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Questionnaire survey assessing the leisure-time physical activity of hospital doctors and awareness of UK physical activity recommendations

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ABSTRACT

Objective The UK Government Physical Activity Recommendations suggest that adults should aim for 150 min of physical activity each week to maintain health. We assessed the total volume, frequency, intensity and type of exercise taken by hospital doctors in association with their specialty, age and knowledge of the specific components of the recommendations.

Methods An anonymous paper-based questionnaire was distributed to doctors working in the two largest teaching hospitals in Glasgow. 332 questionnaires were analysed with a response rate of 60.3%.

Results 239 (72%) doctors felt they exercised regularly with 212 (63.9%) meeting the recommended volume of cardiovascular activity, similar to an age and sex-matched cohort of the general Scottish population. Only 78 (23.5%) doctors achieved the recommended muscle-strengthening activities. 108 (35.5%) doctors were aware recommendations for activity existed but only 45 (13.6%) were able to state the recommended duration of activity per week. Doctors who were aware of the recommendations were more likely to personally achieve them (OR 1.802, 95% CI 1.104 to 2.941) although other additional factors may contribute.

Conclusion Although this was a small study in two hospitals, our results suggest that hospital doctors are as active as the general public in the UK of a similar age. Eight years after implementation, knowledge of specific components of the current physical activity recommendations remains poor. Efforts to improve this prior to graduation, combined with improving confidence and competence in counselling practices and enhancing the opportunities for doctors to exercise, could translate into improved healthcare promotion.

BACKGROUND

Physical inactivity is the fourth leading cause of mortality worldwide and one of the leading risk factors for non-communicable disease.[1–3] Globally, 42.3% of adults in high-income countries are deemed to be physically inactive.[3] In the UK, the benefits of participating in physical activity are clear as this 'therapy' has been included in at least 76 National Institute for Health and Care Excellence guidelines.[4] Data from the Scottish Government published in 2011 showed that 32% women and 43% men aged 19 years and over achieved enough physical activity to yield health benefits.[5] This had improved by 2015 to 63% of Scottish adults meeting the target.[6]

The WHO Global Recommendations on Physical Activity for Health were accepted by the UK Chief Medical Officers in 2011.[1 5] These state that adults aged 19–64 years should aim to be active daily, taking part in at least 150 min/week of moderate-intensity aerobic activity, 75 min of vigorous intensity, or a combination of the two, with additional muscle-strengthening activities on 2 or more days per week. Despite these recommendations, 1 in 4 adults worldwide still do not meet the criteria,[7] with muscle-strengthening activities falling far behind cardiovascular (CVS) exercise[8] despite the well-documented health benefits.[9]

Doctors' participation in health promotion

Doctors are ideally placed to counsel the general public on various aspects of health promotion. There is a well-demonstrated positive link between both doctors'[10–16] and medical students'[17–19] personal and clinical practices, including around exercise. Despite clinicians who personally exercise being more likely to counsel their patients to do the same, doctors' knowledge of the relevant UK recommendations has been reported in several studies to be as low as 7%–27%.[20 21] This knowledge gap has implications for dissemination of accurate advice to the public, irrespective of counselling practice.

Physical activity of doctors

The physical activity of doctors, both at work[22–25] and during leisure time, in the UK[15 26–30] and worldwide[14 31–40] has been assessed. Most of this work focused predominantly on the total volume of activity without

Table 1 Participant characteristics (n=332) including duration, frequency and intensity of cardiovascular (CVS) and strength exercise, specific sports, use of any electronic equipment and participation in organised or competitive activities. Doctors taking part in more than one type of exercise or using more than one form of equipment were included in all relevant subgroups

