, spirituality, and exercise—the higher order factor physical self and total wellness, and negatively associated with self-care, self-worth, love, and cultural identity.
Conclusion: This study suggests that relationships exist between self-reported physical activity and various elements of wellness. Future research should use controlled trials of physical activity and wellness to establish causal links among youth populations. Understanding the nature of these relationships, including causality, has implications for the justification of youth physical activity promotion interventions and the development of youth physical activity engagement programs.

IMPLICATIONS AND CONTRIBUTION

This study suggests that relationships exist between self-reported physical activity and various elements of wellness. These findings may have implications for those seeking to justify youth physical activity promotion interventions or providing ongoing funding or allocation of resources for youth physical activity engagement programs, such as policy-makers and various government bodies.

Physically inactive pursuits during childhood and adolescence, as well as poor physical fitness in adolescence, have both been associated with poor adult health outcomes [1]. This is of concern, given the consistent findings of insufficient physical activity among youth populations and the high prevalence of recreational, educational, and occupational activities that do not involve physical activity—particularly not at moderate or vigorous intensities [2]. The latest report from the World Health Organization (WHO) on the Health Behavior in School-Aged Children Study, with 11-, 13-, and 15-year-old pupils in 35 countries of the WHO European Region and in North America,

Conflicts of Interest: The authors have no conflicts of interest or financial disclosures to report.

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1054-139X/$ – see front matter
http://dx.doi.org/10.1016/j.jadohealth.2014.01.021

demonstrated that more than two thirds of young people did not report meeting the current recommendation for physical activity of 60 minutes per day at a moderate-to-vigorous intensity, on 5 or more days a week [3].

The number and magnitude of youth physical activity promotion interventions have been increasing as the preventative focus of contemporary health care moves to target younger age groups. Regular physical activity in youth has various immediate benefits, including improved musculoskeletal health, mental health, growth, and development [4]. Recent systematic reviews have found that physical activity in adolescence had positive short-term effects on self-esteem [5], positive effects on academic performance [6], and the potential to reduce depression [7]. A prospective study including 4,594 adolescents concluded that physical activity was inversely related to depressive symptoms in early adolescence [8]. The potential for physical activity interventions to provide benefits beyond physical health enhances the value of these interventions and provides justification for further research investigating the relationships between physical activity and the wellness of youth from a holistic, rather than a piecemeal, viewpoint.

Wellness has been described as focusing on lifestyle behaviors that contribute toward individuals living to their fullest potential and is often portrayed as multidimensional, whereby these dimensions contribute to make an integrated whole [9]. Although the lack of a "gold standard" definition of wellness has been highlighted as an area of concern in the field [9], several consistencies among wellness definitions and models have been identified. Wellness is often defined as being both holistic and multidimensional, with these dimensions being inter-related [9]. The majority of wellness models [10–14] contain each of the following five dimensions: social, emotional, physical, intellectual, and spiritual wellness. Additionally, some contain psychological [10], occupational [11–13], and environmental [14] wellness dimensions. Wellness is therefore an integrated construct determined by behaviors which facilitate the journey toward optimal states on multiple dimensions. The wellness paradigm offers an important point of difference from related constructs. For example, well-being has been described as the balance-point between an individual's resource pool and the challenges faced, whereby stable well-being is when individuals have the psychological, social, and physical resources they need to meet a particular psychological, social, and/or physical challenge [15]. Health-related quality of life focuses on an individual's functional health status, often with reference to illness or recovery from a disease, including evaluation of symptoms, physical function, cognitive performance, psychological condition, emotional status, and adaptation to disease [16]. The wellness construct may be particularly useful when conceptualizing the benefits (or otherwise) of positive lifestyle behaviors among youth, at a time before chronic diseases associated with negative behaviors have developed.

