Context of Physical Activity in a Representative Sample of Adults

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ABSTRACT

WELK, G. J., and Y. KIM. Context of Physical Activity in a Representative Sample of Adults. *Med. Sci. Sports Exerc.*, Vol. 47, No. 10, pp. 2102–2110, 2015. **Purpose**: The establishment of formal physical activity (PA) guidelines has led to considerable interest in quantifying participation in moderate to vigorous PA (MVPA). However, evidence on the context of MVPA at the population level is scarce. The aim of this study was to provide information on the type, location, and purpose of MVPA in a representative sample of adults. **Methods**: Data from a representative sample of 1234 Iowa adults were included in this study. Each participant performed a telephone-administered 24-h PA recall method to recall PA in the previous 24 h. Self-reported data from the recall instrument included time and types of reported activities across five distinct location and purpose codes. Reported activities were matched with corresponding metabolic equivalent (MET) scores from a reduced list of compendium of physical activities. MVPA was defined as any activity with assigned MET ≥ 3.0. **Results**: Of the top 30 most frequently reported MVPA, 16 were lifestyle activities involving walking, and only 4 can be regarded as traditional "exercises." Occupational activities (41% for purpose and 40% for location) and household activities (37% for purpose and 39% for location) accounted for nearly 80% of total reported MVPA time. Time allocations across purpose and location codes considerably differed by sociodemographic indicators. **Conclusion**: Lifestyle activities are more frequently reported than sports and/or recreational activities. Individuals with varying levels of sociodemographic indicators exhibit different patterns of use of time within a given day. A multidomain approach is needed to better understand and increase MVPA in diverse populations of US adults.
Key Words: CONTEXT, PHYSICAL ACTIVITY, ADULTS, MEASUREMENT

EPIDEMIOLOGY

The establishment of formal physical activity (PA) guidelines (29) has led to considerable interest in quantifying participation in moderate to vigorous PA (MVPA). Unfortunately, studies have reported highly disparate prevalence rates of MVPA when objective and subjective methods are compared (25,27). Differences have generally been attributed to overestimation of self-reported activity, but this is likely an overly simplistic explanation. Standard accelerometry-based methods are not well suited for capturing the more sporadic activities of daily living (20). Therefore, it is likely that accelerometers may underestimate movement and energy expenditure (EE) of lower-intensity activities that make up the bulk of our day. Objective methods can also only provide absolute (movement-based) criteria for evaluating PA. It is well known that a "light" activity may actually be of "moderate" or even "vigorous" intensity for low-fit individuals (14), but this issue is ignored with standard accelerometer processing techniques. Thus, disparities between objective and subjective estimates of PA may be due, in part, to differences between absolute and relative indicators of MVPA. To advance research on the assessment and promotion of PA, it is important to better understand the primary sources and types of PA, as well as the context in which it occurs.

A recent consensus conference sponsored by the National Institutes of Health (NIH) highlighted the specific advantages of self-report measures in providing information about the context of PA behavior (4,26). However, relatively few studies have systematically utilized self-report data to specifically understand adult PA behaviors. The most common design has been to examine time spent in different PA domains (e.g., work, household, and transportation) across various sociodemographic variables (8,9,16,21,24). Prior research (14) has identified the most frequently occurring "types" of lifestyle MVPA, and several other studies (5,10) have investigated social and environmental contexts of MVPA in adults. The American Time Use Survey has provided perhaps the richest source of information on activity patterns (10,11,28), but this data source was not designed specifically for characterizing PA behavior. No study, to date, has comprehensively characterized the underlying context and nature of MVPA in a representative sample of adults using an established and well-validated self-report measure. Experts in behavioral epidemiology have emphasized the importance of understanding the context of PA behavior to plan more effective public health interventions (23).

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The present study fills this gap by characterizing variability in the type, purpose, and location of reported MVPA using replicate single-day recalls collected as part of the Physical Activity Measurement Survey (PAMS). The PAMS project was an NIH-funded study (R01 HL91024-01A1) designed to specifically improve the accuracy and utility of self-report measures of PA (32). A representative sample of adults completed a detailed 24-h survey that captured both the purpose and the location of PA reported on a randomly selected day. The present study capitalizes on this database to advance understanding of the context of PA behaviors in healthy adults.

METHODS

Study design. Data collection for the PAMS took place over 2 yr to capture a representative sample of adults from four target counties in the US state of Iowa. Participants were recruited through a randomized telephone screening procedure using a sample purchased from Survey Sampling International. Targeted counties (two urban and two rural) were divided into two costrata based on higher or lower percentages of minorities in order to balance recruitment while keeping variation in weights down to the extent possible. Participants were required to be age between 21 and 70 yr, able to walk, and able to complete both telephone survey and written paper survey in either English or Spanish. Participants in the study were asked to complete two single-day recalls of PA on a randomly selected day.

A total of 3222 households (of 5913 valid telephone numbers) completed screening; 2143 were deemed eligible, 1648 had an adult who conceptually agreed to participate, and 1501 adults completed data collection (70% of eligible households). Details of sampling and weighting procedures are described in a separate methodology report available from the authors. Each participant signed an informed consent form before participation, and the study protocol was approved by the local Institutional Review Board.

