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ABSTRACT

National guidelines recommend physically active interruptions to sitting time, however, the characteristics of these interruptions are broadly stated and ill-defined. A robust methodology for population surveillance for such interruptions is needed.

PURPOSE: To describe the frequency and characteristics (i.e., duration, stepping time, and estimated intensity) of all interruptions and physically active interruptions to adults' free-living sitting time (i.e., transitions from sitting to upright posture) across segments of the population.

METHODS: Australian Diabetes, Obesity and Lifestyle (AusDiab) study participants (321 men; 406 women; mean ± SD 58.0 ± 10.3 years) wore the activPAL3^{TM} for ≥1 valid day. The characteristics of interruptions from laboratory studies demonstrating health benefits were selected to define active interruptions (≥5 min upright and/or ≥2 min stepping) and ambulatory interruptions (≥2 min stepping). The frequency and characteristics of all, active, and ambulatory interruptions were described and compared by age, gender, diabetes status, and body mass index.

RESULTS: Adults averaged 55.0 ± 21.8 interruptions per day, but only 20.3 ± 6.7 were active and 14.0 ± 5.4 were ambulatory. Median (25th, 75th percentile) duration was 2.6 (0.9, 7.8) minutes, stepping time was 0.8 (0.3, 2.0) minutes, and estimated energy expenditure was 4.3 (1.4, 12.5) MET-min. Those who were older, had obesity, or had diabetes had significantly ($p<0.05$) fewer interruptions of all types and less stepping time during active interruptions than their counterparts (Cohen's d <0.2).

CONCLUSION: Free-living interruptions were often less active than interruptions performed in effective acute laboratory studies and their content varied widely between population groups. Monitoring all interruptions as well as those that are more active is advisable to provide a comprehensive understanding of free-living sedentary behavior.

KEY WORDS: sedentary behavior, interruptions, breaks, epidemiology, population

INTRODUCTION

High volumes of sitting time are associated with adverse health outcomes and with indices of poorer metabolic health (1, 2). In contrast, interrupting sitting time with brief bouts of standing, walking, or simple resistance activities can have metabolic health benefits, including the attenuation of glucose (3-9) and insulin responses (3-5, 7-9). The World Health Organization (2) recommends replacing sedentary behavior with physical activity of any intensity. Additionally, several national guidelines (10-13) and the American Diabetes Association (10) have specific recommendations to regularly interrupt to sedentary time with physical activity. Findings of acute experimental studies in at-risk groups lend further support and demonstrate some metabolic health benefits of standing interruptions lasting as little as five minutes or walking interruptions lasting two minutes compared to sedentary control conditions (4, 14).

The emergence of mostly non-quantitative sedentary behavior guidelines worldwide brings challenges in monitoring adherence to the recommendations, especially with the lack of a specific dose that is recommended for interruptions to sitting. Interruptions performed in laboratory settings usually involve brief bouts (2-5 mins) of continuous fixed physical activity that are prescribed based on frequency, duration, activity type, and intensity. By contrast, free-living sedentary breaks, or interruptions to sitting time, are measured using activity monitors by observing transitions between a sedentary to a non-sedentary state (15, 16). These interruptions to sitting time can involve any activity, at any intensity, and last for any duration that meets or exceeds the detection limit of the device (17).

The focus on interruptions to sitting time and postural transitions is often in terms of the act of the transition itself (i.e., primarily counting the frequency of transitions). However, the content of the interruptions is likely to be highly heterogeneous. From a physiological perspective, there is reason to suspect that characteristics of interruptions beyond their frequency may be important and that more physically active interruptions (akin to those performed in laboratory-based studies) may confer greater health benefits than very short and relatively inactive interruptions. Epidemiological studies have indicated that replacing sitting time with standing or stepping is associated with differential benefits in some cardiometabolic health parameters cross-sectionally, using isotemporal analyses (18) and in terms of intervention-induced changes evaluated via compositional data analyses (19). Similarly, experimental evidence has shown that physically active walking interruptions result in superior improvements in postprandial glucose and insulin concentrations compared to standing interruptions (20, 21). Thus, the simple description of the frequency of interruptions commonly applied within epidemiological investigations may form an incomplete and misleading picture if there are also differences in how these interruptions occur (e.g., duration, stepping content and energy expenditure) across different segments of the population.

