



## OPEN ACCESS

# Physical activity counselling in sports medicine: a call to action

Elizabeth (Liz) Joy,<sup>1</sup> Steven N Blair,<sup>2</sup> Patrick McBride,<sup>3</sup> Robert Sallis<sup>4</sup>

<sup>1</sup>Clinical Outcomes Research, Intermountain Healthcare, Salt Lake City, Utah, USA

<sup>2</sup>Department of Exercise Science, Arnold School of Public Health, University of South Carolina, Columbia, South Carolina, USA

<sup>3</sup>Department of Family Medicine, School of Medicine and Public Health, University of Wisconsin, Madison, Wisconsin, USA

<sup>4</sup>Department of Family Medicine, Kaiser Permanente, Fontana, California, USA

## Correspondence to

Dr Elizabeth Joy, Clinical Outcomes Research, Intermountain Healthcare, 36 S. State Street, 16th Floor, Salt Lake City, UT 84111, USA; [liz.joy@imail.org](mailto:liz.joy@imail.org)

Received 23 July 2012

Revised 13 September 2012

Accepted 6 October 2012

Published Online First

13 November 2012

## ABSTRACT

Physical activity (PA) is a key component of healthy lifestyle and disease prevention. In contrast, physical inactivity accounts for a significant proportion of premature deaths worldwide. Physicians are in a critical position to help patients develop healthy lifestyles by actively counseling on PA. Sports medicine physicians, with their focus on sports and exercise medicine are uniquely trained to provide such expertise to patients, learners and colleagues. To succeed, physicians need clinical tools and processes that support PA assessment and counseling. Linking patients to community resources, and specifically to health and fitness professionals is a key strategy. Efforts should be made to expand provider education during medical school, residency and fellowship training, and continuing medical education. Lastly, physically active physicians are more likely to counsel patients to be active. A key message for the sports medicine community is the importance of serving as a positive PA role model.

## INTRODUCTION

**The benefits of physical activity to health**  
Why should physical activity be assessed and prescribed

Non-communicable chronic diseases (NCDs) are the leading causes of death in the world. According to a 2004 report from the World Health Organization there were 58.8 million deaths worldwide.<sup>1</sup> The top five risk factors and corresponding number of deaths attributed to each were: high blood pressure (7.5 million), tobacco use (5.1 million), high blood glucose (3.4 million), physical inactivity (3.2 million) and overweight and obesity (2.8 million). A recent review by Lee *et al* reports even higher numbers of NCDs attributable to physical inactivity. These recent calculations estimate that there are 5.3 million deaths/year due to inactivity. If the prevalence of inactivity was decreased by 25%, 1.3 million deaths/year could be prevented.<sup>2</sup>

The estimate for physical inactivity is probably low, given that it is based primarily on studies of self-reported leisure-time physical activity (PA), which is not a very accurate measure. In the Aerobics Center Longitudinal Study, which included both self-reported activity and objectively measured cardiorespiratory fitness from a maximal exercise test on a treadmill, the risk of mortality for those meeting the current PA recommendation by self-report was 24% lower in women and 27% lower in men when compared with self-reported inactive individuals. Mortality risks in this same population for individuals who were moderately fit, as objectively measured on a treadmill test, were

44% lower in women and 45% lower in men, when compared with objectively measured unfit persons.<sup>3</sup> The bottom line is that physical inactivity and low cardiorespiratory fitness are major public health problems and we must increase efforts to get more people to be more active more often.<sup>4 5</sup>

## Why sports medicine physicians should lead this movement

Helping patients to move safely from being sedentary to engaging in moderate levels of PA significantly reduces the risk of mortality.<sup>6</sup> Physicians and other healthcare providers have an ethical, and some would even say legal,<sup>7</sup> obligation to assess and prescribe exercise. The medical specialty closest to the intersection of PA and health are sports (and exercise) medicine physicians. They are poised to promote comprehensive lifestyle interventions to patients for the prevention and management of chronic disease given their breadth and depth of expertise in injury management and prevention, along with expertise in the evaluation and management of medical conditions affecting activity and sports. A third competency, the promotion of PA for the prevention of chronic disease, is perhaps the most important competency and clearly the domain in which the primary care sports medicine community is likely to have the greatest public health impact.