Instrument. Data were collected using a customized interviewer-administered version of the 24-h Physical Activity Recall (PAR) developed specifically for the PAMS. The PAR protocol was based on an established, facilitated recall methodology that has been shown in previous studies to be effective for capturing details of the type and intensity of occupational, household, and leisure-time PA (6,19). Participants were asked to provide details of the type and intensity of PA performed during the day, and raw PA data were converted into estimates of EE using established metabolic equivalent (MET) codes from the compendium of physical activities (1). The present study necessitated the use of a telephone-based methodology; thus, the PAR protocol was modified to work with a Computer-Assisted Telephone Interviewing (CATI) system using Blaise software. The CATI system incorporated a reduced set of 270 activity codes that were refined using cognitive testing procedures and input from experts in PA recall. A recent study (32) supported the validity and utility of the PAR protocol for capturing PA and EE. Data from the PAR yielded estimates of EE that were equivalent to those observed from the objective monitor. Small mean absolute percent errors (i.e., 11.8%) and high correlations (i.e., 0.83) between the PAR and the objective monitor were identified (32).

A unique aspect of the refined PAR protocol was the inclusion of additional contextual codes that captured the location and purpose of each reported activity. Location of PA was coded using five distinct categories ("Work," "Home/Indoor," "Home/Outdoor," "Transportation," and "Community"). Purpose was initially coded using six different categories ("Work," "Home/Family," "Volunteering," "Exercise/Sports," "Education," and "Leisure"). However, a preliminary analysis indicated that two of the six codes ("Volunteering" and "Education") had minimal time allocations; thus, these were combined to create a combined purpose code "Other." This resulted in a total of five purpose codes: "Work," "Home/Family," "Leisure," "Exercise/Sports," and "Other." In the representative sample of adults in the present study, emphasis was placed on reported allocations based on these location and purpose codes.

Data collection. Data for the PAMS project were collected by an experienced and trained research group over a continuous 2-yr period (24 months; eight 3-month quarters) to capture the inherent variability in PA due to seasonality and weather patterns. Participants completed two separate 1-d monitoring protocols on a randomly selected day; each trial involved wearing an objective measurement tool for a 24-h period and then completing a PAR on the following day to recall the activities performed.

PAR interviews were conducted by a team of trained interviewers using a CATI system programmed specifically for the project. Each day was divided into four 6-h blocks starting from midnight, and participants were asked to report only activities performed for 5 min or greater. The interviewers selected a named activity from a computerized list of activities (based on the reduced set of activities from the compendium of physical activities [1]) and then recorded the location, purpose, and number of minutes for each activity. A series of semistructured probes was used to prompt recall and to facilitate accurate recall of the day by the participant. Greater detail is described elsewhere (32). Only data from the PAR collected in trial 1 were used for analyses in this study.

Data processing. Self-reported data were processed using standard techniques to determine reported minutes of MVPA during the day. Each PAR activity code in the data set was first assigned a corresponding MET code based on the compendium of physical activities (1). The minutes were then aggregated by participant and activity code, and accumulated minutes were checked to confirm that all participants had 1440 min of coded data. The present study focused only on the context of MVPA behaviors; thus, we created a separate data set that contained only reported activities with MET > 3.0. Sedentary behavior (i.e., MET $\leq$ 1.5) and

light PA (i.e., >1.5 MET and <3.0 MET) were not included in the analysis for the present study. The subsample of reported MVPA included corresponding location and purpose codes. The data were aggregated by ID (i.e., participants), activity type, and categories of purpose and location such that each purpose or location code had its own MVPA minutes for each reported activity for each participant. The data were then merged with a data file that included sociodemographic variables for each participant. The six sociodemographic variables of interest in the study were gender (i.e., female and male), age group (i.e., 20–29, 30–39, 40–49, and 50–71 yr), weight status defined by body mass index (i.e., normal weight, overweight, and obese), ethnicity (i.e., White, Black, and other), education background (i.e., less than high school, high school diploma/some college, and college/graduate school), and income level (i.e., <US$25,000, US$25,000–75,000, and >US$75,000).

Statistical analyses. Analyses focused on characterizing the context of the top 30 most frequently reported types of MVPA. Thus, the data were first restricted to the sample of participants who reported participating in some form of MVPA during the assessed day. Corresponding minutes for each purpose and location category across all the 30 identified MVPA were calculated and presented in proportion using stacked bars. The proportion of MVPA minutes spent in each of the five purpose and location categories was calculated across six sociodemographic variables. Differences in the proportions of MVPA between levels of each sociodemographic variable were examined for each purpose and location category using one-way analysis of variance with Bonferroni adjustment at an alpha level of 0.05. The analyses incorporated derived sampling weights to account for the complex sampling design of the PAMS project and to obtain population-level estimates of parameters. Data were managed and analyzed with STATA/SE version 12 for Windows (StataCorp LP, College Station, TX).

RESULTS

The final data set included 1489 participants with complete PAR records from the first trial, but 255 cases did not include any reported MVPA. Therefore, approximately 17% of participants (64% men and 36% women) were removed, leaving 1234 participants in the final data set. The average self-reported MVPA time (for those reporting MVPA) was 175 min (standard error, 6.9 min). Detailed characteristics of the participants (n = 1234) are presented in Table 1.