Characteristic	Value (n=332)	Characteristic	Value (n=332)
Graduation	2001 (1992–2008)	Type of exercise	
Grade		Cycling	120 (36.1)
ST3-4	43 (13)	Fitness	93 (28)
ST5-8	77 (23.1)	Other	37 (11.1)
Consultant	212 (63.9)	Racquet sports	23 (6.9)
Specialty		Running	124 (37.3)
Anaesthetics	108 (32.5)	Swimming	55 (16.6)
ED	30 (9)	Team sports	22 (6.6)
Laboratory	31 (9.4)	Brisk walking	139 (41.9)
Medicine	58 (17.5)	Organised activity	96 (28.9)
Surgery	105 (31.6)	Competitive activity	87 (26.2)
Regular exerciser	239 (72)	Equipment used	
CVS exercise, days	3 (2–5)	Fitbit	29 (8.7)
CVS exercise, hours		GPS	63 (19)
Total	4 (2–6)	HRM	38 (11.4)
Low intensity	0 (0–2)	iPhone	85 (25.6)
Moderate intensity	1.5 (0–3)	Step counter	20 (6.0)
Vigorous intensity	1 (0–2)	None	155 (46.7)
Strength, days/week	0 (0–1)		
Strength, hours/week	0 (0–1)		

Data presented as number (percentage) or median (IQR).
ED, emergency department; GPS, Global Positioning System; HRM, heart rate monitor; ST, specialty trainee.

specifically assessing frequency, intensity, type of exercise and muscle-strengthening activities.

One systematic review demonstrated a 45%–90% compliance with leisure-time physical activity recommendations in medical staff[14] while other studies indicated that between 43% and 46% of hospital doctors[25] and general practitioners[22 24] did not take part in enough activity to meet the recommendations.

While there is significant previous work focusing both on the relationship between doctors' own physical activity and their counselling practice[10–12 17] and the association between doctors' knowledge of physical activity recommendations and counselling practice,[21] as far as we are aware, only one previous study from India has assessed any association between knowledge of recommendations and a doctor's own personal exercise habits.[36]

OBJECTIVE

This questionnaire study had three aims. First, to document in detail the physical activity taken by hospital doctors including the type, frequency, duration and intensity of exercise and compare this with the general adult UK population aged 19–64 years. Second, to assess specific knowledge of the separate components of the UK Government Physical Activity Recommendations with the proportion of doctors able to personally attain these. Finally, we assessed any correlation between specific exercise patterns and specialty, time since graduation and knowledge of the recommendations.

METHODS

The West of Scotland Research Ethics Committee confirmed that no ethical approval was required for this anonymous staff survey. The questionnaire was piloted by 10 individuals not participating in the study. A data collector was recruited from as many individual departments as possible in Glasgow Royal Infirmary and the Queen Elizabeth University Hospital—the two largest teaching hospitals in the city of Glasgow.

Data collection

Data were collected between October 2017 and May 2018. Following verbal consent, all doctors of specialty trainee 3 level and above, who were committed to their specialty, were given an envelope containing a questionnaire. The importance of non-exercisers also participating was emphasised by each data collector. Doctors were asked to complete questions regarding their own leisure-time

Table 2 Comparison of participants who attained cardiovascular (CVS) (n=95) and both CVS and strength (n=34) recommendations compared with those who did not

Characteristic	Attained CVS (n=95)	Did not attain CVS (n=237)	P value	Attained CVS and strength (n=34)	Did not attain CVS and strength (n=298)	P value
Specialty			0.265			0.756
Anaesthetics	32 (33.7)	76 (32.1)		12 (35.3)	96 (32.2)	
ED	13 (13.7)	17 (7.2)		6 (17.6)	24 (8.1)	
Laboratory	8 (8.4)	23 (9.7)		3 (8.8)	28 (9.4)	
Medicine	18 (18.9)	40 (16.8)		4 (11.8)	54 (18.1)	
Surgery	24 (25.3)	81 (34.2)		9 (26.5)	96 (32.2)	
Grade			0.220			0.677
ST3-4	13 (13.7)	30 (12.7)		6 (17.6)	37 (12.4)	
ST5-8	16 (16.8)	61 (25.7)		7 (20.6)	70 (23.5)	
Consultant	66 (69.5)	146 (61.6)		21 (61.8)	191 (64.1)	
Aware of guidelines	43 (45.3)	75 (31.6)	0.019	19 (55.9)	99 (33.2)	0.009
Organised activity	48 (50.5)	48 (20.3)	<0.001	23 (67.6)	73 (24.5)	<0.001
Competitive activity	44 (46.3)	43 (18.1)	<0.001	18 (52.9)	69 (23.2)	<0.001
CVS exercise, hours (total)	7 (6–10)	3 (1.5–5)	<0.001	7 (6–10)	4 (2–6)	<0.001

