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Influence of Guideline Operationalization on Youth Activity Prevalence in the International Children's Accelerometry Database

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Introduction: The United Kingdom and World Health Organization recently changed their youth physical activity (PA) guidelines from 60 minutes of moderate-vigorous PA (MVPA) *every day*, to an *average* of 60 minutes of MVPA per day, over a week. The changes are based on expert opinion due to insufficient evidence comparing health outcomes associated with different guideline definitions. This study used the International Children's Accelerometry Database to compare approaches to calculating youth PA compliance and associations with health indicators.
Methods: Cross-sectional accelerometer data (n=21,612, 5-18y) was used to examine compliance with four guideline definitions: daily method (DM; ≥60 minutes MVPA every day), average method (AM; average of ≥60 minutes MVPA per day), AM5 (AM compliance and ≥five minutes of vigorous PA [VPA] on ≥three days), AM15 (AM compliance and ≥15 minutes VPA on ≥three days). Associations between compliance and health indicators were examined for all definitions.
Results: Compliance varied from 5·3% (DM) to 29·9% (AM). Associations between compliance and health indicators were similar for AM, AM5, and AM15. For example, compliance with AM, AM5, and AM15 was associated with a lower BMI z-score (statistics are coefficient [95%CI]): AM (-0.28[-0.33,-0.23]), AM5 (-0.28[-0.33,-0.23], AM15 (-0.30[-0.35,-0.25]). Associations between compliance and health indicators for DM were similar/weaker, possibly reflecting fewer DM-compliant participants with health data and lower variability in exposure/outcome data.
Conclusions: Youth completing 60 minutes of MVPA *every day* do not experience superior health benefits to youth completing an *average* of 60 minutes of MVPA per day. Guidelines should encourage youth to achieve an average of 60 minutes of MVPA per day. Different guideline definitions impact inactivity prevalence estimates; this must be considered when analyzing data and comparing studies.

Key Words: ICAD, accelerometer, physical activity, compliance, vigorous-intensity physical activity

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INTRODUCTION

Regular physical activity (PA) among youth (5-17 years) has beneficial effects on health(1). The World Health Organization (WHO) and multiple individual countries promote guidelines specifying how much PA youth should engage in for healthy growth and development. Up until 2019, guidelines stated that youth should accumulate 60 minutes of moderate-vigorous intensity PA (MVPA) per day(1). Interpreted literally, this required youth to do ≥60 minutes of MVPA on *every day* of the week, and those who are active for three hours/day, six days/week are deemed insufficiently active. In comparison, the adult PA guidelines promote a weekly volume (150 minutes/week), permitting a more flexible activity pattern(2). The greater flexibility in the adult guidelines has likely contributed to substantially different estimates of guideline compliance between youth and adults. For example, self-reported data indicate that globally, 76.7% of adults, 21.6% of adolescent boys, and 15.6% of adolescent girls meet PA guidelines(2).

Global surveillance of PA guideline compliance is currently based on self-report methods(2) However, increased use of device-based measurement tools has highlighted inconsistencies in data processing and the operationalization of the youth guidelines, limiting cross-study comparisons(3–5). Some define guideline compliance when MVPA averaged over a measurement period is ≥60 minutes/day ('average method')(6) while others define compliance as ≥60 minutes of MVPA achieved on *every measured day* ('daily method')(7). The use of different guideline definitions has a substantial influence on the proportion of individuals deemed to be meeting PA guidelines(8,9). For example, studies comparing average and daily methods report compliance rates of, respectively, 30·6 vs. 3·2% (British youth using the wrist worn GENEActiv accelerometer and Phillips cut points)(3), 51·7 vs. 23·7% (Estonian youth using the waist worn

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Actigraph accelerometer and Evenson cut points)(4), and 68 vs. 20% (Australian youth using the Multimedia Activity Recall for Children and Adolescents survey)(5). To fully understand the public health burden of physical inactivity, guideline operationalization and the corresponding data analysis approach needs to be consistent across research studies. This is in addition to other data collection and processing issues that lack consensus, such as cut-point selection and where the monitor should be worn(10).

The question of how guidelines *should* be operationalized has elicited conflicting opinions. The 'daily method' has been advocated on the basis of literal interpretation of the guidelines and some evidence that this may be associated with superior beneficial cardio-metabolic health(11). Others recommend the 'average method' because most evidence underpinning the guidelines is based on associations between a wide range of health indicators and average levels of MVPA, and there is no evidence that greater flexibility in activity accumulation negatively influences its health benefits(4,12,13). Recently, both the UK and WHO revised the youth PA recommendation from 60 minutes of MVPA on each day to the achievement of 'at least an average of 60 minutes per day of MVPA, across the week'(13,14). This change was based on expert opinion, evidence on the variable nature of youth PA across the week(15) and the rationale that the evidence base is mostly based on the average approach to quantify activity levels(12). However, there is a lack of evidence directly comparing the health benefits associated with each; such evidence is needed to identify the most appropriate public health recommendation.

Global and national PA guidelines also state that youth should participate in vigorous PA (VPA) on ≥three days/week(1). Compliance with this VPA recommendation is rarely reported,

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likely because the guidelines do not specify a duration for VPA. However, increasing evidence suggests that VPA is particularly beneficial for child and adolescent health(16). The small number of studies that have attempted to quantify the optimum duration of VPA associated with health benefits suggest that approximately 15 minutes of VPA/day appears to be associated with improved health outcomes(6,17–19).

In summary, there is a lack of evidence supporting the *daily* recommendation of 60 minutes of MVPA for youth, and the daily phrasing of the youth guidelines has contributed to misleading and inconsistent estimates of PA compliance among youth. Previous research comparing different approaches to calculating the proportion of active youth is limited by the use of self-reported data(5) varied accelerometer data reduction decisions, and homogenous samples. A robust analysis of how physical activity guideline operationalization influences (i) estimates of physical activity prevalence and (ii) associations between guideline compliance and health indicators is needed. The International Children's Accelerometry Database(20) (ICAD) provides accelerometer-assessed PA and health data on a large, heterogeneous sample, making it suitable to address these questions. The purposes of this study are therefore to: (1) quantify the magnitude of differences in compliance estimates when different methods of operationalizing the youth MVPA and VPA guidelines are applied, and (2) test differences in the magnitude of associations between PA guideline compliance and health indicators, using different compliance methods.

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METHODS

Study design

The ICAD (http://www.mrc-epid.cam.ac.uk/research/studies/icad) is a collection of accelerometer-assessed PA data from 20 studies (ten countries). All studies used waist-worn Actigraph accelerometers to assess PA in youth (3-18 years) and all data underwent an identical reduction procedure(20).

Participants

Data in this study are baseline (cross-sectional) measurements from youth (≥5 years) from 17 studies (nine countries; see Appendix, SDC 1, for included studies, http://links.lww.com/MSS/C514). All studies were ethically approved and obtained appropriate consent. Consistent with recommendations, youth with ≥600 minutes of valid accelerometer wear/day for ≥four days, including ≥one weekend day were included in analyses(21).

Measurements

Physical activity

Published work(20) describes the accelerometer data reduction process in ICAD. Briefly, PA data were analyzed using vertical axis count data in 60-second epochs (most original data files were only available in 60-second epochs)(20). Non-wear time was defined as 60 minutes of consecutive zeros (≤two minutes of non-zero interruptions allowed)(22). A valid day constituted ≥600 minutes of valid accelerometer wear time, recorded between 6am and midnight. Based on the recommendations of previous research(23), Evenson cutpoints were used to classify MVPA (≥2296 counts per minute [cpm]) and VPA (≥4012 cpm)(24).

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Guideline compliance

Four interpretations of guideline compliance were examined (Table 1). The 'daily method' (DM) and 'average method' (AM) were operationalized based on methods currently used in the youth PA literature(6,7). In addition, two definitions including compliance with the VPA component of the guidelines were examined. As current guidelines just specify VPA frequency, not duration, a definition was derived based on recent evidence on the association between VPA and health indicators among youth. Approximately 15 minutes of VPA/day appears to be associated with improved health outcomes (cardiovascular health indicators, weight status and body fat percentage)(6,17–19). As such, a duration of ≥15 minutes of VPA was used to identify compliance/non-compliance for each day. Because some studies report low levels of VPA among youth(8), we also examined a lower threshold of five minutes of VPA/day, to ensure a sufficient sample size for examining associations between compliance and health indicators. Complying with five or 15 minutes of VPA on ≥three days(1) was combined with AM to create AM5 and AM15, respectively. Compliance with AM5 indicates that a participant achieved an average of at least 60 minutes of MVPA per day and also engaged in at least 5 minutes of VPA on at least 3 days of the week. Likewise, compliance with AM15 indicates that a participant achieved an average of at least 60 minutes of MVPA per day and also engaged in at least 15 minutes of VPA on at least 3 days of the week. As such, participants complying with AM5 and AM15 represent a subset of those complying with AM.

Studies examining the association between VPA and health have typically assessed the influence of VPA as a subset of MVPA, rather than a complement to moderate-intensity PA (MPA). In addition, at least two studies advise that 15 minutes of VPA be recommended as *part*

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of the ≥60 minute MVPA recommendation, not in addition to it(18,19). Therefore, we considered participants compliant with AM5 and AM15 definitions regardless of whether the five or 15 minutes of VPA were also part of their ≥60 minutes of MVPA (i.e., ≥60 minutes of MVPA per day including ≥5 or ≥15 minutes of VPA on ≥3 days). As such, AM15 compliance could be achieved through completing an average of 60 minutes of MPA per day and 15 minutes of VPA on ≥3 days per week or through completing an average of 45 minutes of MPA per day and 15 minutes of VPA per day.