A listing of the top 30 most frequently reported MVPA, along with their corresponding time allocations for purpose and location, is presented in Figures 1 and 2, respectively. Of the top 30 reported MVPA, 24 were moderate PA (3 < MET < 5.9) and 6 were vigorous PA (MET ≥ 6). Various forms of walking dominated the list of predominant MVPA, with 16 of 30 codes specifically incorporating walking. Only four of the activities can be thought of as traditional "exercise," and these were reported by a relatively small percentage of the sample ["walk briskly for exercise" (3.2%), "health club exercise" (3.5%), "running or jogging" (3.6%), and "exercises general vigorous" (3.4%)]. It is interesting to note that the context of these four activities was not universally reported as "Exercise/Sports" (Fig. 1). Jogging/running, for example, was attributed as "Leisure" by 44.5% but as "Exercise/Sports" by 27.1%. "Weight lifting—light/moderate" was reported by approximately 4%; however, interestingly, it was categorized primarily as "Work" by nearly 60% of those who reported it, with smaller percentages of participants zreporting it as "Leisure" (13.3%) or "Exercise/Sports" (11.7%). Closer examination of the data revealed that a smaller percentage of people (n = 16) reported "weight lifting, body building, vigorous," but this did not make it to the list of top 30 activities.

TABLE 1. Sociodemographic characteristics of participants.

Variables	All (n = 1234)	Female (49.7%)	Male (50.3%)
Age, mean (SD), yr	46.1 (0.4)	46.7 (0.6)	45.6 (0.6)
Age category, % (SE)			
20–29 yr	7.8 (1.1)	6.6 (1.4)	8.9 (1.6)
30–39 yr	23.3 (1.8)	21.0 (2.5)	25.5 (2.7)
40–49 yr	34.8 (2.0)	38.1 (2.7)	31.5 (2.7)
50–71 yr	34.2 (1.6)	34.2 (2.2)	34.1 (2.4)
Body mass index, mean (SD), $kg \cdot m^{-2}$	29.8 (0.3)	29.2 (0.4)	30.4 (0.4)
Body mass index category, % (SE)			
Normal weight	25.3 (1.7)	32.1 (2.6)	18.7 (2.1)
Overweight	33.4 (1.8)	31.4 (2.5)	35.4 (2.7)
Obese	41.3 (1.9)	36.6 (2.6)	46.0 (2.8)
Ethnicity, % (SE)			
White	89.5 (1.4)	89.7 (1.8)	89.3 (2.0)
Black	6.3 (1.0)	7.1 (1.4)	5.6 (1.3)
Other	4.2 (1.0)	3.2 (1.2)	5.1 (1.6)
Education background, % (SE)			
Less than high school	3.1 (0.7)	3.9 (1.2)	2.3 (0.7)
High school diploma/some college	50.3 (2.0)	49.5 (2.7)	51.2 (2.8)
College/graduate school	46.6 (2.0)	46.7 (2.7)	46.5 (2.8)
Income level, % (SE)			
<US$25,000	12.2 (1.2)	13.9 (1.6)	10.6 (1.7)
US$25,000–75,000	45.0 (2.0)	49.3 (2.8)	40.8 (2.7)
>US$75,000	42.8 (2.0)	36.9 (2.8)	48.6 (2.9)

All values were weighted to account for the complex sampling design.
Hispanics predominated the ethnicity group "Other" (2.7% of overall sample), but there were insufficient data to produce generalizable results.

The diversity in the allocated purposes of the other top 30 activities is readily apparent in Figure 1, with the respective bars (left to right) capturing allocations from "Work," "Home/Family," "Leisure," "Exercise/Sports," and "Other," respectively. However, the patterns for some specific activities merit specific mention. Approximately 8% of the sample reported the activity "walk the dog," but there was considerable variability in the allocated purpose, with varying proportions of participants attributing it to "Work" (11%), "Home/Family" (23%), "Leisure" (23%), "Exercise/Sports" (32%), and "Other" (11%). This shows that people may view the same activity very differently. The activity "mow lawn, walking" could be thought of as a chore (i.e., Work," 11%), but the majority of people categorized it as either "Leisure" (45%) or "Exercise/Sports" (44%). Gardening is often assumed to be a hobby (i.e., "Leisure," 32%), but this was frequently categorized as "Exercise/Sports" (27%). Similar diversity was evident in the location where the activity occurred (Fig. 2).

To quantitatively examine in more detail the purpose and location of the reported activities, we averaged percent time allocations for both variables across the 30 activities (allocations

Rank	Activity Description	MET	Frequency
1	Walk gathering things or ready to leave	3	268
2	Walk moderately, strolling	3.5	235
3	Cleaning, moderate [a]	3.5	224
4	Stand child care [b]	3	182
5	Walk moderate carrying < 10lbs or nothing	3.3	157
6	Walk briskly	3.8	153
7	Stand moderate effort [c]	3.5	114
8	Walk carrying 10-25lbs	4	104
9	Stand/walk moderate work [d]	3	103
10	Walk the dog	3	101
11	Cleaning, vigorous [e]	4	79
12	Walking briskly	4	76
13	Walk outside picking up yard or garden items	3	68
14	Stand/walk heavy work [f]	5	65
15	Mow lawn, walking [g]	5	64
16	Walk and gather things [h]	3	62
17	Walk pulling hand-truck or pushing cart/wheelchair	3	52
18	Weight lifting, light/moderate	4	52
19	Running or jogging	8	45
20	Health club exercise, general	5.5	44
21	Exercises general vigorous [I]	8	43
22	Walk briskly for exercise	3.8	39
23	Shovel snow by hand	6	38
24	Carrying furniture/heavy item/boxes/household item	6	37
25	Walk carrying 25-49lbs	5	36
26	Gardening, general (planting)	4	33
27	Stand/walk very heavy work	8	32
28	Walk/run play with children, moderate	4	30
29	Driving a bus, heavy truck or tractor	3	29
30	Walk carrying 50+lbs	7.5	26

