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Title: Predictors of physical activity and barriers to exercise in nursing and medical students

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Abstract

Aims

To investigate physical activity levels of nursing and medicine students; examine predictors of physical activity level; and examine the most influential benefits and barriers to exercise.

Background

Healthcare professionals have low levels of physical activity, which increases their health risk and may influence their health promotion practices with patients.

Design

We surveyed 361 nursing (n=193) and medicine (n=168) students studying at a UK medical school.

Methods

Questionnaire survey, active over 12 months in 2014-2015. Measures included physical activity level, benefits and barriers to exercise, social support, perceived stress and self-efficacy for exercise.

Results

Many nursing and medicine students did not achieve recommended levels of physical activity (nursing: 48%; medicine: 38%). Perceived benefits of exercise were health-related, with medicine students identifying additional benefits for stress-relief. Most notable barriers to exercise were: lack of time, facilities having inconvenient schedules and exercise not fitting around study or placement schedules. Nursing students were less active than medicine students; they perceived fewer benefits and more barriers to exercise and reported lower social support for exercise. Physical activity of nursing and medicine students was best predicted by self-efficacy and social support, explaining 35% of the variance.

Conclusion

Physical activity should be promoted in nursing and medicine students. Interventions should aim to build self-efficacy for exercise and increase social support. Interventions should be developed that are targeted specifically to shift-working frontline care staff, to reduce schedule-related barriers to exercise and increase accessibility to workplace health and wellbeing initiatives.

Keywords

Exercise

healthcare students

nursing

physical activity

self-efficacy

social support

Summary statement

Why is this research or review needed?

- Physical activity is a crucial factor for health and well-being
- Healthcare students' (medics and nurses) physical activity may have an impact on their health and quality of care they provide, but we do not know what predicts their physical activity and how best to increase it
- We lack knowledge about benefits and barriers to exercise that healthcare students perceive, which can guide future interventions aimed at improving their physical activity

What are the key findings?

- Physical activity levels of healthcare students are best predicted by self-efficacy and social support for exercise
- Perceived benefits to exercise are mostly health-related; medicine students highlight additional benefits for stress-relief
- Lack of time and difficulty fitting exercise around the schedules of frontline care staff are the most notable barriers to exercise
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How should the findings be used to influence policy/practice/research/education?

- Intervention is needed to increase physical activity in healthcare students; this should build self-efficacy, enhance social support networks and be accessible around shift work and study schedules
- Such intervention should benefit healthcare providers directly, with potential benefits for patients by improving the quality of health services provided
- Future research might deliver and evaluate physical activity interventions for nursing and medicine students and investigate effectiveness of educational initiatives around health behaviours of frontline care staff.

INTRODUCTION

Background

Globally, concerns have been raised about high levels of physical inactivity (WHO 2010, Hallal *et al.* 2012) and the detrimental impact that physical inactivity has on health is widely acknowledged (WHO 2009, 2010). The UK government has published of several polices aimed at getting the population more active (DoH 2004,

2009, 2010). Similarly, other national and international organisations have introduced health initiatives to improve health of the global population (WHOLPSCG 2009). Although there are an abundance of studies demonstrating beneficial effects that physical activity has on health maintenance, longevity (e.g., Blair & Morris 2009), wellbeing (e.g., Penedo & Dahn 2005), health-related quality of life (e.g., Bize *et al.* 2007) and disease prevention (e.g., Warburton *et al.* 2006, Reiner *et al.* 2013), a significant proportion of the population remains inactive, which has an impact on the health of the population and places greater strain on our health services (DoH 2011, Farell *et al.* 2013). Understanding determinants of physical activity is important in the general population; equally, there is a need to better understand factors that determine whether our future healthcare providers choose to be active or sedentary, as they play an important role in providing health and lifestyle recommendations to their patients.

