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COMMENTARY

No or Low Moderate-to-Vigorous Physical Activity: Focusing on the Least Active as an Additional Approach for Physical Activity Surveillance

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Physical activity (PA) is a well-established protective factor for several negative health outcomes, which include aspects related to physical, mental, and social health, and have been reported among different subgroups.[1] Accordingly, guidelines have been developed to inform different population subgroups (eg, children, adolescents, and adults) on an adequate amount of PA for health benefits.[1] For instance, 2020 World Health Organization (WHO) guidelines recommend that adults achieve at least 150 minutes per week of moderate-intensity PA or at least 75 minutes of vigorous-intensity PA per week, or an equivalent combination of moderate-to-vigorous PA (MVPA).[1] For children and adolescents (5–17 y), WHO guidelines recommend a daily average of 60 minutes of MVPA.[1] Studies have sought to identify the global prevalence across the lifespan who achieve these guidelines and alarmingly found the prevalence of not meeting the WHO guidelines was 27.5% among adults and 81.0% among adolescents.[2,3] Although the information from these publications is useful in identifying those meeting and not meeting desired targets, it provides no insight into those with no or low MVPA.

Previous studies have demonstrated that the association between MVPA and health outcomes tends to be curvilinear, with important increasing benefits of more MVPA among those who have no or low MVPA.[4–6] For instance, in a cohort with 416,175 adults ≥20 years (mean follow-up of 8.05 [4.21] y), Wen et al[7] observed that when compared with the inactive group (<3.75 metabolic equivalent-h/wk), those with low-volume leisure-time PA (3.75–7.49 metabolic equivalent-h/wk, average of 15 min/d) reduced their risk of mortality by 14%, followed by a reduction of 4% for each additional 15 minutes per day, until reaching a plateau around 100 minutes per day (interactions were not observed between the covariates used, such as age). Similarly, studies with adolescents showed that when compared with accumulating 0 to 14 minutes per day of MVPA, reaching at least 15 to 29, 30 to 59, and ≥60 minutes per day of MVPA reduced the probability of low high-density lipoprotein and elevated triglycerides[8]; and, when compared with no MVPA, there was observed a reduction of 50% and 63% in the probability for hypertension at 30 and 60 minutes per day of MVPA, respectively.[9] Also, McMahon et al[10] found that compared with those who reported 0 to 3 days of at least 60 minutes per day of MVPA during the past 2 weeks, adolescents who reported 4 to 7 and 8 to 14 days presented lower depression and anxiety scores, as well as higher scores of well-being. Therefore, increasing MVPA for those with no or low MVPA is an important issue that deserves attention from a population-level point of view, and using only the official guideline to code the participants as active/inactive could hide significant information concerning population PA levels.

In addition, there may be important differences between groups in the prevalence of practicing some MVPA even when there are no differences between these same groups in the prevalence of PA guideline achievement. To illustrate this, we used data from the Global School-based Student Health Survey (GSHS) from Latin American countries (Table 1).[11] We observed that the prevalence of meeting PA guidelines among adolescents was similar in Argentina, The Bahamas, and Barbados (16.5%, 15.1%, and 18.6%, respectively); however, when we look at the prevalence of those with no or low MVPA (0 d/wk with at least 60 min/d of MVPA), a greater difference is noticed (17.2% in Argentina, 31.8% in The Bahamas, and 29.9% in Barbados). Thus, it is plausible that despite a similar percentage of those who meet PA guidelines, Argentina might provide better opportunities and access for youth PA than The Bahamas and Barbados.

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Table 1 Prevalence of 0 and 7 Days per Week of at Least 60 Minutes per Day of MVPA Among Adolescents