Therefore, using device-based (activPAL data from 727 middle-aged and older adults in the Australian Diabetes, Obesity and Lifestyle (AusDiab) study, this study aimed to describe the frequency and characteristics (i.e., duration, stepping time, and estimated intensity) of all interruptions and physically active interruptions to adults' free-living sitting time. Physically active interruptions were defined based on the upright and stepping time used during interruptions in experimental laboratory-based conditions. The frequency and characteristics of

all and physically active interruptions were also compared by age, gender, body mass index (BMI), and diabetes status (normoglycemia, pre-diabetes, diabetes).

METHODS

Study Design

The Australian Diabetes, Obesity and Lifestyle (AusDiab) study is a longitudinal study of community-dwelling Australian adults that began as a nationally representative sample in 1999-2000, and which completed its third wave of data collection in 2011-2012 (n=4614). The original sampling methods and response rates have been previously described (3). At the third data collection, a sub-sample of participants from 46 sites across Australia were recruited for an ancillary study to measure physical activity and sedentary behavior with body-worn physical activity monitors. At the on-site visits, participants were invited consecutively until at least five participants were recruited each day or there were no more monitors available for distribution. In total, 1014 participants were invited to the ancillary study and 782 provided written informed consent to wear the physical activity monitors. The study protocol was approved by the Alfred Health Ethics Committee and was in compliance with the Declaration of Helsinki Ethics.

Measuring Interruptions to Sedentary Time

Participants were instructed to wear the thigh-mounted activPAL3 (PAL Technologies, Glasgow, Scotland, UK) physical activity monitor continuously (24 hours/day) for one week, while recording sleep and device removals in a daily log. The activPAL3 is a triaxial accelerometer that measures sitting time and interruptions to sitting time with high precision and accuracy (16, 22, 23). Sitting/lying versus upright posture is assigned based on the angle of the

device as estimated from triaxial acceleration signals when the device is stationary (≈ angle of the thigh) relative to a threshold. Changes in posture are recorded when they last for a minimum upright/sitting period, which by default, is 10 seconds. Stepping is classified by combined input from the position of the device (i.e., being upright) and periods of active acceleration. Using previously reported procedures (24), non-wear time, non-wear days and sleep were excluded. An interruption to sitting time was defined as any upright event following a bout of sitting. The interruption's content in terms of total duration and stepping duration was quantified using the 'Events' output. Average and total energy expenditure (in estimated metabolic equivalents [MET] and MET-min) were also calculated by using the method proposed and validated by Powell et al. (25). Estimated MET-min were calculated during every 15 second time period from summed vector magintude and were then used to determine the MET-min and average METs during each interruption.

In the absence of an accepted criteria for a minimally effective interruption, the evidence cited as underpinning the public health recommendations regarding interrupting sitting time was examined (2, 10). The minimal interruptions in sitting time which have resulted in significant benefits to glucose metabolism were interruptions that comprised at least 5 minutes standing (14) or at least 2 minutes of light stepping (3-5, 14, 26). Subsequently, interruptions were classified as active interruptions if they lasted ≥5 minutes or contained ≥2 minutes of stepping time. In light of the possible importance of stepping, subset of the active interruptions that had ≥2 minutes stepping time were evaluated as 'ambulatory' interruptions. Interruptions were considered per day and per hour of sitting, since greater sitting time provides more opportunities for interruptions.