Nurses and other healthcare professionals have an increasingly important role in providing health promotion advice to the general population (DoH 2009, 2010). Often, greater emphasis is placed on nurses with regards health promotion because they are considered to have the greatest contact time with patients (Blaber 2005). Evidence suggests that healthcare professionals' own health practices can have an impact on the care they deliver to their patients (Healy & McSharry 2010, Esposito & Fitzpatrick 2011). Additionally, it has been argued that nurses and doctors may be seen as more credible by their patients if they are perceived to be following their own health promotion advice (Lobelo *et al.* 2009, Fie *et al.* 2012, Blake 2013). Worryingly, a significant proportion of nurses are physically inactive, with nurses reporting lower physical activity (PA) levels than other healthcare professionals (Kumbrija *et al.* 2007). As one of the largest employers in Europe, it is advocated that

the National Health Service (NHS) should set a public health example for other employers (DoH 2009, 2010). The NHS has responded to concerns about the health behaviours of its staff by implementing workplace wellness schemes that promote the adoption of healthier behaviours (Blake *et al.* 2013, Malik *et al.* 2014). The workplace is considered to be an ideal environment to promote physical activity as adults spend the majority of their waking hours at work (Black 2008).

Nursing and medicine students are our next generation of NHS employees and so action should be taken to increase the likelihood that these individuals adopt healthy lifestyle behaviours before they enter the public health workforce (DoH 2010). In doing so, we aim to generate improvements in the health of future NHS employees, which may influence standards of care, reduce sickness absence rates and staff burnout (DoH 2009). Although nursing and medicine students are educated about the benefits of physical activity for health, this knowledge does not always translate into their personal lifestyle choices. For example, many nursing and medicine students do not meet physical activity guidelines (e.g., nursing: Blake *et al.* 2011, Blake & Harrison 2013; medicine: Dąbrowska-Galas *et al*. 2013, Frank *et al.* 2008). It is unclear what factors predict physical activity levels in nursing and medicine students, although predictors may differ to students of other disciplines and the general population because of their high level of health knowledge. This understanding is crucial to inform the design of appropriate and tailored interventions to support those nursing and medicine students who are less active, to make healthy lifestyle choices.

THE STUDY

For the purposes of this research, we refer to nursing and medicine students as 'healthcare students'. In this study we examine the prevalence of low levels of physical activity in this sample and whether psychological factors that were previously found to be relevant for physical activity among general public, such as self-efficacy (e.g., Luszczynska & Haynes 2009, Ferrier *et al.* 2010, Reavenall & Blake 2010), perceived benefits and barriers (e.g., Vaughn 2009, cf., Lovell *et al.* 2010, Blake *et al.* 2011) and social support (Treiber *et al.* 1991, Gruber 2008) are predictive of physical activity level among healthcare students. Lack of time, fatigue and lack of motivation have previously been identified as barriers to exercise by registered staff nurses (Mo *et al.* 2010, Fernandes *et al.* 2013, Patra *et al.* 2015), although to our knowledge, no research has investigated these predictors in nursing and medicine students. We might expect to see higher levels of physical activity among nursing and medicine students than in general population, as these students obtain specific training in health related knowledge, including the beneficial health effects of physical activity. Due to this education and knowledge, it is possible that the benefits and barriers to physical activity perceived by healthcare students may be different to those found with general student samples or a more general audience. Knowing the factors that are most relevant with regards physical activity level of healthcare students should provide specific knowledge to help to inform future research and the design of new health interventions.

We also examine whether there are differences in physical activity levels and factors related to this, between nursing and medicine students as two different healthcare student populations. This will help to determine whether these two groups

of healthcare students require similar or discipline-specific attention when focusing on physical activity promotion. Additionally, we investigate whether physical activity levels of nursing and medicine students influence their perceived stress level and whether they view physical activity as a way of reducing one's stress (one of the benefits examined). Early research shows that exercising reduces stress among adolescents (Norris *et al.* 1992) and adults (Aldana *et al.* 1996). However, a previous study by Nguyen-Michel *et al.* (2006) showed no association between physical activity and perceived stress in a general college population. To the best of our knowledge, no studies have examined the interrelation of stress and physical activity among nursing and medicine students specifically, which may be relevant given the high levels of stress identified in these populations (e.g., Dutta *et al.* 2005).

Design

Cross-sectional design was used for this study.

METHODS

Ethical approval and data collection

Ethical approval was granted in May 2014 by the institutional research ethics committee board (ref: J13032014 SoHS). Convenience sampling technique was used to recruit participants. Data were collected between May 2014 and May 2015. Students were recruited from a single academic institution in the UK. All the students enrolled into nursing and medicine course at that institution were invited to take part in this study (via email) and provided with a link to an online website where they could anonymously record their responses.

Participants

All undergraduate nursing and medicine students (n = 2,355) at a higher education institution in the UK were invited to participate in the study.