Country	Survey year	0 d/wk of at least 60 min/d of MVPA (95% CI)	7 d/wk of at least 60 min/d of MVPA (95% CI)
Anguilla	2016	27.1 (24.1–30.5)	19.3 (16.6–22.3)
Antigua and Barbuda	2009	30.0 (28.0–33.8)	22.7 (20.1–25.4)
Argentina	2018	17.2 (17.2–18.5)	16.5 (15.9–17.1)
The Bahamas	2013	31.8 (28.8–34.1)	15.1 (13.0–17.4)
Barbados	2011	29.9 (26.9–31.8)	18.6 (16.7–20.8)
Belize	2011	31.7 (29.7–33.8)	21.2 (19.4–23.1)
Bolivia	2018	25.5 (24.5–26.6)	11.4 (10.7–12.2)
British Virgin Islands	2009	31.9 (28.9–33.5)	18.0 (16.2–20.0)
Cayman Islands	2007	22.2 (20.2–25.0)	14.8 (12.9–17.0)
Chile	2013	17.7 (15.7–19.6)	13.9 (12.3–15.7)
Costa Rica	2009	18.7 (16.7–19.8)	18.5 (17.0–20.0)
Curaçao	2015	32.2 (30.2–33.9)	11.8 (10.6–13.2)
Dominica	2009	35.7 (32.7–37.6)	16.2 (14.4–18.2)
Dominican Republic	2016	33.2 (30.2–36.2)	12.6 (10.6–14.8)
El Salvador	2013	30.6 (28.6–33.2)	12.9 (11.4–14.6)
Grenada	2008	38.9 (35.9–41.4)	15.2 (13.3–17.3)
Guatemala	2015	30.5 (27.5–33.1)	10.6 (9.0–12.5)
Guyana	2010	40.4 (38.4–42.7)	15.6 (14.1–17.2)
Honduras	2012	29.3 (27.3–31.9)	15.7 (14.0–17.6)
Jamaica	2017	29.9 (26.9–31.7)	23.7 (21.5–26.2)
Panama	2018	23.0 (22.0–25.3)	14.8 (13.5–16.2)
Paraguay	2017	22.7 (20.7–23.8)	16.7 (15.4–18.1)
Peru	2010	18.9 (16.9–19.8)	15.3 (14.0–16.7)
St. Kitts and Nevis	2011	32.1 (30.1–34.8)	18.6 (16.7–20.7)
St. Lucia	2018	29.5 (27.5–31.9)	21.3 (19.4–23.3)
St. Vincent and the Grenadines	2018	31.4 (29.4–33.8)	18.5 (16.7–20.4)
Suriname	2016	34.2 (32.2–36.5)	19.0 (17.3–20.8)
Trinidad and Tobago	2017	26.1 (25.1–28.6)	20.3 (18.8–22.0)
Uruguay	2012	20.8 (19.4–22.2)	15.7 (14.4–17.0)

Abbreviation: MVPA, moderate-to-vigorous physical activity. Note: Global School-based Student Health Survey from Latin American countries.

The use of different thresholds to monitor PA could also influence interpretations of related correlates. For instance, beyond the use of PA guidelines as a cutoff in PA surveillance, a country interested in using an additional cutoff to identify those with no or low MVPA could find 4 possible scenarios. Figure 1 presents an example of possible scenarios considering differences in PA levels between boys and girls, each providing different information for action(s). Cell A presents the worst scenario, where the difference occurs in both guideline adherence and no or low MVPA. This scenario indicates that a subgroup is more universally struggling with achieving adequate MVPA. Cell B presents a scenario where there is no difference in the prevalence of guideline adherence, but there is a difference between subgroups with no or low MVPA. This scenario indicates that although reaching the recommendations could happen similarly among the subgroups, other inequalities appear at the low end of MVPA that may signal differences in access/opportunities to PA or failure in influencing the least active groups with the current strategies. Cell C presents a scenario where

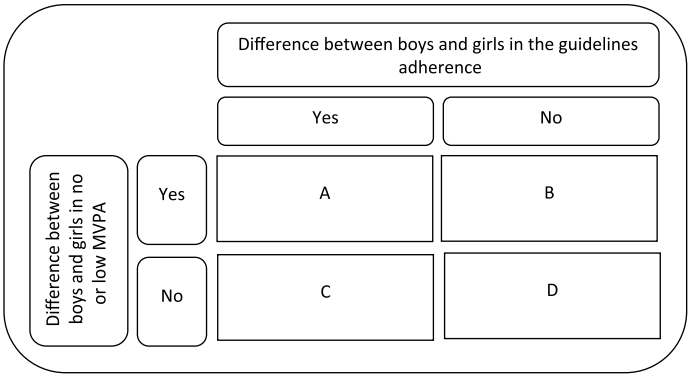

Figure 1 — Possible scenarios for analysis aiming to identify differences between boys and girls concerning "no or low MVPA" and guideline adherence. MVPA indicates moderate-to-vigorous physical activity.

there is a difference in guideline adherence but not for those with no or low MVPA, which could indicate that the subgroups have similar access/opportunities to PA practice, such as in cases of a larger coverage of PA for the entire population, but that the overall impetus for PA falls short of meeting the guidelines. Finally, cell D presents a more equitable scenario, where there is no difference in any threshold used, suggesting broader equality of access and opportunity. In any scenario, the same correlate may present different associations according to the cutoff used and, consequently, result in different interpretations and resultant strategies.