Data presented as number (percentage) and median (IQR).
ED, emergency department; ST, specialty trainee.

physical activity by considering an average week of exercise. Standardised descriptive terms for subjective effort levels (low, moderate and vigorous intensity) used in the questionnaire were the same as those described in the recommendations.[5] Free-text responses were used for questions assessing knowledge of the UK Physical Activity Recommendations.

The completed questionnaire was returned in an anonymised envelope to the study team via the data collectors. Each data collector also reported the total number of possible participants in their specialty to allow calculation of response rate. All data were recorded anonymously on an Excel spreadsheet prior to analysis.

Statistical analysis

Statistical analyses were carried out using R V.3.5.1. Summary statistics were calculated using Pearson's χ^2 testing for categorical analysis with Wilcoxon rank-sum and Kruskal-Wallis testing for non-parametric continuous data. Multivariable regression modelling was carried out to adjust for the main confounding effects. Logistic regression modelling was used for binomial outcomes with Poisson regression for simple count data and vectorised Poisson regression for multivariate count data. A vector generalised linear model with Poisson errors and the standard log function was chosen when analysing duration of low, moderate and vigorous-intensity exercise due to an intercorrelation between the three models. A p value <0.05 was considered significant.

RESULTS

Twenty-seven departments were included in analysis, giving a total of 368 respondents with an overall response rate of 60.3%. Individual specialty response rates were 53.5% for anaesthetists, 73.3% for emergency medicine (emergency department, ED), 84.2% for laboratory specialties, 61.2% for medical specialties and 64.2% for surgical specialties. After exclusion of 36 questionnaires due to unanswered questions precluding evaluation, 332 responses were analysed.

Regular exercise habits

Table 1 shows the personal characteristics of all participants including the duration, frequency and intensity of both CVS and strength exercise during an average week. Seventy-two per cent of all participants felt that they exercised regularly, with walking, followed by running and cycling, the most popular activities.

Following multivariable regression analysis, there was no difference in the total number of hours of CVS activity between anaesthetists, surgeons and ED doctors. Compared with anaesthetists, medical specialties performed 21.8% (95% CI 0.074 to 0.363) and laboratory specialists 29.2% (95% CI 0.121 to 0.463) more CVS exercise per week.

Considering intensity of activity, ED doctors completed 69% (p<0.0001) more vigorous-intensity exercise when compared with anaesthetists. Doctors who knew that physical activity recommendations existed performed 21% (p=0.031) less low-intensity activity than those who

Table 3 Knowledge of UK Government Physical Activity Recommendations in the subgroup claiming to be aware that guidelines exist (n=118)

Component of recommendations	Response (n=118)
CVS activity	
Duration, frequency and intensity correct	0 (0.0)
Duration correct	45 (38.1)
Frequency correct	30 (25.4)
Intensity correct	35 (29.7)
All criteria incorrect or no response	43 (36.4)
Overall overestimation	10 (8.5)
Overall underestimation	29 (24.6)
Strength	
Any comment regarding strength	8 (6.8)
Frequency correct	6 (5.1)
Frequency incorrect	2 (1.7)

Knowledge of CVS recommendations separated by duration (150 min/week), intensity (moderate or vigorous) and frequency (at least 5 days/week). Strength recommendations assessed as correct if response was 2 days/week of any form of strength training. Data presented as number (percentage). Each individual factor analysed separately for whole group (n=118), meaning some participants scored more than once.
CVS, cardiovascular.

did not. Older doctors carried out 3.8% (p<0.0001) more low-intensity exercise than younger doctors. No other correlations proved significant.