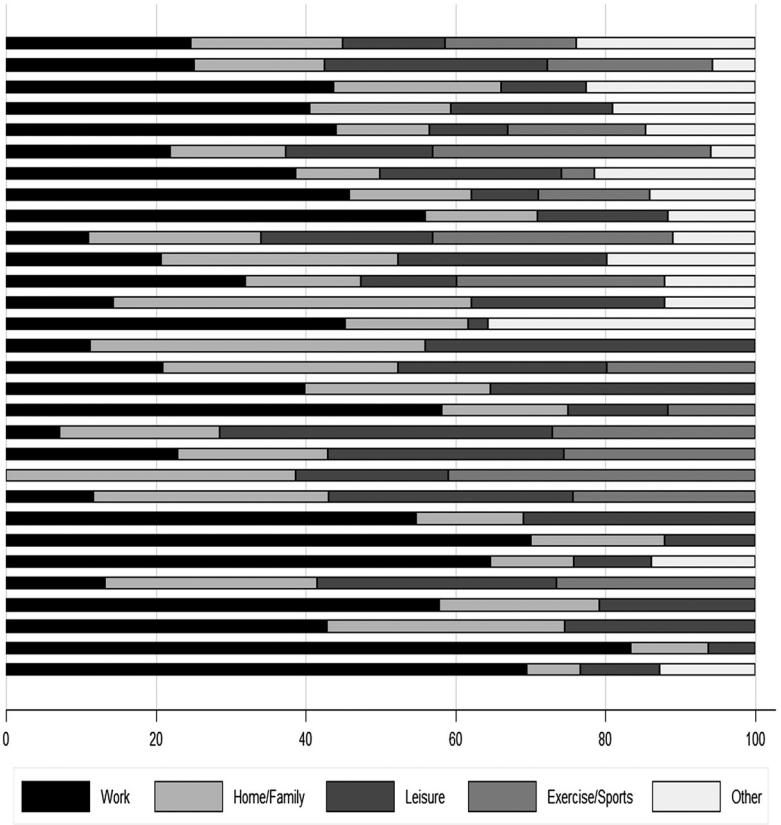

FIGURE 1—Top 30 most frequently reported MVPA and corresponding time allocations across five purpose codes: "Work," Home/Family," "Leisure," "Exercise/Sports," and "Other." [a]Cleaning, moderate (vacuum, mop, sweep). [b]Stand, child care (dressing, bathing, grooming, feeding, lifting). [c]Stand, moderate effort (packing/unpacking boxes, light lifting). [d]Stand/walk, moderate work (waiter, patient care, stocking shelves, auto repair). [e]Cleaning, vigorous (scrub floors, walls, and bathroom; sweep outside; clean garage). [f]Stand/walk, heavy work (moving furniture and boxes, loading/unloading trucks). [g]Mow lawn, walking (push, power, self-propelled mower). [h]Walk and gather things (leave, shut/lock doors, close windows). [i]Exercises general vigorous (push-ups/sit-ups/pull-ups/jumping jacks).

in Figs. 3 and 4, respectively). For purpose, the largest aggregated allocation was for "Work" (41%), followed by "Home/Family" (37%), "Leisure" (14%), "Exercise/Sports" (7%), and "Other" (1%). Men had significantly larger proportions of MVPA from "Work" than women ($P = 0.003$), but women showed a significantly larger proportion of MVPA from "Exercise/Sports" ($P = 0.049$). Younger people (20–29 yr) also reported a significantly larger proportion of MVPA from "Work" ($P = 0.080$) compared with older people (40–49 yr). However, they showed a smaller proportion for "Home/Family" ($P = 0.013$) than older people (50–71 yr). Normal-weight people had significantly smaller proportions for "Home/Family" ($P = 0.014$) than overweight people and significantly smaller proportions for "Other" ($P = 0.020$) than obese people. The "Other" ethnicity group showed significantly smaller proportions for "Leisure" than Whites ($P < 0.001$) and Blacks ($P = 0.026$). Less educated individuals reported greater proportions for "Work" ($P < 0.001$) and "Home/Family" ($P = 0.009$) but a smaller proportion for "Leisure" ($P < 0.001$) in comparison with more educated individuals. People with lower income had significantly larger proportions for "Work" ($P = 0.002$) than those with the highest amount of income.

Parallel analyses were conducted to examine the location where MVPA occurred (allocations in Fig. 4). Consistent with the purpose codes, "Work" accounted for the largest average percent MVPA time (40%). However, the combined allocation for "Home/Indoor" (26%) and "Home/Outdoor" (13%) accounted for nearly 39% of total MVPA. An additional 21% can be attributed to activity outside the home ("Community," 19%; "Transportation," 2%). In contrast to the purpose codes, women had a significantly larger allocation for MVPA ($P = 0.006$) taking place at work, but larger allocations for "Home/Indoor" ($P < 0.001$) and "Transportation" ($P = 0.044$) (compared with men). People age 40–49 yr had a significantly larger proportion for "Work" than people age 20–29 yr ($P = 0.049$) but had a significantly smaller proportion for "Work" than people age 50–71 yr ($P = 0.044$). The "Other" ethnicity group showed significantly smaller proportions for "Home/Indoor" and "Home/Outdoor" compared with Whites ($P = 0.005$ for both categories) and Blacks ($P = 0.044$ for "Home/Indoor" and $P = 0.022$ for "Home/Outdoor") and a significantly larger proportion for "Community" compared with Blacks ($P = 0.004$). People with college and/or graduate degrees showed significantly smaller proportions for "Work" ($P < 0.001$) and "Transportation"