Measures – validity, reliability and rigour

Demographic data were collected to determine representativeness of the sample. Participants were asked to provide their gender, age, course studied (i.e., nursing or medicine), year of study and ethnicity.

Participants completed the 10-item Perceived Stress Scale (PSS-10: Cohen *et al.* 1983). All questions are answered with a 4-point Likert scale (from 0=never to 4=very often) and relate to psychological stress experienced over the previous month. The higher the PSS score, the more likely it is that the individual will perceive that environmental demands exceed their ability to cope. Validity and reliability of the scale have been demonstrated (Cohen & Williamson 1988, Lee 2012, Roberti *et al.* 2006). Cronbach's alpha for this scale in our study was 0.90, demonstrating good reliability.

The Exercise Benefits and Barriers Scale (EBBS: Sechrist *et al.* 1987) was included in this study. This scale consists of 40 items, demonstrating barriers and benefits that people associate with exercising. This scale is answered using a 4-point Likert scale, from 1=strongly disagree - 4=strongly agree. The higher a person's score the more benefits to exercise they perceive in relation to barriers. Reliability of this scale was established previously (Sechrist *et al.* 1987, Grubbs & Carter 2002,

Brown 2005) and Cronbach's alpha for this scale in our study was 0.94, demonstrating good reliability. This scale was successfully validated in previous studies (e.g., Ortabag et al. 2010).

Participants were asked to complete the Self-Efficacy for Exercise Scale (Resnick & Jenkins 2000), indicating their feelings of self-efficacy for exercising when presented with different barriers to exercise. This nine item scale, uses a Likert-style response system, from 0 = not confident, to 10 = very confident. A higher score suggests a higher confidence level for participating in PA. This scale was previously shown to be reliable (Resnick & Jenkins 2000). In our study, Cronbach's alpha was equal to 0.88, demonstrating good reliability. The scale's validation was reported previously (e.g., Resnick & Jenkins 2000, Wilcox *et al.* 2005).

The Social Support for Exercise Habits Scale (Sallis *et al.* 1987) was used. This scale comprises 13 questions that ask participants to indicate their answers regarding support for exercising they obtain from friends and family. Answers are rated on a Likert scale, from 1=none/does not apply, to 5=very often. A higher value indicates a greater level of perceived social support. This scale has demonstrated satisfactory reliability in previous research (Sallis *et al.* 1987) and showed good reliability in this study with Cronbach's alpha equal to 0.90. This scale was successfully validated in previous studies (Sallis *et al.* 1987, Sallis *et al.* 1992a, Sallis *et al.* 1992b).

Lastly, participants indicated their level of PA with the use of the International Physical Activity Questionnaire (IPAQ - Short Version: Craig *et al.* 2003). This consists of seven items, asking participants to report on the duration of time they have spent doing the following activities over last week: walking, moderate activity, vigorous activity and sitting. IPAQ scoring features categorical and continuous

scoring. Continuous scores are expressed in terms of MET (multiples of the resting metabolic rate) - min/week. The energy requirement for each activity level is represented in METs score: walking – 3.3 METs, moderate intensity – 4.0 METs and vigorous intensity – 8.0 METs (Craig *et al.* 2003). A participant's total score is then calculated by adding the sum total of the duration and frequency of all of the activity levels over the seven-day period to give a total MET - min/week. In categorical scoring, participants are placed into one of three categories of PA: low, moderate or high. Previous evidence using test-retest approach indicates that this scale is reliable (Craig *et al.* 2003, Lachat *et al.* 2008).

Data analysis

Data were analysed using IBM SPSS statistics Version 22.0. All data were manually inputted and a 10% data check was conducted. Missing data were excluded from the respective analyses. The analyses include descriptive statistics, χ^2 tests, Pearson's product-moment partial correlations (controlling for degree), independent groups t-tests, one-way ANOVAs and linear regression model.

RESULTS

Sample characteristics

There were 361 respondents (15.3%; n=193 nursing, n=168 medicine), of which the majority were female (n=180 nursing, 93.3%; n=116 medicine, 69%, respectively) – typical for this career setting; and of White British/Irish origin (n=171, 89.1%; n=124, 73.8%, respectively). Age ranged from 19-51 years (mean age of whole sample = 23.19; SD=5.04). The demographic characteristics of the study sample were

broadly comparable with those reported previously in studies with healthcare students (e.g., Blake *et al.* 2011, Malik *et al.* 2011).

