Title: Physical Activity, Mental and Personal Well-Being, Social Isolation, and Perceptions of Academic Attainment and Employability in University Students: The Scottish and British Active Students Surveys

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Human Kinetics

Physical Activity, Mental and Personal Well-Being, Social Isolation, and Perceptions of Academic Attainment and Employability in University Students: The Scottish and British Active Students Surveys

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Background: Physical activity (PA) promotes health and well-being. For students, university represents a transitional period, including increased independence over lifestyle behaviors, in addition to new stressors and barriers to engaging in PA. It is, therefore, important to monitor PA trends in students to gain a greater understanding about the role it might play in physical and mental well-being, as well as other factors, such as attainment and employability. *Methods:* Cross-sectional surveys were conducted in 2016 in Scottish universities and colleges, and in 2017 in universities and colleges across the United Kingdom, and the data were pooled for the present study (N = 11,650). Cumulative ordinal logistic regression was used to model the association between PA levels and mental and personal well-being, social isolation, and perceptions of academic attainment and employability. *Results:* Only 51% of the respondents met the recommended levels of moderate to vigorous PA per week. There was a linear relationship between PA levels and all outcomes, with better scores in more active students. *Conclusions:* UK university students are insufficiently active compared with the general population of 16- to 24-year olds. Yet, students with higher PA report better outcomes for mental and personal well-being, social isolation, and perceptions of academic attainment and employability.

Keywords: physical education, sport, wellness

Sufficient physical activity (PA) is well accepted as a means of improving health and preventing noncommunicable disease conditions.[1,2] In addition, PA has been argued to be a means to enhance various aspects of emotional health and produce psychological benefits.[3] A key element of health promotion in many countries, therefore, includes strategies to increase PA levels to meet the recommended guidelines. Despite children and adolescents being more likely to meet PA recommendations than adults,[4,5] research has identified a substantial decrease in PA during the transition from adolescence to young adulthood.[6] The proportion of young adults (18–24 y) achieving PA recommendations is much lower than that of adolescents (11–17 y), which may be attributed to changing environments and priorities resultant from undertaking further education (eg, college and university studies[7]). This period of transition for young adults can be key, as the development and maintenance of positive health behaviors during this age has been argued to lead to sustained behaviors and improved health into adulthood.[8] Furthermore, a lack of PA is one of the top 3 modifiable risk factors for many chronic diseases, and therefore, increasing levels of PA at this crucial stage in a person's life can help increase the health of the emerging adult population.[8]

While not all young people proceed to higher education, in the United Kingdom, approximately one third of 18-year-olds continue on to this level of education after school and further education.[9] The transition to higher education is associated with increased independence over lifestyle and dietary habits.[10] Yet, it is relatively uncommon for students to consider the long-term risk of developing chronic diseases when making behavior choices,[7] despite it being established that PA is clearly linked with morbidity risk.[11] During university life, students face a combination of individual agency factors (ie, decision making), social factors (ie, influence of friends), and physical factors (ie, accessibility and availability) that contribute to decreased PA and an increase in emotional and psychological stress.[12,13] In turn, specific stressors can lead to a further decline in PA, including change of residence, increasing responsibility, peer pressure, coursework management, and difficult schedules.[12] Students also spend a high percentage of time performing sedentary activities (eg, sitting in class and at a computer, on social media, and studying), thus giving students the perception of reduced time to engage in PA.[13] Students who meet the recommendations from the chief medical officers' (CMO) guidelines for PA[14] (ie, 150 min of moderate to vigorous PA and 2 sessions of muscle-strengthening activity per week) tend to engage in wider healthy behaviors,[15,16] and the potential role of PA within all domains (work, transport, domestic, and leisure time) has been positively associated with the health-related quality of life in students.[17] Though students have not always been aware of the benefits of meeting PA recommendations,[18] recent work suggests that PA levels, along with dietary habits, are recognized by students as being important; yet, recommendations for these lifestyle behaviors still are rarely implemented in practice.[19]

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Limited engagement in PA not only acts as a contributor to decreased physical health in students but also is associated with indicators of poorer mental health and well-being, increased risk of depression, and weaker cognitive functioning.[3,8,13] There is also an emerging body of evidence that suggests that regular engagement in PA may have cognitive effects and is associated with improved academic attainment in adolescents.[20] This, in turn, may result in improved graduate employment and longer term employability.[21,22] Though there is less data on this relationship specifically in young adults attending university with respect to PA generally, what is available argues that sport positively impacts graduate employability.[23]

It is clear that the collective benefits of engagement in PA, particularly in young adults, have the potential to positively impact an individual's physical and mental well-being.[24] It is, therefore, important to monitor PA trends in students and to gain a greater understanding about the role it might play in physical and mental well-being, attainment, and employability.[18] The recent (2014–2015) Student Activity and Sports Participation Survey Ireland (SASSI), with a sampling of 8122 students, reported that those meeting the PA guidelines were more likely to report greater overall health, mental well-being, and happiness than inactive peers.[25] Two similar surveys have also recently been conducted both in Scotland and across the United Kingdom in general: the Scottish Active Student Survey (SASS) and British Active Student Survey (BASS). As such, the aim of the present study was to examine the PA levels of students and explore the relationships between PA, physical and mental well-being, perceptions of attainment, and perceptions of employability in a large sample of UK students, using pooled data from both the SASS and BASS.

Methods

Design

Cross-sectional surveys were conducted in 2016 in Scottish universities and colleges and in 2017 in universities and colleges across the United Kingdom. The respondents were entered into a raffle (prizes ranged from a £219.00 activity tracker to £50.00 shopping vouchers) as an incentive to complete the survey. Both the SASS and BASS surveyed students on their PA level, mental well-being, social isolation, and perceived attainment and employability. The data from these 2 surveys were pooled for secondary analysis. Replicate data from Scottish university students participating in both surveys were identified and removed, with the most recent survey data kept. For the purposes of the present analysis, only the data from the university students were examined. The aim was to examine the relationships between PA levels and other outcomes measured in the surveys. Ethical approval to conduct the present secondary analysis was granted by the Health, Exercise, and Sport Science Ethics Committee at Solent University (ID no: steej2019).