Primary care sports medicine physicians trained in the past 20 years likely spend much of their clinical practice focused on the evaluation and management of musculoskeletal disease, and the care of competitive and recreational athletes. However, sports medicine physicians, given their expertise in restoring function, along with the culture of 'team care' in sports medicine, are uniquely positioned to expand their scope of practice to serve as experts in PA promotion within their communities. Embracing George Sheehan's philosophy that, 'every patient is an athlete and every physician is a coach', is a concept that should be adopted by sports medicine physicians.

## Importance of PA counselling

The evidence supporting the health benefits of PA is indisputable, and there is good evidence that physicians can influence patients to significantly improve their health through proactive advising on the positive health impacts of PA during an office visit. In the Activity Counseling Trial, simple physician advice and written educational materials resulted in about a 1 kcal/kg/day increase in PA some 6 months later.<sup>8</sup> In an 80 kg man, this would translate into almost a 600 kcal/week increase in PA. When viewed in the context of the Harvard



► <http://dx.doi.org/10.1136/bjsports-2012-092010>

**To cite:** Joy E (L), Blair SN, McBride P, *et al*. *Br J Sports Med* 2013, **47**, 49–53

Alumni Study data, this amount of activity results in about a 25% lower mortality when compared with those doing less than 500 kcal/week of PA.<sup>9</sup> Every physician should be able to find the time to include a simple intervention into their practice that has been shown to lower mortality by 25%! Recent evidence affirms the positive impact of physician counselling on patient PA levels.<sup>10</sup> In addition, there are numerous studies to suggest something as simple as a written exercise prescription, telephone advice and support, using a pedometer, or an online programme can have a significant impact on engaging patients in being more active and staying that way.<sup>10</sup>

It is interesting to note that while poor compliance with physician prescribed exercise is often highlighted as a reason for low PA counselling rates, poor compliance with physician prescribed medication is often ignored. This fact is seldom acknowledged as the vast majority of physicians believe that patients take the medication they prescribe.<sup>11</sup> Unfortunately, this is not the case, and on average 15% of patients do not pick up that first prescription, and after 6 months, only 50% of patients suffering from chronic diseases take their medications as prescribed.<sup>12</sup> Therefore, any programme leading to a sustained increase in a patient's level of PA for 6 months or more will surpass prescribed medication in terms of compliance.

### PA counselling rates

The rates of physician advice and counselling in promoting patient PA is low, with only about one-third of patients reporting that their physician advised them to be physically active.<sup>13</sup> Two of the objectives for Healthy People 2020 are related to increasing the proportion of physician office visits that include counselling or education as related to the effects of PA on health. Significant opportunity exists, as patients state that their primary physician is an important source of health information, and nearly half of patients see their primary physician at least annually.<sup>14</sup> Sports medicine physicians can play a key role in promoting PA for health and educating and encouraging their colleagues in other specialties to assess and prescribe exercise to their patients.

### Barriers to PA counselling in the USA

Barriers to PA counselling include patient, physician, practice and payer factors.<sup>15</sup> Barriers to counselling in clinical practice include time demands, insufficient reimbursement, lack of training and expertise in behavioural change, lack of perceived efficacy, along with limited support systems for patient education.<sup>16</sup>

Physicians report that they lack education on the benefits of PA, knowledge on how to write an effective exercise prescription, and counselling strategies that will promote behavioural change.<sup>17 18</sup>

Practice and system barriers include the lack of organised systems to provide counselling, including the limited use of practice staff, inadequate time to provide counselling services and patient visits that are primarily focused on acute care or problem-based care, rather than on preventive care or health promotion.<sup>18</sup> Payers often do not reimburse for patient education or for counselling that is provided primarily for prevention. Patient barriers also contribute to the lack of counselling efficacy aimed at increasing PA levels.