Personal achievement of physical activity recommendations

Of all participants (n=332), 95 (28.6%) attained the recommended duration and intensity of CVS guidelines over the recommended frequency which was taken as at least 5 days/week. This increased to 212 (63.9%) when frequency was not considered, to allow comparison with previous studies assessing only duration. Only 78 (23.5%) participants achieved the recommended strength guidelines of 2 days/week. Combining both CVS and strength guidelines, 34 (10.2%) achieved these over more than 5 days/week with 63 (19%) managing to achieve them over less than 5 days/week.

Factors influencing attainment of recommendations

Table 2 shows the difference in characteristics between those participants who did and did not personally achieve the recommendations. Participants who took part in organised or competitive physical activity were more likely to achieve both the CVS and strength recommendations.

Those participants who claimed to be aware of the recommendations were more likely to achieve both the recommended CVS and combined CVS and strength guidelines with ORs after multivariable regression of 1.802 (95% CI 1.104 to 2.941) and 2.546 (95% CI 1.241 to 5.224) respectively.

Awareness and knowledge of physical activity recommendations

Table 3 shows the familiarity with all components of the current UK Physical Activity Recommendations in those who claimed to be aware of them (n=118). Duration, frequency and intensity of CVS activity are presented individually. From a strength perspective, a frequency of 2 days/week was taken as being a correct response.

Two hundred and fourteen (64.5%) participants were not aware of any recommendations and their knowledge was not assessed further. Of those who knew that recommendations existed, 38.1% correctly responded with the total duration per week. CVS recommendations were overestimated by 8.5% and underestimated by 24.6%. Only 6.8% commented on any form of muscular-strengthening exercise.

DISCUSSION

Physical activity participation

Our results show that 63.9% of hospital doctors achieved the recommended 150 min of moderate to vigorous-intensity activity per week, a little better than a previous cohort of UK healthcare professionals showing that nearly 50% were not active enough.[25] Data from Audit Scotland show that 50% of Scottish hospital doctors are female.[41] Our results correspond with 65% of an age and sex-matched population of Scottish adults in 2016 achieving the recommendations.[2] There may however be other differences between doctors and the general population such as social class, ethnicity, alcohol history and deprivation category.

Comparing participation in specific sports, our cohort chose more cycling (36.1% vs 11%) and running (37.3% vs 13%) but less walking (41.9% vs 67%) than the general Scottish population aged 19–64 years, although walking remained the most popular activity among doctors.[5] Like many adults, this might be explained by the fact that these are time-efficient activities, which can be carried out from the doorstep at any time, require no particular forward planning and can also be linked into a commute.

ED doctors participated in more vigorous-intensity exercise than any other specialty. ED is a fast-paced and highly stimulating specialty and it may be that doctors who choose to work in this way also execute their extracurricular activities in the same manner. We also found that with increasing age, there was a small increase in total activity but with a greater proportion of this being low intensity. This increased activity may be achievable due to a decrease in other commitments with age, such as examinations, night shifts or childcare, but may also be explained by a greater appreciation of the importance of activity in remaining healthy. Due to the small sample size of this study, these hypotheses should be interpreted with caution and require further larger scale study.

While 63.9% of participants achieved the recommended duration of CVS exercise per week, this decreased to only 28.6% if the recommended frequency of 'most days' was also considered. It is difficult to extrapolate this to other

groups as most previous studies assessed only volume of exercise, with less emphasis on frequency although the Scottish Household Survey found that the mean number of days in a 4-week period that Scottish adults took part in sport and exercise was 5.6, with participation in brisk walking over a mean of 8.6 days.[2]