Sample

The full combined data sets from the SASS and BASS contained the students' data from the respondents across 117 further (sixth form colleges—typically ages 16–18 y) and higher education (universities—typically ages >18 y) institutions in the United Kingdom. The data from the further education institutions were excluded (n = 769), leaving a sample size of 11,650 undergraduate and postgraduate students from higher education institutions. Table 1 contains the descriptive demographics of the sample.

Surveys were disseminated through institutions' direct emails, social media platforms, and face-to-face engagement. All respondents gave informed consent to participate in the survey and for their anonymized data to be used for research purposes, including the conduct of future studies and publication of the findings from these studies.

Survey Measures

The PA was examined via self-report using a modified, single-item, minute-based activity question,[26] which aligned with Sport England's measure of PA, permitting comparison with their Active Lives survey.[27] The participants were asked, "In the past week, how much moderate intensity physical activity have you completed in total?" and they answered with either under 30 minutes, 31 to 90 minutes, 90 to 149 minutes, or >150 minutes. Moderate-intensity physical activity was clarified as ". . . activity you do that gets you out of breath or raises your heartbeat—this is called moderate-intensity activity. This may include sport, exercise, and brisk walking or cycling for recreation or to get to and from places but should not include housework or physical activity that may be part of your job." From this, the participants were grouped into 3 categories, based upon their total weekly PA: "Inactive" (under 30 min), "fairly active" (31–90 and 90–149 min), and "active" (>150 min). The participants were also asked how much time they had spent sitting on weekdays during the last 7 days, including time spent at work, at home, while doing course work, and during leisure time.

Mental well-being was examined via self-report using the Short Warwick–Edinburgh Mental Wellbeing scale,[28] which is a shortened (7 of the 14 items) version of the full Warwick–Edinburgh Mental Wellbeing scale.[29,30] The score for items is transformed to a metric value and the score primarily reflects functioning, as opposed to feeling.[31] The Warwick–Edinburgh Mental Wellbeing scale has previously been used in populations of students[32] similar to those included in the SASS and BASS. Mental well-being scores were categorized as an ordinal variable with the categories of "low" (7–19.3), "medium" (20.0–27.0), and "high" (28.1–35), based upon the means and SDs from The Health Survey for England.[33]

Personal well-being was examined using the Personal Wellbeing 4 questions from the Office for National Statistics.[34] The questions were scored on an 11-point Likert scale (0–10) measuring life satisfaction ("Overall, how satisfied are you with your life nowadays?"), worthwhileness ("Overall, to what extent do you feel that the things you do in your life are worthwhile?"), happiness ("Overall, how happy did you feel yesterday?"; a higher score indicates a more positive answer), and anxiety ("Overall, how anxious did you feel yesterday?"; a lower score indicates a more positive answer). Personal well-being scores were categorized as an ordinal variable, with life satisfaction, worthwhileness, and happiness as "low" (0–4), "medium" (5–6), "high" (7–8), and "very high" (9–10), and anxiety as "very low" (0–1), "low" (2–3), "medium" (4–5), and "high" (6–10), according to the thresholds used in the 'Measuring National Wellbeing, Personal Wellbeing across the UK' survey.[35]

Social isolation was examined using the PROMIS Social Isolation 4a questions,[36] which consist of 4 items: "I feel left out," "I feel that people barely know me," "I feel isolated from others," and "I feel that people are around me but not with me." Each item is scored on a 5-point Likert scale, with the response options of "Never," "Rarely," "Sometimes," "Usually," and "Always." The scores could range from 4 to 20, with a higher score indicating greater perceived social isolation. These scores

Table 1   Descriptive Statistics for Demographics and Measures

Variable	
Age, y	22 (5)
Sex, n (%)	
Female	7167 (63%)
Male	4186 (37%)
Ethnicity, n (%)	
White	9850 (87%)
Nonwhite	1503 (13%)
Health problem/disability, n (%)	
None	5915 (91%)
Yes, limited a little	502 (8%)
Yes, limited a lot	53 (1%)
PA levels, n (%)	
Inactive	942 (8%)
Fairly active	4526 (41%)
Active	5656 (51%)
Mental well-being (mean [SD] metric score)	22.04 (4.21)
Low, n (%)	3162 (29%)
Medium, n (%)	6386 (58%)
High, n (%)	1377 (13%)
Personal well-being, n (%)	
Low	937 (9%)
Medium	2317 (21%)
High	5897 (54%)
Very high	1707 (16%)
Social isolation, n (%)	
Low	449 (4%)
Medium	8860 (81%)
High	1616 (15%)
Perceptions of attainment, n (%)	
Undergraduate	
Third	58 (1%)
2:2	237 (5%)
2:1	3098 (61%)
First	1839 (33%)
Postgraduate	
Pass	189 (22%)
Merit	257 (30%)
Distinction	419 (48%)
Perceptions of employability (median [range])	
Employment confidence	4 (1,5)
Verbal communication	4 (1,5)
Written communication	4 (1,5)
Teamwork	4 (1,5)
Commercial awareness	4 (1,5)
Analyzing and investigating	4 (1,5)
Initiative/self-motivation	4 (1,5)
Drive	4 (1,5)
Planning and organizing	4 (1,5)

(continued)

Table 1 *(continued)*

Variable	
Flexibility	4 (1,5)
Time management	3 (1,4)
Gym member, n (%)	
Yes	7926 (70%)
No	3343 (30%)
Sports club member, n (%)	
Yes	7399 (66%)
No	3858 (34%)
Aware of PA guidelines, n (%)	
Yes	3738 (58%)
No	2732 (42%)
Part-time work, n (%)	
Yes	4751 (43%)
No	6272 (57%)
Study time, n (%)	
<5 h	96 (1%)
5–10 h	504 (8%)
10–15 h	878 (14%)
15–20 h	1206 (19%)
20–25 h	1199 (18%)
25–30 h	1023 (16%)
>30 h	1564 (24%)