Health indicators

Details on study-specific data collection and harmonisation procedures are published elsewhere(25). All studies contributed height and weight data. Height and weight were measured by trained staff in all studies; BMI was calculated (weight[kg] / height[m^2]) and converted to age- and sex-specific BMI z-scores. Other health indicators examined were: waist circumference (partially available for 11 studies/47·0% of participants), resting systolic and diastolic blood pressure (partially available for 10 studies/37·8% of participants), glucose, triglycerides, LDL, and HDL cholesterol (partially available for nine studies/10·5-29·9% of participants), and insulin levels (partially available for 8 studies/10·4% of participants).

Covariates

Details on the collection of demographic data have been previously published(20). Data on covariates (age, study, country, sex, race, maternal education) were used to explore the influence of guideline definition on PA prevalence estimates among sub-groups for which activity levels are reported to differ. The harmonized maternal education variable indicated whether the mother

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completed (at most) compulsory education, or any post-compulsory education. Age was calculated using time elapsed between birth date and date of accelerometer assessment. If this information was not available, an alternative age variable was derived from the study's data set. The harmonized race variable classified participants as 'white' or 'other', based on self- or proxy-reported race.

Statistics

Descriptive statistics (percentages) on compliance with the four guideline definitions for the whole sample and sub-groups were examined. Odds ratios were used to explore differences in compliance rates among sub-groups (e.g., males vs. females), for each definition. Each odds ratio was adjusted for covariates: sex, race, maternal education, age, study, and country. McNemar's tests (a test of paired proportions) were used to examine if there were statistical differences in compliance rates among the four definitions. Linear regression models were used to test associations between guideline compliance and health indicators, adjusting for the same covariates. Of the included studies, two did not provide data on maternal education (CHAMPS UK, CoSCIS; n=4,798 participants) and four did not provide data on race (CLAN, CoSCIS, HEAPS, KISS; n=4,380 participants), so were excluded from analyses involving these variables. Two-level models were used to account for clustering of children within studies. We conducted sensitivity analyses to examine how data analysis decisions influenced the results. We ran the same statistical procedures using: (1) different cut points for MVPA (≥3000cpm) and VPA (≥6000cpm), (2) a MVPA compliance threshold of 55 minutes (instead of 60), and (3) participants providing seven days of data (instead of ≥four). We did not conduct sensitivity analyses to examine the influence of

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including or excluding VPA from the 60-minute AM on compliance rates. Statistical analyses were completed using SPSS, 25.0.

RESULTS

Applying the accelerometer data inclusion criteria resulted in a sample of 21,612 youth (62·4% female; Figure 1). Included participants provided an average of 5·6 (SD=1·1) valid days of accelerometer data (range 4-7 days). Of the 21,612 participants, 4,758 (22·0%) provided four days of data, 4,595 (21·3%) provided five days, 6,538 (30·3%) provided six days, and 5,721 (26·5%) provided seven days. Sample descriptive statistics and PA prevalence according to different guideline definitions are shown in Tables 2 and 3, respectively. In addition, Figure 2 shows the proportions of youth complying with different combinations of the guideline definitions. Prevalence estimates varied by definition with the lowest rates associated with DM (5.3%) and the highest rates with AM (29.9%; AM5=29.4%, AM15=23.7%). McNemar's tests confirmed that prevalence estimates were different across definitions (see Appendix, SDC 1, Tables 3 and 4, http://links.lww.com/MSS/C514). There was little difference in prevalence estimates between AM and AM5. Prevalence using AM was approximately 20% higher than with AM15 for the total sample and across most sub-groups, suggesting that approximately 80% of youth complying with AM *also* comply with AM15. Among the youngest participants (5-9·9 years) the difference between AM and AM15 compliance rates was larger (30%), suggesting that among AM-compliant 5-9·9 year olds, a smaller proportion comply with AM15 compared to other sub-groups.

Regardless of operationalization method, children who were younger, male, white, or had a mother with no more than compulsory education were more likely to comply with guidelines

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than their reference groups. Associations varied slightly in magnitude across definitions, but the direction was consistent. For example, the odds ratio for male (reference category) vs. female compliance varied from 0·19-0·24 across definitions, but consistently indicated that females were less likely to comply with guidelines than males.

Sensitivity analyses results are shown in the Appendix (see Appendix, SDC 1, Tables 5-8, http://links.lww.com/MSS/C514). Prevalence when using a 55-minute MVPA compliance threshold (instead of 60) and when restricting analyses to those with seven days of data (instead of ≥four) was similar to that reported in the main analysis. However, prevalence dropped substantially when higher intensity thresholds (cut-points) were applied. For example, the proportion of DM-compliant youth was 5·3% in the main analysis, 7·0% with a 55-minute MVPA compliance threshold (instead of 60), 4·1% when restricting analyses to those with seven days of data (instead of ≥four), and 0·8% with higher intensity thresholds (see Appendix, SDC 1, Table 5, http://links.lww.com/MSS/C514). Subgroup differences, however, remained similar, suggesting that different analysis decisions did not alter the overall pattern of results.

For all guideline definitions, associations with health indicators were in expected directions (with compliance favourably associated with each indicator; Table 4). For example, meeting each guideline definition was associated with a lower BMI z-score (statistics are coefficient [95% CI]): DM (-0.21 [-0.31,-0.11], AM (-0.28 [-0.33,-0.23]), AM5 (-0.28 [-0.33,-0.23], AM15 (-0.30, [-0.35,-0.25]). The magnitude of associations between compliance and health indicators (assessed by comparing parameter estimates) was similar for AM, AM5, and AM15 while compliance with DM was less consistently associated with health indicators. For example, meeting the AM, AM5,

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or AM15 definitions was associated with a lower waist circumference (cm), with coefficients between -2.63 and -2.82, whereas the coefficient for DM compliance was -1.93. Sensitivity analyses results are shown in the Appendix (see Appendix, SDC 1, Tables 9-17, http://links.lww.com/MSS/C514). Most associations were similar in magnitude to those reported in the main analysis; associations between guideline compliance and waist circumference and insulin levels were stronger when analyses included participants with seven days of data (instead of ≥four).

DISCUSSION

Different methods of operationalizing youth PA guidelines yield different compliance estimates (5·3-29·9%). Of the youth achieving an average of 60 minutes of MVPA/day, the majority (79·3%) also engaged in ≥15 minutes of VPA, on ≥three days/week. Associations between guideline compliance and health indicators were favourable and similar in magnitude for AM, AM5, and AM15, but less consistent for DM.

Guideline operationalization and compliance estimates

As expected, AM and DM definitions produced different compliance estimates, with the stricter DM producing lower estimates. An additional 24·6% of youth were classified as compliant when AM was used, compared to DM. This is consistent with previous studies reporting discrepancies of 27-28% (accelerometer data) and 48% (self-report data)(3–5). Even with the most lenient AM definition only 29% of youth complied with guidelines, consistent with previous estimates(26).

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Compliance with AM was 50.3% among males and 17.7% among females; this difference is consistent with previous estimates based on objective PA monitoring and use of the AM approach to assess guideline compliance among youth(3,17,27). Compliance with DM was 10.6% among males and 2% among females; these estimates are similar to previous estimates based on accelerometer data and the DM approach (5.5% for boys, 1.2% for girls)(3) although lower than estimates based on self-report data and the DM approach (21.6% for boys, 15.6% for girls)(2). Differences in device-based vs. self-report estimates support the shift towards using device-based methods for PA surveillance. The findings also support the need for consistent guideline operationalization to permit cross-study comparisons of compliance estimates. Importantly, with the DM the proportion of compliant youth will tend towards zero as the number of measurement days increases(5). Our main analysis included youth with ≥four days of data and 5·3% were DM-compliant. Sensitivity analyses restricted to those with seven days of data showed that DM compliance dropped to 4·1%. While a small drop in absolute terms, a relative change of ~20% implies the importance of accounting for measurement day frequency when calculating DM compliance. As such, DM compliance estimates to some extent reflect the availability of accelerometer data within a sample. To permit cross-study comparisons of DM compliance measurement day frequency would need to be standardized within and across studies, or reported separately for individuals with different numbers of valid days of data. Conversely, sensitivity analyses showed that compliance rates for AM, AM5, and AM15 increased (by 5.2%, 5.6% and 7.9%, respectively) when examining participants with seven days of data instead of those with ≥four days. This might be explained by higher physical activity levels among participants who wear their accelerometer for a greater number of days. Previous research reports that more active youth wear their monitors more, and are more likely to provide reliable accelerometer data(28,29).

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Compliance rates for AM, AM5, and AM15 were similar and ~80% of youth compliant with AM also complied with AM15. This suggests that the majority of youth engaging in 60 minutes of MVPA also engage in ≥15 minutes of VPA, on ≥three days/week. This is encouraging as evidence indicates the health gains from VPA are greater than from MPA for youth(6,18). These findings are consistent with several studies which report average VPA levels among youth to be ≥15 minutes/day(18,19). Recent studies suggest a *daily* dose of 15-20 minutes is beneficial for health, however, the VPA compliance threshold in this study (≥15 minutes on ≥three days) means estimates may not reflect daily compliance. As research on the dose, duration, and frequency of VPA needed for health benefits evolves it will be important to evaluate whether the VPA component of the guidelines (VPA on ≥three days/week) needs to be revised (i.e., adding duration and/or changing the frequency recommendation).