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1	Walk gathering things or ready to leave	3	268
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4	Stand child care [b]	3	182
5	Walk moderate carrying < 10lbs or nothing	3.3	157
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25	Walk carrying 25-49lbs	5	36
26	Gardening, general (planting)	4	33
27	Stand/walk very heavy work	8	32
28	Walk/run play with children, moderate	4	30
29	Driving a bus, heavy truck or tractor	3	29
30	Walk carrying 50+lbs	7.5	26

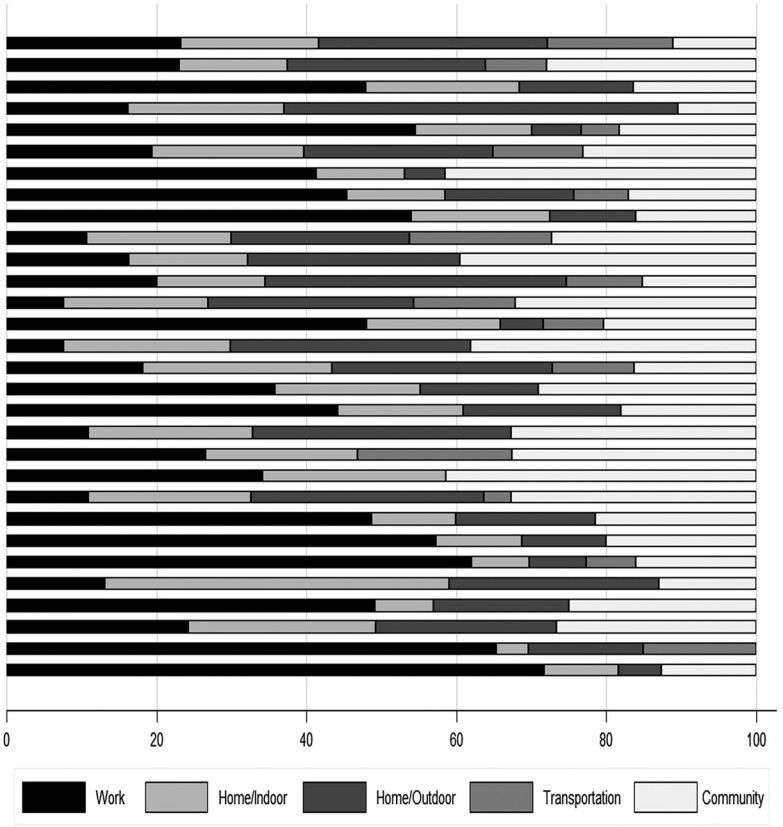

FIGURE 2—Top 30 most frequently reported MVPA and corresponding time allocations across five location codes: "Work," "Home/Indoor," "Home/Outdoor," "Transportation," and "Community." [a]Cleaning, moderate (vacuum, mop, sweep). [b]Stand, child care (dressing, bathing, grooming, feeding, lifting). [c]Stand, moderate effort (packing/unpacking boxes, light lifting). [d]Stand/walk, moderate work (waiter, patient care, stocking shelves, auto repair). [e]Cleaning, vigorous (scrub floors, walls, and bathroom; sweep outside; clean garage). [f]Stand/walk, heavy work (moving furniture and boxes, loading/unloading trucks). [g]Mow lawn, walking (push, power, self-propelled mower). [h]Walk and gather things (leave, shut/lock doors, close windows). [I]Exercises general vigorous (push-ups/sit-ups/pull-ups/jumping jacks).

(P = 0.030), but a larger proportion for "Home/Indoor" (P = 0.026), than those without college and/or graduate degrees. People with the lowest level of income showed a significantly larger proportion for "Work" (P = 0.004) than people with the highest level of income.

DISCUSSION

The present study provides novel information about the context of PA behaviors in a representative sample of adults. There have been strong recommendations for increased efforts to understand the context of PA (13,26), but systematically evaluating different contextual factors has proved to be challenging. The PAR used in the PAMS project provides detailed information on both the purpose and the location for self-reported PA. Because codes were obtained for each activity, it was possible to compare the most commonly reported activities in the population, as well as the time allocations for both purpose and location. The present analyses focused on characterizing allocations for the most commonly reported activities at the population level so that activity patterns in adults can be better understood.

Consistent with previous studies (24,28), the most commonly reported activities were mostly household tasks. Tudor-Locke et al. (28) reported that, in the American Time Use Survey sample, "food and drink preparation" was the most commonly reported activity (~26% of the population), followed by "lawn and garden tasks" (~11%). A code for food preparation was not included in the reduced PAR form, but activities linking walking with various cleaning tasks were commonly reported in the present study. Two different "lawn and garden tasks" were also in the top 30. These clearly indicate the importance of lifestyle tasks as the predominant source of adults' PA.