### PA counselling from a public health perspective Inactivity as a public health problem

Physical inactivity is a strong determinant of chronic diseases, ranking as the fourth leading risk factor in the number of deaths worldwide.<sup>1</sup> In the Aerobics Center Longitudinal Study, low

cardiorespiratory fitness causes more deaths than smoking, diabetes and obesity combined.<sup>6</sup> Over the past few decades, obesity rates have steadily increased around the world making obesity an important public health problem. Unfortunately, obesity receives far more attention than physical inactivity. As a search term, the word obesity garnered 90 million hits on Google as compared with only 3.3 million hits for physical inactivity (September 2012). Numerous studies over the past 15 or more years clearly illustrate that cardiorespiratory fitness is far more important than obesity as a cause of morbidity and mortality.<sup>6 19–23</sup> In fact, obese persons who are at least moderately fit, have death rates of approximately half those of people within a normal weight range who are not fit.<sup>6</sup> We must find a creative way to focus more attention on the importance of a fit and active lifestyle for everyone.

### A CALL TO ACTION

We propose three principle actions aimed at engaging the sports and exercise medicine community in PA promotion: (1) providing physicians with the methods and support necessary to assess and prescribe exercise to their patients; (2) developing educational programmes aimed at increasing and improving the competencies sports medicine physicians have related to PA promotion and (3) encouraging medical students, residents and practising physicians to serve as physically active role models to their families, patients and communities.

### Physicians

#### Action 1: give physicians the methods and support they need to counsel patients

Use of a PA or exercise vital sign

Vital signs have historically been utilised as key indicators of health status and include pulse, blood pressure, temperature, respiratory rate and body weight (body mass index). As the causes of illness have changed in the past century, new measures of health status have been proposed to address more contemporary causes of death and disability. In the past two decades, smoking status has been demonstrated to be an important vital sign that led to increased physician smoking cessation counselling.<sup>24</sup>

In light of a worldwide explosion of NCDs, and dangerously low PA levels in the USA and worldwide,<sup>2</sup> it is clear that a practice prompt that can increase physician awareness of a patient's sedentary lifestyle or insufficient activity levels, and encourage counselling around increasing levels of PA is truly needed. A PA (or exercise) vital sign is an easy way to meet this need and is recommended as a key healthcare strategy in the US National Physical Activity Plan.<sup>25</sup>

From a practical perspective, asking about PA is a minimal time investment with a high yield. Staff can be trained to ask and document responses to questions about patient PA. Respiratory rate, which is almost never accurate,<sup>26</sup> and temperature, which needs to be measured when the patient complains of infectious symptoms, are commonly measured vital signs that could easily be eliminated to provide the 30–60 s necessary to collect and record a PA vital sign that is sure to have a higher impact on patient health.

#### Connecting fitness industry with healthcare industry

Despite efforts within healthcare to improve PA assessment and counselling, the physical inactivity problem we are facing will not be solved entirely by healthcare providers. In fact, efforts made by healthcare systems to increase the PA habits of patients will be negligible if 'patients' are not transformed into

'participants'. Free-living participation in PA is rarely performed within the context of the healthcare setting, the exception being cardiac rehabilitation programmes and other supervised exercise programmes such as physical therapy. Sports medicine physicians should call for an increase in the use of exercise as a therapeutic modality.

The analogy between pharmaceutical prescribing and PA promotion drives home the link between health and fitness. As previously stated, compliance with medication use is surprisingly low and despite this fact the prescription of medications continues to be the major focus for physicians and other healthcare providers. On the basis of the growing evidence that increasing PA provides greater benefits to health than any single pill, physicians must begin to use an exercise prescription as a first-line therapy. In keeping with this idea, when we prescribe PA to our patients, we should provide information to them about how and where they can 'fill' the prescription, and consider referral for professional advice regarding that prescription.