In regards to the influence of guideline operationalization on sub-group compliance, among the youngest participants (5-9·9 year olds) a lower proportion of those compliant with AM also complied with AM15 compared to other sub-groups, indicating lower levels of VPA among the youngest group. The more sporadic/incidental nature of younger children's activity is more likely to be moderate in nature than vigorous and the use of 60-second epochs means that short bursts of VPA were likely not detected(10). Consistent with previous research, groups more likely to comply with guidelines were males(8), white youth(30), and younger children(8). The overall pattern of results was consistent across guideline definitions, suggesting that while absolute estimates of compliance from studies using different definitions are not comparable, our understanding of differences in sub-group compliance is not affected by guideline operationalization.

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The influence of different guideline operationalization methods on PA prevalence estimates has implications for making cross-study comparisons and synthesizing evidence. Guideline operationalization method adds to the other youth accelerometry data analysis issues which lack consensus including epoch length(10), cut-points(10), and raw vs. count-based processing methods(31). Researchers need to be explicit when describing their methodologies to facilitate interpretation of results and appropriate synthesis of evidence.

Guideline operationalization and associations between compliance and health indicators

The strength of associations between health indicators and guideline compliance demonstrated minimal variation across definitions. Given that previous research has reported a dose-response relationship between MVPA and several health indicators(32,33), it was reasonable to expect that the present study would find stronger associations between DM compliance and health indicators than between AM definition compliance and health indicators. However, this study found that associations between DM compliance and health indicators were generally similar or weaker than associations between health indicators and compliance with AM definitions. One explanation could be that youth participating in >60 minutes of MVPA every day have a preference for MPA over VPA, and MPA is more weakly associated with metabolic health(16). However, the results should be interpreted cautiously – in the present study only 5.3% of participants complied with DM, and only a portion of the DM-compliant participants provided health data (22·0-99·0% depending on which health indicator is considered). The smaller sample size and resulting lower variability in exposure and outcome data may explain why this study found weaker and/or inconsistent associations between DM compliance and health indicators. Notwithstanding this, our findings support the recent changes to the UK and WHO youth PA guidelines to AM wording.

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Further to this, the use of AM wording permits youth to engage in their characteristically varied PA pattern across the week(34) and allows for rest- and sick-days.

Consistent with previous research, guideline compliance was associated with favourable health outcomes (lower resting blood pressure(32), waist circumference(35), blood glucose and insulin levels(35), and a favourable lipid profile)(33); the magnitude and direction of the associations were consistent across the three AM definitions. Given the growing evidence base reporting the health benefits of VPA(6,18,19), it is noteworthy that in these analyses compliance with AM15 did not demonstrate stronger associations with health indicators than AM. Approximately 80% of AM-compliant youth also complied with AM15, so the statistics are based on similar participant pools, which could explain the similarity in estimates of association. Importantly, VPA has benefits beyond the health outcomes examined in this study (e.g., bone health, mental health)(32,36), and the findings can't be generalized to those health outcomes.

Strengths and limitations

Strengths of this study include the large, heterogeneous sample of youth and harmonized accelerometer, exposure, and outcome data. We also conducted sensitivity analyses to explore the influence of data analysis decisions on results. Limitations include that a small proportion of the sample were compliant with DM and had health indicator data. As such, associations between DM compliance and health indicators should be interpreted cautiously. There is still underrepresentation of youth from low- and middle-income countries, and of older adolescents (15-18 years old) in the ICAD, which limits the generalisability of the findings. In addition, the use of a 60-second epoch may have underestimated time spent above the VPA threshold for

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younger children (10,37–39). Finally, the use of absolute thresholds/count cut-points for MPA and VPA assumes that they are suitable for all participants (regardless of age and sex), as such it is possible that PA intensity was misclassified for a proportion of the participants in the heterogeneous sample. The Evenson intensity cut-points used for this study were calibrated for 15-second epochs and therefore their application to 60-second epoch data is a deviation from their intended use. However, previous research recommends the use of the Evenson intensity cut-points over other sets of cut-points among 5-15 year olds (23). In addition, the Evenson intensity cut-points have been regularly used to explore ICAD accelerometer data (as recently 2021) for the same age range of participants as included in this study(7,40–43). Further, our sensitivity analyses showed that even if a different set of cut-points are applied, our main conclusions hold (even though the compliance estimates change).

CONCLUSIONS

Youth achieving 60 minutes of MVPA every day do not experience superior health benefits to youth achieving an average of 60 minutes/day of MVPA. The majority of youth achieving an average of 60 minutes of MVPA also achieve 15 minutes of VPA, indicating some VPA is typically included in youth activity patterns. These findings provide evidence to support the recent change to the UK and WHO guidelines (to the AM approach), which are currently based on expert opinion due to a lack of evidence on the health benefits of the DM. The AM should be used for guideline operationalization and public health promotion.

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Conflict of Interest

None of the authors have any professional relationships with companies or manufacturers who will benefit from the results of the present study. The results of the present study do not constitute endorsement by ACSM. The results of the study are presented clearly, honestly, and without fabrication, falsification, or inappropriate data manipulation.

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Author contributions

CG conceptualized the study, analyzed and interpreted the data, drafted the initial manuscript and revised the manuscript. AJA, KC, UE, BHH, LS and EMFvS conceptualized the study, contributed to data analysis and interpretation, and reviewed and revised the manuscript. LBA, SA, RD, PCH, RJ, SK, PLK, SK, KN, RP, JS, LBS, and EMFvS contributed data from original studies and reviewed and revised the manuscript.

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FIGURE LEGENDS

Figure 1. Flow chart of included and excluded studies and participants

Figure 2. Venn diagram showing the number and percentage of the total sample (N=21,612) meeting different combinations of the guideline definitions**.**

