

differentially affect activities during different types of plays during competitions and hence would not bias this analysis. Confounding by player or game characteristics changing over time and surveillance bias are possible.

The action taken by Ivy League leadership based on epidemiologic evidence demonstrates how targeted policy changes can reduce sport-related concussion. Although these results may not generalize beyond the Ivy League, they may inform the NCAA as it considers adjusting the kickoff rules in football in all collegiate conferences.⁶

Douglas J. Wiebe, PhD
Bernadette A. D'Alonzo, MPH
Robin Harris
Margot Putukian, MD
Carolyn Campbell-McGovern

Author Affiliations: University of Pennsylvania, Philadelphia (Wiebe, D'Alonzo); Ivy League, Princeton, New Jersey (Harris, Campbell-McGovern); Princeton University, Princeton, New Jersey (Putukian).

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Corresponding Author: Douglas J. Wiebe, PhD, Department of Biostatistics, Epidemiology, and Informatics, Perelman School of Medicine, University of Pennsylvania, Blockley Hall, 423 Guardian Dr, Room 902, Philadelphia, PA 19104-6021 (dwiebe@upenn.edu).

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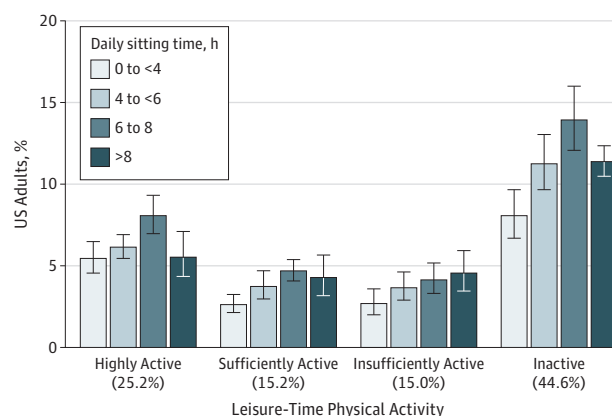
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Joint Prevalence of Sitting Time and Leisure-Time Physical Activity Among US Adults, 2015-2016

High amounts of sedentary behavior and low levels of physical activity are associated with increased risk of premature mortality and some chronic diseases.¹ Engaging in high volumes of moderate- to vigorous-intensity physical activity may reduce the mortality risk associated with excessive sedentary behavior.^{1,2} Understanding the combined prevalence of these behaviors could help practitioners determine whether to prioritize interventions targeting sedentary time, physical activity, or both. We examined patterns in joint categories of sitting time and leisure-time physical activity among US adults.

Methods | We used data from the 2015-2016 National Health and Nutrition Examination Survey (NHANES), a nationally representative survey of the noninstitutionalized, civilian US population.³ NHANES collects health information through in-home interviews and physical examinations. The National Center for Health Statistics research ethics review board approved NHANES. Adult participants (aged ≥18 years) provided written consent. The overall 2015-2016 interview response rate was 61.3%, and there were 5992 adult respondents.

Figure. Joint Distribution of Self-Reported Sitting Time and Leisure-Time Physical Activity Among US Adults, NHANES, 2015-2016



Data are percentage of US adults who reported each joint category of daily sitting time and leisure-time physical activity. Error bars indicate 95% confidence intervals. NHANES indicates National Health and Nutrition Examination Survey.

Sedentary behavior was measured as sitting time, defined as daily time spent “sitting at work, at home, getting to and from places, or with friends, including time spent sitting at a desk, traveling in a car or bus, reading, playing cards, watching television, or using a computer” and was assessed with the question “How much time do you usually spend sitting on a typical day?” Reported sitting time was categorized into quartiles of 0 to less than 4 hours, 4 to less than 6 hours, 6 to 8 hours, and more than 8 hours per day.² Respondents also reported the frequency and duration of moderate- and vigorous-intensity

leisure-time physical activity during a typical week. Total leisure-time physical activity was calculated as weekly minutes of moderate-intensity activity plus twice the reported minutes of vigorous-intensity activity and was categorized according to current guidelines as inactive (no moderate- or vigorous-intensity activity), insufficiently active (some activity but not enough to meet sufficiently active definition), sufficiently active (150-300 min/wk), or highly active (>300 min/wk).⁴

Categorical variables for sitting time and leisure-time physical activity were cross-tabulated to estimate the proportion of

Table. Joint Distribution of Self-Reported Sitting Time and Leisure-Time Physical Activity by Sex and Age Category, NHANES, 2015-2016

