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The Influence of Daily Stress on Sedentary Behavior: Group and Person (N of 1) Level Results of a 1-Year Observational Study

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Abstract

Objectives—The purpose of this study, which used mobile technologies to continuously collect data over 1 year, was to examine the association of psychological stress with objectively measured sedentary behavior in adults at both the group (e.g. nomothetic approach) and individual (e.g. idiographic approach) level.

Methods—Data were collected in an observational study of healthy adults ($n=79$) residing in the New York City metro area who were studied for 365 days from 2014–2015. Sedentary behavior was objectively measured via accelerometry. A smartphone-based electronic diary was used to assess level of stress (“Overall, how stressful was your day?”; 0–10 scale) and sources of stress.

Results—The end-of-day stress rating was not associated with total sedentary time ($B = -1.34$, $p = 0.767$) at the group-level. When specific sources of stress were evaluated at the group-level, argument-related stress was associated with increased sedentariness; while running late- and work-related stress were associated with decreased sedentariness. There was a substantial degree of inter-individual variability in the relationship of stress with sedentary behavior. Both the level and sources of stress were associated with increased sedentariness for some, decreased sedentariness for others, and had no effect for many (within-person variance p -value < 0.001).

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Conclusions—These findings suggest that the influence of stress on sedentary behavior varies by source of stress and from person-to-person. A precision medicine approach may be warranted to target reductions in sedentary time; although further studies are needed to confirm the observed findings in light of study limitations including a small sample size and enrollment of participants from a single, urban metropolitan area.

Keywords

Sedentary; physical activity; accelerometer; stress; psychosocial

INTRODUCTION

Technological advancements have fostered changes in occupational, home, and social settings that encourage a sedentary lifestyle (1, 2). U.S. adults now spend an alarming 11-12 hours/day sedentary (3). Epidemiological evidence indicates time spent in sedentary behavior (e.g. total sedentary time) is associated with cardiovascular disease and mortality (4). Experimental studies furthermore show that acute periods of prolonged, uninterrupted sedentary behavior (e.g. sitting for hours at a time) elicit greater detrimental cardiometabolic effects compared to sedentary behavior that is periodically interrupted; suggestive that it is not only total sedentary time that is relevant to health outcomes, but also the pattern in which sedentary time is accumulated (5–7). Importantly, the risk conferred by prolonged sedentariness (both its volume and pattern) has been demonstrated to be independent of moderate-to-vigorous physical activity (4). As such, sedentary behavior is now thought to represent a clinically important aspect of an individual's physical activity profile that can influence disease risk irrespective of exercise (8).

Despite recognition that sedentary behavior is an important health risk factor, there is limited evidence on the determinants of sedentary behavior among adults. A recent systematic review noted that the determinants identified in 22 studies generally examined who engages in more sedentary behavior (e.g. elderly, obese, retired) rather than *why* they do so (9). Individuals constantly and dynamically interact with their personal life stimuli such as work, relationships, and financial/time pressures; thus the ability to assess complex and personalized associations between life exposures and sedentary behavior is challenging and has been largely limited by dated theoretical, measurement, and statistical models. However, with advances in mobile health technologies, the assessment of the everyday factors that influence why individuals are sedentary on a given day is now possible. Coupling wearable physical activity trackers (e.g. Fitbit) with ecological momentary assessment (EMA) via smartphone, we can repeatedly collect real-time exposure data on daily features of the natural environment while simultaneously collecting objective measures of sedentary behavior to elucidate the daily determinants of prolonged sedentariness. Importantly, as the determinants of sedentary behavior may differ from person to person, the use of mobile technologies to repeatedly collect exposure and outcome data continuously over months makes possible the use of N-of-1 statistical modeling to ascertain associations at the level of the individual, thereby overcoming the limitations of between-subject methods wherein only the average association is evaluated and any individual variability is ignored (10).