The Indivisible Self-Model of Wellness (IS-Wel) is an empirically-based model, developed from a factor analysis of Wellness Evaluation of Lifestyle data [17], a previously developed instrument established to measure wellness. The IS-Wel is grounded in Adlerian counseling theory that emphasizes the indivisibility of the self. This is what Adler defined as holism, and it is based on a single, higher order wellness factor that includes all wellness components [18]. The IS-Wel model is shown in Figure 1, and it comprises five higher order factors of the self (creative self, coping self, social self, essential self, and physical self). The creative self higher order factor includes the dimensions of thinking, emotions, control, work, and positive humor. The coping self higher order factor includes the dimensions of leisure, stress management, self-worth, and realistic beliefs. The social self higher order factor includes the dimensions of friendship and love. The essential self higher order factor includes the dimensions of spirituality, gender identity, cultural identity, and self-care. The physical self higher order factor contains the dimensions of exercise and nutrition.

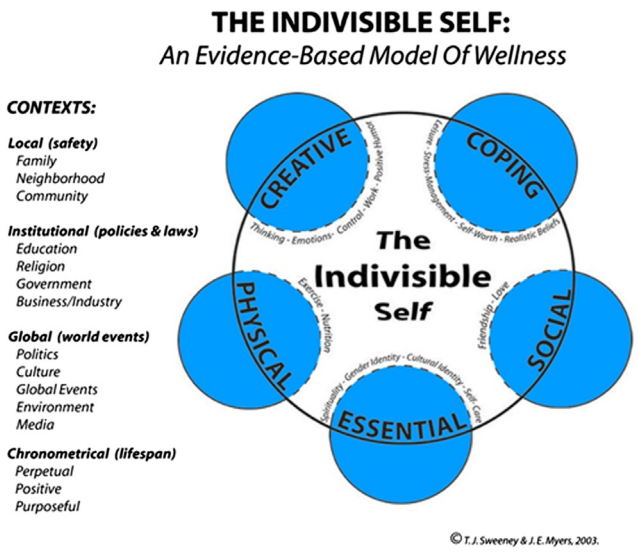

Figure 1. The indivisible self model of wellness, as measured by the Five-Factor Wellness Inventory, including the five higher order factors, and dimensions of which they are comprised. Reprinted with permission.

Positive associations between youth self-reported physical activity and wellness would add to the body of literature supporting the potential inclusion of physical activity as a component within youth wellness programs. Additionally, positive associations between physical activity and wellness would add to the growing evidence base emphasizing the potential value of youth physical activity engagement and promotion interventions, beyond the many established physiological and psychological benefits of increased physical activity. The purpose of this study was to explore the associations between adolescents' self-reported physical activity and wellness domains.

Existing literature indicates that some elements of wellness may be more strongly associated with self-reported physical activity than others. For example, positive associations may be present between physical activity and the IS-Wel dimensions of nutrition [19], self-worth [20], self-care [21], friendship [22], thinking [6], and cultural identity [23]. It is also expected that the exercise subscale (measured in the IS-Wel model as engagement in, and perceptions of exercise and physical activity [24]) may also be positively associated with self-reported physical activity levels. However, this relationship may have an element of circularity, given the content similarities between these two outcomes. Conversely, it is expected that self-reported physical activity may not be associated with a number of IS-Wel dimensions among youth, including realistic beliefs, work, positive humor, love, and emotions [24].

Methods

Participants

This investigation included 493 adolescents (165 males and 328 females) aged between 12 and 15 years. Participants were recruited from six secondary schools in metropolitan Brisbane, Australia. Schools were categorized as either from low, medium, or high socioeconomic status (SES) backgrounds. SES background was determined by the Australian Curriculum, Assessment, and Reporting Authority's Index of Community Socio-Education Advantage (ICSEA). Briefly, ICSEA is a scale that enables meaningful comparisons to be made across schools in Australia. Variables used in calculating a value on the ICSEA scale include student-level data on the occupation and education level of parents/carers and/or socioeconomic characteristics of the areas where the students live; whether a school is in a metropolitan, regional, or remote area; the proportion of students from a language background other than English; and the proportion of Indigenous Australian students enrolled at the school [25,26]. High-SES participants were recruited from two nondenominational same-sex private schools. Mid-SES participants were recruited from one same-sex and one co-ed private school and one public school. Low-SES participants were recruited from one public school.

