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CURRENT OPINION

Time to Challenge Public Health Guidelines on Physical Activity

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Abstract There is striking evidence in support of physical activity (PA) as a very strong factor in health promotion and disease prevention. Since the mid-1990s, public health guidelines on PA have established PA recommendations to promote health and prevent several non-communicable diseases (NCDs). However, it is not clear that there is universal agreement on the validity of all aspects of these recommendations. Indeed, a growing body of evidence has accumulated over the last 20 years showing that less than 150 min/week of moderate PA, i.e. the minimum PA level currently recommended, promotes health and prevents NCDs. Moreover, when determining whether someone achieves the minimum PA recommendations, the quantities of PA undertaken are added together regardless of what domain of PA they represent, i.e. leisure-time, occupational, transport or housework. However, while convincing evidence exists to show that leisure-time and transport PA are important factors for promoting health, the evidence for occupational PA and housework is mixed. Therefore, the purpose of this article is to discuss two major issues relating to public health guidelines on PA for adults and older adults: the minimum volumes of PA required and the importance of PA domains in health promotion. A proposal on how to tackle these issues and ultimately strengthen PA recommendations is also presented.

Key Points

The main pillars of public health guidelines on physical activity (PA) were established 20 years ago.

The minimum amount of PA required to promote health was established through experts' critical reviews (qualitative analysis).

Quantitative analysis is indispensable to establish precisely the minimum amounts of PA as well as to determine the importance of PA domains on health promotion.

1 Introduction

Physical activity (PA) is a very strong factor in health promotion and disease prevention. There is now striking evidence showing the benefits of overall PA for health; physical inactivity is the fourth leading risk factor for global mortality [1], with almost 3.2 million deaths being attributed to it [2]. A physically inactive lifestyle is the tenth main cause of disability-adjusted life years [2] and is associated with the burden of several non-communicable diseases (NCDs), particularly cardiovascular diseases, diabetes, some types of cancer [3, 4], and even Alzheimer's disease [5].

Guidelines on PA and exercise have been published since the mid-60s [6] by health authorities, such as the American College of Sports Medicine (ACSM), the

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American Heart Association (AHA), the Centers for Disease Control and Prevention (CDC), and more recently the World Health Organization (WHO) [7]. In terms of public health, guidelines on PA establishing the minimum recommended amount of PA to promote health and prevent several NCDs [particularly focusing on coronary heart disease (CHD)] were only recently added to complement previous recommendations on exercise for improving fitness [8]. Therefore, since the mid-90s, public health guidelines on PA supporting that every adult "should accumulate 30 minutes or more of moderate-intensity PA on most, preferably all, days of the week" [8] have been disseminated among/through public health agencies and several classes of health professionals. Despite this widespread dissemination of PA guidelines in the last [2] decades, physical inactivity is a very prevalent and persistent public health issue [9], particularly among Western countries. In this article, I discuss two main issues related to public health guidelines on PA for adults and older adults: the minimum amount of PA required for health promotion and the importance of PA domains in achieving this goal. I also propose a way for overcoming these issues and strengthening PA recommendations.

2 Public Health Guidelines on Physical Activity (PA): Achievements and Issues

A stronger public health perspective/message on PA guidelines was firstly introduced by Pate et al. [8], in 1995. The PA recommendations released by Pate et al. were formulated after a meeting (promoted and endorsed by ACSM and CDC) of a panel of experts on PA and health, who reviewed the scientific evidence at that moment regarding the health benefits associated with PA. The main recommendation conveyed in Pate et al.'s article, that is, adults should accumulate at least 30 min/day of at least moderate-intensity PA on most/all days of the week, was further endorsed and disseminated by a report from the US Surgeon General [6] released in the year following Pate et al.'s publication. This recommendation about the minimum amounts of PA required for promoting health is still one of the main recommendations conveyed by current public health guidelines on PA for adults, lastly updated in 2007 [10, 11].

Pate et al.'s recommendations and subsequent reports and guideline updates largely contributed to public awareness about the role of PA in promoting health and in reducing morbidity and premature mortality. Subsequent works of Dr. Pate and several of his colleagues who participated in the guideline article of 1995 [8] have highlighted the dose-response associations between PA and health [12–14] even among people who have not achieved the minimum PA recommendations [12]. In the light of the epidemiological evidence accumulated in the last 20 years, two main issues introduced in Pate et al.'s recommendations and still composing the content of current PA recommendations must be addressed: (1) the overall acceptance of the 150 min/week of moderate PA as the minimum PA required for health promotion; and (2) the fact of assuming that PA promotes health equally regardless of PA domain/type.