Psychological stress has been reported to have a deleterious effect on engagement in healthful behaviors including smoking, exercise, and dietary intake (11–14). The conceptual link between stress and unhealthful behaviors is hypothesized to be related to mood management wherein aversive states (e.g. stress) motivate individuals to engage in unhealthy behaviors that bring them short-term pleasure (15). In this context, as many individuals perceive short-term pleasure from engaging in sedentary activities such as television viewing and computer use, sedentary behavior may be a preferred coping response to psychological stress (16, 17). Alternatively, individuals who engage in prolonged sedentary behavior may lose the anxiolytic/stress reduction effects of physical activity and, in turn, may have greater perceived stress (18, 19). Few studies, however, have examined the relationship between daily psychological stress and objectively-measured sedentary behavior. Using mobile health technologies to collect continuous data over 1 year, the purpose of this study was to examine the association of daily stress with the volume and pattern of objectively-measured sedentary behavior in healthy adults at both the group (e.g. nomothetic, between-subjects approach) and individual (e.g. idiographic, within-subjects approach or N-of-1) level.

METHODS

Study Design

This study was a single cohort, 12-month, intensive observational study (20). Participants completed questionnaires at baseline and thereafter initiated daily accelerometer-based measurement of sedentary behavior and smartphone-based EMA of stress for the 12-month study period. The study was approved by Columbia University Medical Center's (CUMC) institutional review board. All participants provided informed consent. Access to the study dataset and information about the study's execution and materials is publicly available at <https://osf.io/kmszn>.

Study participants

We recruited a convenience sample of 79 adults through advertising at CUMC. Participants were English speaking, 18 years or older, self-reported intermittent exercisers (exercise 6-11 times/month, not on a regular basis), had access to a computer with Internet, and had an iPhone or Android phone. We excluded individuals who were unavailable for 12 continuous months, had a serious medical problem that would affect their ability to engage in physical activity, or had an occupation that demands rigorous activity or would make responding to the EMA dangerous.

Objective measurement of sedentary behavior

Sedentary behavior was objectively measured using a wrist-based model of the Fitbit (Fitbit Flex; Fitbit, Inc., San Francisco, CA). The Fitbit Flex is a microelectromechanical triaxial accelerometer that tracks the wearer's physical activity including steps, intensity of activity (sedentary, light, moderate, or vigorous), and energy expenditure. We and others have shown the Fitbit Flex is valid and reliable for measuring physical activity and sedentary behavior in adults (21–23). Data from the device automatically uploads to the Fitbit website whenever the device is within 15 feet of the base station, which for this study was plugged into the participant's own computer. Participants were instructed to sync and charge their device

every 5-7 days to ensure no loss of activity data. The Fitbit Flex was selected because it is simple to use and more convenient than research-grade accelerometers which require the participant to return to the study office for syncing and battery charging/replacement. With the Fitbit Flex, participants could sync and charge the device on their own.

Minute-by-minute activity data were extracted from the manufacturer's website using Fitabase (Small Steps Labs, San Diego, California). Non-wear periods were defined as >120 consecutive minutes of 0 counted steps and an intensity classification of 0 (defined as sedentary activity according to manufacturer). Participant's habitual sleep and wake times were ascertained by questionnaire at baseline. Self-reported sleep hours (+1 hour earlier for sleep time and +1 hour later for wake time), were excluded from quantification of sedentary time. Only days with 10 hours of waking wear time were included in analyses. Total time spent sedentary was determined by summing minutes in a day when the following criteria were met: [1] 0 counted steps and [2] an intensity classification of 0. A sedentary bout was defined as consecutive minutes in which the sedentary criteria were met. Although previous studies using Fitbit devices typically define sedentary behavior by just an intensity classification of 0 (24, 25); we observed occasions in which step counts were recorded in a 1-minute epoch scored as a 0 for intensity. To be consistent with the consensus definition of sedentary behavior (waking activities with an energy expenditure <1.5 metabolic equivalents, while in a sitting, reclining, or lying posture), the additional criteria of 0 counted steps was included in our sedentary definition.