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes

SUPPLEMENTAL DIGITAL CONTENT

SDC 1: Supplemental Digital Content.docx – Appendix

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Figure 1

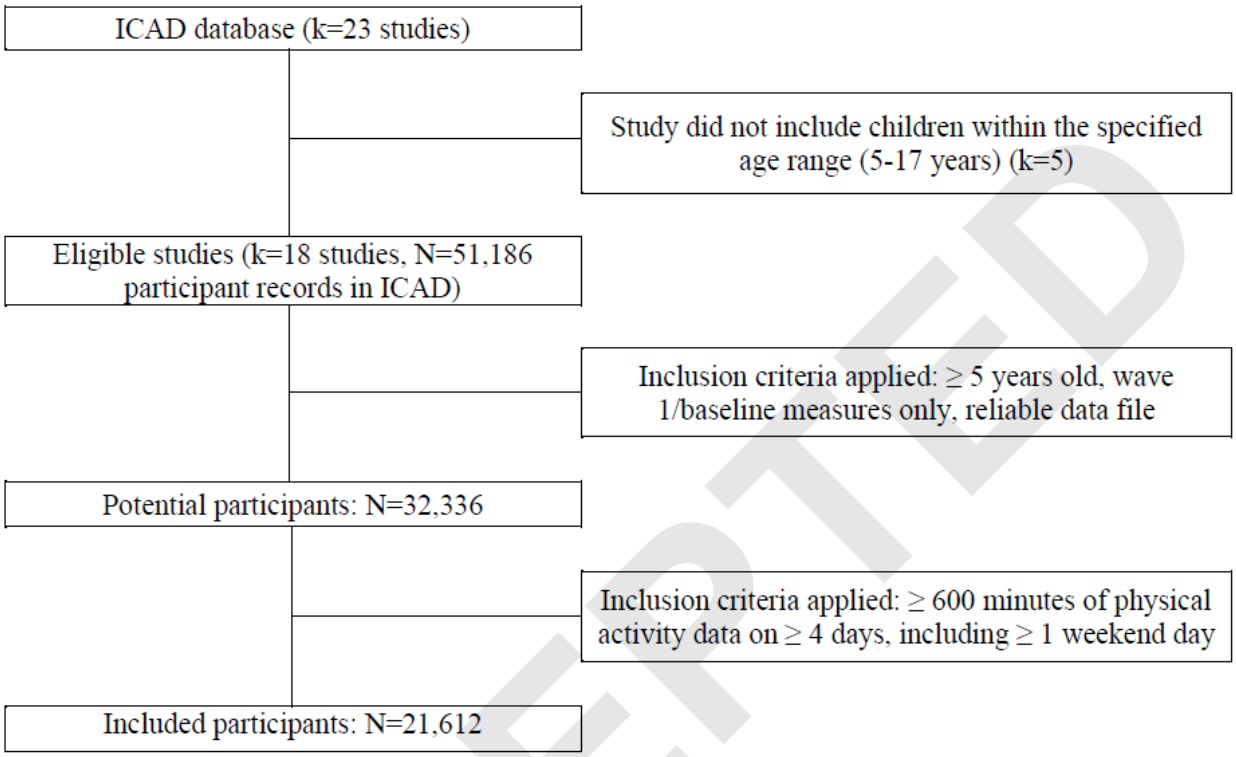

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Figure 2

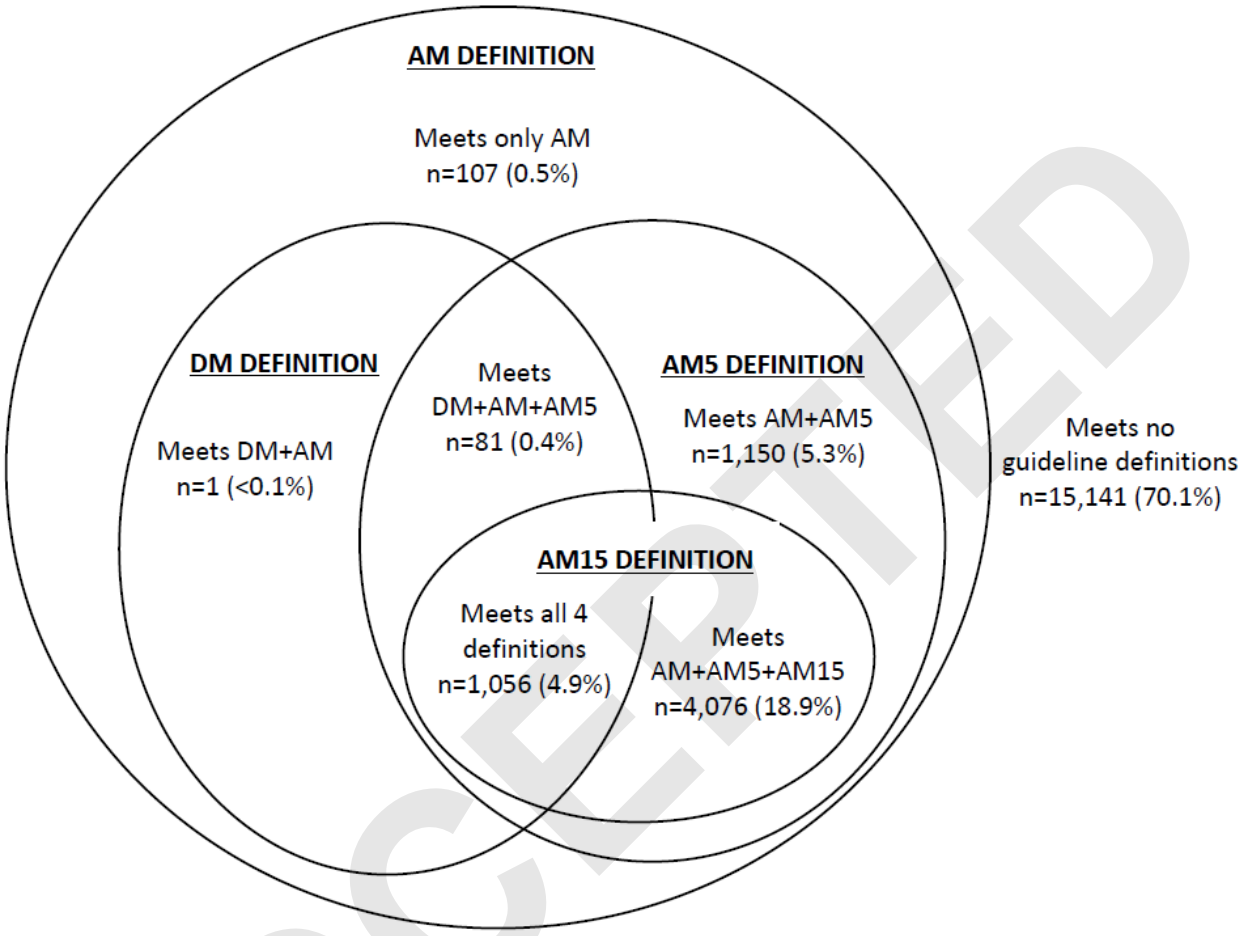

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Table 1. Different definitions of physical activity guideline compliance.

Daily method (**DM**)	Participants achieving ≥60 minutes MVPA on every measured day.
Average method (**AM**)	Participants achieving an average of ≥60 minutes MVPA per day, over the measurement period.
Average method + 5 (**AM5**)	Participants achieving an average of ≥60 minutes of MVPA per day including ≥5 minutes of VPA on ≥3 days.
Average method + 15 (**AM15**)	Participants achieving an average of ≥60 minutes of MVPA per day including ≥15 minutes of VPA on ≥3 days.

MVPA: moderate-vigorous physical activity; VPA: vigorous physical activity

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Table 2. Descriptive statistics of the ICAD population and study sample

	Population (N=32,336)		Study Sample (N=21,612)	
	N	**Mean (SD) or %**	**N**	**Mean (SD) or %**
Age (years)	32,336	11·9 (2·6)	26,612	11·8 (2·5)
Height (cm)	32,030	149·7 (15·2)	21,422	149·2 (14·5)
Weight (kg)	32,053	46·3 (17·2)	21,442	45·3 (16·0)
BMI z-score	32,002	0·5 (1·2)	21,403	0·5 (1·2)
Average minutes of MVPA[a] per day	21,612	49·2 (28·3)	21,612	49·2 (28·3)
Sex: N (%) female	32,330	20,305 (63%)	21,606	13,472 (62%)
IOTF[b] grade: N (%) overweight and obese	31,798	8,516 (27%)	21,323	5,393 (25%)
Race: N (%) White	25,854	15,189 (59%)	17,232	10,595 (62%)
Maternal education: N (%) up to and including compulsory education	24,303	9,489 (39%)	16,814	6,160 (37%)

[a]MVPA = moderate-vigorous physical activity; [b]IOTF = International Obesity Task Force; SD = standard deviation

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Table 3. Physical activity prevalence under different operationalisations of the public health guidelines

		Prevalence: n (%)			
	N	**DM**	**AM**	**AM5**	**AM15**
Total sample	21,612	1138 (5.3%)	6471 (29.9%)	6363 (29.4%)	5132 (23.7%)
Sex					
Males	8,134	862 (10.6%)	4090 (50.3%)	4023 (49.5%)	3301 (40.6%)
Females	13,472	276 (2.0%)	2380 (17.7%)	2339 (17.4%)	1830 (13.6%)
OR[a] (95% CI)	..	*0·19 (0·15,0·23)*	*0·23 (0·21,0·25)*	*0·23 (0·21,0·25)*	*0·24 (0·22,0·27)*
Race					
White	10,595	562 (5·3%)	3271 (30·9%)	3199 (30·2%)	2525 (23·8%)
Other	6,637	194 (2·9%)	1308 (19·7%)	1288 (19·4%)	1019 (15·4%)
OR[b] (95% CI)	..	*0·75 (0·61,0·92)*	*0·74 (0·67,0·81)*	*0·75 (0·68,0·82)*	*0·76 (0·69,0·85)*
Maternal Education					
≤compulsory	6,160	383 (6·2%)	1927 (31·3%)	1893 (30·7%)	1539 (25·0%)
>compulsory	10,654	528 (5·0%)	3216 (30·2%)	3170 (29·8%)	2595 (24·4%)
OR[c] (95% CI)	..	*0.80 (0.67,0.95)*	*0·89 (0·82,0·98)*	*0·90 (0·82,0·98)*	*0·89 (0·81,0·98)*
Age					
5-9y	4,219	458 (10·9%)	1878 (44·5%)	1821 (43·2%)	1324 (31·4%)
10-13y	13,657	617 (4·5%)	4086 (29·9%)	4041 (29·6%)	3417 (25·0%)
OR[d] (95% CI)	..	*0·51 (0·42,0·63)*	*0·46 (0·42,0·52)*	*0·48 (0·43,0·54)*	*0·59 (0·52,0·67)*
≥14y	3,676	60 (2%)	498 (13·5%)	492 (13·4%)	384 (10·4%)
OR[d] (95% CI)	..	*0.23 (0.16,0.33)*	*0·27 (0·24,0·32)*	*0·29 (0·25,0·34)*	*0·38 (0·32,0·44)*

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA; OR = odds ratio

[a] Reference category = males, adjusted for country, study, race, maternal education, and age; [b] Reference category = White, adjusted for country, study, sex, maternal education, and age; [c] Reference category = ≤compulsory education, adjusted for country, study, race, sex, and age; [d] Reference category = 5-9.9y, adjusted for country, study, race, maternal education, and sex.