Note: n's do not total to full sample noted where not all respondents answered that question or indicated "prefer not to say."

were converted to a metric *T* score ranging from 34.8 to 74.2, centered on a score of 50, with an SD of 10. Social isolation scores were categorized as an ordinal variable, with the categories of "low" (<40), "medium" (40–60), and "high" (>60) based upon previous population normative data.[37]

Perceptions of academic attainment were examined via self-report by asking the respondents what grade they expected to achieve at the end of this year (for undergraduates—third, 2:2, 2:1, first, or too early to say; for postgraduates—pass, merit, distinction, or too early to say; and postgraduates were also asked what they achieved for their undergraduate degree). For the purposes of analysis, we removed those participants who, at the time of survey, answered, "Too early to say" (n = 4244).

Perceptions of employability were examined using a range of questions. This included confidence that they will be employed within 6 months of graduation (scored 1 [not at all confident] to 5 [very confident]) and their agreement with a range of statements relating to key employability skills (scored as 1 [not at all] to 5 [very] how well they felt they met these skills based on the statements provided), including verbal communication ("You are able to express your ideas clearly and confidently in speech"), teamwork ("You work confidently in a group"), commercial awareness ("You are able to understand the commercial realities affecting an organization"), analyzing and investigating ("You can gather information systematically to establish facts and principles"), initiative/self-motivation ("You are able to act on initiative, identify opportunities and you are proactive in putting forward ideas and solutions"), drive ("You have a determination to get things done. Make things happen and you are constantly looking for better ways of doing things"), written communication ("You are able to express yourself clearly in writing"), planning and organizing ("You are able to plan activities

and carry them through effectively"), flexibility ("You can adapt successfully to changing situations and environments"), and time management ("You manage time effectively, prioritizing tasks and are able to work to deadlines"). Questions were also asked regarding the extent to which the respondents felt that participation in PA and/or sport improves employability and whether they would refer to this when applying for jobs (scored 1 [not at all] to 5 [it's the most important factor]).

Finally, questions were also asked regarding whether the respondents were currently members of gyms and/or sports clubs (yes or no), whether they were aware of the current CMO Guidelines for PA (yes or no), whether they currently were employed in part-time work alongside their studies (yes or no), and how many hours per week they spent studying and in classes (<5 h, 5–10 h, 10–15 h, 15–20 h, 20–25 h, 25–30 h, or >30 h).

Statistical Analysis

Statistical analysis was performed using a cumulative ordinal logistic regression to model the association between the independent ordinal variable PA level ("inactive" = 0, "fairly active" = 1, and "active" = 2) with the dependent ordinal variables of mental well-being, personal well-being, social isolation, perceived attainment (undergraduate and postgraduate modeled separately), and perceptions of employment. Assumptions of proportional odds were checked using Brant test,[38] which was met for all models described below. Unadjusted models with just the PA level were performed, as well as 4 other adjusted models with the first (model 1) including age (y), sex[I] ("female" = 0, "male" = 1), ethnicity[II] ("white" = 0, "nonwhite" = 1), and whether a health problem/disability was present that limited daily activity[III] ("no" = 0, "yes, limited a little" = 1, "yes, limited a lot" = 2). The second (model 2) added daily sitting (min); the third (model 3) added gym membership ("no" = 0, "yes" = 1), sports membership ("no" = 0, "yes" = 1), and knowledge of PA guidelines ("no" = 0, "yes" = 1); and the final, fully adjusted model added part-time work ("no" = 0, "yes" = 1). Study time per week ("<5 h" = 0, "5–10 h" = 1, "10–15 h" = 2, "15–20 h" = 3, "20–25 h" = 4, "25–30 h" = 5, ">30 h" = 6) was also included in a final fully adjusted model but this was done separately, as the data was not available for this from the SASS. Separate models were also produced for employability outcomes as dependent variables, adjusting for perceptions of whether physical activity/sport improved employability and whether they would refer to it in an interview. Models were produced hierarchically, and model comparisons were examined using likelihood ratio tests. The PA level was modeled as a first-degree (linear) polynomial in each instance. Odds ratios (OR) with 95% confidence intervals (CI) were calculated. All analysis was performed using *R* (version 3.5.0; R Core Development Team, https://www.r-project.org/). An α of .05 was used to determine statistical significance for the tests of assumptions and model fit, and the results were considered as point estimates and precision of estimates (ORs [95% CIs]) for the effects of PA level in both unadjusted and adjusted models.

Results

The final data set analyzed included 11,462 participants. Table 1 reports the descriptive statistics for the demographics and measures. The majority of the respondents were female (63%), white (87%), without health problems or disability (91%), active (51%), had moderate mental well-being (58%), high personal well-being

(54%), medium social isolation (81%), anticipated attaining a 2:1 (61%) or distinction (48%), were gym (70%) and sports club members (66%), aware of the PA guidelines (58%), were not employed in part-time work (57%), and studied for >30 hours a week (24%).

Mental Well-being

When considering the mental well-being category as the dependent variable, the unadjusted ordinal regression model with just the PA level provided a significantly improved fit over the intercept-only model according to the likelihood ratio test (χ^2 = 123.03, df = 2, $P < .001$). The addition of sex, ethnicity, and health problem/disability to the model provided a significantly improved fit over the unadjusted model (χ^2 = 140.1, df = 5, $P < .001$). The addition of daily sitting time also resulted in a model that was significantly improved over the prior partially adjusted model (χ^2 = 23.218, df = 1, $P < .001$). The addition of both gym membership and sports club membership also significantly improved model fit compared with the prior partially adjusted model (χ^2 = 27.383, df = 3, $P < .001$). The final fully adjusted model including part-time work did not improve fit compared with the prior model (χ^2 = 0.3654, df = 1, $P < .999$).