Ecological momentary assessment of stress

An electronic diary that used the participant's own iPhone or Android phone was used to capture momentary and summary aspects of their perceived stress. Each evening, a summary rating of perceived stress for the day was assessed on a browser using a single item visual analog scale (VAS, "Overall, how stressful was your day?") ranging from 0 ("Not at all") to 10 ("Extremely"). The VAS has been demonstrated to have good psychometric properties for measuring stress and its scores strongly correlate with validated stress scales (e.g. Perceived Stress Scale) (26, 27). In addition, the diary system was programmed to query the participant via text message or email 3 random times/day over their preset hours of wakefulness. Notifications were separated by 1 hour. Each of the 3 daytime assessments included a question that ascertained key sources of stress: "Since the last prompt, did you experience any of these (check all that apply)? work, argument, traffic, deadline trouble, paying bills, running late, none, or other". The sources of stress ascertained in the present study were derived from several sources. We first adapted items from the Daily Stress Inventory (DSI) (28). The DSI is a 60-item questionnaire designed to assess the daily sources of stressful events. To reduce participant burden, we selected a subset of DSI items for inclusion by consensus between investigators. We supplemented these items with an additional item for work-related stress, the most commonly reported source of stress in a representative national sample of adults (29).

Each of the 3 daytime assessments also included a rating of momentary stress using a single item ("Just before the prompt, how stressed did you feel?") VAS ranging from 0 ("Not at

all”) to 10 (“Extremely”). Because the mid-day stress rating was highly correlated with the end-of-day stress rating ($r=0.81$), these data are not presented.

The text messages/emails contained a URL linked to a mobile web browser page that expired after 70 minutes and could be completed on smartphone or computer. Data transmission was secured via SSL and sent to a managed server.

Additional measures

Any individual-level differences in the stress-sedentary behavior relationship raises the question of whether there are person characteristics that account for these differences; i.e., whether person characteristics moderate the effect of stress on sedentary behavior. A number of potential psychosocial moderators of the relationship between stress and sedentary behavior were assessed in exploratory analyses. These included sociodemographics (sex, education), perceptions of and satisfaction with social support (ENRICH Social Support Instrument) (30), sense of mastery (Pearlin Mastery Scale) (31), and anxiety sensitivity (32). All self-report questionnaires were administered at baseline.

Statistical analyses

Sedentary behavior characteristics were quantified at the day-level. Total sedentary time was our measure of the volume of sedentary behavior and was expressed in minutes/day. Mean sedentary bout duration was quantified as a measure of overall prolonged, uninterrupted sedentary behavior (e.g. pattern of sedentary time accumulation) that accounts for all bout lengths on a given day. Previous studies have reported that sedentary bouts of shorter and longer duration comprise a different mix of activities (shorter bouts at work; longer bouts during leisure-based activities) (33). Thus, to allow for the possibility that sedentary bouts of a certain length are inherently different and therefore may be more or less influenced by stress, the percentage of total sedentary time accumulated in bouts of 1-29, 30-59, 60-89, and 90 minutes. Bout duration thresholds were selected in accordance with a previous study that demonstrated an association between the selected thresholds and all-cause mortality risk (34) and after considering that adults have few sedentary bouts that exceed the 90-minute threshold (3, 35).

Two stress measures were examined at the day-level: [1] end-of-day stress rating, expressed continuously, [2] source of stress (work, argument, traffic, deadline trouble, paying bills, running late, or other), each expressed as a binary measure (yes or no regarding whether a stress source was reported on a given day). For the stress measures derived from the 3 mid-day momentary assessments, a given day was included in analyses if 1 EMA response was recorded.

To examine the association of daily stress with sedentary behavior, random coefficients linear regression models predicting sedentary behavior (volume and pattern) from the stress ratings/stress sources were estimated. Both the intercept and coefficient of stress rating/stress source were treated as random effects, with an unstructured covariance matrix. In addition, all analyses were adjusted for wear time by including both linear and quadratic terms for total wear time, also treated as random effects. This analysis yielded an estimate of the wear time-adjusted average within-person effect of stress on sedentary behavior, a test of

whether this average effect was significantly different from zero, an estimate of the person-to-person variability (the standard deviation (*SD*) of the person-specific effects), and a test of whether this variability was statistically significant. For models testing each source of stress, all other sources of stress were included as (fixed effect) covariates (e.g. in the model examining the effect of work-related stress, this predictor was treated as a random effect while the other six sources were included, but not treated as random effects). As an exploratory analysis, the above analyses were repeated testing for effect modification by sex, education, social support, sense of mastery, and anxiety sensitivity by including their multiplicative interaction with the stress measures to the random coefficients models.