Of respondents, 48% (n=92) of nursing students and 38% (n=63) of medicine students were not meeting recommended levels of physical activity required to benefit their health (i.e., 150 minutes of moderate intensity physical activity per week: DoH 2011b). We divided students according to their PA level (low, moderate, high). Of the nursing students, 19% (n=23) reported low, 45% (n=56) reported moderate and 36% (n=44) reported high PA. Of the medicine students, 11% (n=12) reported low, 41% (n=46) reported moderate and 48% (n=53) reported high PA. The difference in the distribution of PA levels did not differ between nursing and medicine students ($X^2 = 4.67, p = 0.097$).

One-way ANOVAS showed a significant difference between the PA level groups in age ($F(2,228) = 7.67, p = 0.001$), self-efficacy ($F(2,228) = 13.27, p < 0.001$), benefits to barriers ratio ($F(2,209) = 9.63, p < 0.001$) and perceived support ($F(2,218) = 20.18, p < 0.001$). There was no significant difference in perceived stress ($F(2,230) = 0.78, p = 0.46$). The between groups comparisons showed that students in the low PA group were significantly older than students in the high PA group ($p < 0.02$), but no different in age from the moderate PA group ($p = 0.15$). Those with high PA had significantly higher self-efficacy for exercise than the two other groups ($p < 0.001$). The latter two did not differ in self-efficacy ($p = 0.24$). The high PA group perceived a significantly greater level of benefits to exercise than barriers, than two other groups ($p < 0.02$). The latter two did not differ ($p = 0.10$). Finally, perceived support for exercising from friends and family differed according to PA group, with the low PA group reporting the lowest amount of support, followed by the moderate PA group and high PA group with the highest amount of perceived support ($p <$

0.04). There were no differences between PA groups in gender ratio ($X^2 = 3.08$, $p = 0.21$). However, PA group classifications varied with year of study ($X^2 = 15.77$, $p = 0.046$). Table 1 shows descriptive statistics for overall sample characteristics.

Differences between nursing and medicine students

Apart from comparing groups based on PA level, we also examined differences between students from nursing and medicine degrees on the study variables (see Table 2). The nursing students were significantly older than medicine students ($t(267.08) = 5.50$, $p < 0.001$), which has been reported previously (e.g., Salamonson *et al.* 2009) and included more females ($\boldsymbol{X}^2 = 35.68$, $p < 0.001$), which is typical for the overall gender ratio in these disciplines. Since age was significantly different between the groups, to compare differences between nursing and medicine students on other study variables we conducted one-way ANOVAs (with respective outcome variables, degree as a fixed factor and age as a covariate). The results showed that compared with medicine students (and controlling for age), nursing students reported a non-significant trend towards a lower mean level of PA ($F(1,229) = 3.47$, $p = 0.064$). Similarly, a Chi-square test ($\boldsymbol{X}^2 = 3.15$, $p = 0.076$) showed a non-significant trend towards fewer nursing students meeting the physical activity guidelines than medicine students. Compared with medicine students, nursing students reported a higher level of perceived stress ($F(1,349) = 48.39$, $p < 0.001$), lower benefits-barriers ratio ($F(1,301) = 11.18$, $p = 0.001$) and lower perceived social support from family and friends ($F(1,287) = 5.60$, $p = 0.019$). There were no significant differences between the healthcare disciplines in self-efficacy for exercise ($F(1,314) = 2.72$, $p = 0.10$).

Reported benefits and barriers to exercise

We investigated which benefits and barriers were perceived to be most important among both nursing and medicine students. These were ranked using mean ratings for each group. The most frequently reported five benefits ranked by medicine students were: improved fitness (mean=3.66, SD 0.48), stamina (mean=3.55, SD 0.52), cardiovascular system (mean=3.55, SD 0.50), decreased stress (mean=3.50; SD 0.68) and sense of accomplishment (mean=3.49, SD 0.61). Student nurses rated highest the following benefits: improved fitness (mean=3.48, SD 0.53), cardiovascular system (mean=3.45, SD 0.51), muscle strength (mean=3.38, SD 0.52), stamina (mean=3.36, SD 0.56) and sense of accomplishment (mean=3.35, SD 0.64). Reported benefits were relatively comparable between disciplines. However, the mean rating of the two factors that differed on these lists were compared using independent samples t-test. We observed that medicine students (mean=3.50, SD 0.68) were more likely to view reduction of stress due to exercise as a benefit than nursing students (mean=3.31, SD 0.69), [$t(336) = 2.51$, $p = 0.01$]. There was not, however, a significant difference in the rating of 'improved muscle strength' [$t(315.57) = 1.06$, $p = 0.29$] between the two groups.