Though model fit was improved with the addition of certain parameters, the ORs for the effect of the PA level upon the mental well-being category were not substantially affected. Both the partially and fully adjusted models compared with the initial unadjusted model all suggested that higher PA levels were associated with increased odds of being in a higher mental well-being category (ORs = 1.48–1.66). The fully adjusted model with study time per week (using only BASS data) produced similar results (OR = 1.47 [1.27–1.70]). Table 2 shows the ORs and 95% CIs for the unadjusted and fully adjusted models.

Personal Well-being

When considering the personal well-being scores categorized as ordinal variables for life satisfaction, worthwhileness, happiness, and anxiety, it was found that all respondents were similarly categorized across the questions. Thus, the personal well-being scores were simply considered a single ordinal variable with a higher coded grouping, indicating a better score for each question (Note: anxiety was negatively scored, and so was coded with low scores, indicating a more positive response).

When considering the personal well-being category as the dependent variable, the unadjusted ordinal regression model with just the PA level provided a significantly improved fit over the intercept-only model according to the likelihood ratio test (χ^2 = 138.69, df = 2, $P < .001$). The addition of sex, ethnicity, and health problem/disability to the model provided a significantly improved fit over the unadjusted model (χ^2 = 99.222, df = 5, $P < .001$). The addition of daily sitting time also resulted in a model that was significantly improved over the prior partially adjusted model (χ^2 = 23.218, df = 1, $P < .001$). The addition of both gym membership and sports club membership also significantly improved the model fit compared with the prior partially adjusted model (χ^2 = 37.312, df = 3, $P < .001$). The final, fully adjusted model including part-time work did not improve fit compared with the prior model (χ^2 = 2.496, df = 1, $P = .114$).

Though model fit was improved with the addition of certain parameters, the ORs for the effect of the PA level upon the personal well-being category were not substantially affected. Both partially and fully adjusted models compared with the initial unadjusted

Table 2   Summary of Cumulative Ordinal Regression for Independent Variables Predictive of Mental Well-Being Category (Low, Medium, and High)

	Odds ratios (95% CIs)	
	Unadjusted	Fully adjusted
PA level (linear)	1.66 (1.51–1.83)	1.48 (1.28–1.72)
Age, y	–	1.03 (1.01–1.04)
Sex		
Male	–	Reference
Female	–	0.72 (0.65–0.80)
Ethnicity		
Nonwhite	–	Reference
White	–	0.83 (0.72–0.95)
Health problem/disability		
No	–	Reference
Yes, limited a little	–	0.48 (0.40–0.57)
Yes, limited a lot	–	0.47 (0.27–0.82)
Daily sitting, min	–	1.00
Gym membership		
No	–	Reference
Yes	–	1.11 (1.00–1.24)
Sports membership		
No	–	Reference
Yes	–	1.08 (0.96–1.22)
Knowledge of PA guidelines		
No	–	Reference
Yes	–	1.26 (1.14–1.40)
Part-time work		
No	–	Reference
Yes	–	0.97 (0.88–1.07)

Abbreviations: CI, confidence interval; PA, physical activity.

Table 3   Summary of Cumulative Ordinal Regression for Independent Variables Predictive of Personal Well-Being Category (Life Satisfaction, Worthwhileness, and Happiness—Low, Medium, High, and Very High; Anxiety—High, Medium, Low, and Very Low)

	Odds ratios (95% CIs)	
	Unadjusted	Fully adjusted
PA level (linear)	1.65 (1.50–1.82)	1.47 (1.27–1.69)
Age, y	–	1.01 (1.00–1.02)
Sex		
Male	–	Reference
Female	–	0.96 (0.88–1.07)
Ethnicity		
Nonwhite	–	Reference
White	–	1.00 (0.88–1.16)
Health problem/disability		
No	–	Reference
Yes, limited a little	–	0.45 (0.37–0.53)
Yes, limited a lot	–	0.35 (0.20–0.59)
Daily sitting, min	–	1.00
Gym membership		
No	–	Reference
Yes	–	1.06 (0.96–1.18)
Sports membership		
No	–	Reference
Yes	–	1.22 (1.09–1.36)
Knowledge of PA guidelines		
No	–	Reference
Yes	–	1.26 (1.16–1.41)
Part-time work		
No	–	Reference
Yes	–	0.93 (0.84–1.02)

Abbreviations: CI, confidence interval; PA, physical activity.

model all suggested that higher PA levels were associated with increased odds of being in a higher personal well-being category (ORs = 1.47–1.65). The fully adjusted model with study time per week (using only BASS data) produced similar results (OR = 1.43 [1.24–1.65]). Table 3 shows the ORs and 95% CIs for the unadjusted and fully adjusted models.

Social Isolation

When considering the social isolation category as the dependent variable, the unadjusted ordinal regression model with just the PA level provided a significantly improved fit over the intercept-only model according to the likelihood ratio test ($\chi^2 = 73.99$, df = 2, $P < .001$). The addition of sex, ethnicity, and health problem/disability to the model provided a significantly improved fit over the unadjusted model ($\chi^2 = 140.31$, df = 5, $P < .001$). The addition of daily sitting time also resulted in a model that was significantly improved over the prior partially adjusted model ($\chi^2 = 14.482$, df = 1, $P < .001$). The addition of both gym membership and sports club membership also significantly improved the model fit compared with the prior partially adjusted model ($\chi^2 = 40.243$, df = 3, $P < .001$). The final fully adjusted model including part-time work did not improve fit compared with the prior model ($\chi^2 = 0.099$, df = 1, $P = .753$).

Though model fit was improved with the addition of certain parameters, the ORs for the effect of the PA level upon the social isolation category were not substantially affected. Both partially and fully adjusted models compared with the initial unadjusted model all suggested that higher PA levels were associated with increased odds of being in a lower social isolation category (ORs = 0.60–0.75). The fully adjusted model with study time per week (using only BASS data) produced similar results (OR = 0.76 [0.63–0.90]). Table 4 shows the ORs and 95% CIs for the unadjusted and fully adjusted models.