Possibly, long shifts in some specialties may produce a greater challenge for doctors to exercise on most days of the week. The median of 3 days/week taken by our cohort suggests that doctors may exercise in a 'week-end-warrior' style. This pattern of attaining more than 150 min of activity throughout the week, acquired over sometimes as little as 1–2 days, can still result in significant health benefits,[42] although some of the acute metabolic and physiological responses to exercise, lasting up to 24 hours, continue to support the recommendation that daily activity may be superior.[5 43] As with all other groups studied, participation in muscle-strengthening activities was low in doctors at 23.5%.[8]

Knowledge of physical activity recommendations

Despite the current UK physical activity recommendations not changing since 2011, a 64.5% of participants were not aware that they existed. Of those who were aware, only 38.1% were able to state the correct duration of CVS activity per week with even less being familiar with the intensity, frequency and muscle strengthening recommendations. This corresponds to only 13.6% of the total participants identifying that 150 min of activity is required each week to achieve health benefits. This is disappointingly no better than a cohort of 1724 UK adults where 18% answered the same question correctly.[44]

The lack of time granted to teaching physical activity in the UK medical undergraduate curriculum, with the resultant lack of knowledge of medical students, has been well documented.[4 45–47] Following a concerted effort, all Scottish medical schools have included this teaching in their curriculum since 2015[6] and a free online learning resource is now available to all UK medical schools.[48]

Although our study cohort was small, it is clear that hospital doctors' knowledge of the physical activity recommendations is poor. Previous studies suggest that primary care practitioners may, however, fare slightly better.[16 18 23]

Simply having the correct knowledge of the dose of activity recommended for health benefits is not enough to translate into improved health promotion for the population. In addition, doctors must be confident and have developed competence in counselling practices which begins at medical school.[16] Third, as discussed in the introduction, medical students and doctors who are physically active themselves are much more likely to counsel their patients.

Our results suggest that in-depth knowledge of the specific components of the physical activity recommendations may not significantly influence personal exercise habits, although this finding probably cannot be extrapolated to other population groups. Purely being aware that recommendations exist, rather than knowing the specific content of them, was associated with a doctor attaining the recommended activity level. The converse of this may however be true, in that those individuals who take part in more physical activity are more interested in sport and therefore may be more likely to be aware of the recommendations. Either way, despite the fact that any increase in baseline physical activity, even to that below the current recommendations, does have some health benefits,[42 43 49 50] it is difficult to dispute that doctors of all specialties, not just primary care, should be aware of the current recommendations and counsel their patients appropriately.[44 51]

Strengths and weaknesses

We aimed to attain a higher response rate than traditional online questionnaires by using face-to-face invitations by data collectors working in each department. This provided a response rate of 60.3%, better than several previous studies. While we were unable to assess demographic data for the non-responders and therefore cannot be certain, we hope that this method may have included more doctors who do not routinely exercise. Unlike previous studies, we assessed doctors' knowledge of the physical activity recommendations in detail, breaking down total volume, and frequency, intensity and type of exercise. We also assessed the personal physical activity of participants with their knowledge of the recommendations. As far as we are aware, this has only been studied once before in India.

The sample size in this study was small and consisted of doctors working in two hospitals in one UK city and is therefore subject to error. We accepted a smaller sample size from that which an online invitational questionnaire may have produced, as we felt that this might result in a larger response rate. Age and sex of our cohort were not recorded as this would have eliminated the anonymity of many participants in smaller departments. We did not assess barriers to exercise or specifically enquire about active commuting to work or counselling practice. We also chose not to assess physical activity during the working day and concentrated purely on leisure-time activity as we felt that the effort levels attained while at work were likely to be low intensity, lasting less than 10 min at a time and therefore not additive to the physical activity recommendations, despite individuals feeling they remained active at work. As with all questionnaire-based assessments of activity, intensity and, to a lesser extent, duration of exercise is a subjective measure. We cannot be certain that what was documented by each participant is a true reflection of actual activity. We do however feel that this study provides some additional detail for further study in a larger cohort.