The most frequently reported barriers (with lowest scores, as barriers were reverse-coded) among medicine students were that exercising was tiresome (mean=2.18, SD 0.79), hard work (mean=2.24, SD 0.79), fatigue-prone (mean=2.32, SD 0.71), took too much of their time (mean=2.46, SD 0.84) and did not work around their schedule (mean=2.67, SD 0.82). Similar barriers were ranked highly among student nurses, where the most commonly selected barriers were: exercises being

tiresome (mean=2.24; SD 0.67), hard work (mean=2.30, SD 0.78), time-consuming (mean=2.37, SD 0.79), causing fatigue (mean=2.46, SD 0.73) and exercise facilities having inconvenient schedules (mean=2.54, SD 0.83).

Relationships between variables

Healthcare students' physical activity level (controlling for discipline) was correlated positively and significantly with level of self-efficacy for exercise (r = 0.40, $p < 0.01$), perceived benefits to barriers to exercise (r = 0.36, $p < 0.01$) and perceived support from friends and family (r = 0.46, $p < 0.01$). No significant relationship was observed between overall PA level and perceived stress (*$r = 0.02$, $p = 0.76$*). However, there was a significant relationship between achieving government recommended levels of physical activity (i.e., at least 30 min of moderate physical activity for 5 days a week: DoH 2011b) and level of perceived stress; students who met (mean=17.34, SD=7.13) and did not meet (mean=18.78, SD=6.54) these requirements, showed a marginally significant difference in stress level (*$t(352) = 1.95$, $p = 0.052$*). Partial correlations between variables (controlling for discipline) are shown in Table 3.

Multivariate Regression

Lastly, a linear regression model was undertaken to investigate factors potentially influencing the reported level of PA. Perceived stress, self-efficacy for exercise, benefits/barriers to exercise score, perceived support for exercising, subject discipline (nursing or medicine), age, gender and year of the degree were entered into

a multiple linear regression model predicting the PA level of students (see table 4). The overall model was significant [$F(8,176) = 11.84$, $p < 0.001$] and explained 35% of the variance in PA. The only significant predictors in the model were self-efficacy ($\beta = 0.29$, $p < 0.001$) and perceived support ($\beta = 0.35$, $p < 0.001$), suggesting that PA level can be explained by an individual's self-efficacy to exercise and perceived support for exercise from family and friends. Other variables did not show any significant relationships with the level of PA. The benefits to barriers ratio initially showed a significant association with PA level ($\beta = 0.23$, $p = 0.004$), but became non-significant after the perceived support variable was entered into the model.

DISCUSSION

Physical activity (PA) levels are less than exemplary in healthcare professionals and students (e.g., Kumbrija *et al.* 2007, Blake *et al.* 2011, Blake & Harrison 2013), although similar to those found in the general population. This is concerning given their education and training around the health benefits of physical activity and their roles as advocates of health and wellbeing. With the current focus on improving healthy behaviours in hospital workers as role models to the general public (DoH 2009, 2010), this study aimed to increase our understanding of the factors associated with PA in nursing and medicine students, our healthcare providers of the future. This knowledge will support the provision of interventions to promote active lifestyles and encourage the establishment of healthy lifestyle behaviours in nurses and medical doctors before they join the public health workforce.

Our findings show that a significant proportion of healthcare students responding to our survey was not meeting recommended levels of physical activity required to benefit their health (48% of nursing respondents; 38% of medicine respondents). High levels of inactivity in healthcare students is consistent with previous studies that used similar samples (Blake *et al.* 2011, Blake & Harrison 2013), which demonstrates a clear need to actively promote physical activity among healthcare student.

There were no differences in the distribution of low, moderate and high PA between genders or disciplines of study (nursing/medicine). However, older students were more likely to have low PA than younger students (e.g., Troiano *et al.* 2008), which may be related to an increased likelihood of competing demands on time, such as caregiving responsibilities (Roos *et al.* 2007). Thus, for example, offering physical activities for students and their children, might aid PA levels of older students.