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Table 4. Associations between health indicators and different definitions of physical activity guideline compliance

	BMI-z score	Waist (cm)	LDL (mmol/l)	Insulin (pmol/l)	HDL (mmol/l)	Glucose (mmol/l)	Triglycerides[a]	DBP (mmHg)	SBP (mmHg)
N[b]	14,026	10,157	5,049	2,248	6,467	2,267	5,040	8,172	8,194
DM									
N[c]	1,127	866	494	250	566	254	489	753	755
Est. (S.E.)	-0·21 (0.05)	-1·93 (0.41)	-0·09 (0.04)	-7·94 (3.89)	0·05 (0.02)	-0·10 (0.04)	-0·03 (0.01)	-0·41 (0.37)	-1·74 (0.46)
P-value	<0·001	<0·001	0·02	0·04	0·01	0·01	<0·001	0·27	<0·001
AM									
N[c]	6,407	4,983	2,570	1,118	2,999	1,130	2,549	4,129	4,137
Est. (S.E.)	-0·28 (0.03)	-2·63 (0.21)	-0·06 (0.02)	-10·62 (2.22)	0·05 (0.01)	-0·09 (0.02)	-0·02 (0.01)	-0·80 (0.20)	-2·01 (0.24)
P-value	<0·001	<0·001	<0·001	<0·001	<0·001	<0·001	<0·001	<0·001	<0·001
AM5									
N[c]	6,299	4,895	2,532	1,086	2,957	1,098	2,511	4,055	4,063
Est. (S.E.)	-0·28 (0.03)	-2·65 (0.21)	-0·06 (0.02)	-10·26 (2.23)	0·04 (0.01)	-0·09 (0.02)	-0·02 (0.01)	-0·79 (0.20)	-1·96 (0.24)
P-value	<0·001	<0·001	<0·001	<0·001	<0·001	<0·001	<0·001	<0·001	<0·001
AM15									
N[c]	5,083	3,915	2,073	785	2,432	794	2,057	3,307	3,314
Est. (S.E.)	-0·30 (0.03)	-2·82 (0.22)	-0·07 (0.02)	-10·60 (2.45)	0·05 (0.01)	-0·10 (0.02)	-0·02 (0.01)	-0·66 (0.21)	-1·70 (0.25)
P-value	<0·001	<0·001	<0·001	<0·001	<0·001	<0·001	<0·001	<0·001	<0·001

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA; Est = estimate; S.E. = standard error; LDL = low density lipoprotein cholesterol; HDL = high density lipoprotein cholesterol; DBP = diastolic blood pressure; SBP = systolic blood pressure

[a] Triglyceride values (mmol/l) were log-transformed due to skewed data; [b] Number of participants with data for each health indicator; [c] Number of participants with data for the health indicator *and* complying with the physical activity guideline definition.

Associations were adjusted for sex, ethnicity, maternal education, age, study, and country.

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Supplemental digital content

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List of included studies

1. Avon Longitudinal Study of Parents And Children (UK)
    - Please note that the study website contains details of all the data that is available through a fully searchable data dictionary and variable search tool: Explore data and samples | Avon Longitudinal Study of Parents and Children | University of Bristol. http://www.bristol.ac.uk/alspac/researchers/our-data/ (accessed 10 Sep2019)
    - Boyd A, Golding J, Macleod J, et al. Cohort Profile: the 'children of the 90s'- the index offspring of the Avon Longitudinal Study of Parents and Children. *Int J Epidemiol* 2013;42:111–127.
    - Fraser A, Macdonald-Wallis C, Tilling K, et al. Cohort Profile: the Avon Longitudinal Study of Parents and Children: ALSPAC mothers cohort. *Int J Epidemiol* 2013;42:97–110
2. Children's Health and Activity Monitoring for Schools (CHAMPS; UK)
3. CHAMPS (USA)
4. Children Living in Active Neighbourhoods (CLAN; Australia)
5. Copenhagen School Child Intervention Study (Denmark)
6. European Youth Heart Study (EYHS; Denmark)
7. EYHS (Estonia)
8. EYHS (Norway)
9. EYHS (Portugal)
10. Healthy Eating And Play Study (HEAPS; Australia)
11. Iowa Bone Development Study (USA)
12. Kinder-Sportstudie (KISS; Switzerland)
13. National Health And Nutrition Examination Survey 2003-04 and 2005-06 (USA)
14. Personal and Environmental Associations with Children's Health (UK)
15. Pelotas 1993 Birth Cohort (Brazil)
16. Trial of Activity for Adolescent Girls (USA)
17. Sport, Physical activity and Eating behavior: Environmental Determinants in Young people (UK)

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Table 1. Descriptive characteristics of participants with and without race data

	Participants with race data		Participants without race data	
	N	**Mean (SD) or %**	**N**	**Mean (SD) or %**
Age (years)	17232	12.0 (2.3)	4380	10.7 (2.9)
Height (cm)	17162	150.5 (13.4)	4260	144.1 (17.5)
Weight (kg)	17175	46.5 (16.1)	4267	40.5 (14.9)
Moderate-vigorous physical activity (minutes per day)	17232	46.8 (27.9)	4380	58.7 (28.0)
BMI z-score	17152	0.50 (1.2)	4251	0.43 (1.1)
Male (%)	17232	35.3%	4374	46.7%
Healthy weight status (%)	17232	66.1%	4380	69.0%
Overweight weight status (%)	17232	18.0%	4380	17.0%
Obese weight status (%)	17232	7.8%	4380	5.0%
Mother has > compulsory education (%)	14087	64.4%	2727	58.1%

SD = standard deviation; BMI = body mass index

Table 2. Descriptive characteristics of participants with and without maternal education data

	Participants with maternal education data		Participants without maternal education data	
	N	**Mean (SD) or %**	**N**	**Mean (SD) or %**
Age (years)	16814	11.7 (2.5)	4798	11.9 (2.5)
Height (cm)	16684	149.1 (14.5)	4738	149.7 (14.4)
Weight (kg)	16701	45.1 (16.0)	4741	46.0 (16.3)
Moderate-vigorous physical activity (minutes per day)	16814	49.4 (28.4)	4798	48.3 (28.1)
BMI z-score	16670	0.48 (1.2)	4733	0.51 (1.3)
Male (%)	16811	38.1%	4795	36.0%
Healthy weight status (%)	16814	67.3%	4798	64.6%
Overweight weight status (%)	16814	17.5%	4798	18.5%
Obese weight status (%)	16814	7.0%	4798	7.8%
Race is 'White' (%)	14087	63.0%	3145	54.8%

SD = standard deviation; BMI = body mass index

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Table 3. Results of McNemar's test, examining the magnitude and significance of differences in compliance rates among youth, across physical activity guideline definitions (for the total sample, by sex, and by race)

	Total sample		Males		Females		White		Other race	
	χ^2	p	χ^2	p	χ^2	p	χ^2	p	χ^2	p
% compliant with DM vs AM	5331·00	<0·01	3226·00	<0·01	2102·00	<0·01	2707·00	<0·01	1112·00	<0·01
% compliant with AM vs AM5	106·01	<0·01	65·02	<0·01	39·02	<0·01	70·01	<0·01	··	<0·01
% compliant with AM vs AM15	1337·00	<0·01	787·00	<0·01	548·00	<0·01	744·00	<0·01	287·00	<0·01
% compliant with AM5 vs AM15	1229·00	<0·01	720·00	<0·01	507·00	<0·01	672·00	<0·01	267·00	<0·01

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA

Table 4. Results of McNemar's test, examining the magnitude and significance of differences in compliance rates among youth, across physical activity guideline definitions (by maternal education status and age)

	≤ compulsory education		> compulsory education		5-9.9y		10-13.9y		>14y	
	χ^2	p	χ^2	p	χ^2	χ^2	p	χ^2	p	χ^2
% compliant with DM vs AM	1542·00	<0·01	2686·00	<0·01	1418·00	1542·00	<0·01	2686·00	<0·01	1418·00
% compliant with AM vs AM5	32·03	<0·01	44·02	<0·01	55·02	32·03	<0·01	44·02	<0·01	55·02
% compliant with AM vs AM15	386·00	<0·01	619·00	<0·01	552·00	386·00	<0·01	619·00	<0·01	552·00
% compliant with AM5 vs AM15	1542·00	<0·01	2686·00	<0·01	1418·00	1542·00	<0·01	2686·00	<0·01	1418·00

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA

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Table 5. Sensitivity analyses to test the effects of data analysis decisions on physical activity compliance estimates (results for males and females)

		Total sample	Males	Females	*OR*[a] *(95% CI[b])*
		n=21,612	n=8,134	n=13,472	
% compliant with DM	Evenson cutpoints, 60 minutes, ≥4 valid days[c]	5·3	10·6	2·0	*0·19 (0·15,0·23)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	7·0	13·3	3·2	*0·23 (0·20,0·27)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	0·8	1·9	0·2	*0·19 (0·12,0·31)*
	Evenson cutpoints, 60 minutes, 7 valid days[d]	4·1	7·6	1·1	*0·14 (0·08, 0·23)*
% compliant with AM	Evenson cutpoints, 60 minutes, ≥4 valid days	29·9	50·3	17·7	*0·23 (0·21,0·25)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	35·5	56·7	22·8	*0·25 (0·23,0·27)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	8·6	17·7	3·1	*0·17 (0·14,0·19)*
	Evenson cutpoints, 60 minutes, 7 valid days[d]	35·1	53·2	20·1	*0·20 (0·17, 0·23)*
% compliant with AM5	Evenson cutpoints, 60 minutes, ≥4 valid days	29·4	49·5	17·4	*0·23 (0·21,0·25)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	34·7	55·4	22·3	*0·25 (0·23,0·27)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	6·4	13·3	2·3	*0·17 (0·14,0·20)*
	Evenson cutpoints, 60 minutes, 7 valid days[d]	35·0	53·2	20	*0·20 (0·17, 0·23)*
% compliant with AM15	Evenson cutpoints, 60 minutes, ≥4 valid days	23·7	40·6	13·6	*0·24 (0·22,0·27)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	26·4	43·4	16·2	*0·27 (0·25,0·29)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	2·4	4·8	1·0	*0·20 (0·15,0·27)*
	Evenson cutpoints, 60 minutes, 7 valid days[d]	31·6	48·2	17·9	*0·21 (0·18, 0·25)*