Instruments

Two instruments were used to measure self-reported wellness and physical activity among participants in this study.

Five-Factor Wellness Inventory. The Five-Factor Wellness Inventory (5F-Wel) T version (the 5F-Wel modified to a sixth grade reading level) was designed to measure factors on the IS-Wel model of wellness [18]. The 5F-Wel-T is a 97-item questionnaire that includes attitudinal and behavioral statements (e.g., "I eat a healthy diet") where respondents rate their agreement with the statement using a four-point Likert scale ranging from strongly agree to strongly disagree [18]. These 97 items are grouped into 17 dimensions. Mean item ratings for each dimension are computed and modified using a linear transformation to make the dimension scales comparable, with each having a range of 25–100. The 17 dimensions are also grouped into five higher order factors consistent with the IS-Wel model of wellness. An illustration of the IS-Wel, as measured by the 5F-Wel, including the five higher order factors and dimensions of which they are comprised is shown in Figure 1. Responses to the questionnaire are also used to generate a total wellness score [18]. The 5F-Wel-T takes approximately 15 minutes to complete and has favorable evidence supporting its reliability as a self-reported measure of wellness among adolescents [27], while validity has been demonstrated for a variety of 5F-Wel factors [24].

International Physical Activity Questionnaire for Adolescents. The International Physical Activity Questionnaire for Adolescents (IPAQ-A), adapted from the International Physical Activity Questionnaire Long Version, was developed for use in adolescents [28,29]. This adapted version also measures physical activity over the previous 7 days and covers four domains of physical activity being school-related physical activity, including activity during physical education classes and breaks; transportation; housework; and leisure time. In each of the four domains, the number of days per week and time spent per day in walking, in moderate activity, and in vigorous activity are recorded. Variations from the adult version include questions about physical activity at work being replaced by physical activity at school, and including only one question about physical activity in the garden or at home (vs. three in the standard IPAQ) [28]. It has been reported that the minimum dose of physical activity per week in youth to gain health benefits is 420 minutes per week (1 hour per day) at a moderate-to-vigorous intensity [30]. Total time spent per week engaging in moderate-to-vigorous physical activity can be summed across each of the four domains and computed to establish whether participants are meeting physical activity recommendations [31,32]. The IPAQ-A was used in this way for this investigation to identify those participants who were (and were not) meeting the minimum physical activity levels recommended for receiving health benefits.

Procedure

Questionnaires were distributed to students via teaching staff at their respective schools. Students were invited to complete the survey at home. Questionnaires included a participant information sheet for both parents and students detailing their involvement in the study. Questionnaires were then returned to the teaching staff and later collected by the principal researcher. This study was approved by the Human Research Ethics Committee of the Queensland University of Technology.

Data analysis

Analyses were performed using the IBM Statistical Package for the Social Sciences (SPSS) version 21 (IBM Corp., Armonk, NY). Demographic information (age, gender, and SES) was described using conventional descriptive statistics. Participants were categorized as either sufficiently or insufficiently physically active as determined by meeting physical activity guidelines of at least 420 minutes per week of moderate-to-vigorous physical activity, as recommended by the WHO [31] and Australian Federal Government Department of Health and Ageing [32]. Physical activity was categorized to ensure greater clinical meaningfulness of results (regarding which participants were sufficiently physically active for health benefits), as well as to enable comparisons with internationally published categorical data for youth physical activity [3].