Finally, although there were investigations already employing an approach to identify those with lower PA levels,[12,13] studies on the prevalence and/or correlates of PA have focused on those who meet the PA guidelines.[2,3,14] Thus, we seek to initiate a discussion on the use of "no or low MVPA" as a complementary approach to PA surveillance, which is in line with the premise of the 2020 WHO PA and sedentary behavior guidelines that "every movement counts." We hypothesize that analyses of no or low MVPA can present a more comprehensive view of the most unfavored/disadvantaged groups concerning PA practice, adding a complementary insight into PA surveillance between and within different populations. Furthermore, countries could target and monitor not only increasing the prevalence of PA, but also reducing no or low MVPA, nudging toward the PA guidelines.

Concept and Application

A cutoff based on no or low MVPA will code people into at least 2 groups, those with no or low MVPA and those with some MVPA. In operational terms, no or low MVPA should be considered as the lowest possible amount of MVPA for an assessment method; therefore, this approach would not need to have a standard way of classification and interpretation. For example, among adults, several studies have used self-reported questionnaires, such as the International Physical Activity Questionnaire (IPAQ) and the Global Physical Activity Questionnaire (GPAQ).[15,16] These questionnaires assess MVPA considering the time spent in each PA domain (ie, work, transport, household, and leisure), where overall MVPA is calculated as the sum of the time spent in each domain assessed. Both GPAQ and IPAQ ask to report activities with at least 10 minutes continuous duration; therefore, in these cases, the no or low MVPA approach might be applied to code those who reported not having performed MVPA as no/low MVPA. Among adolescents, international surveys (eg, GSHS, Health Behaviour in School-aged Children—HBSC) tend to assess the weekly frequency of days with at least 60 minutes of MVPA, with possible answers ranging from 0 to 7 days in the past week. In this case, it is not possible to identify adolescents with 0 minutes of MVPA per week. However, aiming to identify those with no or low MVPA versus some MVPA, the use of a cutoff of less than 1 day per week of 60 minutes per day of MVPA might be considered.

The concept of no or low MVPA can also be applied to investigating the PA domains separately, as well as different types of PA. For instance, as both IPAQ and GPAQ use questions that allow an estimate of the time spent in MVPA during leisure time, the approach could be used to determine the prevalence of those with no or low leisure-time PA and help identify specific population groups that should be the target of leisure-related public policies. Furthermore, considering that PA guidelines also recommend specific activities—such as those related to muscle and bone strengthening—investigating these activities from an access/opportunity perspective could identify scenarios concerning subgroups systematically unfavored/disadvantaged (eg, racialized communities and people with lower educational levels).[17] This could result in a call for public policies promoting types of PA that often are related to private structures (eg, gyms). The approach based on no or low MVPA could also indicate that without reducing social inequality, physical inactivity reduction would be more difficult to achieve.

Given that many countries assess PA in their national health surveys using methodologies that can be harmonized, the no or low MVPA approach could also be used as an additional approach in global PA surveillance. For instance, for adults, the STEPS (STEPwise approach to noncommunicable diseases risk factor surveillance) uses GPAQ to assess information on PA. Data from STEPS were previously used to estimate the global prevalence of PA and are available from the WHO website by formal request.[18] For adolescents, both GSHS and HBSC (nationally representative school-based health surveys) assess PA among adolescents by the use of a question about the number of days per week with at least 60 minutes per day of MVPA. Similar to STEPS, these data were used for estimating PA among adolescents and data are available on their respective websites.[18,19]

Although global PA surveillance has been carried out predominantly by self-report questionnaires, it is important to highlight that the no or low MVPA approach could be also applied with device-based methods, such as accelerometers. However, considering that 0 minutes of MVPA per week would be very rare, specific procedures should be developed to identify thresholds for low MVPA, which could be done, for example, from the distribution of PA in specific populations and through the combination with self-report methods to identify the domains and types of PA.

Advantages of No or Low MVPA Approach in the Investigation of Social Inequalities

Although several studies have reported inequalities in PA, such as between gender and socioeconomic status, when research reports that men are more active than women or that those with higher socioeconomic levels are more active than those with lower socioeconomic levels in leisure-time PA, the results tend to reflect the relative or absolute difference based on the prevalence of those who reach/do not reach the PA guidelines. Using only this threshold can hide important information at the root of the inequalities, as people with higher social vulnerability tend to have less access to PA lessons and facilities. Therefore, the inequalities can be even higher when thresholds are more sensitive for identifying those with no or low MVPA, especially for domains such as leisure time.