When aggregated across activities, the results provide a way to examine the relative contributions of different contextual variables (both purpose and location). When examining purpose, the majority of PA were attributed to "Work" (41%), followed by "Home/Family" (37%), "Leisure" (14%), "Exercise/Sports" (7%), and "Other" (1%). When stratified by location, the majority of PA were allocated as "Work" (40%), followed by "Home/Indoor" (26%), "Community" (19%), "Home/Outdoor" (13%), and "Transportation" (2%). Similar patterns were identified in a related study by Kozey Keadle et al. (17), which compared reported PA patterns with directly observed PA patterns. Kozey Keadle et al. (17) reported time allocations for three location categories (i.e., Work/School, 48%; Home, 34%;

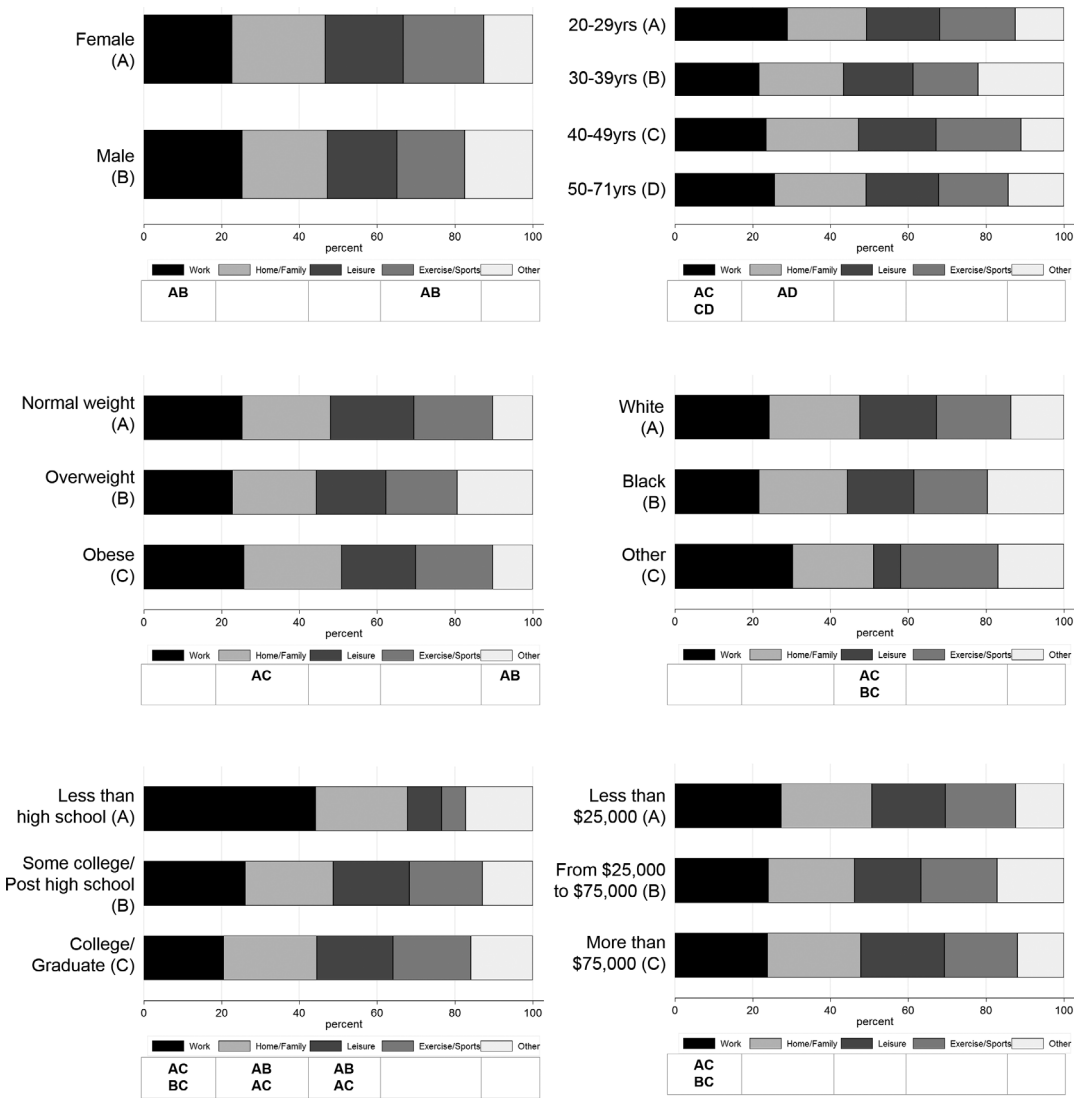

FIGURE 3—Time allocations for five purpose codes ("Work," Home/Family," "Leisure," "Exercise/Sports," and "Other") across six sociodemographic variables. Significant differences are indicated by combinations of "A," "B," and "C."

Community, 18%) and five purpose categories (i.e., Office Work, 45%; Home Activity, 23%; Leisure, 21%; Transportation, 8%; Education, 4%). A unique aspect of the present study is that we reported the variability in allocations for specific activities. This allowed us to empirically demonstrate that people report the same activity very differently (e.g., as work or leisure, etc.). Another unique contribution of the present study is that aggregated time allocations were further segmented by various sociodemographic indicators. These analyses revealed that the context (purpose and location) of PA varies considerably in the population, both within and between defined demographic strata. Differential time allocations support the importance of targeting multiple domains to promote adults' MVPA at the population level.