For three of the exploratory outcome measures - percent of total sedentary time accrued in bouts of 30-59, 60-89, and 90 min - we were concerned that values of zero might be qualitatively different from non-zeros. Accordingly, for these outcomes, we estimated a "limited dependent variable" variant of the above-described model (a random coefficients Tobit model(36)) which assumes that zeros are not an exact value, but rather indicate that the participant did not experience any sedentary bouts of the specified duration that day.

Three sensitivity analyses were conducted. First, to exclude possible accelerometer wear during sleep, analyses were repeated restricting the accelerometer analysis period to 8AM-8PM. Second, analyses were repeated restricting the sample to the 75 participants with 122 days of observation (1/3 of the 365-day study period). Finally, for stress measures derived from the 3 mid-day momentary assessments (stress source), analyses were repeated restricted to days where all 3 EMA responses were recorded. Data analyses were conducted using SAS, version 9.4 (SAS Institute).

RESULTS

Participant characteristics

Among the 79 participants, the mean ($\pm$ standard deviation) age was 31.9 ± 9.5 years, 43.0% were male, 13.9% were Black, 27.9% were Hispanic, and 40.5% reported a Graduate/Professional Degree Education (Table 1). The mean number of days with an evening EMA report or 1 mid-day EMA report were 214.6 ± 91.6 and 282.8 ± 93.8 , respectively. Participants wore the accelerometer for a mean of 14.7 ± 1.2 h/day over a mean of 213.2 ± 89.3 valid wear days. Sedentary behavior accounted for $71.3 \pm 5.9\%$ of total wear time, equivalent to a mean of 10.5 ± 1.2 h/day. Mean sedentary bout length was 9.1 ± 2.4 min/bout. Sedentary bouts 30-59, 60-89, and 90 min accounted for $20.8 \pm 4.5\%$, $10.3 \pm 3.5\%$, and $6.2 \pm 2.6\%$ of total sedentary time, respectively. Figure 1 and Supplemental Figure 1 (Supplemental Digital Content) show the variation in the volume and pattern of sedentary behavior over the 12-month study period, respectively.

End-of-day stress report and sedentary behavior

The mean end-of-day stress rating across all participant days was 3.2. Supplemental Figure 2 (Supplemental Digital Content) shows the variation in the end-of-day stress rating over the 12-month study period. In the random coefficients models, the end-of-day stress report was not associated with total sedentary time ($B = -1.34$ [95% *CI*: -10.32, 7.65], $p = 0.767$) or

mean sedentary bout duration ($B = -0.07$ [95% CI: $-0.41, 0.28$], $p = 0.703$). There was, however, a high degree of inter-individual variability in the relationship between the end-of-day stress rating and both total sedentary time (SD of $B = 34.67$; $p < 0.001$) and mean sedentary bout duration (SD of $B = 1.23$; $p < 0.001$). Figure 2 shows forest plots of the estimated effect of end-of-day stress rating on total sedentary time and mean sedentary bout duration for each participant. High end-of-day stress ratings were significantly associated with greater total sedentary time ($n = 9$) for some, with lower total sedentary time for others ($n = 8$), and was not associated with total sedentary time for the remainder ($n = 62$). Similarly, positive ($n = 4$), negative ($n = 7$), and null ($n = 68$) associations were observed between the end-of-day stress rating and mean sedentary bout duration across participants.

When prolonged, uninterrupted sedentary bouts were examined at differing bout duration thresholds, the end-of-day stress report was significantly associated with the percent of total sedentary time accrued in bouts ≥ 90 min ($B = -1.58$ [95% CI: $-2.67, -0.49$], $p = 0.005$), but not with bouts of 1-29 min ($B = 1.22$ [95% CI: $-0.05, 2.49$], $p = 0.060$), 30-59 min ($B = 0.11$ [95% CI: $-0.49, 0.72$], $p = 0.708$), or 60-89 min ($B = -0.39$ [95% CI: $-1.18, 0.41$], $p = 0.339$).