Perceived Attainment

When considering the perceived attainment of the undergraduate students as the dependent variable, the unadjusted ordinal regression model with just the PA level provided a significantly improved fit over the intercept-only model according to the likelihood ratio test ($\chi^2 = 42.436$, df = 2, $P < .001$). The addition of sex, ethnicity, and health problem/disability to the model provided a significantly improved fit over the unadjusted model ($\chi^2 = 47.428$, df = 5, $P < .001$). The addition of daily sitting time to the model did not improve fit over the prior partially adjusted model ($\chi^2 = 0.0376$,

Table 4 Summary of Cumulative Ordinal Regression for Independent Variables Predictive of Social Isolation Category (Low, Medium, and High)

	Odds ratios (95% CIs)	
	Unadjusted	Fully adjusted
PA level (linear)	0.60 (0.54–0.68)	0.75 (0.63–0.90)
Age, y	–	0.97 (0.95–0.98)
Sex		
Male	–	Reference
Female	–	1.33 (1.16–1.52)
Ethnicity		
Nonwhite	–	Reference
White	–	0.89 (0.74–1.06)
Health problem/disability		
No	–	Reference
Yes, limited a little	–	2.65 (2.16–3.24)
Yes, limited a lot	–	4.66 (2.67–8.13)
Daily sitting, min	–	1.00
Gym membership		
No	–	Reference
Yes	–	0.86 (0.75–0.99)
Sports membership		
No	–	Reference
Yes	–	0.65 (0.56–0.75)
Knowledge of PA guidelines		
No	–	Reference
Yes	–	0.90 (0.79–1.02)
Part-time work		
No	–	Reference
Yes	–	0.98 (0.86–1.11)

Abbreviations: CI, confidence interval; PA, physical activity.

Table 5 Summary of Cumulative Ordinal Regression for Independent Variables Predictive of Undergraduate Student Perceived Attainment Category (Third, 2:2, 2:1, and First)

	Odds ratios (95% CIs)	
	Unadjusted	Fully adjusted
PA level (linear)	1.64 (1.31–2.05)	1.76 (1.38–2.24)
Age, y	–	1.00 (0.98–1.02)
Sex		
Male	–	Reference
Female	–	0.69 (0.60–0.80)
Ethnicity		
Nonwhite	–	Reference
White	–	0.67 (0.54–0.82)
Health problem/disability		
No	–	Reference
Yes, limited a little	–	1.03 (0.79–1.35)
Yes, limited a lot	–	1.87 (0.86–4.08)
Daily sitting, min	–	1.00
Gym membership		
No	–	Reference
Yes	–	1.11 (0.94–1.30)
Sports membership		
No	–	Reference
Yes	–	0.76 (0.64–0.90)
Knowledge of PA guidelines		
No	–	Reference
Yes	–	1.06 (0.92–1.30)
Part-time work		
No	–	Reference
Yes	–	0.87 (0.75–1.00)

Abbreviations: CI, confidence interval; PA, physical activity.

df = 1, P < .8463). The addition of both gym membership and sports club membership also significantly improved the model fit compared with the prior partially adjusted model (χ^2 = 12.025, df = 3, P = .007). The final fully adjusted model including part-time work did not improve fit compared with the prior model (χ^2 = 3.8181, df = 1, P = .0507).

Though model fit was improved with the addition of certain parameters, the ORs for the effect of the PA level upon perceived attainment were not substantially affected. Both partially and fully adjusted models compared with the initial unadjusted model all suggested that higher PA levels were associated with increased odds of being in a higher of perceived attainment category (ORs = 1.64–1.76). The fully adjusted model with study time per week (using only BASS data) produced similar results (OR = 1.67 [1.31–2.13]). Table 5 shows the ORs and 95% CIs for the unadjusted and fully adjusted models.

When considering the perceived attainment of the postgraduate students as the dependent variable, the unadjusted ordinal regression model with just the PA level did not significantly improve fit over the intercept-only model according to the likelihood ratio test (χ^2 = 2.2979, df = 2, P = .317). None of the examined models provided significantly improved fit. The ORs for the effect of the PA level upon the perceived attainment of postgraduate students were not clearly suggestive of the PA levels being

predictive of perceived attainment in postgraduate students (ORs for unadjusted model = 1.13 [0.71–1.78]).

Perceived Employability

When considering the perception of employability success and skills as the dependent variable, the unadjusted ordinal regression model with just the PA level provided a significantly improved fit over the intercept-only model according to the likelihood ratio test for most variables (χ^2 = 9.6131–94.004, df = 2, P = .008 to < .001), with the exception of written communication (χ^2 = 0.4628, df = 2, P = .7934). The addition of sex, ethnicity, and health problem/disability to the model provided a significantly improved fit over the unadjusted model for all variables (χ^2 = 26.865–230.31, df = 5, P < .001). The addition of daily sitting time to the model significantly improved fit over the prior partially adjusted model (χ^2 = 3.8579–22.662, df = 1, P = .0495 to < .001), with the exception of written communication (χ^2 = 0.4586, df = 1, P = .4983) and flexibility (χ^2 = 2.2493, df = 2, P = .1337). The addition of both gym membership and sports club membership also significantly improved the model fit compared with the prior partially adjusted model for all variables (χ^2 = 13.96–95.331, df = 3, P < .001). The final fully adjusted model including part-time work improved fit

compared with the prior model for all variables (χ^2 = 5.2382–42.872, df = 1, P = .0221 to < .001), with the exception of employment confidence (χ^2 = 0.008, df = 1, P = .9269) and analyzing and investigating (χ^2 = 0.1263, df = 1, P = .7223).