3 Issue 1: Is 150 Min/Week of Moderate PA the *Minimum* Time Required for Health Promotion?

The minimum amount of PA introduced by Pate et al. [8], i.e. 30 min/day of moderate-intensity PA, remains 2 decades later one of the pillars of the current public health guidelines on PA for adults/older adults. Although this minimum PA guidelines is already well-established, many (maybe most) people do not wish or are unable to engage in PA to such a high extent; targeting these guidelines may be discouraging for sedentary subjects, especially when they get older [15]. Moreover, a growing body of evidence has been accumulated in the last 20 years showing that less than the recommended 150 min/week of moderate PA promotes health and prevents NCDs [4, 16–22]. For example, a pooled analysis of six prospective cohort studies ($n = 654{,}827$), with a median follow-up of 10 years and 82,465 deaths [22], showed that as little as walking briskly for 1–74 min/week was associated with a reduced mortality risk [hazard ratio = 0.81; 95 % confidence interval (CI) 0.79–0.83] almost 20 % lower than doing no moderate or vigorous PA during leisure-time (multivariate model adjusted for several confounders, including sex, education, alcohol consumption, smoking, heart disease and cancer). Similarly, a large ($n = 416{,}175$) Taiwanese cohort study [18] showed a 17 % increased all-cause mortality risk and 11 % increased cancer mortality risk in people doing no leisure-time PA compared with people doing less than recommended PA (average 92 min/week of moderate PA). Well-conducted prospective studies have found that lower than guideline-recommended PA levels were also associated with a reduced risk of developing NCDs (see the reviews by Warburton et al. [4] and Powell et al. [14] for more details).

Therefore, although there is indisputable evidence showing that the 150 min/week of moderate PA promotes health and prevents the onset of several NCDs [4, 5, 7, 10, 11], the question needing to be addressed is: Is the 150 min/week the *minimum* PA required for health promotion? Answering this question must be a priority for the field of PA and public health since it may (and probably

will) modify current PA guidelines and, then, the overall public health message surrounding PA. Although experts may consider debating the development of more detailed guidelines that take into account the outcome-dependent associations between PA and health [14], in my opinion, priority must be given to the dissemination of a core public health message that is simple and clearly identifiable and thus more easily able to be adopted by health professionals in daily practice. Insisting on the 20-year-old PA recommendations, which represents the critical viewpoint of experts (qualitative approach), without examining other possibilities (especially through a quantitative approach) for the minimum PA required to promote health means scientific evidence is being neglected.

4 Issue 2: Is Information on the PA Domain/Type Not Useful for Health Promotion?

Currently, the main domains used to categorise PA are leisure-time, transport, occupation and household. To evaluate if someone achieves the minimum PA recommendations, we only need to add the volumes of PA in each of these domains, i.e. the simple addition of PA in each domain gives a total PA score. As indicated in Pate et al.'s study [8], the "amount of activity is more important than the specific manner in which the activity is performed (i.e., mode, intensity, or duration of the activity bouts)" [8]. However, assuming that leisure-time PA (e.g. exercise training), for example, will promote health to the same extent as housework PA (e.g. vacuuming) provided these activities reach the same overall PA volume is a major error in public health recommendations.

Indeed, whereas there is striking evidence showing that both leisure-time [22–26] and transport [27, 28] PA are important factors in health promotion and disease prevention, the evidence regarding both occupational [23] PA and housework is mixed. For example, when comparing the group with the highest occupational PA levels to the group with the lowest occupational PA levels, the meta-analysis by Samitz et al. [28] found a mortality risk reduction [relative risk (RR) = 0.83; 95 % CI 0.71–0.97] ($n = 6$ studies for this analysis), whereas the meta-analysis by Li et al. [23] showed an increased risk of developing cardiovascular disease (RR = 1.24; 95 % CI 1.05–1.47), particularly CHD. A recent prospective observational study [29] found that people with high occupational PA and low leisure-time PA had an increased mortality risk, whereas people with high leisure-time PA, independently of their occupational PA, did not have an increased mortality risk. Several other prospective studies investigating the long-term associations of occupational PA with health outcomes have obtained opposite results, with some studies finding positive effects for occupational PA on health [30, 31] and others finding no effects [32–34] or even negative effects [35–37]; Andersen et al. [38] found a protective factor of occupational PA against mortality among women, but not in men.