The large allocations (in both purpose and location codes) for "Work" reinforce the importance of "Work" as a primary source of PA for adults, as it accounted for nearly 40% of total PA reported. Several other studies have specifically examined the contribution of work to PA (16,24,30). Salmon et al. (24) controlled for various confounders and demonstrated that blue-collar workers were less likely to report any form of leisure-time PA. Kirk and Rhodes (16) reached a similar conclusion in a comprehensive review. However, the study by Kirk and Rhodes (16) revealed positive correlations between occupational PA and leisure-time PA (LTPA), disputing the notion that individuals with active jobs would have lower LTPA. Blue-collar workers accumulated more total PA, prompting Kirk and Rhodes (16) to conclude that white-collar workers are not accumulating sufficient LTPA to offset their predominantly sedentary jobs. Work hours and work stress were negatively associated with leisure-time PA (16). However, Van Domelen et al. (30) reported that employed individuals had more activity than unemployed individuals, even though they were employed in sedentary professions.

An interesting observation in the present study is that men allocated a higher proportion of their MVPA for work (purpose)

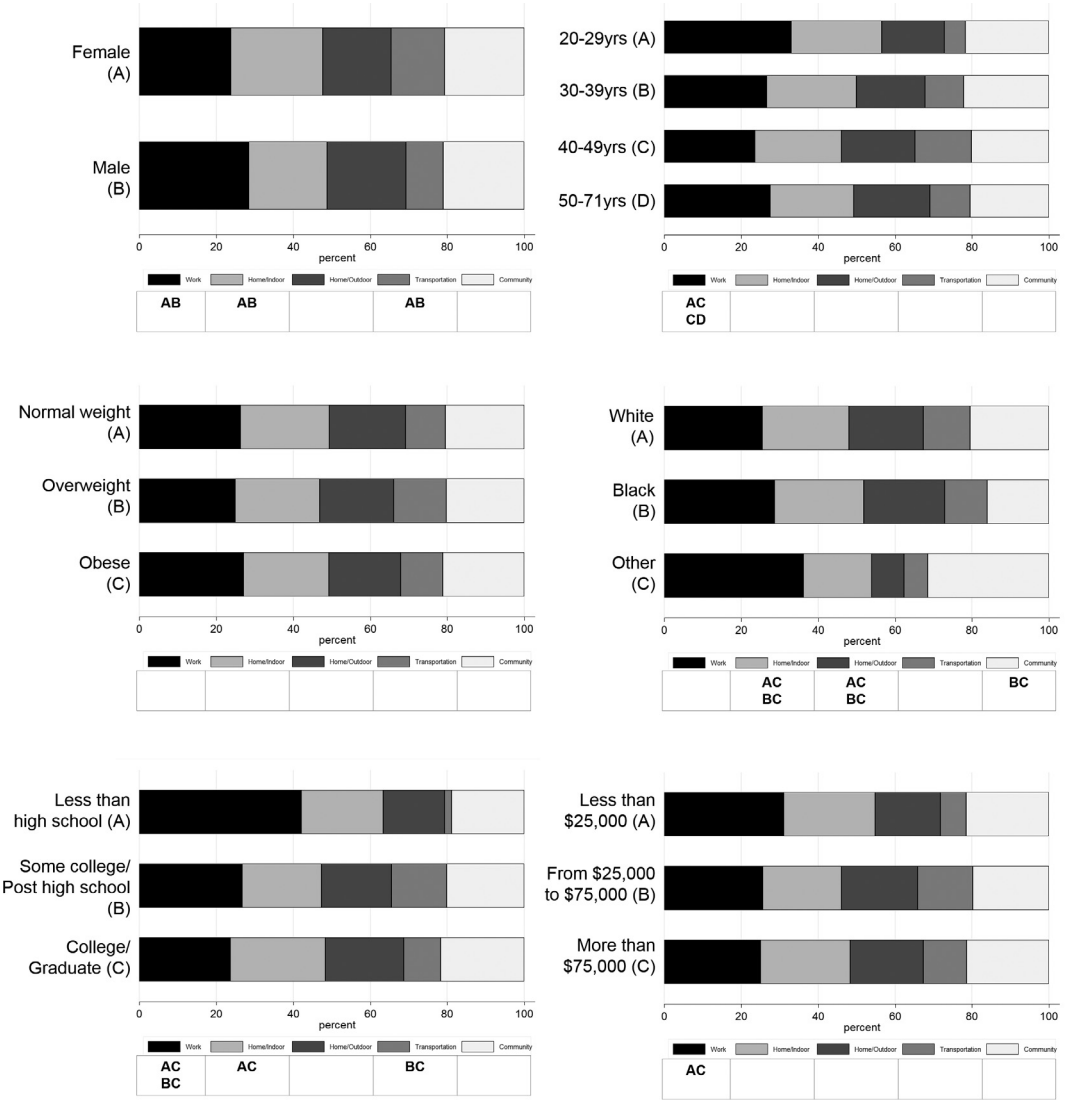

FIGURE 4—Time allocations for five location codes ("Work," "Home/Indoor," "Home/Outdoor," "Transportation," and "Community") across six sociodemographic variables. Significant differences are indicated by combinations of "A," "B," and "C."

and at work (location); women, in contrast, had a higher proportion of MVPA for family (purpose) and at home (location). This fits the traditional or assumed work/home roles of men and women. This notion is also evidenced by a previous study indicating higher levels of leisure-time PA in men and higher levels of household PA in women (18). However, it is also known that participation in leisure-time PA is confounded by the interaction between gender and occupation (16). Patterns are further complicated by complex webs linking education, occupation, and socioeconomic status (SES). Salmon et al. (24) demonstrated that individuals with <12 yr of education and belonging to the "less skilled" category of profession were less likely to engage in leisure-time/vigorous occupational/home PA than individuals with university degrees and belonging to the "professional" category of profession. Moreover, a systematic review study by Beenackers et al. (2) identified specific patterns of socioeconomic inequalities in different domains of PA. Beenackers et al. (2) showed that leisure-time PA was higher in people of higher SES than in those of relatively lower SES, but people of higher SES were less likely to be active at work than were people of lower SES. Cerin and Leslie (7) found out that both individual-level (i.e., education background, income level, and household size) and society-level (i.e., household income and household size of included districts) SES indicators mediated the relationships between social–economic inequalities and participation in leisure-time PA.