In sensitivity analyses, all results were similar when restricting the accelerometer analysis period to 8AM-8PM and when restricting the sample to participants with ≥ 122 days of observation (data not shown).

Sources of stress and sedentary behavior

Stress related to work, argument, traffic, deadline trouble, paying bills, running late, none, or other were reported on 38.8%, 7.4%, 5.8%, 7.6%, 6.1%, 12.6%, 16.4% and 10.2% of days, respectively. Supplemental Figure 3 (Supplemental Digital Content) shows the variation in each source of stress over the 12-month study period. Argument-related stress was associated with increased total sedentary time, mean sedentary bout length, and percent of total sedentary time accrued in bouts of 60-89 min and decreased percent of total sedentary time accrued in bouts of 1-29 min (Table 2 and Supplemental Table 1 [Supplemental Digital Content]). Running late-related stress was associated with decreased total daily sedentary time, mean sedentary bout length, and percent of total daily sedentary time accrued in bouts of 30-59 and 60-89 min and increased percent of total daily sedentary time accrued in bouts of 1-29 min. Work-related stress was associated with decreased percent of total daily sedentary time accrued in bouts 60-89 and ≥ 90 min and increased percent of total daily sedentary time accrued in bouts of 1-29 min.

There was a high degree of inter-individual variability in the relationship between many of the sources of stress and the sedentary behavior characteristics (Supplemental Table 2, Supplemental Digital Content). Large inter-individual variability was particularly noted for work-related stress and both the volume and pattern of sedentary behavior (Figure 3). For example, work-related stress was significantly associated with greater total daily sedentary time for some ($n = 12$), with lower total daily sedentary time for others ($n = 13$), and was not associated with total daily sedentary time for the remainder ($n = 54$).

In sensitivity analyses, the pattern of results were similar when: 1) restricting the accelerometer analysis period to 8AM-8PM, 2) restricting the sample to participants with

122 days of observation, and 3) restricting analyses to days wherein all 3 EMA responses were recorded (data not shown).

Moderation of effects

Effect modification analyses revealed that sense of mastery moderated the effect of work-related stress on total sedentary time (p -interaction = 0.011). For participants with low sense of mastery scores (below median score of 16), work-related stress was associated with greater total sedentary time ($B=6.5$ [95% CI: -4.1, 17.0]). Conversely, for participants with high sense of mastery scores (at or above median score of 16), work-related stress was associated with lower total sedentary time ($B=-7.4$ [95% CI: -16.8, 2.0], p -difference comparing B among participants above and below median = 0.040). The associations of the level and sources of stress with the sedentary behavior characteristics did not vary by sex, education, social support, or anxiety sensitivity (p -interaction > 0.05; data not shown).

DISCUSSION

In this cohort of 79 healthy adults in whom objectively-measured sedentary behavior and psychological stress were assessed daily for 1-year, perceived stress was generally not associated with the volume or pattern of sedentary behavior for the average person (that is, the group level using a nomothetic, between-subjects approach). When specific sources of stress were evaluated, there was heterogeneity in the effect of stress on the volume and pattern of sedentary behavior, with argument-related stress associated with *increased* sedentariness (both total sedentary time and prolonged uninterrupted sedentary bouts); while late- and work-related stress were associated with *decreased* sedentariness. However, there was a large degree of inter-individual variability in the relationship of the level and sources of stress with sedentary behavior. Both level of stress and momentary sources of stress were associated with increased sedentariness for some, decreased sedentariness for others, and had no significant effect for many.