Though model fit was generally improved with the addition of certain parameters, the ORs for the effect of the PA level upon the perception of employability success and skills were not substantially affected. Both the partially and fully adjusted models compared with the initial unadjusted model all suggested that higher PA levels were associated with increased odds of being in a higher perception of employability success and skills category, with the lowest ORs being for written communication (employment confidence, ORs = 1.33–1.27; verbal communication, ORs = 1.23–1.12; written communication, ORs = 1.04–1.18; teamwork, ORs = 1.53–1.27; commercial awareness, ORs = 1.22–1.15; analyzing and investigating, ORs = 1.43–1.58; initiative/self-motivation, ORs = 1.54–1.51; drive, ORs = 1.62–1.57; planning and organizing, ORs = 1.35–1.38; flexibility, ORs = 1.29–1.25; and time management, OR = 1.39). The fully adjusted model with study time per week (using only BASS data) produced similar results, though verbal communication and time management had the lowest ORs, with 95% CIs crossing 1.00 (employment confidence, OR = 1.20 [1.05–1.38]; verbal communication, OR = 1.09 [0.95–1.26]; written communication, OR = 1.17 [1.02–1.34]; teamwork, OR = 1.25 [1.09–1.44]; commercial awareness, OR = 1.15 [1.00–1.32]; analyzing and investigating, OR = 1.51 [1.31–1.74]; initiative/self-motivation, OR = 1.44 [1.25–1.66]; drive, OR = 1.49 [1.30–1.71]; planning and organizing, OR = 1.33 [1.15–1.53]; flexibility, OR = 1.15 [1.00–1.32]; and time management, OR = 1.09 [0.95–1.26]). Table 6 shows the ORs and 95% CIs for the unadjusted and fully adjusted models. The separate model examining the effect of the PA level on the perception of employability success and skills, adjusting for perceptions of whether PA or exercise/sport improves employability and whether the respondent would refer to PA or exercise/sport when applying for jobs again, showed largely similar ORs (employment confidence, OR = 1.20 [1.05–1.38]; verbal communication, OR = 1.12 [0.98–1.29]; written communication, OR = 1.06 [0.92–1.20]; teamwork, OR = 1.23 [1.07–1.41]; commercial awareness, OR = 1.14 [1.00–1.30]; analyzing and investigating, OR = 1.48 [1.29–1.69]; initiative/self-motivation, OR = 1.40 [1.23–1.60]; drive, OR = 1.46 [1.28–1.67]; planning and organizing, OR = 1.27 [1.11–1.46]; flexibility, OR = 1.18 [1.03–1.35]; and time management, 1.29 [1.13–1.47]).

Discussion

This study has reported on a pooled secondary analysis of data from the SASS and BASS. The results suggest that students across the United Kingdom are less likely to meet the recommended PA levels (51%) when compared with individuals their age, as shown in the recent data from both England and Scotland. The most recent findings from Sport England's Active Lives survey have reported that 76% of 16- to 24-year olds meet the current CMO PA recommendations,[27] and the findings from the Scottish Health Survey have reported that 78% of 16- to 24-year olds meet the current CMO PA recommendations.[39] Furthermore, the data from the SASSI reported that 64% of the students in Ireland were meeting the CMO PA recommendations, which Murphy et al[25] noted, is higher than the comparable population data for 16- to 24-year olds in Ireland,[40] contrasting the findings in this study. Despite the relatively low PA participation, the analysis revealed that students who were more physically active tended to be 48% more likely to

have higher mental well-being (fully adjusted model OR = 1.48 [1.28–1.72]), 47% more likely to have higher personal well-being (fully adjusted model OR = 1.47 [1.27–1.69]), and 25% less likely to feel socially isolated (fully adjusted model OR = 0.75 [0.63–0.90]). Additionally, more physically active undergraduate students were 76% more likely to perceive their attainment to be higher, 27% more likely to have higher confidence in their ability to obtain employment upon graduation (fully adjusted model OR = 1.27 [1.17–1.51]), and 12% to 58% more likely to have higher perceptions of a range of employability skills (see Table 6).

Mental well-being in this particular population is crucial, as this group of young adults is exposed to a number of stressors that can negatively impact mental well-being.[12] These stressors include changes in residence, increases in responsibility, peer pressure, and the issues that arise with balancing academic classes, managing coursework, and part-time employment.[41,42] Similar to the current study that determined that 29% of the sample were categorized as low mental well-being, the SASSI revealed that 22.7% of the students were categorized as having "probable mental health problems."[25] Furthermore, Murphy et al[25] stated that those students meeting the PA guidelines were 55% more likely to report better mental health than those classified as inactive (OR = 1.55 [1.25–1.92]) comparable to 48% of the current investigation. Several other studies have also highlighted the association between PA levels and aspects of mental health and well-being in students.[3,8,13] It has been argued that, considering the positive effect that PA can have on mental health, there is a need to move toward the implementation of initiatives to increase PA levels.[43] Indeed, PA interventions aimed at university students have been shown to improve perceived stress,[44] and the results from the present analysis, showing positive associations between PA and mental well-being, provide support for the importance of promoting and facilitating PA in university settings.

The present study also included an examination of the association between PA levels and personal well-being in light of evidence that suggests the perception of overall quality of life is influenced by PA.[45] The results show that only 9% of the sample had a low personal well-being rating but a positive association between increased PA levels and greater personal well-being. Murphy et al[25] reported that, compared with students who did not meet the PA guidelines, students who met the PA guidelines were 2.2 times more likely to report feeling happy, and those who were moderately active were 1.46 times more likely to report feelings of happiness. In the present study, we found a similar association between greater PA and happiness, in addition to other elements of personal well-being, with more active students 47% more likely to report better personal well-being. Other prior work has shown greater quality of life in students who meet the PA recommendations mediated by self-esteem and positive affect.[12] Furthermore, positive attitudes toward sport may be associated with self-esteem and life satisfaction.[46] Indeed, within the adjusted models in the present study, membership of a sports club influenced personal well-being and social isolation.