CONCLUSION

The physical activity habits of hospital doctors are similar or slightly better than the general Scottish public of a similar age but with participation in a greater proportion

of time-efficient activities. Very few doctors were able to stay active on most days of the week and tended to exercise for longer periods of time over fewer days. This may be associated with their working patterns rather than a specific lifestyle choice but requires further work to ascertain. Focusing particularly on the workplace and providing facilities to encourage active commuting may permit physical activity opportunities to be built, more frequently, into the working day. This may in turn increase the number of doctors remaining physically active and translate into increased counselling of their patients.

Hospital doctors' knowledge of the current physical activity recommendations remains poor. This is likely to significantly impact on their ability to correctly and confidently counsel patients. Only time will tell whether the recent changes to the undergraduate curriculum have proved successful in remedying this.

In future work we plan to assess on a much larger scale, the knowledge level, physical activity habits and barriers to physical activity in a variety of healthcare professionals—hospital doctors, general practitioners, staff nurses and physiotherapists. This could provide further data to assess if the pattern of physical activity and knowledge seen in hospital doctors is prevalent throughout other healthcare professionals. We hope this larger scale study will allow us to clarify some of the issues highlighted by our initial work.

What are the new findings?

- This was the first study to assess all specific components of leisure-time physical activity in hospital doctors and compare this with their knowledge of the current UK Government Physical Activity Recommendations.
- A similar proportion of doctors and the general public achieve the recommended volume of moderate to vigorous physical activity.
- Doctors who were aware recommendations existed were more likely to personally achieve them.
- Hospital doctors' knowledge of the current physical activity recommendations, 8 years after implementation, remains poor.

How might it impact on clinical practice in the future?

- Measures to increase doctors' knowledge, counselling confidence and their own physical activity could translate into improved healthcare promotion for the general public.
- The recent positive change to medical undergraduate teaching may significantly improve familiarity with the recommendations, but this is unlikely to be apparent for several years.

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Contributors JAC conceived the idea, designed the questionnaire, collected the data and performed data entry. MS performed data entry and analysis. JAC drafted the initial paper and MS contributed to the drafting process.

Competing interests None declared.

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Ethics approval The West of Scotland Research Ethics Committee confirmed that ethical approval was not required for this anonymous staff survey.

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REFERENCES

1. World Health Organisation. *Global recommendations on physical activity for health*. Geneva, 2010.
2. Scottish Household Survey. Scotland's People Annual Report 2016. A National Statistics publication for Scotland. The Scottish Government, 2017September. Available: https://www.gov.scot/publications/scotlands-people-annual-report-results-2016-scottish-household-survey/
3. Guthold R, Stevens GA, Riley LM, *et al*. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1·9 million participants. *Lancet Glob Health* 2018;6:e1077–86.
4. Gates AB. Training tomorrow's doctors, in exercise medicine, for tomorrow's patients. *Br J Sports Med* 2015;49:207–8.
5. Active S, Active S. *A report on physical activity for health from the four home countries' Chief Medical Officers*. London: Department of Health, 2011.
6. Murray A, Calderwood C, O'Connor N, *et al*. Scotland's progress in putting policy about physical activity into practice. *Br J Sports Med* 2016;50:320–1.
7. World Health Organisation. *Global action plan on physical activity 2018-2030. more active people for a healthier world*. Geneva: World Health Organisation, 2018.
8. Public Health England. *Muscle and bone strengthening and balance activities for general health benefits in adults and older adults. Summary of a rapid evidence review for the UK Chief Medical Officers' update of the physical activity guidelines*. London: Public Health England, 2018.
9. García-Hermoso A, Cavero-Redondo I, Ramírez-Vélez R, *et al*. Muscular strength as a predictor of all-cause mortality in an apparently healthy population: a systematic review and meta-analysis of data from approximately 2 million men and women. *Arch Phys Med Rehabil* 2018;99:2100–13.
10. Belfrage ASV, Grotmol KS, Tyssen R, *et al*. Factors influencing doctors' counselling on patients' lifestyle habits: a cohort study. *BJGP Open*2018;40.
11. Abramson S, Stein J, Schaufele M, *et al*. Personal exercise habits and counseling practices of primary care physicians: a national survey. *Clin J Sport Med* 2000;10:40–8.
12. Frank E, Rothenberg R, Lewis C, *et al*. Correlates of physicians' prevention-related practices. Findings from the women physicians' Health study. *Arch Fam Med* 2000;9:359–67.
13. Lobelo F, Duperly J, Frank E. Physical activity habits of doctors and medical students influence their counselling practices. *Br J Sports Med* 2009;43:89–92.
14. Lobelo F, de Quevedo IG, Quevedo Gde I. The evidence in support of physicians and health care providers as physical activity role models. *Am J Lifestyle Med* 2016;10:36–52.
15. Chatterjee R, Chapman T, Brannan MG, *et al*. GPs' knowledge, use, and confidence in national physical activity and health guidelines and tools: a questionnaire-based survey of general practice in England. *Br J Gen Pract* 2017;67:e668–75.
16. Frank E*et al*. Correlates of physicians' Prevention-Related practices: findings from the women physicians' Health study. *Arch Fam Med* 2000;9:359–67.
17. Frank E, Tong E, Lobelo F, *et al*. Physical activity levels and counseling practices of U.S. medical students. *Med Sci Sports Exerc* 2008;40:413–21.
18. Frank E, Carrera JS, Elon L, *et al*. Predictors of US medical students' prevention counseling practices. *Prev Med* 2007;44:76–81.
19. Frank E, Elon L, Hertzberg V. A quantitative assessment of a 4-year intervention that improved patient counselling through improving medical student health. *Med GenMed* 2007;9.