As might be expected, the more active students were more likely to have higher self-efficacy for exercise (Luszczynska & Haynes 2009, Ferrier *et al.* 2010, Reavenall & Blake 2010), perceive more benefits than barriers to exercising (Vaughn 2009, Blake *et al.* 2011) and report high levels of social support for exercise from family and friends (Treiber *et al.* 1991, Gruber 2008). Whilst there is scope to increase physical activity in healthcare students of both disciplines, intervention is particularly warranted with nursing students who are less likely to meet government recommendations for physical activity than medicine students, perceive more barriers to exercise, report higher levels of stress and generally feel less well supported for engaging in exercise. It is likely that nursing students overall are a less physically active group than medicine students, although this should be replicated with a bigger

and more gender balanced sample, as a trend in physical activity was observed but this did not reach statistical significance.

With regards predictors of PA level, we observed that self-efficacy for exercise and perceived support for exercising from friends and family were its only significant and positive predictors. Although perceived benefits and barriers were associated with PA in isolation, their significance was far outweighed by the role of social support in predicting PA. This is not unusual, as emotional factors (such as belief about one's social support) are often more predictive of behaviours than cognitive factors, such as one's beliefs or attitudes (e.g., Lawton *et al.* 2007). Self-efficacy and social support have both been previously identified as important factors in determining PA level in students (Allison *et al.* 1999, Leslie *et al.* 1999, Wallace *et al.* 2000, Bray 2007). We show that these factors are also important for healthcare students, above and beyond any discipline-specific barriers to active lifestyles.

Moving forward, interventions need to be developed that build self-efficacy for physical activity and increase social support for active lifestyles. For example, universities could offer 'gym buddy' programmes with flexible schedules, or 'walking groups' during university study days, which might build self-efficacy and generate social support for being active, particularly for nursing students where support for exercise is perceived to be low.

Promoting physical activity is important for nursing and medicine students alike; although both groups should be knowledgeable about the health and wellbeing benefits of PA (which is emphasised from the outset of their training), there was room for overall improvement in self-efficacy for exercise, evidenced by the mean score falling around the mid-point of the self-efficacy scale. Increases in self-efficacy have

been achieved with healthy eating and physical activity interventions in other student populations and online health promotion interventions have met with some success (i.e., Dishman *et al.* 2004, Franko *et al.* 2010). However, intervention is required that is designed specifically for healthcare students who report discipline and job-related barriers to exercise (e.g., inflexible hours restricting access to facilities or interventions, shift-work).

The perceived benefits of exercise were similar for both groups and were predominantly health-related - associated with improved body condition functioning; this might be expected in those who have received specific training and education in health disciplines. However, medicine students indicated that relieving stress was one of the most important benefits of exercise, a factor that was less notable for their nursing peers, despite the fact the nursing students actually reported greater perceived stress than medicine students. Although there was no statistically significant relationship between perceived stress and overall reported PA level, we did note that those students meeting recommendations for physical activity reported lower levels of perceived stress. This suggests that there may be a potential stress-related benefit of improving PA level in healthcare students, who on the whole, report high levels of stress (e.g., Beck 1991, Jones & Johnston 1997, Shaikh *et al.* 2004). Given that nursing students (who are less active than medicine students) report high levels of perceived stress and that medicine students report stress-relief as an important benefit of PA, there is an argument for focusing on the well-established role of PA in the management or reduction of work or study-related stress (Aldana *et al.* 1996, Nguyen-Michel *et al.* 2006, Conn *et al.* 2009).

Reported barriers to being active were relatively comparable for both nursing and medicine students. As with the general population, lack of time to exercise was commonly reported as a barrier to exercise (Humpel *et al.* 2002, Trost *et al.* 2002). Students of both these shift-working disciplines reported that exercise did not fit well around their schedules, or that exercise facilities were not accessible at convenient times. Workplace wellness programmes are advocated in National Health Service (NHS) settings aimed at improving the health and wellbeing of NHS employees (Blake *et al.* 2013, Malik *et al.* 2014, NHS 2015). However, in practice, nurses and medical employees can be harder to reach with such initiatives. Attendance at workplace physical activity sessions, groups and clubs is usually higher in those with sedentary, office based job roles and lower in shift-working frontline care staff. It is imperative to develop workplace physical activity promotion initiatives that respond to the needs of healthcare employees and healthcare students that are working shifts. This may involve research to better understand their needs, increasing the availability and accessibility of employee health and wellbeing services and facilities, or delivering innovative, technology-based health promotion interventions that are already showing promise (Gartshore & Blake 2014, Blake *et al.* 2015).