The health and fitness industry in the USA is a \$19.5 billion business, with over 250 000 professionals working in health clubs, community centres, gyms, etc.<sup>27</sup> Certification programmes through the American College of Sports Medicine (ACSM), the Exercise Is Medicine Program and the National Strength and Conditioning Association, provide health and fitness professionals with the knowledge and skill to work with patients to deliver safe and effective PA programming. Increasingly, health and fitness professionals have undergraduate and graduate degrees in health promotion and exercise science. Certification as a Health Fitness Specialist through the ACSM requires at a minimum a bachelor's degree in exercise science.<sup>28</sup> Future efforts should focus on effective collaboration between healthcare and health and fitness professionals to help our patients fill their exercise prescription. Sports medicine physicians, with their focus on PA, exercise and sport should take the lead in establishing and maintaining those connections for their practices and communities.

#### Reimbursement strategies

Lack of financial reimbursement is often cited as a reason for healthcare providers not engaging in PA promotion. In the USA, most reimbursement comes in the form of fee-for-service. In this payment model, counselling activities are significantly undervalued compared to procedures that may take half as long to perform.<sup>29</sup> Healthcare and payment reform efforts in the USA are a step forward in providing a financial incentive for physicians and healthcare systems to promote healthy lifestyle. In addition, encouragement for patients to engage in healthy lifestyle in the form of incentives and insurance premium reduction is also needed. Likewise, as accountable care organisations and shared accountability models for healthcare delivery expand, finances will shift from being predominantly revenue driven to predominantly cost driven. This will no doubt elevate prevention activities as a strategy to reduce the incidence of costly chronic disease. As healthcare systems shift their focus to prevention, sports medicine has an opportunity to be the go to experts at guiding patients, even populations, towards physically active lifestyles as a way to prevent and manage chronic disease, thereby lowering healthcare costs.

#### Action 2: develop programmes to educate physicians

##### Medical school and residency training

Surveys indicate that physicians lack the knowledge, training and self-efficacy to confidently provide counselling for PA. In addition, surveys suggest that though physicians recognise the

importance of PA to health, they do not believe that counselling will consistently result in patient behavioural change. In 2010, 10% of deans of US medical schools felt that graduates could provide an exercise prescription for their patients, yet only 6% had a core curriculum in exercise guidelines.<sup>30</sup> Surveys of medical schools in both the USA and the UK have found PA teaching to be 'sparse or non-existent', and recommend that urgent changes be made to the curriculum to equip physicians with the knowledge and skills necessary to effectively promote PA.<sup>31-32</sup> Schools that incorporate exercise into the curriculum have been successful by doing so over all 4 years of medical school, providing knowledge and skills the student can incorporate and practice throughout their career.<sup>33</sup> The curriculum can and should be integrated into multiple courses including physiology, musculoskeletal, cardiology, pulmonary, endocrinology, primary care, paediatrics, internal medicine and population health.

##### Medical school curricula should include

- ▶ Exercise physiology
- ▶ Structure and function of skeletal muscle
- ▶ Cardiopulmonary and metabolic responses to PA
- ▶ Social and health determinants of PA
- ▶ Risks of sedentary lifestyle/inactivity on cardiovascular, pulmonary, musculoskeletal and neurological systems
- ▶ Health benefits of PA
- ▶ Risks of PA
- ▶ Principles of exercise training
- ▶ Optimising sport performance
- ▶ Components of a PA history
- ▶ The components of an exercise prescription
- ▶ Preparticipation screening guidelines
- ▶ Patient education: benefits and limitations of counselling
- ▶ Counselling to promote behavioural change
- ▶ Methods of behavioural change counselling (eg, motivational interviewing)
- ▶ PA in at-risk patients (cardiac, pulmonary, etc)
- ▶ PA guidelines in special populations
- ▶ Physicians as role models

Students who participate in a curriculum on PA have been shown to be more likely to exercise, have more favourable attitudes toward PA and the effects of counselling, and to have improved functional capacity.<sup>31</sup> Intervention studies in primary care suggest that physician training in counselling and system-based interventions can improve patient PA.<sup>34-35</sup>