Alongside the increased independence with transitioning to higher education can be an accompanying increased perception of social isolation and loneliness for many students.[47] In fact, 15% of the sample from the present study reported high social isolation. The present study also found that the students who were more physically active were 25% less likely to report high social isolation. Few studies have examined the impact of engaging in PA on social isolation levels; however, research has found links

Table 6   Summary of Cumulative Ordinal Regression for Independent Variables Predictive of Perception of Employability Success and Skills (1–5)

	Employment confidence		Verbal communication		Written communication		Teamwork[a]		Commercial awareness		Analyzing and investigating[a]		Initiative/self-motivation		Drive		Planning and organizing		Flexibility		Time management	
	Unadjusted	Fully Adjusted	Unadjusted	Fully Adjusted	Un-adjusted	Fully Adjusted	Un-adjusted	Fully Adjusted	Un-adjusted	Fully Adjusted	Un-adjusted	Fully Adjusted	Un-adjusted	Fully Adjusted	Un-adjusted	Fully Adjusted	Un-adjusted	Fully Adjusted	Unadjusted	Fully Adjusted	Unadjusted	Fully Adjusted
PA level (linear)	1.33 (1.17–1.51)	1.27 (1.11–1.46)	1.23 (1.08–1.40)	1.12 (0.98–1.29)	1.04 (0.92–1.18)	1.18 (1.03–1.36)	1.53 (1.34–1.74)	1.27 (1.11–1.46)	1.22 (1.07–1.38)	1.15 (1.00–1.31)	1.43 (1.26–1.63)	1.58 (1.38–1.82)	1.54 (1.35–1.76)	1.51 (1.31–1.74)	1.62 (1.42–1.85)	1.57 (1.37–1.81)	1.35 (1.19–1.55)	1.38 (1.20–1.59)	1.29 (1.13–1.47)	1.25 (1.08–1.43)	1.39 (1.23–1.58)	1.39 (1.22–1.59)
Age, y	–	1.06 (1.05–1.08)	–	1.04 (1.03–1.05)	–	1.03 (1.02–1.04)	–	1.02 (1.01–1.03)	–	1.03 (1.02–1.04)	–	1.04 (1.03–1.06)	–	1.05 (1.03–1.06)	–	1.02 (1.01–1.03)	–	1.03 (1.02–1.04)	–	1.03 (1.02–1.04)	–	1.02 (1.01–1.03)
Sex																						
Male	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference
Female	–	0.69 (0.63–0.75)	–	0.86 (0.78–0.94)	–	1.43 (1.30–1.58)	–	1.00 (0.91–1.10)	–	0.62 (0.57–0.68)	–	0.76 (0.69–0.84)	–	1.20 (1.09–1.33)	–	1.33 (1.21–1.47)	–	1.87 (1.70–2.06)	–	0.94 (0.85–1.03)	–	1.61 (1.47–1.77)
Ethnicity																						
Nonwhite	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference
White	–	1.06 (0.93–1.21)	–	1.31 (1.15–1.49)	–	1.05 (0.92–1.20)	–	1.16 (1.01–1.33)	–	1.02 (0.90–1.16)	–	1.06 (0.93–1.21)	–	1.00 (0.87–1.14)	–	1.18 (1.03–1.34)	–	1.23 (1.08–1.41)	–	0.88 (0.77–1.01)	–	1.24 (1.09–1.42)
Health problem/ disability																						
No	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference
Yes, limited a little	–	0.81 (0.68–0.96)	–	0.88 (0.74–1.04)	–	0.89 (0.75–1.06)	–	0.76 (0.64–0.90)	–	1.05 (0.89–1.25)	–	1.10 (0.93–1.32)	–	0.83 (0.70–0.99)	–	0.93 (0.79–1.11)	–	0.81 (0.68–0.96)	–	0.73 (0.62–0.87)	–	0.82 (0.70–0.98)
Yes, limited a lot	–	0.67 (0.41–1.11)	–	1.38 (0.81–2.36)	–	0.81 (0.49–1.35)	–	0.79 (0.47–1.34)	–	1.30 (0.79–2.15)	–	1.35 (0.81–2.25)	–	0.72 (0.42–1.23)	–	0.57 (0.34–0.94)	–	0.66 (0.39–1.12)	–	0.41 (0.24–0.70)	–	0.57 (0.33–0.96)
Daily sitting, min	–	1.00	–	1.00	–	1.00	–	–	–	1.00	–	–	–	1.00	–	1.00	–	1.00	–	1.00	–	1.00
Gym membership																						
No	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference
Yes	–	1.17 (1.05–1.29)	–	1.17 (1.05–1.29)	–	1.00 (0.90–1.10)	–	1.25 (1.13–1.39)	–	1.16 (1.05–1.29)	–	1.01 (0.91–1.12)	–	1.25 (1.13–1.39)	–	1.27 (1.15–1.41)	–	1.19 (1.07–1.32)	–	1.04 (0.94–1.15)	–	1.18 (1.06–1.30)
Sports membership																						
No	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference
Yes	–	1.00 (0.90–1.12)	–	1.16 (1.04–1.30)	–	0.79 (0.71–0.88)	–	1.53 (1.37–1.71)	–	1.00 (0.90–1.11)	–	0.79 (0.70–0.88)	–	1.05 (0.94–1.17)	–	1.02 (0.91–1.14)	–	0.94 (0.85–1.05)	–	1.07 (0.96–1.20)	–	0.92 (0.82–1.02)
Knowledge of PA guidelines																						
No	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference
Yes	–	1.32 (1.21–1.45)	–	1.18 (1.08–1.30)	–	1.21 (1.10–1.32)	–	1.22 (1.11–1.35)	–	1.19 (1.08–1.30)	–	1.07 (0.97–1.17)	–	1.36 (1.24–1.50)	–	1.37 (1.24–1.50)	–	1.16 (1.06–1.27)	–	1.16 (1.06–1.27)	–	1.34 (1.22–1.47)
Part-time work																						
No	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference
Yes	–	1.00 (0.92–1.10)	–	1.34 (1.22–1.47)	–	1.11 (1.06–1.22)	–	1.32 (1.20–1.45)	–	1.29 (1.18–1.42)	–	1.02 (0.93–1.12)	–	1.23 (1.12–1.35)	–	1.37 (1.25–1.50)	–	1.26 (1.15–1.38)	–	1.33 (1.21–1.46)	–	1.17 (1.07–1.28)