| Leisure-Time Physical Activity ^a | Daily Sitting Time, No. (%) [95% CI] ^b | | | |
|---|---|------------------------|------------------------|---------------------------------|
| | 0 to <4 h | 4 to <6 h | 6 to 8 h | >8 h |
| Sex | | | | |
| Men (n = 2858) | | | | |
| Inactive | 309 (7.9) [6.5-9.7] | 369 (11.2) [9.3-13.4] | 414 (13.1) [11.3-15.1] | 293 (10.5) [9.1-12.1] |
| Insufficiently active | 74 (2.5) [1.9-3.4] | 87 (3.3) [2.5-4.2] | 99 (3.6) [2.7-4.8] | 89 (4.4) [2.8-6.6] |
| Sufficiently active | 64 (2.3) [1.6-3.2] | 86 (3.2) [2.2-4.5] | 95 (4.4) [3.5-5.6] | 89 (4.6) [2.9-7.0] |
| Highly active | 182 (6.0) [4.6-7.7] | 208 (7.4) [6.3-8.8] | 252 (9.8) [8.3-11.5] | 148 (6.0) [4.4-8.1] |
| Women (n = 3065) | | | | |
| Inactive | 373 (8.2) [6.4-10.5] | 409 (11.3) [9.6-13.2] | 501 (14.7) [12.3-17.5] | 350 (12.2) [11.0-13.6] |
| Insufficiently active | 90 (2.8) [2.0-4.0] | 110 (4.0) [2.9-5.6] | 142 (4.7) [3.5-6.3] | 114 (4.7) [3.3-6.5] |
| Sufficiently active | 101 (2.9) [2.3-3.8] | 110 (4.3) [3.2-5.7] | 120 (4.9) [4.0-6.0] | 90 (3.9) [2.8-5.5] |
| Highly active | 141 (5.0) [4.1-6.0] | 137 (4.9) [4.1-5.9] | 161 (6.5) [5.0-8.4] | 116 (5.1) [3.7-7.1] |
| Age, y | | | | |
| 18-39 (n = 2208) | | | | |
| Inactive | 200 (7.6) [6.1-9.0] | 234 (9.5) [7.3-11.7] | 250 (10.5) [8.7-12.2] | 182 (8.1) [6.8-9.3] |
| Insufficiently active | 48 (2.1) [1.2-2.9] | 66 (3.2) [2.1-4.3] | 83 (3.5) [2.6-4.4] | 78 (4.1) [3.0-5.3] |
| Sufficiently active | 66 (3.1) [2.2-4.0] | 86 (3.9) [2.8-5.1] | 89 (4.7) [3.3-6.1] | 86 (5.0) [3.2-6.7] |
| Highly active | 177 (7.6) [6.0-9.2] | 181 (8.6) [7.7-9.5] | 231 (10.7) [8.9-12.5] | 151 (8.0) [6.2-9.7] |
| 40-64 (n = 2362) | | | | |
| Inactive | 329 (9.0) [6.8-11.2] | 320 (11.6) [9.0-14.1] | 366 (14.4) [11.4-17.4] | 267 (12.6) [11.0-14.3] |
| Insufficiently active | 85 (3.6) [2.0-5.1] | 79 (3.1) [1.9-4.2] | 100 (3.8) [2.6-5.1] | 94 (5.7) [3.6-7.9] |
| Sufficiently active | 67 (2.3) [1.4-3.2] | 70 (3.7) [2.3-5.2] | 84 (4.7) [3.9-5.5] | 70 (4.1) [2.4-5.7] |
| Highly active | 103 (4.6) [3.3-5.8] | 105 (4.7) [3.3-6.0] | 128 (7.2) [5.6-8.8] | 95 (5.0) [3.2-6.8] |
| ≥65 (n = 1353) | | | | |
| Inactive | 153 (7.0) [5.3-8.7] | 224 (13.7) [11.0-16.5] | 299 (19.5) [16.0-22.9] | 194 (15.1) [12.7-17.6] |
| Insufficiently active | 31 (1.9) [0.5-3.4] ^c | 52 (5.9) [2.9-9.0] | 58 (6.0) [3.5-8.6] | 31 (2.6) [0.8-4.3] ^c |
| Sufficiently active | 32 (2.2) [0.7-3.7] ^c | 40 (3.4) [1.6-5.1] | 42 (4.5) [2.3-6.8] | 23 (3.2) [1.6-4.8] |
| Highly active | 43 (3.3) [2.1-4.5] | 59 (4.6) [2.6-6.7] | 54 (4.8) [3.3-6.4] | 18 (2.1) [1.1-3.2] |

Abbreviation: NHANES, National Health and Nutrition Examination Survey.

^a Leisure-time physical activity was assessed with the following questions: (1) “In a typical week, do you do any vigorous-intensity sports, fitness, or recreational activities that cause larger increases in breathing or heart rate like running or basketball for at least 10 minutes continuously [excluding work and transportation activities that have already been mentioned]?” (2) “In a typical week, on how many days do you do vigorous-intensity sports, fitness, or recreational activities?” (3) “How much time do you spend doing vigorous-intensity sports, fitness, or recreational activities on a typical day?” (4) “In a typical week, do you do any moderate-intensity sports, fitness, or recreational activities that cause a small increase in breathing or heart rate such as brisk walking, bicycling, swimming, or golf for at least 10 minutes continuously?” (5) “In a typical week, on how many days do you do moderate-intensity sports, fitness, or recreational activities?” (6) “How much time do you spend doing moderate-intensity sports, fitness, or recreational activities on a typical day?” Total leisure-time physical activity was calculated as weekly minutes of moderate-intensity physical activity plus twice the reported minutes of vigorous-intensity physical activity and was categorized

according to current guidelines as highly active (>300 min/wk), sufficiently active (150-300 min/wk), insufficiently active (some activity but not enough to meet sufficiently active definition), or inactive (no moderate- or vigorous-intensity activity of ≥10 minutes).