##### Fellowship training

Fellowship training in Sports Medicine provides the ideal opportunity to impart physicians with additional training and experiences in PA promotion. According to the *American College of Graduate Medical Education Program Requirements for Graduate Medical Education in Sports Medicine*, fellowship programmes:<sup>36</sup>

- ▶ Must provide fellows with experiences in the promotion of physical fitness and wellness.
- ▶ Should emphasise psychological aspects of exercise, performance, and competition.
- ▶ Must evaluate the knowledge and competency of fellows in social-behavioural sciences, and its application to patient care.

As a result of those experiences, fellows must demonstrate a level of expertise in:

- ▶ The promotion of physical fitness and healthy lifestyles.
- ▶ The role of exercise in maintaining the health and function of the elderly.

- ▶ Exercise programmes for school-age children.
- ▶ The effect of disease, for example, diabetes, cardiac conditions, arthritis, on exercise and the use of exercise in the care of medical problems.

Future efforts in fellowship education should include curriculum designed to improve fellows' knowledge, attitudes and behaviours regarding PA promotion/exercise prescription in diverse populations. Such curricular changes should be accompanied by a plan to assess these constructs, including specific competencies in the behavioural approach to PA promotion.

Educational efforts in PA promotion should not be limited to medical students and fellows. Equally important is training during residency, as well as continuing medical education for practising clinicians. Ensuring inclusion of national PA guidelines within the curricula of training programmes is essential.

### Action 3: encourage medical students/physicians to be active

Studies have consistently demonstrated a positive association between personal PA habits of both medical students and practising physicians and PA counselling behaviours.<sup>37</sup> Medical students exposed to curricula promoting healthy lifestyle were more likely to engage in healthy habits, have a more positive attitude regarding lifestyle counselling, and more likely to counsel patients regarding healthy lifestyle.<sup>38</sup> These results suggest that efforts to imprint medical students with knowledge regarding their personal health, in addition to curricula designed to increase knowledge and skill in PA counselling could lead to higher frequencies of patient counselling.

Given the expanding evidence base on the dangers of sitting,<sup>39, 40</sup> and the hours and hours medical students sit in class, efforts to 'activate' the classroom environment should be considered. Creating breaks for students to get up and move between classes and deliberately facilitating PA and/or exercise demonstrate a commitment to health promotion among medical students, and recognition that a healthy doctor leads to a healthy patient.

Finally, physicians are seen as trusted, highly credible members of the communities they care for. This position in the community provides not only an opportunity, but also a responsibility to both promote PA and model a physically active lifestyle.

### SUMMARY

The evidence for PA in the promotion of health, wellness and the prevention and treatment of chronic disease is overwhelming. On the basis of this evidence, physicians have a moral, ethical and professional obligation to inform patients of the risks of being inactive and provide them with a proper exercise prescription. Unfortunately, many physicians do not have the means or expertise to effectively assess and prescribe exercise to their patients in the midst of a busy clinic visit. Sports (and exercise) medicine physicians are the obvious group to promote this message and provide teaching about the tools and expertise necessary for all physicians to effectively promote exercise for their patients.

As healthcare professionals, we must use our relationships, credibility, expertise and professional networks to promote PA to our patients, our colleagues and our communities. Education is a key component moving forward, and curricular changes in medical school, residency and fellowship programmes will provide foundational knowledge regarding the influence of PA on health and disease. In addition, we must extend those educational efforts to the practising clinician in every specialty, many

of whom have looked at exercise as 'something extra' and not as a modifiable factor to decrease the risk of chronic disease it is. Finally, we must also serve as positive role models for physically active lifestyles for our families, our patients, and our communities. Clinical sports medicine should evolve into 'sports and exercise medicine', and must not only talk the talk, but also walk the walk, and lead the way.