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA
[a] Reference category = Male, adjusted for study, maternal education, age, race; [b] CI: confidence interval; [c] Analyses reported in main tables; [d] Sample size of 5,721 (2,587 males, 3,131 females)

ACCEPTED

Table 6. Sensitivity analyses to test the effects of data analysis decisions on physical activity compliance estimates (results by race)

		White	Other	*OR*[a]
		n=10,595	n=6,637	*(95% CI[b])*
% compliant with DM	Evenson cutpoints, 60 minutes, ≥4 valid days	5·3	2·9	*0·71 (0·59,0·85)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	7·2	4·0	*0·75 (0·61,0·92)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	0·8	0·5	*1·10 (0·68,1·78)*
	Evenson cutpoints, 60 minutes, 7 valid days[c]	3·7	2·3	*0·68 (0·41, 1·14)*
% compliant with AM	Evenson cutpoints, 60 minutes, ≥4 valid days	30·9	19·7	*0·74 (0·67,0·81)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	36·5	24·0	*0·74 (0·67,0·81)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	9·1	5·0	*0·77 (0·65,0·90)*
	Evenson cutpoints, 60 minutes, 7 valid days[c]	34·5	26·1	*0·88 (0·72, 1·07)*
% compliant with AM5	Evenson cutpoints, 60 minutes, ≥4 valid days	30·2	19·4	*0·75 (0·68,0·82)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	35·4	23·6	*0·75 (0·68,0·82)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	6·4	3·9	*0·76 (0·64,0·91)*
	Evenson cutpoints, 60 minutes, 7 valid days[c]	34·4	26·0	*0·87 (0·71, 1·07)*
% compliant with AM15	Evenson cutpoints, 60 minutes, ≥4 valid days	23·8	15·4	*0·77 (0·70,0·85)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	26·5	17·5	*0·76 (0·69,0·85)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	2·1	1·9	*1·07 (0·82,1·39)*
	Evenson cutpoints, 60 minutes, 7 valid days[c]	31·3	22·6	*0·80 (0·65, 0·98)*

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA
[a] Reference category = White, adjusted for study, maternal education, age, sex; [b] CI: confidence interval; [c] Sample size of 2,905 for 'White' participants and 1,338 for 'Other' participants

ACCEPTED

Table 7. Sensitivity analyses to test the effects of data analysis decisions on physical activity compliance estimates (results by socioeconomic status)

		≤compulsory ed[a] n=6,160	>compulsory ed[b] n=10,654	*OR[c] (95% CI[d])*
% compliant with DM	Evenson cutpoints, 60 minutes, ≥4 valid days	6·2	5·0	*0·83 (0·71,0·97)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	8·1	6·7	*0·80 (0·67,0·95)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	1·0	0·7	*0·84 (0·55,1·29)*
	Evenson cutpoints, 60 minutes, 7 valid days[e]	4·8	4·2	*0·76 (0·51, 1·13)*
% compliant with AM	Evenson cutpoints, 60 minutes, ≥4 valid days	31·3	30·2	*0·94 (0·86,1·02)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	36·5	36·0	*0·89 (0·82,0·98)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	9·0	8·7	*0·95 (0·83,1·10)*
	Evenson cutpoints, 60 minutes, 7 valid days[e]	36·9	35·3	*0·85 (0·71, 1·01)*
% compliant with AM5	Evenson cutpoints, 60 minutes, ≥4 valid days	30·7	29·8	*0·94 (0·86,1·02)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	35·6	35·2	*0·90 (0·82,0·98)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	6·8	6·8	*0·99 (0·84,1·17)*
	Evenson cutpoints, 60 minutes, 7 valid days[e]	36·8	35·3	*0·85 (0·71, 1·01)*
% compliant with AM15	Evenson cutpoints, 60 minutes, ≥4 valid days	25·0	24·4	*0·93 (0·85,1·02)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	27·4	27·3	*0·89 (0·81,0·98)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	2·5	2·6	*1·07 (0·83,1·39)*
	Evenson cutpoints, 60 minutes, 7 valid days[e]	33·6	31·7	*0·86 (0·72, 1·03)*

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA
[a] mother received compulsory education or less; [b] mother completed more than compulsory education; [c] Reference category = ≤ compulsory ed, adjusted for study, race, age, sex; [d] CI: confidence interval; [e] Sample size of 1,445 for '≤compulsory ed' and 3,154 for '>compulsory ed'.

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Table 8. Sensitivity analyses to test the effects of data analysis decisions on physical activity compliance estimates (results by age group)

		5-9·9y[a] n=4,219	10-13·9y[a] n=13,657	*OR[b] (95% CI[c])*	≥14y[a] n=3,676	*OR[b] (95% CI[c])*
% compliant with DM	Evenson cutpoints, 60 minutes, ≥4 valid days	10·9	4·5	*0·51 (0·42,0·63)*	1·6	*0·23 (0·16,0·33)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	13·7	6·2	*0·51 (0·42,0·61)*	2·3	*0·24 (0·18,0·33)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	1·8	0·7	*0·53 (0·33,0·84)*	0·4	*0·48 (0·25,0·94)*
	Evenson cutpoints, 60 minutes, 7 valid days[d]	8·8	3·8	*0·52 (0·25, 1·05)*	1·3	*0·35 (0·12, 1·00)*
% compliant with AM	Evenson cutpoints, 60 minutes, ≥4 valid days	44·5	29·9	*0·46 (0·42,0·52)*	13·5	*0·27 (0·24,0·32)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	51·7	35·6	*0·44 (0·39,0·49)*	16·9	*0·27 (0·23,0·31)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	12·1	8·6	*0·64 (0·54,0·76)*	4·6	*0·51 (0·40,0·65)*
	Evenson cutpoints, 60 minutes, 7 valid days[d]	52·8	35·7	*0·37 (0·27, 0·49)*	13·9	*0·21 (0·14, 0·32)*
% compliant with AM5	Evenson cutpoints, 60 minutes, ≥4 valid days	43·2	29·6	*0·48 (0·43,0·54)*	13·4	*0·29 (0·25,0·34)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	49·7	35·1	*0·47 (0·42,0·52)*	16·5	*0·29 (0·25,0·34)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	9·0	6·7	*0·62 (0·51,0·76)*	2·6	*0·39 (0·29,0·52)*
	Evenson cutpoints, 60 minutes, 7 valid days[d]	52·8	35·6	*0·36 (0·27, 0·49)*	13·9	*0·21 (0·14, 0·32)*
% compliant with AM15	Evenson cutpoints, 60 minutes, ≥4 valid days	31·4	25·0	*0·59 (0·52,0·67)*	10·4	*0·38 (0·32,0·44)*
	Evenson cutpoints, 55 minutes, ≥4 valid days	33·5	28·1	*0·62 (0·55,0·69)*	12·2	*0·40 (0·35,0·47)*
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	3·4	2·5	*0·55 (0·41,0·75)*	1·2	*0·35 (0·22,0·56)*
	Evenson cutpoints, 60 minutes, 7 valid days[d]	45·7	32·4	*0·41 (0·30, 0·56)*	12·8	*0·24 (0·16, 0·37)*

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA

[a] y = years of age; [b] Reference category = 5-9·9y, adjusted for study, race, maternal education and sex; [c] CI = confidence interval; [d] Sample size for 5-9·9 year olds = 600, for 10-13·9 year olds = 4,490, and for >14 year olds = 626.

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Table 9. Sensitivity analyses to test the effects of data analysis decisions on associations between physical activity compliance and health indicators (results for BMI-z score)

		N	Est.	S.E.	Sig	95% C.I.[b]
Compliance with DM	Evenson cutpoints, 60 minutes, ≥4 valid days[a]	14,026	-0·21	0·05	<0·01	-0·31, -0·11
	Evenson cutpoints, 55 minutes, ≥4 valid days	14,026	-0·21	0·04	<0·01	-0·30, -0·13
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	14,026	-0·27	0·12	0·02	-0·51, -0·04
	Evenson cutpoints, 60 minutes, 7 valid days	3,551	-0·43	0·11	<0·01	-0·65, -0·21
Compliance with AM	Evenson cutpoints, 60 minutes, ≥4 valid days	14,026	-0·28	0·03	<0·01	-0·33, -0·23
	Evenson cutpoints, 55 minutes, ≥4 valid days	14,026	-0·26	0·02	<0·01	-0·31, -0·22
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	14,026	-0·30	0·04	<0·01	-0·38, -0·22
	Evenson cutpoints, 60 minutes, 7 valid days	3,551	-0·31	0·05	<0·01	-0·40, -0·22
Compliance with AM5	Evenson cutpoints, 60 minutes, ≥4 valid days	14,026	-0·28	0·03	<0·01	-0·33, -0·23
	Evenson cutpoints, 55 minutes, ≥4 valid days	14,026	-0·26	0·02	<0·01	-0·31, -0·22
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	14,026	-0·34	0·05	<0·01	-0·43, -0·25
	Evenson cutpoints, 60 minutes, 7 valid days	3,551	-0·31	0·05	<0·01	-0·41, -0·22
Compliance with AM15	Evenson cutpoints, 60 minutes, ≥4 valid days	14,026	-0·30	0·03	<0·01	-0·35, -0·25
	Evenson cutpoints, 55 minutes, ≥4 valid days	14,026	-0·29	0·03	<0·01	-0·35, -0·24
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	14,026	-0·38	0·07	<0·01	-0·52, -0·24
	Evenson cutpoints, 60 minutes, 7 valid days	3,551	-0·39	0·05	<0·01	-0·48, -0·29