Understanding perceived benefits and barriers to exercise and the relationship between psychosocial factors and PA levels of healthcare students (i.e., self-efficacy, stress and social support) contributes to the evidence in this field. However, physical activity participation and maintenance is likely to be influenced by a complex combination of psychological, biological and socio-economic determinants. Factors such as social status (Raudsepp 2006), socio-economic status (Sequeira *et al.* 2011), or conscientiousness (Kern & Friedman 2008) could be further investigated in these

healthcare groups. Socioeconomic differences may potentially be evident between nursing and medicine student populations and these may influence engagement in health behaviours and active lifestyle choices. Although studies do not appear to have directly compared socio-demographic characteristics of nursing and medicine samples, financial concerns are commonly raised by nursing students (e.g., Brown & Edelmann 2000, Lo 2002) whereas medicine students tend to report concerns of a non-financial nature, such as study workload (e.g., Shaikh *et al.* 2004, Dahlin *et al.* 2005). Moreover, selection of medical students in the UK is biased towards those achieving high grades at school exams, which appears driven by social status (Hughes 2002). The influence of wider determinants of physical activity participation in nursing and medicine students warrants further study.

Limitations

This study was limited by sampling strategy and a low overall response rate (15.3%); and although we do not know the characteristics of non-responders, our sample demographics are broadly comparable with those of the student populations from which we drew our sample. We had a high proportion of responses from female students although this might be expected given the higher response rate from nursing samples. Nevertheless, there may be gender differences in predictors of behaviour (e.g., Eagly & Wood 1991) and this warrants further investigation. Our participants were self-selected and physical activity was self-reported. Self-report measures do not correspond perfectly to objective measures (e.g., Prince *et al.* 2008) and objective measures of physical activity, such as accelerometers would generate more accurate indications of physical activity participation (e.g., Troiano 2005, Ward *et al.* 2005).

Nevertheless, self-reports are more commonly associated with over-estimation of activity levels, rather than under-reporting (e.g., Reilly 2006) which would only serve to emphasise concerns relating to low levels of physical activity in these samples. Finally, due to the cross-sectional nature of the study, no causal conclusions can be made.

CONCLUSION

Efforts should be made to promote physical activity in healthcare students to increase the proportion meeting the basic daily recommendation for the level of physical activity required to benefit health. This is important since healthcare professionals are often regarded as health role models for general society and their own PA habits may influence the quality of the service they provide (e.g., Lobelo & de Quevedo 2016). Universities should target health promotion campaigns to healthcare students and focus on the health and psychological benefits of exercise. Interventions for healthcare students should aim to build self-efficacy for exercise and increase social support, particularly for nursing students, who appear to be less active and report lower levels of confidence in and support for being active. The wider determinants of physical activity participation should be more fully investigated in these populations. Interventions should be developed that are targeted specifically to shift-working frontline care staff, to reduce schedule-related barriers to exercise and increase accessibility to workplace health and wellbeing initiatives. For example, future research might evaluate the impact of online or technology-based educational or health behaviour change interventions, flexible group physical activity challenges,

exercise buddy schemes, or walking groups for healthcare students organised around shifts.

Author Contributions:

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE*):

1) substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;

2) drafting the article or revising it critically for important intellectual content.

* http://www.icmje.org/recommendations/

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Table. 1. Descriptive statistics and differences in study variables between groups of healthcare students with varied PA level.

	Full sample	Low PA group	Moderate PA group	High PA group	*p* level
	M (SD)	M (SD)	M (SD)	M (SD)	
Age	23.35 (5.67) n=229	26.40[a] (8.20) n=35	23.43[ab] (5.59) n=99	22.14[b] (4.02) n=95	.001
Stress	17.82 (6.81) n=231	19.14[a] (7.03) n=35	17.56[a] (6.89) n=101	17.60[a] (6.66) n=95	.460
Self-efficacy	43.86 (17.57) n=229	35.00[a] (15.04) n=34	40.81[a] (17.18) n=99	50.16[b] (16.73) n=96	<.001
Benefits to barriers score	120.30 (15.51) n=210	112.09[a] (15.16) n=32	118.69[a] (15.07) n=90	124.93[b] (14.64) n=88	<.001
Perceived support	29.68 (9.62) n=219	23.16[a] (9.44) n=33	27.98[b] (8.88) n=93	33.69[c] (8.65) n=93	<.001
	Full sample	Low PA group	Moderate PA group	High PA group	*p* level