^b Data are the unweighted number of respondents and percentage estimates weighted using full sample interview weights provided with NHANES data. Daily sitting time was assessed with the following question: “The following question is about sitting at work, at home, getting to and from places, or with friends, including time spent sitting at a desk, traveling in a car or bus, reading, playing cards, watching television, or using a computer. Do not include time spent sleeping. How much time do you usually spend sitting on a typical day?” Reported sitting time was categorized in approximate quartiles of 0 to less than 4, 4 to less than 6, 6 to 8, and more than 8 hours per day.

^c The relative standard error for this estimated prevalence is greater than 30%, indicating that the estimate is potentially unreliable and should be interpreted with caution.

adults in each joint category. Estimates were stratified by sex and age category. Analyses were conducted in Stata version 13.1 (StataCorp) using survey commands to account for the sampling design, and full sample interview weights were applied.

Results | We analyzed data from 5923 adults with complete data (98.8% of total). Overall, 25.7% (95% CI, 23.0%-28.5%) reported sitting for more than 8 hours per day and 44.6% (95% CI, 40.2%-49.0%) were inactive. Across joint categories, the greatest proportion of adults reported sitting for 6 to 8 hours per day and being inactive (13.9%; 95% CI, 12.1%-16.0%), followed by sitting for more than 8 hours per day and being inactive (11.4%; 95% CI, 10.5%-12.4%), and sitting for 4 to less than 6 hours per day and being inactive (11.2%; 95% CI, 9.6%-13.0%) (**Figure**). The smallest proportions reported sitting for less than 4 hours per day and being sufficiently active (2.6%; 95% CI, 2.1%-3.2%) or sitting for less than 4 hours per day and being insufficiently active (2.7%; 95% CI, 2.0%-3.6%). Patterns were similar by sex (**Table**). Some differences in the joint distribution of sitting time and leisure-time physical activity were observed between age categories. For example, the joint prevalence of sitting for more than 8 hours per day and being inactive increased with increasing age.

Discussion | These data reveal a substantial prevalence of high sitting time and physical inactivity among US adults: about 1 in 4 sit for more than 8 hours a day, 4 in 10 are physically inactive, and 1 in 10 report both. The limitations of this study include possible bias inherent in self-reported data and that physical activity episodes shorter than 10 minutes may not have been captured.

Both high sedentary behavior and physical inactivity have negative health effects, and evidence suggests that the risk of premature mortality is particularly elevated when they occur together.^{1,2} Evidence-based strategies to reduce sitting time, increase physical activity, or both would potentially benefit most US adults, particularly older adults. Practitioners can support efforts to implement programs, practices, and policies where adults live, learn, work, and play to help them sit less and spend more time being physically active.^{1,5,6}

Emily N. Ussery, PhD
Janet E. Fulton, PhD
Deborah A. Galuska, PhD
Peter T. Katzmarzyk, PhD
Susan A. Carlson, PhD

Author Affiliations: Division of Nutrition, Physical Activity, and Obesity, Centers for Disease Control and Prevention, Atlanta, Georgia (Ussery, Fulton, Galuska, Carlson); Pennington Biomedical Research Center, Louisiana State University, Baton Rouge (Katzmarzyk).

Corresponding Author: Emily N. Ussery, PhD, National Center for Chronic Disease Prevention and Health Promotion, Division of Nutrition, Physical Activity, and Obesity, Centers for Disease Control and Prevention, 4770 Buford Hwy NE, Atlanta, GA 30341 (yzv4@cdc.gov).

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Concept and design: Ussery, Fulton, Katzmarzyk, Carlson.

Acquisition, analysis, or interpretation of data: All authors.

Drafting of the manuscript: Ussery.

Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Ussery, Carlson.

Administrative, technical, or material support: Ussery, Fulton, Carlson.

Supervision: Fulton, Katzmarzyk, Carlson.

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COMMENT & RESPONSE

Validity of the qSOFA Score in Low- and Middle-Income Countries

To the Editor Dr Rudd and colleagues¹ concluded that the quick Sequential (Sepsis-Related) Organ Failure Assessment (qSOFA) score was superior to the systemic inflammatory response syndrome (SIRS) score and a baseline risk model in predicting in-hospital mortality in low- and middle-income countries (LMICs), an issue that has been debated since its introduction in the Sepsis-3 definitions.^{2,3} We are concerned that the treatment of missing data may have introduced significant bias.

More than half the data set was incomplete with respect to human immunodeficiency virus or transfer status (components of the baseline risk model) or white blood cell count (a SIRS component). The authors used the same imputation strategy (substitution of clinically normal values) that was used in the original qSOFA derivation.³ Simple imputation schemes of this kind are known to potentially yield biased estimates and systematically underestimate uncertainty in estimated parameters,⁴ both of which can lead to wrongly concluding that one score is superior. The assumption of clinical normality