Using data from the Brazilian National Health Survey for adults (≥18–64 y old), we illustrated a situation of inequalities that can be hidden when only the threshold of 150 minutes per week of leisure-time PA is used. Table 2 shows the prevalence of adults who fail to achieve at least 150 minutes per week of leisure-time PA according to ethnicity (White, Black, and Brown). We observed that Black and Brown people were more likely to not achieve at least 150 minutes per week of leisure-time PA than White people but with minor differences between the groups. However, larger differences between groups (Black vs White; Brown vs White) were observed when no or low leisure-time PA was the outcome. When examined by educational level, we observed that those with no formal education were less likely to achieve at least 150 minutes per week of leisure-time PA than their peers at higher educational levels, with a larger difference compared with those with complete college or more (32.6 percentage points). Like ethnicity, we observed greater differences when no or low MVPA was used

Table 2 Prevalence of Moderate-to-Vigorous LTPA Among Brazilian Adults According to Ethnicity and Educational Level

	No/low moderate-to-vigorous LTPA		<150 min/wk of moderate-to-vigorous LTPA	
	% (95% CI)	PR (95% CI)	% (95% CI)	PR (95% CI)
Ethnicity				
White	52.7 (51.0–53.3)	Ref	68.9 (67.9–70.0)	Ref
Black	59.3 (57.3–61.2)	1.13 (1.09–1.18)	72.0 (70.2–73.8)	1.04 (1.01–1.07)
Brown	59.4 (58.4–60.4)	1.13 (1.10–1.17)	72.7 (71.8–73.6)	1.05 (1.03–1.07)
Educational level				
No formal education	80.0 (77.3–82.5)	Ref	87.4 (85.0–89.4)	Ref
Less than secondary	68.3 (67.3–69.3)	0.85 (0.82–0.89)	80.6 (79.7–81.4)	0.92 (0.90–0.95)
Complete secondary	51.6 (50.4–52.7)	0.64 (0.62–0.67)	67.5 (66.3–68.5)	0.77 (0.75–0.80)
Complete college or more	35.8 (34.3–37.4)	0.45 (0.42–0.47)	54.8 (53.2–56.4)	0.63 (0.60–0.65)

Abbreviations: CI, confidence interval; LTPA, leisure-time physical activity; PR, prevalence ratio; Ref, reference. Note: Brazilian National Health Survey for adults (≥18–64 y old), 2019.

(44.2 percentage points). The difference in no or low MVPA could be worse than the difference in achieving at least 150 minutes per week of leisure-time PA and maybe a more sensitive indicator of access/opportunities to PA practice. Differences in achieving at least 150 minutes per week of PA during leisure time can reflect alternate differences that occur in the access/opportunities to be active. Thus, studies might consider using both thresholds to identify what is behind inequalities in access/opportunities to PA practice as well as proposing ways to overcome them.

In contrast, other possible scenarios could show a large difference in the prevalence of meeting the PA guidelines but with little or no difference in no or low MVPA. For instance, using data from HBSC from Canadian adolescents, we observed that boys and girls present a similar prevalence of less than 1 day per week with 60 minutes per day or more of MVPA (boys: 3.8% vs girls: 4.9%), while greater differences were noticed in failing to achieve the PA guidelines (boys: 71.3% vs girls: 83.0%). This example would indicate a large general coverage of PA opportunities for both boys and girls, and the focus of health policies should be on promoting a higher amount of MVPA for those who have access to PA opportunities but are not achieving the international guidelines (ie, girls).

Limitations

Despite the advantages of using no or low MVPA as an additional way of PA surveillance, some limitations need to be considered. First, some population subgroups could present no or low MVPA due to medical restrictions. In this case, to do some MVPA could be not a question of choice or access/opportunities. Second, in countries with a high prevalence of some MVPA (eg, >90%), this approach would suffer from a ceiling effect. Thus, additional research about other approaches that seek to identify those less favored based on the specific countries' MVPA frequency and distribution could be welcome. Third, as the threshold to identify no or low MVPA is not established, the use of the lowest possible amount of MVPA could limit comparisons between different assessment methods. Fourth, although we have raised hypotheses that no or low MVPA could be explained, at least partially, by the lack of access/opportunities for PA practice, surveillance systems could benefit from including questions about perceived access to PA. Fifth, further studies could deepen the investigation on no or low MVPA seeking to analyze the role of individual determinants (eg, motivation to PA practice), as well as to identify if these factors differ between countries/regions.