A recent scientific statement from the American Heart Association (AHA) that evaluated the current evidence on sedentary behavior as a cardiovascular risk factor has identified the determinants of sedentary behavior as an evidence gap in the literature (8). Data largely exist on who engages in sedentary behavior (9). However, although documentation of demographic groups prone to sedentary behavior has helped identify those at higher risk, such evidence does not identify modifiable factors amenable to intervention. Thus, data on modifiable determinants of sedentary behavior has been identified by the AHA as an important need (8), with a recent international transdisciplinary consensus statement ranking psychosocial factors as one of the top research priorities for the study of determinants of sedentary behavior (37). The present study provides some of the first data on the association of daily stress with sedentary behavior. At the group-level, our findings suggest that overall stress (assessed with an end-of-day question: "Overall, how stressful was your day?") is not generally associated with increases in the volume or pattern of sedentary behavior, with the exception of a modest negative association observed between overall stress and accumulation of sedentary time in extremely long bouts (> 90 min). A recent study among middle-aged women that coupled EMA with accelerometry over a 15-day measurement

period similarly reported that neither positive nor negative affect predicted sedentary behavior (38). Thus, at the group-level, there is limited evidence supportive of psychosocial factors as antecedents to sedentary behavior.

Our finding that the effect of stress on the volume and pattern of sedentary behavior varied by source of stress is suggestive of a more complex stress-sedentary behavior relationship wherein the source rather than the level of stress may influence sedentary behavior. According to mood management theory, stress motivates individuals to engage in unhealthy behaviors that bring them pleasure to alleviate negative affect. In support of this hypothesis, adults reporting stressful life events have been found to watch more television (a sedentary behavior), in part, as a stress relief coping response and additionally as a means of social withdrawal that reduces the likelihood of further stress-induced conflict (16). In this context, our finding that argument-related stress was associated with increased sedentary behavior aligns with mood management theory. Our finding that late- and work-related stress were associated with decreased sedentary behavior similarly may align with the mood management framework as individuals might seek to alleviate the negative affect associated with these stressors through expending efforts to meet deadlines/time demands and/or complete work tasks (and hence are less sedentary). However, as work-related stress is a multi-dimensional concept that exists on a continuum from healthy stress (achieving a demanding goal while not being overpressured) to impairment stress (unable to cope with stress and maintain professional responsibilities) and is contingent on the balance between work demand and work control, future studies are needed to further elucidate these relationships (39, 40). Notably, our finding that the association of work-related stress with total sedentary time is moderated by sense of mastery (the extent to which individuals believe they can control the events/circumstances of their lives) underscores a need to examine work locus of control (autonomy and decisional latitude) as a psychosocial factor that influences sedentary behavior.

A key result of this study is the finding that there is a large degree of inter-individual variability in the effect of stress on sedentary behavior. These findings highlight the limitations of nomothetic or between-subjects methods, and the potential of N-of-1 – or single-subject – methods that assume the existence of unique associations and factors related to health behaviors at the level of the individual (10). Furthermore, they suggest that a precision medicine approach, whereby disease prevention and treatment takes into account individual variability in genes, environment, and lifestyle for each person (41, 42), may be warranted to target reductions in sedentary time. For example, for individuals in whom work stress was associated with increased sedentariness, stress reduction strategies might be warranted, while for individuals in whom work stress was not associated with sedentary behavior, alternative modifiable factors would need to be identified/targeted.

Several limitations should be noted when interpreting our findings. First, the study cohort was a relatively young, healthy, urban sample who were not engaged in employment that limited completion of EMA reports. Thus, study generalizability is limited. Future studies in older adults, diseased populations, and suburban/rural samples are needed. Second, the mean number of valid days with EMA (~215 days) or accelerometer data (~213 days) was only moderate. However, this is one of the longest EMA/accelerometer studies ever conducted

with >12,000 person-days available for analysis. Conventional accelerometer protocols require only 4 valid days over a 7-day wear period to be considered valid. Nonetheless, we cannot assume that findings for days with valid data would be mirrored for days without valid data. Third, self-reported sleep time, which queried participants' general (or usual) sleep/wake times and were excluded from analyses, was assessed only upon study enrollment. Thus, job/lifestyle changes, vacations, and weekday-weekend differences as they relate to variations in sleep/wake time were not accounted for. However, in a sensitivity analysis restricted to 8AM-8PM (to exclude possible accelerometer wear during sleep), all results were similar. Finally, because of the cross-sectional nature of our analyses, we cannot infer causality. Thus, it should be acknowledged that prolonged sedentary behavior could be a cause rather than a consequence of psychological stress.