20. Das BM, DuBose KD, Peyton A. Active health care providers' practices and views on counselling patients to be active. *Translational Journal of the ACSM* 2018;3:190–5.
21. Douglas F, Torrance N, van Teijlingen E, *et al*. Primary care staff's views and experiences related to routinely advising patients about physical activity. A questionnaire survey. *BMC Public Health* 2006;6.
22. Cuthill JA, Fitzpatrick K, Glen J. Anaesthesia - a sedentary specialty? Accelerometer assessment of the activity level of anaesthetists while at work. *Anaesthesia* 2008;63:279–83.
23. Kovacheva VP, Tsen LC. Predictors of achieving recommended daily physical activity among Anesthesiologists at a large tertiary care academic center. *J Clin Med Res* 2018;10:50–5.
24. Vandelanotte C, Short C, Rockloff M, *et al*. How do different occupational factors influence total, occupational, and leisure-time physical activity? *J Phys Act Health* 2015;12:200–7.
25. Blake H, PKH M, Lee S, *et al*. Health in the NHS: lifestyle behaviours of hospital employees. *Perspectives in Public Health* 2012;132:213–5.
26. Daley AJ, Bassi S, Haththotuwa HR, *et al*. 'Doctor, how much physical activity should I be doing?': how knowledgeable are general practitioners about the UK Chief Medical Officer's (2004) recommendations for active living to achieve health benefits? *Public Health* 2008;122:588–90.
27. Gupta K, Fan L. Doctors: fighting fit or couch potatoes? *Br J Sports Med* 2009;43:153–4.
28. McGrady FP, McGlade KJ, Cupples ME, *et al*. Questionnaire survey of physical activity in general practitioners (PHIT GP study). *Ulster Med J* 2007;76:91–7.
29. Mittal TK, Cleghorn CL, Cade JE, *et al*. A cross-sectional survey of cardiovascular health and lifestyle habits of hospital staff in the UK: do we look after ourselves? *Eur J Prev Cardiol* 2018;25:543–50.
30. O'Cathail M, O'Callaghan M. A profile of hospital consultants: the health practices of a cohort of medical professionals. *Irish Medical Journal* 2013;106:134–6.
31. Rao CR, Darshan BB, Das N, *et al*. Practice of physical activity among future doctors: a cross sectional analysis. *Int J Prev Med* 2012;3:365–9.
32. Tsiga E, Panagopoulou E, Niakas D. Health promotion across occupational groups: One size does not fit all. *Occupational Medicine* 2015;65:552–7.
33. Ahmad W, Taggart F, Shafique MS, *et al*. Diet, exercise and mental-wellbeing of healthcare professionals (doctors, dentists and nurses) in Pakistan. *PeerJ* 2015;3.
34. Al Reshidi FS. Level of physical activity of physicians among residency training program at Prince Sultan military medical City, Riyadh, KSA 2014. *Int J Health Sci* 2016;10:39–46.
35. Kosteva AR, Salata BM, Krishnan SM, *et al*. Physician variation in perceived barriers to personal health. *Int J Gen Med* 2012;5:53–7.