Compared to work, recreation (i.e., volitional activity) makes a relatively small contribution to PA. For example, only 7% of total MVPA time was explained by the purpose category "Exercise/Sports." A similar finding was derived from a previous American Time Use Survey study (12), which observed that only 2.9% and 12.7% of total use of time on a random day were attributable to sports and exercise, respectively. A novel and particularly interesting observation

in the present study is that the same activity can be categorized very differently, depending on personal interests and perspectives. These distinctions are important for researchers to consider when characterizing activity patterns in the population. Current public health initiatives focus on promoting leisure-time PA, but additional work is needed to better understand what constitutes leisure-time PA, as well as domestic, occupational, and recreational PA, in adults.

It is noteworthy that, in the present study, a relatively large proportion (~19%) of total MVPA was explained by "Community" and a relatively small amount (~2%) of total MVPA was explained by "Transportation." These are two frequently targeted domains in intervention studies. A review study by Wanner et al. (31) found out that active transportation was associated with increased PA (in the cross-sectional studies reviewed). Similarly, meta-analyses (3,15) demonstrated the effectiveness of community-based interventions in increasing PA in adults. The present study adds value to these lines of work by showing how adults' MVPA in these two domains varies by sociodemographic factors. To be specific, transportation MVPA was more commonly reported by men (compared with women) and by individuals with some years of college or by high school graduates (compared with college graduates). Moreover, individuals in the "Black" category of ethnicity reported more community MVPA time compared with the "Other" group. Additional research is needed to clearly understand the interacting effects of various sociodemographic variables on accumulating MVPA time during transportation and/or in communities.

Detailed insights on the type and nature of PA reveal the benefits of self-report measures for understanding the context of PA. Considerable research on objective measures has been performed, and the general consensus is clearly that objectivity is better than subjectivity. However, it is important for researchers to appreciate that objective measures cannot capture this rich contextual information. This is why experts now often recommend multimethod approaches to understanding PA pattern (4,26). Tucker et al. (27) reported highly disparate levels and patterns of PA when they compared subjective and objective measures of PA from the National Health and Nutrition Examination Survey. The observed prevalence of meeting established PA guidelines was considerably higher for subjective (self-report) measures, but an interesting observation was that the patterns varied by ethnicity. With self-report measures, fewer Mexican Americans (43.7%)—compared with non-Hispanic Whites (65.0%) and non-Hispanic Blacks (52.1%)—achieved PA guidelines. However, with objective accelerometry methods, there was little variability in these percentages (values ranged from 8.0% to 10.1%) among the three ethnicity groups. The differences can be attributed to a number of factors; thus, additional research is needed to understand how people report and interpret PA behavior and how perceptions may vary by demographic factors and by fitness. An advantage of the PAR format used in the PAMS is that the short duration (single day) helps to improve the validity of recall while also enabling detailed information on the context of PA. These advantages have been highlighted in other reviews of self-report measures (20), and the validity of the specific version of the PAR tool used in the PAMS has been previously established (32). Additional studies from this PAMS project will provide robust measurement error models and calibration models to further enhance the utility of data from the PAR for public health research. However, combination methods employing both objective and subjective measures are encouraged.

Collectively, this study provides new insights on activity patterns in a representative sample of adults. Strengths of the study include the large and representative nature of the sample and the refined and well-controlled protocol for capturing activity patterns. Limitations of the study include the somewhat overlapping nature of the purpose and location codes. An activity may be categorized as "Work" (purpose) but may take place at "Work" or at "Home/Family" (location). This distinction was intentionally created as part of the PAR format, but it may have been confusing for participants reporting their behavior. Another limitation is that telephone administration necessitated the use of a reduced set of activity codes. This prevents a direct comparison with other studies using the compendium of physical activities, but it provides a streamlined version that may have more utility because it avoids duplication and redundancy in coding. The utility of Bonferroni correction has been questioned (22); however, this method is more conservative than other correction methods (i.e., Sidak).

Future work in this area will help to better characterize activity patterns in the adult population. Additional research is also warranted to investigate the underlying context of sedentary behaviors and its variation according to various socioeconomic indicators in adults. Activities Completed Over Time in 24 Hours (ACT24) is a newly developed online tool that provides considerable advantages. As an online tool, it can be administered less expensively than the present telephone-administered version of the PAR. As work evolves, this tool will provide researchers options to improve the utility of a previous-day activity recall method and to reach out to more diverse populations.

CONCLUSION

This study employed a well-established 24-h activity recall method to systematically characterize the type, location, and purpose of commonly reported MVPA in a representative sample of adults. A unique aspect of the study is that time allocations for MVPA were characterized according to specific sociodemographic variables across location and purpose categories. In general, lifestyle activities were more prevalent than sports and/or recreational activities, and patterns of time allocations for MVPA considerably varied by sociodemographic indicators for each location and purpose category. A multidomain approach is needed to better understand and increase MVPA in US adults.

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