Regarding the long-term associations between housework PA and health outcomes, the evidence is very sparse. One prospective cohort study investigating this association [39] recently showed that, while walking/cycling and exercise were associated with longer life, household PA was not. Although the meta-analysis by Samitz et al. [28] indicated that "PA of daily living" reduced the risk of all-cause mortality, the definition of this concept (i.e. a combination of housework, gardening, stair climbing, walking and cycling as part of daily life) renders it impossible to disentangle the effects of housework alone on mortality risk. Despite this uncertainty about the health benefits of housework, it is well-known that housework is a major contributor to achieving current PA guidelines [40], especially for middle-aged and older women.

5 Addressing PA Guideline-Related Issues: Adding Quantitative Information to Qualitative Viewpoints

When we examine the history of public health guidelines on PA for adults and older adults, from Pate et al.'s article [8] to the updates provided in 2007 [10, 11] and the WHO global recommendations published in 2010 [7] we realise that PA guidelines have been established from the critical analysis of experts about the most up-to-date information on PA and health promotion/disease prevention. Although extremely valuable, this qualitative approach expresses experts' personal viewpoints, and should be seen as a first step in the establishment of recommendations; even though experts' viewpoints were established on the basis of quantitative original studies, we are forced to recognise that no quantitative analysis, gathering together the data from the original studies critically examined, was conducted in the history of public health guidelines on PA. This quantitative approach would be complementary to the experts' critical analysis; in particular, quantitative analysis would be useful for confirming and/or refining the recommendations made as a result of the previous qualitative analysis.

Performing meta-analysis (or pooled analysis, if appropriate) of available data is an indispensable step in establishing the true minimum amounts of PA required to promote health as well as determining the associations between PA domains and health outcomes. Although we must recognise that meta-analysis of observational data (i.e. the design of the majority of studies investigating the

long-term associations between PA and health outcomes) has potential risks (biased and even spurious results in some cases) [41], it may represent the best approach to investigate some long-term adverse events [42] in the public health field, such as mortality, major cardiovascular events, cancer, diabetes, etc. This quantitative approach, after a thorough exploration of the potential sources of heterogeneity, can provide extremely valuable information for establishing new (or confirming current) recommendations in terms of the minimum PA required for health promotion.

6 Conclusions

The main pillars of current public health guidelines on PA were established 2 decades ago. However, compelling evidence suggests that some aspects of the PA guidelines should be revised. For this, one potential approach would be to organise a collaborative group with experts from around the world to analyse, not only qualitatively, but also quantitatively, the associations between PA and health promotion and disease prevention; this workgroup should be ideally piloted by WHO (maybe in collaboration with national public health agencies) to provide an international perspective. After having compiled the eligible studies for the systematic review, the collaborative group, under the auspices of WHO, should invite investigators of the original studies to provide their data for an individual-patient data meta-analysis, the "gold standard" of systematic reviews [42].

The relationship between behaviours and health is a dynamic process undergoing constant change. In the field of PA, for example, technological, environmental, and cultural changes may modify the associations between PA and health, even over short time periods. In the last 2 decades, important changes, such as the advent and dissemination of video game-based PA, the mechanisation of work, the built environment, and increased awareness of the impact of lifestyle on health, may have impacted the PA–health relationship, with the magnitude of the impact probably varying for different health outcomes and different PA domains/types. Therefore, since the publication of the first public health guidelines on PA [8], important changes in society may have influenced population PA in terms of quantity and quality as well as the associations between PA with health outcomes.

There is no doubt that PA promotes health and prevents/delays the onset of several NCDs. However, a few issues related to public health guidelines on PA must be addressed. It is our role, as members of the broader scientific community involved in health promotion/disease prevention, to provide the most precise information on PA recommendations that will guide policymakers and health authorities to develop strategies to promote population health through a physically active lifestyle.

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