Odds ratios (95% CIs)

Abbreviations: CI, confidence interval; PA, physical activity.
[a]Note: Daily sitting minutes was dropped from models for these variables due to multicollinearity.

between PA, socialization, and mental health. Research aimed at investigating the association between vigorous PA and mental health, perceived stress, and socializing reported that socializing partially mediated the relationship between vigorous PA and mental health/perceived stress.[8] This suggests that increased socialization may be the reason behind the positive associations between mental health and personal well-being with PA levels. In fact, a systematic review of 30 studies suggested that sport participation may positively impact the social outcomes for children and adolescents,[48] although more research is needed to ascertain the causal relationships between these factors.

As noted, there is a growing literature suggesting a link between PA, executive function, and academic attainment in adolescents.[20] Though there is a lack of data examining university students, there is plausibility to a link between the two,[22] especially considering the link between PA and health and the suggestion that healthier students are better able to learn.[49] The present study appears to be the first to examine the potential link between PA levels and academic attainment in university level students. It should be noted that in the present survey the students were asked to provide their perceptions of their attainment, as it was not possible to obtain records of their actual grades. However, the present findings implied that the undergraduate students who were more physically active were 75% more likely to perceive their academic attainment to be higher. For the postgraduate students, there was little association, although the reason for this is not clear from the present data. It has been suggested that stress levels are similar between undergraduate and postgraduate students, yet postgraduate students typically have greater social support,[50] which may attenuate the potentially positive relationship between PA and attainment.

The potential positive impact of PA levels upon perceived attainment may, in turn, result in improved graduate employment and longer-term employability.[21] Indeed, the present study found that the students who were more active were 27% more likely to report higher confidence that they would be employed upon graduation. Furthermore, across a range of employability skills, the students who were more active perceived themselves to be 12% to 58% better. The weakest effects were seen for commercial awareness and written communication, seemingly understandable, as these are not generally skills involved during engagement in PA. Some of the additional factors examined in the adjusted models were found to potentially moderate some of the skills (see Table 6). For example, those who were members of a sports club were 53% more likely to rate themselves higher for teamwork. As mentioned, though data are sparse regarding the relationship between sport and attainment or employability, there is some evidence that sport may positively impact graduate employability,[21] and this would tend to support that perspective.

The limitations of the present study should be noted. Primarily, the survey conducted was cross-sectional in nature, rendering it difficult to conclusively draw causal inference from the data. It might also be considered that the directionality of associations may imply that having better mental health, personal well-being, lower social isolation, and greater perception of attainment and employability may increase the likelihood of participating in PA. Self-report was used for all outcomes, and in particular, the PA levels were assessed using a modified, single-item minutes-based activity question[26] and, as noted, this is similar to that used in the Active Lives survey from Sport England.[27] Recent work has suggested that, compared with longer PA questionnaires (ie, the International Physical Activity Questionnaire-Short Form), single item–based measures may offer poorer agreement with objective measures using accelerometers in university students.[51] However, here, the use of the single-item measure in the SASS and BASS was considered most appropriate, given the length of the survey when combined with the other outcomes examined. Further, though most outcomes were measured using existing tools and questions (SWEMWBS, ONSPWB4, and PROMIS-SI4a), perceptions of attainment, and employability confidence and skills were not, rendering their validity less clear. In the case of perceived attainment and employability, it is not clear whether PA is associated with actual attainment and employability. Longitudinal work could be considered to examine this, considering a combination with actual attainment data or the Higher Education Statistics Agency's 'Destination of Leavers from Higher Education' data on employment. Alternatively, retrospective surveys with recent graduates or postgraduates reporting actual attainment or employment could be performed. Lastly, the exact response rates, including the number of students at institutions surveyed at the time of the survey, the proportion of those who clicked the link to the survey, and the proportion of those who completed it is not clear. However, research has suggested that estimates of effects are similar across a range of response rates for college survey data.[52] Nonetheless, though the survey could be considered representative of UK-based university students, the interests of participants have been shown to influence their likelihood of responding, and so it could be that the respondent sample examined here is not necessarily wholly representative of the university student population as a whole.[53]

Conclusions

This combined analysis of the SASS and BASS is the largest representative examination of PA levels in UK-based university students. This data provides a comparator against other populations and for an examination of changes over time in the student population. At present, the data suggests that UK university students are insufficiently active compared with the general population of 16- to 24-year olds. The PA level was positively associated with higher mental and personal well-being, lower social isolation, higher perceived attainment, and higher perceived employability. Students that are more physically active tend to report better outcomes across these measures. Considering the important transitional period that attending a university represents for many young adults, approaches to encourage and facilitate engagement in PA should be considered. PA is widely considered to promote health and well-being, and the results here suggest that it may be associated with wider benefits for students, including reduced social isolation and improved employability. Indeed, it has been suggested that university settings are appropriate for the implementation of lifestyle interventions such as PA; thus, future work should look to implement and evaluate the approaches designed to increase the PA levels of university students and the impact they have upon such outcomes.

Acknowledgments

Notes

[I]Both the SASS and BASS utilized different options for this question. The SASS used "female," "male," and "prefer not to say," while the BASS used "cis Woman," "cis Man," "trans Woman," "trans Man," "in another way," and "prefer not to say." For this only, "female" and "cis Woman" (both coded as "female"), and "male" and "cis Man" (both coded as "male") from the SSS and BASS were used, respectively. Thus, n = 148 participants' data were excluded.

[II]For ethnicity, "prefer not to say" was excluded; thus, n = 109 participants' data were excluded.

[III]For health problem/disability, "prefer not to say" was excluded; thus, n = 40 participants' data were excluded.

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