**Contributors** EJ, as first author, developed the outline for the manuscript, provided substantial writing within each section, and oversaw editing and completion of the manuscript. SNB, helped with the outline of the manuscript and wrote several sections. RS provided significant input in the outline of the manuscript, wrote several sections and provided final editing. PM was the primary author for the section on education, and provided assistance in the final editing process.

**Competing interests** None.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Open Access:** This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 3.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/3.0/>

### REFERENCES

- 1 WHO. Global health risks: mortality and burden of disease attributable to selected major risks. 2009.
- 2 Lee IM, Shiroma EJ, Lobelo F, *et al.*, Lancet Physical Activity Series Working Group. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet* 2012;380:219–29.
- 3 Lee DC, Sui X, Ortega FB, *et al.* Comparisons of leisure-time physical activity and cardiorespiratory fitness as predictors of all-cause mortality in men and women. *Br J Sports Med* 2011;45:504–10.
- 4 Powell KE, Paluch AE, Blair SN. Physical activity for health: what kind? How much? How intense? On top of what? *Annu Rev Public Health* 2011;32:349–65.
- 5 Blair SN, Morris JN. Healthy Hearts—and the universal benefits of being physically active: physical activity and health. *Ann Epidemiol* 2009;19:253–6.
- 6 Blair SN. Physical inactivity: the biggest public health problem of the 21st century. *Br J Sports Med* 2009;43:1–2.
- 7 Weiler R, Feldschreiber P, Stamatakis E. Medicolegal neglect? The case for physical activity promotion and exercise medicine. *Br J Sports Med* 2012;46:228–32.
- 8 Writing Group for the Activity Counseling Trial Research Group. Effects of physical activity counseling in primary care: the Activity Counseling Trial: a randomized controlled trial. *J Am Med Assoc* 2001;286:677–87.
- 9 Paffenbarger RS Jr, Hyde RT, Wing AL, *et al.* The association of changes in physical-activity level and other lifestyle characteristics with mortality among men. *N Engl J Med* 1993;328:538–45.
- 10 Orrow G, Kinmonth AL, Sanderson S, *et al.* Effectiveness of physical activity promotion based in primary care: systematic review and meta-analysis of randomised controlled trials. *BMJ* 2012;344:e1389.
- 11 Goldberg AL, Cohen G, Rubin A-HE. Physician assessments of patient compliance with medical treatment. *Soc Sci Med* 1998;47:1873–6.
- 12 World Health Organization. Adherence to long-term therapies: evidence for action. 2003. [who.int/chp/knowledge/publications/adherence\\_report/en/index.html](http://www.who.int/chp/knowledge/publications/adherence_report/en/index.html) (accessed 26 Jul 2011).
- 13 Barnes PM, Schoenborn CA. *Trends in adults receiving a recommendation for exercise or other physical activity from a physician or other health professional. NCHS data brief, no 86.* Hyattsville, MD: National Center for Health Statistics, 2012.
- 14 Schappert SM, Rechtsteiner EA. Ambulatory medical care utilization estimates for 2007. National Center for Health Statistics. *Vital Health Stat* 2011;13.
- 15 Goldstein MG, Pinto BM, Marcus BH, *et al.* Physician-based physical activity counseling for middle-aged and older adults: a randomized controlled trial. *Ann Behav Med* 1999;21:40–7.
- 16 Pender NJ, Sallis JF, Long BJ, *et al.* Health-care provider counseling to promote physical activity. In: Dishman RK, ed. *Advances in exercise adherence.* Champaign, IL: Human Kinetics, 1994:213–36.
- 17 McKenna J, Naylor PJ, McDowell N. Barriers to physical activity promotion by general practitioners and practice nurses. *Br J Sports Med* 1998;32:242–7.
- 18 Tulloch H, Fortier M, Hogg W. Physical activity counseling in primary care: who has and who should be counseling? *Patient Educ Couns* 2006;64:6–20.
- 19 Lee DC, Sui X, Artero EG, *et al.* Long-term effects of changes in cardiorespiratory fitness and body mass index on all-cause and cardiovascular disease mortality in men: the Aerobic Center Longitudinal Study. *Circulation* 2011;124:2483–90.