Metabolic Testing and Glycemic Characterization

Demographic data were collected at local testing sites. Body mass index (BMI) was calculated from measured height (stadiometer) and weight (beam balance scale). As previously reported (27), a 2-hour oral glucose tolerance test (OGTT, 75g glucose) was administered to all participants except for those who were pregnant or currently receiving treatment for diabetes (e.g., hypoglycemic agents, insulin). Diabetes was classified by self-report of diabetes treatment or from the results of the OGTT (fasting glucose ≥7.0 mmol/L and/or 2-hour glucose ≥11.1 mmol/L). Participants were further classified as having normoglycemia (fasting glucose <6.1 mmol/L) or prediabetes (fasting glucose ≥6.1 and <7.0 mmol/L, and/or 2-hour glucose ≥7.8 and <11.1 mmol/L).

Statistical Analyses

Analyses were performed in STATA version 16.0 (StataCorp, TX USA). Participants were included in analyses (n=727) if they were not pregnant, provided at least one valid activPAL wear day (i.e., worn for ≥80% of waking hours and for ≥10 waking hours when waking hours were inferred from movement), socio-demographic data, and had a classifiable diabetes status. Most participants (707/727) had ≥ 4 valid days of monitor data. Spearman's correlations tested the strength of relationship between the various forms of sitting interruptions, with confidence intervals derived using the bias-corrected cluster bootstrap method (28). The frequency per day of each sitting interruption were described and compared across age, gender, BMI, and diabetes-status groups using linear regression models. Both mean ± SD and regression models were corrected for the study's stratified multistage sampling, using linearized variance estimation. The average content of interruptions (their duration, stepping time, MET-duration

and average MET-value) were described and compared across the population using mixed models, which corrected for stratification (with a fixed effect for strata), clustering (with a random intercept), and the repeated measures (applying an exchangeable covariance structure to the residuals). Interruption duration, stepping time, MET-duration and METs were log-transformed to improve normality. Results are presented as marginal means or contrasts of marginal means, back-transformed to original units. Three regression and mixed models were reported: unadjusted; adjusted for age and gender; and, adjusted for age, gender, and BMI. Significance was set at $p<0.05$. Effect sizes are described as "small", "medium", or "large" as per Cohen's d thresholds of 0.2, 0.5, 0.8, respectively (29).

RESULTS

Participant Characteristics

Table 1 describes participant characteristics. There were 321 men and 406 women with an average (mean ± SD) age of 58.0 ± 10.3 years. BMI averaged 27.7 ± 5.1 kg/m^2 and waist circumference averaged 93.5 ± 14.1 cm, with 67.8% of participants having a BMI ≥25 kg/m^2. (See Table, Supplemental Digital Content 1, Range of Characteristics of included participants, http://links.lww.com/MSS/C390.) On average participants wore the monitor for 6.7 ± 0.9 valid days with 15.7 ± 1.1 h/day of waking wear time. Waking wear time was split between mostly sitting (8.8 ± 1.9 h/day sitting, of which 4.1 ± 1.7 h/day was in prolonged bouts ≥30 min), some standing (4.9 ± 1.5 h/day) and less stepping (2.0 ± 0.7 h/day), as previously reported (18).

INSERT TABLE 1 HERE

Frequency of Interruptions to Sitting Time

The measures of interruptions to sitting time were correlated with each other, and with other common measures of sedentary behavior and sedentary time accumulation (see Table, Supplemental Digital Content 2, Correlations of measures of interruptions with each other, with time use in sitting and active behaviors, and with sitting accumulation in middle aged and older adults, http://links.lww.com/MSS/C391). Specifically, the number of all interruptions per day was moderately correlated with number of active interruptions (r=0.59, 95% CI: 0.51, 0.66) and number of active stepping interruptions (r=0.47, 95% CI: 0.39, 0.54). Number of active interruptions and ambulatory interruptions were strongly correlated with each other (r=0.86, 95% CI: 0.84, 0.87). Neither active nor ambulatory interruptions had a strong ($r \geq 0.8$) correlation with total interruptions. Correlations between interruption type (all, active, or ambulatory) and measures of sedentary behavior, sedentary time accumulation, and physical activity were typically stronger for active and ambulatory interruptions than all interruptions per day. Overall, correlations between measures of physical activity (e.g., stepping time, light stepping time) were strongest in ambulatory interruptions per day. This pattern of stronger correlations with the ambulatory interruptions per day was less evident in interruptions per hour of sitting, which was more strongly related to most measures than interruptions per day.