36. Patra L, Mini GK, Mathews E, *et al*. Doctors' self-reported physical activity, their counselling practices and their correlates in urban Trivandrum, South India: should a full-service doctor be a physically active doctor? *Br J Sports Med* 2015;49:413–6.
37. Stanford FC, Durkin MW, Blair SN, *et al*. Determining levels of physical activity in attending physicians, resident and fellow physicians and medical students in the USA. *Br J Sports Med* 2012;46:360–4.
38. Steen O, Prebtani APH. Physical activity patterns among resident and staff physicians in Hamilton teaching hospitals. *Canadian Journal of General Internal Medicine* 2015;10:29–33.
39. Tyzuk K. Physician health: a review of lifestyle behaviors and preventive health care among physicians. *BC Medical Journal* 2012;54:419–23.
40. Williams AS, Williams CD, Cronk NJ, *et al*. Understanding the exercise habits of residents and attending physicians: a mixed methodology study. *Family Medicine* 2015;47:118–23.
41. Scotland's NHS Workforce. *The current picture. Audit Scotland*. Edinburgh, 2017.
42. O'Donovan G, Lee I-M, Hamer M, *et al*. Association of "Weekend Warrior" and Other Leisure Time Physical Activity Patterns With Risks for All-Cause, Cardiovascular Disease, and Cancer Mortality. *JAMA Internal Medicine* 2017;177:335–42.
43. Hamer M, O'Donovan G, Lee I-M, *et al*. The 'weekend warrior' physical activity pattern: how little is enough? *Br J Sports Med* 2017;51:1384–5.
44. Knox ECL, Taylor IM, Biddle SJH, *et al*. Awareness of moderate-to-vigorous physical activity: can information on guidelines prevent overestimation? *BMC Public Health* 2015;15:392–8.
45. Dunlop M, Murray AD. Major limitations in knowledge of physical activity guidelines among UK medical students revealed: implications for the undergraduate medical curriculum: Table 1. *Br J Sports Med* 2013;47:718–20.
46. Osborne SA, Adams JM, Fawkner S, *et al*. Tomorrow's doctors want more teaching and training on physical activity for health. *Br J Sports Med* 2017;51:624.2–5.
47. Weiler R, Chew S, Coombs N, *et al*. Physical activity education in the undergraduate curricula of all UK medical schools. are tomorrow's doctors equipped to follow clinical guidelines? *Br J Sports Med* 2012;46:1024–6.
48. Gates AB. Making every contact count for physical activity—for tomorrow's patients: the Launch of the interdisciplinary, undergraduate, resources on exercise medicine and health in the UK. *Br J Sports Med* 2016;50:322–3.
49. Arem H, Moore SC, Patel A, *et al*. Leisure time physical activity and mortality a detailed pooled analysis of the dose-response relationship. *JAMA Intern Med* 2015;175:959–67.
50. Moore SC, Patel AV, Matthews CE, *et al*. Leisure time physical activity of moderate to vigorous intensity and mortality: a large pooled cohort analysis. *PLoS Med* 2012;9:e1001335.
51. Knox ECL, Esliger DW, Biddle SJH, *et al*. Lack of knowledge of physical activity guidelines: can physical activity promotion campaigns do better?: Table 1. *BMJ Open* 2013;3:e003633.