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA
[a] Analyses reported in main tables; [b] 95% confidence interval

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Table 10. Sensitivity analyses to test the effects of data analysis decisions on associations between physical activity compliance and health indicators (results for waist measures)

		N	Est.	S.E.	Sig	95% C.I.[b]
Compliance with DM	Evenson cutpoints, 60 minutes, ≥4 valid days[a]	10,157	-1·93	0·41	<0·01	-2·73, -1·14
	Evenson cutpoints, 55 minutes, ≥4 valid days	10,157	-1·80	0·36	<0·01	-2·50, -1·10
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	10,157	-2·39	0·97	0·01	-4·28, -0·50
	Evenson cutpoints, 60 minutes, 7 valid days	3,223	-3·48	0·89	<0·01	-5·22, -1·74
Compliance with AM	Evenson cutpoints, 60 minutes, ≥4 valid days	10,157	-2·63	0·21	<0·01	-3·04, -2·21
	Evenson cutpoints, 55 minutes, ≥4 valid days	10,157	-2·43	0·20	<0·01	-2·83, -2·03
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	10,157	-2·48	0·32	<0·01	-3·10, -1·86
	Evenson cutpoints, 60 minutes, 7 valid days	3,223	-3·06	0·38	<0·01	-3·80, -2·32
Compliance with AM5	Evenson cutpoints, 60 minutes, ≥4 valid days	10,157	-2·65	0·21	<0·01	-3·06, -2·23
	Evenson cutpoints, 55 minutes, ≥4 valid days	10,157	-2·45	0·20	<0·01	-2·85, -2·05
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	10,157	-2·82	0·36	<0·01	-3·53, -2·11
	Evenson cutpoints, 60 minutes, 7 valid days	3,223	-3·07	0·38	<0·01	-3·81, -2·34
Compliance with AM15	Evenson cutpoints, 60 minutes, ≥4 valid days	10,157	-2·82	0·22	<0·01	-3·26, -2·39
	Evenson cutpoints, 55 minutes, ≥4 valid days	10,157	-2·75	0·21	<0·01	-3·17, -2·32
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	10,157	-2·79	0·58	<0·01	-3·92, -1·66
	Evenson cutpoints, 60 minutes, 7 valid days	3,223	-3·62	0·38	<0·01	-4·36, -2·87

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA
[a] Analyses reported in main tables; [b] 95% confidence interval

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Table 11. Sensitivity analyses to test the effects of data analysis decisions on associations between physical activity compliance and health indicators (results for LDL cholesterol [mmol/l])

		N	Est.	S.E.	Sig	95% C.I.[b]
Compliance with DM	Evenson cutpoints, 60 minutes, ≥4 valid days[a]	5,049	-0·09	0·04	0·02	-0·16, -0·02
	Evenson cutpoints, 55 minutes, ≥4 valid days	5,049	-0·08	0·03	0·01	-0·14, -0·02
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	5,049	-0·10	0·09	0·25	-0·27, 0·07
	Evenson cutpoints, 60 minutes, 7 valid days	1,651	-0·07	0·07	0·36	-0·21, 0·07
Compliance with AM	Evenson cutpoints, 60 minutes, ≥4 valid days	5,049	-0·06	0·02	<0·01	-0·10, -0·03
	Evenson cutpoints, 55 minutes, ≥4 valid days	5,049	-0·05	0·02	0·01	-0·09, -0·01
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	5,049	-0·07	0·03	0·02	-0·12, -0·01
	Evenson cutpoints, 60 minutes, 7 valid days	1,651	-0·09	0·03	0·01	-0·15, -0·02
Compliance with AM5	Evenson cutpoints, 60 minutes, ≥4 valid days	5,049	-0·06	0·02	<0·01	-0·10, -0·03
	Evenson cutpoints, 55 minutes, ≥4 valid days	5,049	-0·05	0·02	0·01	-0·09, -0·01
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	5,049	-0·07	0·03	0·03	-0·13, -0·01
	Evenson cutpoints, 60 minutes, 7 valid days	1,651	-0·09	0·03	0·01	-0·15, -0·02
Compliance with AM15	Evenson cutpoints, 60 minutes, ≥4 valid days	5,049	-0·07	0·02	<0·01	-0·11, -0·03
	Evenson cutpoints, 55 minutes, ≥4 valid days	5,049	-0·06	0·02	<0·01	-0·10, -0·02
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	5,049	-0·06	0·05	0·24	-0·16, 0·04
	Evenson cutpoints, 60 minutes, 7 valid days	1,651	-0·09	0·03	0·01	-0·15, -0·02

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA
[a] Analyses reported in main tables; [b] 95% confidence interval

ACCEPTED

Table 12. Sensitivity analyses to test the effects of data analysis decisions on associations between physical activity compliance and health indicators (results for insulin [pmol/l])

		N	Est.	S.E.	Sig	95% C.I.[b]
Compliance with DM	Evenson cutpoints, 60 minutes, ≥4 valid days[a]	2,248	-7·94	3·89	0·04	-15·57, -0·31
	Evenson cutpoints, 55 minutes, ≥4 valid days	2,248	-7·23	3·43	0·04	-13·97, -0·50
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	2,248	-19·62	8·52	0·02	-36·33, -2·91
	Evenson cutpoints, 60 minutes, 7 valid days	218	-12·32	26·68	0·65	-64·90, 40·26
Compliance with AM	Evenson cutpoints, 60 minutes, ≥4 valid days	2,248	-10·62	2·22	<0·01	-14·98, -6·26
	Evenson cutpoints, 55 minutes, ≥4 valid days	2,248	-10·27	2·15	<0·01	-14·49, -6·05
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	2,248	-11·34	3·15	<0·01	-17·52, -5·15
	Evenson cutpoints, 60 minutes, 7 valid days	218	-21·02	9·81	0·03	-40·36, -1·68
Compliance with AM5	Evenson cutpoints, 60 minutes, ≥4 valid days	2,248	-10·26	2·23	<0·01	-14·63, -5·89
	Evenson cutpoints, 55 minutes, ≥4 valid days	2,248	-9·47	2·16	<0·01	-13·70, -5·24
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	2,248	-14·53	3·90	<0·01	-22·17, -6·88
	Evenson cutpoints, 60 minutes, 7 valid days	218	-21·02	9·81	0·03	-40·36, -1·68
Compliance with AM15	Evenson cutpoints, 60 minutes, ≥4 valid days	2,248	-10·60	2·45	<0·01	-15·42, -5·79
	Evenson cutpoints, 55 minutes, ≥4 valid days	2,248	-9·56	2·40	<0·01	-14·27, -4·85
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	2,248	-14·28	6·55	0·03	-27·12, -1·43
	Evenson cutpoints, 60 minutes, 7 valid days	218	-23·96	10·05	0·02	-43·76, -4·16

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA
[a] Analyses reported in main tables; [b] 95% confidence interval

ACCEPTED

Table 13. Sensitivity analyses to test the effects of data analysis decisions on associations between physical activity compliance and health indicators (results for HDL cholesterol [mmol/l])

		N	Est.	S.E.	Sig	95% C.I.[b]
Compliance with DM	Evenson cutpoints, 60 minutes, ≥4 valid days[a]	6,467	0·05	0·02	0·01	0·01, 0·08
	Evenson cutpoints, 55 minutes, ≥4 valid days	6,467	0·04	0·01	<0·01	0·02, 0·07
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	6,467	0·03	0·04	0·48	-0·05, 0·10
	Evenson cutpoints, 60 minutes, 7 valid days	2,069	0·10	0·03	<0·01	0·03, 0·17
Compliance with AM	Evenson cutpoints, 60 minutes, ≥4 valid days	6,467	0·05	0·01	<0·01	0·03, 0·06
	Evenson cutpoints, 55 minutes, ≥4 valid days	6,467	0·04	0·01	<0·01	0·02, 0·06
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	6,467	0·05	0·01	<0·01	0·02, 0·07
	Evenson cutpoints, 60 minutes, 7 valid days	2,069	0·05	0·02	<0·01	0·02, 0·08
Compliance with AM5	Evenson cutpoints, 60 minutes, ≥4 valid days	6,467	0·04	0·01	<0·01	0·03, 0·06
	Evenson cutpoints, 55 minutes, ≥4 valid days	6,467	0·04	0·01	<0·01	0·02, 0·06
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	6,467	0·05	0·01	<0·01	0·02, 0·08
	Evenson cutpoints, 60 minutes, 7 valid days	2,069	0·05	0·02	<0·01	0·02, 0·08
Compliance with AM15	Evenson cutpoints, 60 minutes, ≥4 valid days	6,467	0·05	0·01	<0·01	0·03, 0·07
	Evenson cutpoints, 55 minutes, ≥4 valid days	6,467	0·05	0·01	<0·01	0·03, 0·06
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	6,467	0·04	0·02	0·10	-0·01, 0·08
	Evenson cutpoints, 60 minutes, 7 valid days	2,069	0·04	0·02	0·01	0·01, 0·07

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA
[a] Analyses reported in main tables; [b] 95% confidence interval