On average, participants performed 53.3 ± 14.9 sitting interruptions per day, less than 40% of which had sufficient duration and/or stepping content to be consistent with the interruptions performed in laboratory studies (i.e., active or ambulatory interruptions; **Table 2**). Participants averaged 19.8 ± 4.9 active interruptions per day (≥5 minutes duration and/or ≥2

minutes stepping) and 13.6 ± 4.5 ambulatory interruptions per day (≥2 minutes of stepping). Participants averaged 6.5 ± 2.7 interruptions, 2.1 ± 1.1 active interruptions and 1.7 ± 0.9 active stepping interruptions per hour of sitting time. The frequency of interruptions overall, and by age, gender, BMI and diabetes status are described in **Table 2,** with the detailed comparisons from adjusted and unadjusted models shown in **Supplemental Table 3** (see Table, Supplemental Digital Content 3, Number of interruptions per day: differences by age, gender, diabetes status and BMI in middle aged and older Australian adults, http://links.lww.com/MSS/C392) and **Supplemental Table 4** (see Table, Supplemental Digital Content 4, Number of interruptions per hour of sitting: differences by age, gender, diabetes status and BMI in middle aged and older Australian adults, http://links.lww.com/MSS/C393).

Overall, large or significant differences between women and men were not observed in the number of interruptions per day. Women performed more total active interruptions, however, this difference was small and did not persist after adjustment. Per hour of sitting time, women performed significantly more interruptions of all types than men **(Table 2)** in both unadjusted and adjusted models **(Supplemental Tables 3, http://links.lww.com/MSS/C392 and 4, http://links.lww.com/MSS/C393)**. Participants who were older performed fewer interruptions of all types than their younger counterparts. Participants with prediabetes or diabetes performed a similar number of total interruptions (50.4 ± 15.6 and 50.0 ± 17.1, respectively) which were lower than normoglycemic participants (56.2 ± 22.9). Active and ambulatory interruptions were also lower in participants with prediabetes or diabetes (**Table 2**). Finally, individuals with higher BMI performed fewer interruptions of all types than their counterparts **(Table 2).** The trends observed by population subgroup were mostly unchanged in adjusted models (**Supplemental**

Table 3, http://links.lww.com/MSS/C392 and 4, http://links.lww.com/MSS/C393). The size of the differences observed between population groups were modest (Cohen's d < 0.2).

INSERT TABLE 2 HERE

Characteristics of Interruptions to Sitting Time

The distributions of total duration, stepping content, and MET-duration of all interruptions, active interruptions and ambulatory interruptions are illustrated in **Figure 1.** Distributions were all right-skewed. On average, interruptions lasted 7.6 (95% CI: 7.5, 7.8) minutes, contained 2.2 (95% CI: 2.1, 2.3) minutes of stepping and had an estimated energy expenditure of 13.0 (95% CI: 12.5, 13.6) MET-min **(Table 3)** when considering all interruptions. By contrast, the active interruptions were longer and more active, on average lasting 17.9 (95% CI: 17.6, 18.3) minutes, with 5.1 (95% CI: 5.0, 5.2) minutes of stepping, and an estimated energy-expenditure of 30.6 (95% CI: 29.5, 31.7) MET-min **(Table 3).** Similar findings were observed for the ambulatory interruptions (all ≥2 min stepping), which lasted on average 21.4 (95% CI: 20.9, 21.9) minutes, contained 6.9 (95% CI: 6.7, 7.1) minutes of stepping, and had an estimated energy-expenditure of 38.7 (95% CI: 37.2, 40.2) MET-min **(Table 3)**.