Previous investigations have indicated that the missing data from physical activity surveys among adolescents may not be missing at random, with adolescents from low-SES backgrounds more likely to have incomplete data sets [33]. This meant that simple list-wise deletion of the participants on the basis of missing data (missing in a systematic way) could negatively influence the robustness of the study findings. Therefore, a logistic regression, with the presence of missing data as the dependent variable and participant characteristics (SES, gender, age, ethnicity, and school status) as independent variables, was used to determine which participant characteristics were associated with missing data. Those characteristics associated with missing data were then used to develop propensity weightings (propensity for missing physical activity data). This was to ensure that participants with complete data and possessing traits in common with participants who had missing data were given a

greater weighting during analysis. To achieve this, propensity weightings were calculated from the probabilities of missing data generated from a logistic regression (with the presence of missing physical activity as the dependent variable and those participant characteristics associated with missing data as independent variables). These propensity weightings were then used during analyses conducted to address the study aims.

To address the primary aim of the study, three logistic regressions were undertaken. The first examined the associations between participants who were sufficiently physically active (dependent variables) and the 17 dimensions of wellness assessed by the 5F-Wel (independent variables). The second examined the associations between self-reported physical activity (dependent variable) and the five higher order factors from the 5F-Wel. The third examined the association between self-reported physical activity and the total wellness summary score. Potential confounding variables such as gender, SES, and the interaction between gender and SES were also added to each of the logistic regressions. For the dependent variable in each of these logistic regressions, sufficiently physically active was coded as 1, and insufficiently physically active was coded as 0. Simulation studies of logistic regressions indicate that a minimum of 10 outcome events per predictor variable are required to avoid poor modeling including coefficient bias, poor confidence interval coverage, and type 1 error [34]. The largest regression model in this analysis contained 20 predictor values, requiring a sample of at least 200 participants. Multicollinearity was assessed using variance inflation factors and tolerance statistics. Variance inflation factors below 10 and tolerance statistics above .2 were deemed acceptable for analysis [35]. Additionally, Pearson chi-square was used to test for differences in physical activity between SES groups and genders.

Results

Three hundred and twenty-four (65.7%) participants (88 males and 236 females) had complete data and were included in the analysis. The average age (SD) of the participants was 13.7 years (.7). The number (%) of participants included were 38 (11.7%) from low-SES backgrounds, 185 (57.1%) from mid-SES backgrounds, and 101 (31.2%) from high-SES backgrounds. The analyses of missing data revealed that SES background ($p < .001$) and gender ($p < .001$) indicated propensity for missing data, and these variables were used to generate propensity weightings.

Two hundred and two (58.6%) participants reported physical activity levels that exceeded the guidelines. Within each SES group, the number (%) of participants who reported being sufficiently physically active were 19 (48.7%) for low-SES participants, 124 (61.9%) for mid-SES participants, and 59 (56.2%) for high-SES participants. Differences in the proportion of participants in each group meeting the physical activity guidelines were not statistically significant (χ^2 (2) = 4.169, $p = .124$). Within each gender, the number (%) of participants who reported being sufficiently physically active was 101 (61.96%) for male participants and 185 (56.40%) for female participants. Differences in the proportion of participants in each group meeting the physical activity guidelines were not statistically significant (χ^2 (1) = 1.324, $p = .250$).

Each of the three regressions examining associations between physical activity and wellness produced significant results. Observed variance inflation factors and tolerance statistics were below 10 and above .2 respectively, indicating that multicollinearity was not present among any of the 5F-Wel dimensions, higher order factors, or total wellness. The first logistic regression (Table 1, $\chi^2 = 127.96$; df = 20; $p < .001$) indicated that friendship ($p = .003$), gender identity ($p = .026$), love ($p = .022$), self-care ($p = .001$), self-worth ($p = .002$), spirituality ($p = .014$), cultural identity ($p = .033$), and exercise ($p < .001$) were all associated with meeting the physical activity guidelines. The second logistic regression (Table 2, $\chi^2 = 58.28$; df = 8; $p < .001$) indicated that the physical self ($p < .001$) higher-order factor was significantly associated with the physical activity. The third logistic regression indicated that the total wellness summary score was associated with physical activity (Table 3; $\chi^2 = 10.98$; df = 4; $p \leq .05$).