	Frequency (n)	Frequency (n)	Frequency (n)	Frequency (n)	
Gender	81% F (190)	89% F (31)	83% F (85)	79% F (74)	.214
Year of study	24% Y1 (56)	23% Y1 (8)[ab]	26% Y1 (26)[a]	23% Y1 (22)[ab]	.046
	31% Y2 (72)	14% Y2 (5)[b]	32% Y2 (33)[a]	35% Y2 (34)[ab]	
	31% Y3 (72)	51% Y3 (18)[a]	30% Y3 (31)[ab]	24% Y3 (23)[b]	
	8% Y4 (18)	3% Y4 (1)[ab]	9% Y4 (9)[ab]	8% Y4 (8)[ab]	
	7% Y5 (16)	9% Y5 (3)[ab]	3% Y5 (3)[b]	10% Y5 (10)[a]	
Degree	47% Medicine (111)	34% Medicine (12)	45% Medicine (46)	55% Medicine (53)	.097
	53% Nursing (123)	66% Nursing[a] (23)	55% Nursing[a] (56)	45% Nursing[a] (44)	

Note: PA= physical activity, F= female, Y= year, n=sample size. Group differences in age, stress, self-efficacy, benefits to barriers ratio, and perceived support between low, moderate and high PA level groups were analysed with one-way ANOVAs with Bonferroni or Dunnett T3 corrections (depending on the equality of the variance) and X^2 tests (gender, year of study, degree). The letters in superscript near mean and percentage values depict values that differ from each other significantly (based on between group comparisons): if the letters next to the respective two values being compared differe (e.g., a and b, or b and c) this depicts that these values are significantly different, however if the same letter (e.g., a) appears near to two values being compared, this represents a no significant difference between these respective values. Significant differences are indicated by bold font.

Table 2. Comparison of mean and frequency values of study variables between nursing and medicine students.

	Medicine students M (SD)	Nursing students M (SD)	*p* value
Age	21.72 (2.72) n=164	24.46 (6.13) n=189	<.001
Stress	15.51 (6.42) n=162	20.10 (6.62) n=187	<.001
Self-efficacy	46.32 (16.82) n=148	41.34 (18.89) n=166	.10
Benefits/barriers score	122.98 (15.47) n=143	117.20 (15.41) n=158	.001
Perceived support	31.14 (9.43) n=143	27.45 (9.69) n=144	.019
PA level	3376.47 (2069.47) n=103	2721.94 (1969.53) n=100	.064
	Medicine students Frequency (n)	Nursing students Frequency (n)	*p* value
Gender	69% F (116)	93% F (180)	<.001
Meeting PA requirements	62% YES (103)	52% YES (100)	.076

Note: F=female, SE=standard error. One-way ANOVAs were used to examine mean differences between continuous variables (stress, self-efficacy, benefits/barriers score, perceived support, PA level) with age as covariate, due to age being significantly different among nursing and medical students (as demonstrated by independent groups t-test). Chi-square tests were used to examine frequency differences between categorical variables (gender, meeting PA requirements).

Table 3. Partial correlations between study variables (controlling for discipline).

	PA level	Stress	Self-efficacy for exercise	Benefits/ barriers to exercise	Perceived support for exercise
PA level		.03	.40**	.36**	.46**
Stress			-.09	-.07	.04
Self-efficacy for exercise				.58**	.35**
Benefits/barriers to exercise					.51**
Perceived support for exercise					

Note: PA=physical activity; * p<.05, ** p<.01. Sample size varies from 234 to 361 due to pairwise exclusion.

Table 4. Linear regression model predicting PA level of healthcare students.

Full sample n=185			
(model R^2 =.35)*	Beta (β)	p value	95% CI
Constant	-	.12	- 4625.85; 533.41
Gender	-.04	.55	- 877.60; 464.87
Age	-.05	.49	- 73.35; 35.28
Degree	.01	.88	- 555.55; 645.95
Year of study	.08	.20	- 78.62; 373.30
Stress	.05	.43	- 24.12; 56.75
Benefits/barriers score	.07	.38	- 12.17; 31.60
Self-efficacy	.29	<.001	16.34; 53.70
Perceived support	.35	<.001	42.27; 103.88

Note: CI=confidence intervals. Significant predictors are written in bold.