INSERT TABLE 3 HERE

Some differences between population subgroups were seen in the content of their interruptions. Population-specific averages are described in **Table 4**, with differences in

unadjusted and adjusted models shown in **Supplemental Tables 5-7** [see Tables; Supplemental Digital Content 5, Mean duration of each interruption (min): differences by age, gender, diabetes status and BMI in middle aged and older adults, http://links.lww.com/MSS/C394; Supplemental Digital Content 6, Mean stepping time of each interruption: differences by gender, age, diabetes status and BMI in middle aged and older adults, http://links.lww.com/MSS/C395; Supplemental Digital Content 7, Mean estimated energy expenditure (MET-min) of each interruption: differences by age, gender, diabetes status and BMI in middle aged and older adults, http://links.lww.com/MSS/C396]. In brief, relative to men, women had interruptions that were significantly longer, but of a similar overall MET-duration. Women also had significantly less stepping content during active and ambulatory interruptions compared to men. With higher participant age, interruptions tended to be longer (borderline significant), included less stepping (especially in the active interruptions), and were slightly lower in MET-duration (not significant). Relative to those identified as normoglycemic, those with diabetes had interruptions that both tended to be shorter and involved less stepping (significantly so within the active interruptions) with a tendency towards lower overall energy expenditure. Interruptions in those with prediabetes more closely resembled interruptions seen in the normoglycaemic rather than the diabetes group. With higher BMI, the interruptions tended to be longer, with less stepping content and an overall higher MET-duration (significant in some models only). The size of differences between population groups observed were modest (Cohen's d <0.2).

INSERT TABLE 4 HERE

DISCUSSION

Sitting time was found to be interrupted on average just over 50 times per day in this population-based sample of middle-aged and older Australians, based on accurate device-based measurement. However, only a modest proportion (<40%) of the interruptions to sitting were of a sufficient duration or contained sufficient amounts of stepping (≥5 minutes upright and/or ≥2 minutes stepping) to be comparable in intensity to the shortest of sitting time interruptions that have shown acute benefits to glucose metabolism in laboratory studies (3-6, 14, 30). These active and ambulatory interruptions followed similar patterns across the population with differences by gender, age, diabetes status and BMI classifications in the frequency and/or content of interruptions. Groups performing fewer interruptions than their counterparts were those who were men, older, had diabetes, and had higher BMIs. Collectively the findings highlight that behavioral risk surveillance focused only on total interruptions sometimes finds the same patterning of these more active and more ambulatory forms of interruptions across population groups, but with vastly differing levels and not necessarily accurately.

Previous studies have attempted to estimate the frequency of interruptions in adult populations. Jefferis et al. measured physical activity with a hip worn ActiGraph GT3x in a cohort of older men. They found that there were 72 interruptions to sedentary time per day, which amounted to 7 interruptions per hour (31). Similarly, in cohort of older English adults, Yerrakalva et al. reported 78 (SD 14.3) interruptions per day with an average duration of 4.6 (SD 5.9) minutes using a hip worn ActiGraph GT1M (32). The majority of research in this area has relied on hip and wrist mounted accelerometers because these placement locations are commonly used in population level surveillance studies. These methods historically overestimate

interruptions compared to direct observation and activPALs (16). Very few have used the posture-based activPAL in large scale studies to quantify the frequency and characteristics of interruptions in sitting time. van der Berg et al. measured interruptions using activPALs and reported that individuals with normal glucose tolerance and no presence of metabolic syndrome performed 55.7 (95% CI: 55.0, 56.4) interruptions per day (33). The absolute frequency interruptions reported by van der Berg is similar to what has been reported in the present study, demonstrating the impact that device and wear location can have on population level estimates of interruptions in sitting time.