In conclusion, in a cohort of healthy adults in whom objectively-measured sedentary behavior and psychological stress were assessed daily for 1-year, perceived stress was not associated with sedentary behavior at the group level. However, specific sources of stress were associated with increased (argument-related stress) or decreased (late- and work-related stress) sedentariness; suggestive that the source rather than the level of stress may influence sedentary behavior. Furthermore, there was a large degree of individual variability in the effect of stress on sedentary behavior. The results of the current study provide evidence that a precision medicine approach may be warranted to target reductions in sedentary time.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Abbreviations

AHA	American Heart Association
CUMC	Columbia University Medical Center
EMA	Ecological momentary assessment
U.S.	United States
VAS	Visual analog scale.

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Figure 1. Heat map of daily total sedentary time over 12-month study period for study sample ($n=79$)

Expression values above and below the group mean are indicated by red and green, respectively. Days with invalid wear (<10 hours of wear) are indicated by white. Each row represents a separate study participant.

Change in total sedentary time with 5-unit increase of end-of-day stress rating

Change in mean sedentary bout duration with 5-unit increase of end-of-day stress rating

Figure 2. Forest plot showing the estimated effect of end-of-day stress rating on total sedentary time (Panel A) and mean sedentary bout duration (Panel B)

Effect size (change in total sedentary time/mean sedentary bout duration given a 5-unit increase in end-of-day stress rating) with 95% confidence interval for each participant. Black vertical line represents “no association”, red vertical line shows average effect across participants.

Change in total sedentary time associated with 5-unit increase in stress related to work (A)

Change in mean sedentary bout duration associated with 5-unit increase in stress related to work (B)

Figure 3. Forest plot showing the estimated effect of stress related to work on total sedentary time (Panel A) and mean sedentary bout duration (Panel B)

Effect size (change in total sedentary time/mean sedentary bout duration given a day when work-related stress is reported) with 95% confidence interval for each participant. Black vertical line represents “no association”, red vertical line shows average effect across participants.

Table 1Characteristics of Study Participants ($n=79$).

Characteristic	Mean $\pm$ SD or%
Age (years)	31.9 $\pm$ 9.5
Male (%)	43.0
Race (%)	
White	41.8
Black	13.9
Asian	19.0
Native Hawaiian/Pacific Islander	3.8
2 or more	5.1
Unknown/Declined	16.5
Hispanic Ethnicity (%)	27.9
Education (%)	
High School/GED	1.3
Some College	15.2
College Degree	43.0
Graduate/Professional Degree	40.5
Partner/Spouse (%)	40.5
Body Mass Index (kg/m ²)	26.4 $\pm$ 5.3

Table 2
Association of Stress Sources With Total Sedentary Time and Mean Sedentary Bout Duration.

Source of Stress	Total Sedentary Time				Mean Sedentary Bout Duration			
	Main Effect		Variance		Main Effect		Variance	
	<i>B</i> (95% CI)	<i>P</i> -Value	<i>SD of B</i>	<i>P</i> -Value	<i>B</i> (95% CI)	<i>P</i> -Value	<i>SD of B</i>	<i>P</i> -Value
Work	-1.34 (-8.92, 6.24)	0.726	30.21	<0.001	-0.08 (-0.38, 0.22)	0.592	1.16	<0.001
Argument	6.70 (1.95, 11.44)	0.006	0.00	1.000	0.28 (0.06, 0.50)	0.012	0.00	1.000
Traffic Jam	0.98 (-4.10, 6.05)	0.703	0.00	1.000	-0.12 (-0.35, 0.12)	0.324	0.00	1.000
Deadline Trouble	4.97 (-1.58, 11.52)	0.135	14.04	<0.001	0.22 (-0.10, 0.53)	0.175	0.65	0.002
Paying Bills	3.70 (-3.70, 11.09)	0.323	12.46	0.006	0.05 (-0.21, 0.32)	0.679	0.00	1.000
Running Late	-12.60 (-17.97, -7.23)	<0.001	13.52	<0.001	-0.63 (-0.80, -0.45)	<0.001	0.00	1.000
Other	5.25 (-1.98, 12.49)	0.152	20.08	<0.001	0.22 (-0.04, 0.48)	0.098	0.59	0.0016

SD, standard deviation.