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Table 14. Sensitivity analyses to test the effects of data analysis decisions on associations between physical activity compliance and health indicators (results for glucose [mmol/l])

		N	Est.	S.E.	Sig	95% C.I.[b]
Compliance with DM	Evenson cutpoints, 60 minutes, ≥4 valid days[a]	2,267	-0·10	0·04	0·01	-0·17, 0·03
	Evenson cutpoints, 55 minutes, ≥4 valid days	2,267	-0·09	0·03	<0·01	-0·15, -0·03
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	2,267	-0·13	0·08	0·10	-0·28, 0·02
	Evenson cutpoints, 60 minutes, 7 valid days	221	-0·42	0·18	0·03	-0·78, -0·05
Compliance with AM	Evenson cutpoints, 60 minutes, ≥4 valid days	2,267	-0·09	0·02	<0·01	-0·13, -0·05
	Evenson cutpoints, 55 minutes, ≥4 valid days	2,267	-0·09	0·02	<0·01	-0·13, -0·06
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	2,267	-0·12	0·03	<0·01	-0·18, -0·07
	Evenson cutpoints, 60 minutes, 7 valid days	221	-0·16	0·07	0·02	-0·29, -0·02
Compliance with AM5	Evenson cutpoints, 60 minutes, ≥4 valid days	2,267	-0·09	0·02	<0·01	-0·13, -0·05
	Evenson cutpoints, 55 minutes, ≥4 valid days	2,267	-0·09	0·02	<0·01	-0·13, -0·06
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	2,267	-0·11	0·04	<0·01	-0·18, -0·04
	Evenson cutpoints, 60 minutes, 7 valid days	221	-0·16	0·07	0·02	-0·29, -0·02
Compliance with AM15	Evenson cutpoints, 60 minutes, ≥4 valid days	2,267	-0·10	0·02	<0·01	-0·14, -0·05
	Evenson cutpoints, 55 minutes, ≥4 valid days	2,267	-0·09	0·02	<0·01	-0·13, -0·05
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	2,267	-0·11	0·06	0·07	-0·23, 0·01
	Evenson cutpoints, 60 minutes, 7 valid days	221	-0·17	0·07	0·02	-0·31, -0·03

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA
[a] Analyses reported in main tables; [b] 95% confidence interval

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Table 15. Sensitivity analysess to test the effects of data analysis decisions on associations between physical activity compliance and health indicators (results for triglycerides [mmol/l; log transformed values])

		N	Est.	S.E.	Sig	95% C.I.[b]
Compliance with DM	Evenson cutpoints, 60 minutes, ≥4 valid days[a]	5,040	-0·03	0·01	<0·01	-0·05, -0·01
	Evenson cutpoints, 55 minutes, ≥4 valid days	5,040	-0·03	0·01	<0·01	-0·05, -0·01
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	5,040	-0·06	0·03	0·02	-0·11, -0·01
	Evenson cutpoints, 60 minutes, 7 valid days	1,651	-0·03	0·02	0·17	-0·07, 0·01
Compliance with AM	Evenson cutpoints, 60 minutes, ≥4 valid days	5,040	-0·02	0·01	<0·01	-0·03, -0·01
	Evenson cutpoints, 55 minutes, ≥4 valid days	5,040	-0·02	0·01	<0·01	-0·03, -0·01
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	5,040	-0·02	0·01	0·02	-0·04, 0·00
	Evenson cutpoints, 60 minutes, 7 valid days	1,651	-0·01	0·01	0·17	-0·03, 0·01
Compliance with AM5	Evenson cutpoints, 60 minutes, ≥4 valid days	5,040	-0·02	0·01	<0·01	-0·03, -0·01
	Evenson cutpoints, 55 minutes, ≥4 valid days	5,040	-0·02	0·01	<0·01	-0·03, -0·01
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	5,040	-0·02	0·01	0·08	-0·04, 0·00
	Evenson cutpoints, 60 minutes, 7 valid days	1,651	-0·02	0·01	0·13	-0·04, 0·00
Compliance with AM15	Evenson cutpoints, 60 minutes, ≥4 valid days	5,040	-0·02	0·01	<0·01	-0·04, -0·01
	Evenson cutpoints, 55 minutes, ≥4 valid days	5,040	-0·02	0·01	<0·01	-0·03, -0·01
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	5,040	-0·05	0·02	<0·01	-0·08, -0·02
	Evenson cutpoints, 60 minutes, 7 valid days	1,651	-0·02	0·01	0·05	-0·04, -0·00

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA
[a] Analyses reported in main tables; [b] 95% confidence interval

ACCEPTED

Table 16. Sensitivity analyses to test the effects of data analysis decisions on associations between physical activity compliance and health indicators (results for diastolic blood pressure [mmHg])

		N	Est.	S.E.	Sig	95% C.I.[b]
Compliance with DM	Evenson cutpoints, 60 minutes, ≥4 valid days[a]	8,172	-0·41	0·37	0·27	-1·14, 0·32
	Evenson cutpoints, 55 minutes, ≥4 valid days	8,172	-0·76	0·33	0·02	-1·41, -0·12
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	8,172	-0·01	0·85	0·99	-1·68, 1·66
	Evenson cutpoints, 60 minutes, 7 valid days	2,640	-0·45	0·77	0·56	-1·96, 1·07
Compliance with AM	Evenson cutpoints, 60 minutes, ≥4 valid days	8,172	-0·80	0·20	<0·01	-1·19, -0·41
	Evenson cutpoints, 55 minutes, ≥4 valid days	8,172	-0·99	0·19	<0·01	-1·37, -0·62
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	8,172	-0·53	0·29	0·07	-1·10, 0·04
	Evenson cutpoints, 60 minutes, 7 valid days	2,640	-0·70	0·34	0·04	-1·36, -0·04
Compliance with AM5	Evenson cutpoints, 60 minutes, ≥4 valid days	8,172	-0·79	0·20	<0·01	-1·18, -0·40
	Evenson cutpoints, 55 minutes, ≥4 valid days	8,172	-0·97	0·19	<0·01	-1·34, -0·59
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	8,172	-0·32	0·33	0·34	-0·96, 0·33
	Evenson cutpoints, 60 minutes, 7 valid days	2,640	-0·71	0·34	0·04	-1·37, -0·04
Compliance with AM15	Evenson cutpoints, 60 minutes, ≥4 valid days	8,172	-0·66	0·21	<0·01	-1·07, -0·25
	Evenson cutpoints, 55 minutes, ≥4 valid days	8,172	-0·73	0·20	<0·01	-1·13, -0·33
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	8,172	-0·33	0·54	0·55	-1·39, 0·74
	Evenson cutpoints, 60 minutes, 7 valid days	2,640	-0·73	0·34	0·03	-1·40, -0·06

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA
[a] Analyses reported in main tables; [b] 95% confidence interval

ACCEPTED

Table 17. Sensitivity analyses to test the effects of data analysis decisions on associations between physical activity compliance and health indicators (results for systolic blood pressure [mmHg])

		N	Est.	S.E.	Sig	95% C.I.[b]
Compliance with DM	Evenson cutpoints, 60 minutes, ≥4 valid days[a]	8,194	-1·74	0·46	<0·01	-2·63, -0·85
	Evenson cutpoints, 55 minutes, ≥4 valid days	8,194	-1·75	0·40	<0·01	-2·54, -0·96
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	8,194	-2·81	1·04	0·01	-4·86, -0·77
	Evenson cutpoints, 60 minutes, 7 valid days	2,649	-1·52	0·98	0·12	-3·45, 0·40
Compliance with AM	Evenson cutpoints, 60 minutes, ≥4 valid days	8,194	-2·01	0·24	<0·01	-2·48, -1·54
	Evenson cutpoints, 55 minutes, ≥4 valid days	8,194	-1·95	0·23	<0·01	-2·41, -1·49
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	8,194	-1·54	0·35	<0·01	-2·23, -0·84
	Evenson cutpoints, 60 minutes, 7 valid days	2,649	-2·02	0·43	<0·01	-2·86, -1·19
Compliance with AM5	Evenson cutpoints, 60 minutes, ≥4 valid days	8,194	-1·96	0·24	<0·01	-2·44, -1·49
	Evenson cutpoints, 55 minutes, ≥4 valid days	8,194	-1·87	0·24	<0·01	-2·33, -1·41
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	8,194	-1·64	0·40	<0·01	-2·43, -0·85
	Evenson cutpoints, 60 minutes, 7 valid days	2,649	-2·04	0·43	<0·01	-2·88, -1·20
Compliance with AM15	Evenson cutpoints, 60 minutes, ≥4 valid days	8,194	-1·70	0·25	<0·01	-2·20, -1·20
	Evenson cutpoints, 55 minutes, ≥4 valid days	8,194	-1·52	0·25	<0·01	-2·01, -1·04
	MVPA≥3000cpm, VPA≥6000cpm; 60 minutes, ≥4 valid days	8,194	-1·81	0·66	0·01	-3·11, -0·52
	Evenson cutpoints, 60 minutes, 7 valid days	2,649	-2·16	0·43	<0·01	-3·00, -1·31

DM = daily method; AM = average method; AM5 = AM + 3 days with ≥5 minutes VPA; AM15 = AM + 3 days with ≥15 minutes VPA
[a] Analyses reported in main tables; [b] 95% confidence interval

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