Some key characteristics relevant to the 'dose' of interruptions that were performed were quantified. Overall, the most prevalent interruptions were short (median duration: 2.7 minutes, median stepping duration: 0.8 minutes) and of low intensity (median estimated energy expenditure: 4.3 MET-min). There was a high degree of variability observed in the duration and content of interruptions, which highlights key issues for the implicit assumptions of measuring all interruptions that has been applied in many previous studies. When no additional criteria are applied, interruptions are treated as a homogenous entity without consideration of variations in their duration, stepping content, or the manner in which they are accumulated (e.g., performed in rapid succession versus sporadically throughout the day). The current evidence is not sufficient to indicate whether there is a minimum 'dose' of an interruption (e.g., duration or intensity) required to confer health benefits, and research in this area is important. There is some evidence to suggest that the intensity of the interruption is associated with lower risk of all-cause mortality (34). At this point, sedentary behavior recommendations have typically been broadly stated and advocate for physically active interruptions and that more activity is better. To improve the

evidence base and move towards more specific and prescriptive clinical guidance, future experimental studies may consider a 'dosing approach' to compare the impact of interruptions of varying duration, stepping content, and intensity to determine whether there are characteristics of interruptions that confer health benefits. In addition to considering the dose of interruptions such as in this study, indicators of temporal accumulation may provide a promising future direction to capture free-living sedentary behavior patterns in meaningful ways (35). Given the emergence of guidelines targeting sedentary behavior and its accumulation, and the increasing availability of device-based activity monitoring in risk surveillance studies such as NHANES (36), considering an evidence-based approach to monitoring interruptions to sitting time is timely.

Existing practice has largely been to focus on all interruptions, and there is some support for this approach. The 2020 sedentary behavior-specific guidelines from the World Health Organization recommend limiting and replacing sedentary time with physical activity performed at any intensity (2). To date, epidemiological studies investigating the relationships between interruptions to sitting time and metabolic biomarkers have effectively treated interruptions in sitting of all types to be equivalent in terms of how they are counted (15, 37), albeit with some variation in how longer and shorter bouts of the heavy-tailed distribution contribute to different statistics. Despite this crude aggregation, a more interrupted accumulation pattern has been shown to be associated with favorable metabolic profiles (e.g., lower HDL, triglycerides and 2-hour glucose concentrations) relative to less interrupted patterns (38-40).

Those with diabetes (predominately type 2 diabetes) are a clinical group for whom evidence-based monitoring of interruptions may be particularly important. Studies show those

with type 2 diabetes have a high prevalence of sedentary time and low rates of participation in moderate or vigorous intensity physical activity (41, 42), and in this study participants with type 2 diabetes also have fewer interruptions to sitting time than those with normal glucose metabolism. However, findings from controlled laboratory experiments suggest that those with prediabetes and type 2 diabetes may derive greater benefit from interrupting sitting time compared to their normoglycemic counterparts (30, 43). Accordingly, the American Diabetes Association recommends that, in addition to regular exercise and incidental activity, adults with type 2 diabetes should decrease sitting time and interrupt sitting time with light activity (10). Based on the analysis performed in this study, any attempt to quantify adherence to the diabetes-management guidelines regarding regularly interrupting sitting should include a quantification of both total interruptions and a subset of those that meet a minimum threshold of activity, such as those used in the present study.

This study provides a framework for developing measurable guidelines for interruptions in a manner that was consistent with current recommendations relating to interrupting to sitting. This approach involved monitoring all interruptions and just those that met some evidence-based criteria that they were at least as active as the most minimalistic of the effective laboratory experiments (3-5, 14, 26) that underpin current recommendations (10) to interrupt sitting time. The definition may seem arbitrary, but the existing practice of monitoring ‘all interruptions’ leaves the measure subject to a different arbitrary threshold: the detection limit of the device. Detection limits are a function of a device’s sampling frequency and data reduction procedures, such as the minimum upright/sitting period setting on the activPAL (17), and epoch settings or window-size choices on other devices. It is not certain the definition is optimal or would operate

identically on all devices used to measure interruptions, but further refinements could be made in future. Some of work done by the Prospective Physical Activity, Sitting, and Sleep consortium (ProPASS) is aimed at consolidating cohort data resources to better understand the relationships between physical activity, sitting and sleep (44). These efforts may provide the opportunities alongside harmonized and federated analysis methods to pool data and understand whether physically active interruptions have important health implications. Notably, while defined based on laboratory-based evidence, 'active' interruptions in laboratory studies — usually continuous, fixed bouts of the same activity, performed over regular intervals (generally every 30–60 minutes) — are not the same as those performed under free-living conditions (i.e., as variable duration periods of any mix of standing and stepping, performed at any interval apart).