- 20 Weiler R, Stamatakis E, Blair SN. Should health policy focus on physical activity rather than obesity? Yes. *BMJ* 2010;340:c2603.
- 21 McAuley PA, Sui XM, Church TS, *et al*. The joint effects of cardiorespiratory fitness and adiposity on mortality risk in men with hypertension. *Am J Hypertension* 2009;22:1062–9.
- 22 Lee DC, Sui X, Church TS, *et al*. Associations of cardiorespiratory fitness and obesity with risks of impaired fasting glucose and diabetes in men. *Diabetes Care* 2009;32:252–67.
- 23 Sui X, LaMonte MJ, Laditka JN, *et al*. Cardiorespiratory fitness and adiposity as mortality predictors in older adults. *J Am Med Assoc* 2007;298:2507–16.
- 24 The U.S. National Physical Activity Plan: Health Care Sector. <http://www.physicalactivityplan.org/healthcare.php> (accessed 19 Jul 2012).
- 25 Fiore MC. The new vital sign. *J Am Med Assoc* 1991;266:3183–4.
- 26 Lovett PB, Buchwald JM, Stürmann K, *et al*. The vexatious vital: neither clinical measurements by nurses nor an electronic monitor provides accurate measurements of respiratory rate in triage. *Ann Emerg Med* 2005;45:68–76.
- 27 United States Department of Labor: Bureau of Labor Statistics Occupational Outlook Handbook. Fitness Trainers and Instructors. <http://www.bls.gov/ooh/personal-care-and-service/fitness-trainers-and-instructors.htm> (accessed 19 Jul 2012).
- 28 ACSM Certification: ACSM Certified Health Fitness Specialist. <http://certification.acsm.org/acsm-certified-health-fitness-specialist> (accessed 19 Jul 2012).
- 29 Wang YR, Pauly MV. Preventive care in managed care and fee-for-service plans: is it cost effective? *Manag Care Interface* 2003;16:47–50.
- 30 Connaughton AV, Weiler RM, Connaughton DP. Graduating medical students' exercise prescription competence as perceived by deans and directors of medical education in the United States: implications for healthy people 2010. *Public Health Rep* 2001;116:226–34.
- 31 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.
- 32 Garry JP, Diamond JJ, Whitley TW. Physical activity curricula in medical schools. *Acad Med* 2002;77:818–20.
- 33 Cohen J, Drury J, Wright JR. Promoting exercise and physical fitness in the medical school curriculum. *J Med Educ* 1988;63:438–41.
- 34 Spink KS, Reeder B, Chad K, *et al*. Examining physician counseling to promote the adoption of physical activity. *Can J Public Health* 2008;99:26–30.
- 35 Jonas S, Phillips EM. *ACSM's exercise is medicine: a clinician's guide to exercise prescription*. Philadelphia, PA: Wolters Kluwer, Lippincott Williams & Wilkins, 2009.
- 36 ACGME (American College of Graduate Medical Education) Program Requirements for Graduate Medical Education in Sports Medicine. [http://www.acgme.org/acWebsite/downloads/RRC\\_progReq/116-127-333-342\\_sports\\_medicine\\_07012011.pdf](http://www.acgme.org/acWebsite/downloads/RRC_progReq/116-127-333-342_sports_medicine_07012011.pdf) (accessed 19 Jul 2012).
- 37 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.
- 38 Lobelo F, Duperly J, Frank E. Physical activity habits of doctors and medical students influence their counseling practices. *Br J Sports Med* 2009;43:89–92.
- 39 Ekblom-Bak E, Hellénus ML, Ekblom B. Are we facing a new paradigm of inactivity physiology? *Br J Sports Med* 2010;44:834–5.
- 40 Patel AV, Bernstein L, Deka A, *et al*. Leisure time spent sitting in relation to total mortality in a prospective cohort of US adults. *Am J Epidemiol* 2010;172:419–29.