Table 1
Logistic regression results between self-reported physical activity and wellness dimensions

Independent variable	β	Standard error	Wald	p Value	Exp(β)
Control	.020	.014	1.912	.167	1.020
Emotions	−.002	.015	.016	.900	.998
Friendship	.052*	.017	9.120	.003	1.053
Gender identity	.029*	.013	4.924	.026	1.030
Leisure	−.016	.012	1.779	.182	.984
Love	−.033*	.015	5.242	.022	.967
Nutrition	.017	.011	2.484	.115	1.017
Realistic beliefs	.013	.011	1.434	.231	1.013
Self-care	−.039*	.012	11.060	.001	.962
Self-worth	−.039*	.012	9.771	.002	.962
Spirituality	.016*	.006	6.060	.014	1.016
Stress management	.008	.012	.423	.515	1.008
Thinking	.000	.014	.001	.981	1.000
Work	−.026	.017	2.407	.121	.974
Exercise	.067*	.010	41.094	.000	1.069
Humor	.004	.011	.156	.693	1.004
Cultural identity	−.024*	.011	4.522	.033	.976
SES	.258	.618	.174	.676	1.294
Gender	−.132	.740	.032	.859	.877
SES × gender	−.181	.356	.259	.611	.834

Model $\chi^2 = 127.96$, $p < .001$.
Pseudo $R^2 = .325$.
n = 324.
* $p < .05$.

Discussion

Data from this investigation indicated that an association between physical activity and wellness exists. While directional causality cannot be established from this cross-sectional study, it

Table 2
Logistic regression results between self-reported physical activity and wellness higher order factors

Independent variable	β	Standard error	Wald	p Value	Exp(β)
Creative self	.000	.018	.000	.983	1.000
Coping self	−.021	.020	1.104	.293	.980
Social self	−.004	.015	.083	.774	.996
Essential self	−.018	.013	1.938	.164	.982
Physical self	.070*	.011	41.682	.000	1.073
SES	.136	.562	.059	.808	1.146
Gender	−.397	.678	.344	.558	.672
SES × gender	.049	.322	.023	.880	1.050

Model $\chi^2 = 58.28$ $p < .001$.
Pseudo $R^2 = .159$.
n = 324.
* $p < .05$.

Table 3
Logistic regression results between self-reported physical activity and total wellness

Independent variable	β	Standard error	Wald	p Value	Exp(β)
Total wellness	.036*	.013	7.858	.005	1.037
SES	.182	.540	.114	.736	1.200
Gender	−.059	.646	.008	.928	.943
SES × gender	−.139	.307	.205	.651	.870

Model $\chi^2 = 10.98$ $p < .05$.
Pseudo $R^2 = .032$.
n = 324.
* $p < .05$.

is plausible that causality may not be unidirectional. Physical activity may contribute to aspects of wellness, particularly physical wellness but potentially nonphysical aspects of wellness too. In contrast, it is also plausible that being "well" in certain aspects of the wellness paradigm may contribute to a synergistic relationship of being able to lead a physically active lifestyle.

While there have not been previous investigations directly evaluating the association between physical activity and wellness among adolescents, findings from this investigation are consistent with previous reports that have indicated that physical activity is associated with a number of psychological constructs and lifestyle behaviors that are represented within the IS-Wel model. Expected significant associations materialized between self-reported sufficient physical activity and wellness elements for the IS-Wel dimensions including friendship and exercise. Positive associations were also found for gender identity and spirituality. Unexpectedly, negative associations were found for the IS-Wel dimensions of self-care, self-worth, love, and cultural identity. Furthermore, specific dimensions of wellness were not expected to be significantly associated with self-reported sufficient physical activity, and these transpired accordingly. These include the IS-Wel dimensions of control, emotions, leisure, realistic beliefs, stress management, work, and positive humor.