Conclusions

Facing the global burden of noncommunicable chronic disease, WHO launched an action plan with the goal of reducing physical inactivity by 15% by 2030.[20] In addition, to monitor the progress of countries, several studies have sought to identify trends in PA/physical inactivity.[2,3] However, when thresholds based solely on PA guidelines are used to code the participants, small increases in PA might not be noticed. Thus, we recommend the use of no or low MVPA as an additional tool in PA surveillance, which might help present a more comprehensive view of progress in improving the coverage of PA, especially in countries/regions with lower coverage.

References

1. Bull FC, Al-Ansari SS, Biddle S, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med*. 2020;54(24):1451–1462. doi:10.1136/bjsports-2020-102955
2. Guthold R, Stevens GA, Riley LM, Bull FC. 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(10):e1077–e1086. doi:10.1016/S2214-109X(18)30357-7
3. Guthold R, Stevens GA, Riley LM, Bull FC. Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1·6 million participants. *Lancet Child Adolesc Health*. 2019;4(1):23–35. doi:10.1016/S2352-4642(19)30323-2
4. Warburton DER, Bredin SSD. Health benefits of physical activity. *Curr Opin Cardiol*. 2017;32(5):541–556. doi:10.1097/HCO.0000000000000437
5. Warburton DER, Bredin SSD. Reflections on physical activity and health: what should we recommend? *Can J Cardiol*. 2016;32(4):495–504. doi:10.1016/j.cjca.2016.01.024
6. Hupin D, Roche F, Gremeaux V, et al. Even a low-dose of moderate-to-vigorous physical activity reduces mortality by 22% in adults aged ≥60 years: a systematic review and meta-analysis. *Br J Sports Med*. 2015;49(19):1262–1267. doi:10.1136/bjsports-2014-094306

7. Wen CP, Wai JPM, Tsai MK, et al. Minimum amount of physical activity for reduced mortality and extended life expectancy: a prospective cohort study. *Lancet*. 2011;378(9798):1244–1253. doi:10.1016/S0140-6736(11)60749-6
8. LeBlanc AG, Janssen I. Dose-response relationship between physical activity and dyslipidemia in youth. *Can J Cardiol*. 2010;26(6):e201–e205. doi:10.1016/S0828-282X(10)70400-1
9. Mark AE, Janssen I. Dose-response relation between physical activity and blood pressure in youth. *Med Sci Sports Exerc*. 2008;40(6):1007–1012. doi:10.1249/MSS.0b013e318169032d
10. McMahon EM, Corcoran P, O'Regan G, et al. Physical activity in European adolescents and associations with anxiety, depression and well-being. *Eur Child Adolesc Psychiatry*. 2017;26(1):111–122. doi:10.1007/s00787-016-0875-9
11. World Health Organization. Global school-based student health survey (GSHS). Accessed February 1, 2020. https://www.who.int/ncds/surveillance/gshs/en/
12. Vigitel Brasil 2006–2020—Prática de Atividade Física—Ministério da Saúde. 2022. Accessed January 9, 2024. https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/svsa/vigitel/vigitel-brasil-2006-2020-estimativas-sobre-frequencia-e-distribuicao-sociodemografica-de-pratica-de-atividade-fisica-nas-capitais-dos-26-estados-brasileiros-e-no-distrito-federal-entre-2006-e-20.pdf/view
13. Active Lives | Sport England. 2023. Accessed January 9, 2024. https://www.sportengland.org/research-and-data/data/active-lives
14. Hallal PC, Andersen LB, Bull FC, Guthold R, Haskell W, Ekelund U. Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet*. 2012;380(9838):247–257. doi:10.1016/S0140-6736(12)60646-1
15. Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc*. 2003;35(8):1381–1395. doi:10.1249/01.MSS.0000078924.61453.FB
16. Cleland CL, Hunter RF, Kee F, Cupples ME, Sallis JF, Tully MA. Validity of the Global Physical Activity Questionnaire (GPAQ) in assessing levels and change in moderate-vigorous physical activity and sedentary behaviour. *BMC Public Health*. 2014;14(1):1255. doi:10.1186/1471-2458-14-1255
17. Araujo RHO, Werneck AO, Silva DR, Jesus GM. Sociodemographic inequalities in the trends of different types of leisure-time physical activity among Brazilian adults between 2006 and 2019. *Int J Equity Health*. 2022;21(1):120. doi:10.1186/s12939-022-01728-y
18. World Health Organization. NCD Microdata Repository. Accessed June 22, 2023. https://extranet.who.int/ncdsmicrodata/index.php/catalog/central/about
19. Health Behaviour in School-aged Children study. Accessed June 22, 2023. https://hbsc.org/
20. World Health Organization. *Global Action Plan on Physical Activity 2018–2030: More Active People for a Healthier World*. World Health Organization; 2018.