It was perhaps interesting to note that some expected significant associations between wellness dimensions and self-reported sufficient physical activity did not materialize. These two IS-Wel dimensions were thinking and nutrition. It is possible that associations between self-reported sufficient physical activity and nutrition, or thinking, may not have been present in this sample. Alternatively, these particular dimensions of the IS-Wel may require further validation to ensure their appropriateness for administration among adolescent populations.

The results from this investigation have added to the growing body of literature supporting the notion that the benefits of physical activity among adolescents are likely to extend beyond the prevention of chronic disease. While this study suggests that relationships may exist between self-reported physical activity and elements of wellness among youth, causality within these relationships cannot be established from cross-sectional data alone. If a causal link between physical activity and a variety of wellness dimensions was to be subsequently demonstrated, the inclusion of physical activity in wellness interventions aimed at youth may be justified not only on the basis of influencing physical wellness but potentially a variety of nonphysical aspects of wellness. Currently, many wellness interventions aimed at youth do not incorporate a physical activity component. For example, Smith-Adcock et al. [36] examined a group counseling intervention (1 hour per week for 8 weeks) developed to promote wellness among adolescent girls at risk of delinquency, who were attending an alternative school. Additional benefits for these adolescents may have been generated from the inclusion of appropriate physical activity promotion as part of the wellness intervention. Similarly, Choate and Smith [37] infused a wellness model into the curriculum design of a first-year college course and examined changes in student wellness. It is plausible that the wellness outcomes for students may have been enhanced by the inclusion of effective physical activity promotion.

This study included a number of important limitations. First, it is noteworthy that the gender gap in youth reading proficiency exists in all 65 countries and economies that participated in the 2009 Organization for Economic Cooperation and Development's Program for International Student Assessment tests [38]. It is therefore likely that lower levels of reading proficiency among students from lower SES backgrounds and among males (in comparison with females) may have meant that these students had a greater propensity not to return the completed self-report questionnaires (and were initially underrepresented in the data set). To overcome this potential shortcoming, propensity score weighting (for missing data) was employed in the analyses to ensure that students with similar attributes to those who had missing data were assigned a higher weighting within the models. The propensity score weighting meant that male individuals and those from low-SES backgrounds would have been weighted more heavily (than, e.g., female individuals from high-SES backgrounds) in the final models reported in this study. Second, while this study included different SES groups, and subsequent propensity weighting methods ensured representation of participants from all SES groups could be considered a strength, this investigation only included participants from a high-income nation where participation in school education is compulsory for adolescents in this age group. Therefore, these findings may not be applicable to youth from dissimilar societies. Third, this study only included participants aged 12–15 years, and consequently, the findings cannot be extrapolated beyond this age group. Further investigations in the 9- to 12-year and 15- to 17-year age groups would enhance the understanding of physical activity's relationship with wellness during continuing decline in physically activity levels among youth [39]. Finally, although the study design was suitable to address the research aim, an intervention trial would be required before any assertions of causality can be confirmed.

There are a number of important priorities for future research. Future research to inform understanding of the relationship between physical activity and wellness among youth populations is of considerable importance. This research may include randomized controlled trials examining, for example, the impact of physical activity on youth wellness (group 1) versus wellness alone (group 2). Furthermore, physical activity levels generally begin to decline at 9 years of age and continue until 15 years [39]. Indeed, this decline is sharper among youth from disadvantaged or low-income communities and remains a priority for subsequent investigations [40]. Other populations of interest include those living or attending schools in rural areas or undergoing schooling in education systems in other geographical regions or dissimilar societies.

This study suggests that relationships exist between self-reported physical activity and various elements of wellness. Future research should use controlled trials of physical activity and wellness to establish causal links among youth populations. Understanding the nature of these relationships, including

causality, has implications for the justification of youth physical activity promotion interventions and the development of youth physical activity engagement programs.

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