Strengths/Limitations: This study used activPAL accelerometers which have established validity for identifying sitting, standing, and stepping and importantly, changes in posture (16, 22, 23, 45). Findings are applicable to monitoring within other large studies that use thigh-mounted accelerometers (33, 46), but not at this point to the national population surveillance studies that use waist or wrist-worn devices (e.g., NHANES (36) UK Biobank (47)). For those studies, accurate monitoring of interruptions and physically active interruptions could potentially come with refinement to data processing methods. A limitation of the study was the estimated energy expenditure (MET-min) of each interruption is subject to some measurement error (48) with a level of validity that is comparable to other estimates from accelerometery without heartrate or other biological parameters that improve accuracy (25). Relative intensity level, which may vary based on gender, age, diabetes status and obesity, was not captured. This study examined a diverse array of community-dwelling adults recruited probabilistically from across

Australia. However, the cohort is not strictly population representative with biases in loss to follow-up since the baseline data collection (49, 50) and with differences between those who participated with the monitoring and those who did not (18). Finally, this secondary analysis was not powered *a priori* but appeared adequate, having sufficient precision to place a tight confidence interval around all non-significant effects ($d \pm 0.2$).

CONCLUSIONS

This study described both the frequency and the characteristics of free-living interruptions in sitting time in middle-aged and older adults, and differences by gender, age, diabetes status and BMI. These interruptions were mostly short (median 2.7 min), contained limited stepping (median 0.8 min), and involved low estimated energy expenditure (median 4.3 MET-min) and most (>60%) fell short of even the most minimal interruptions used in laboratory interventions that have successfully improved acute glycemic control (3-9). An overreliance on quantifying *all* interruptions, which comprise predominantly of very short interruptions with limited stepping, risks failing to obtain an accurate assessment of population levels of interruptions that have been shown to provide acute metabolic benefits. Further research is needed to determine a suitable indicator of minimally effective interruptions. Until such thresholds are defined, rather than focusing only on all interruptions, future studies should also apply some minimum activity threshold to interruptions in sedentary time, albeit imperfect, to provide a more complete picture of free-living sedentary behavior patterns.

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FIGURE CAPTIONS

Figure 1: Histograms illustrating the distribution of the content of all interruptions (A, B, C), active interruptions (D, E, F) and ambulatory active interruptions (G, H, I) measured by the activPAL among 726 participants in the AusDiab study (2011-2012).

SUPPLEMENTAL DIGITAL CONTENT

Supplemental Table 1: Range of Characteristics of included participants (n=727, AusDiab 2011-12)

SUPPLEMENTAL TABLE 2: Correlations of measures of interruptions with each other, with time use in sitting and active behaviors, and with sitting accumulation in middle aged and older adults (n=727, AusDiab 2011-12)

SUPPLEMENTAL TABLE 3: Number of interruptions per day: differences by age, gender, diabetes status and BMI in middle aged and older Australian adults (AusDiab 2011-12)

SUPPLEMENTAL TABLE 4: Number of interruptions per hour of sitting: differences by age, gender, diabetes status and BMI in middle aged and older Australian adults (AusDiab 2011-12)

SUPPLEMENTAL TABLE 5: Mean duration of each interruption (min): differences by age, gender, diabetes status and BMI in middle aged and older adults (AusDiab 2011-12)

SUPPLEMENTAL TABLE 6: Mean stepping time of each interruption: differences by gender, age, diabetes status and BMI in middle aged and older adults (AusDiab 2011-12)

SUPPLEMENTAL TABLE 7: Mean estimated energy expenditure (MET-min) of each interruption: differences by age, gender, diabetes status and BMI in middle aged and older adults (AusDiab 2011-12)

Figure 1

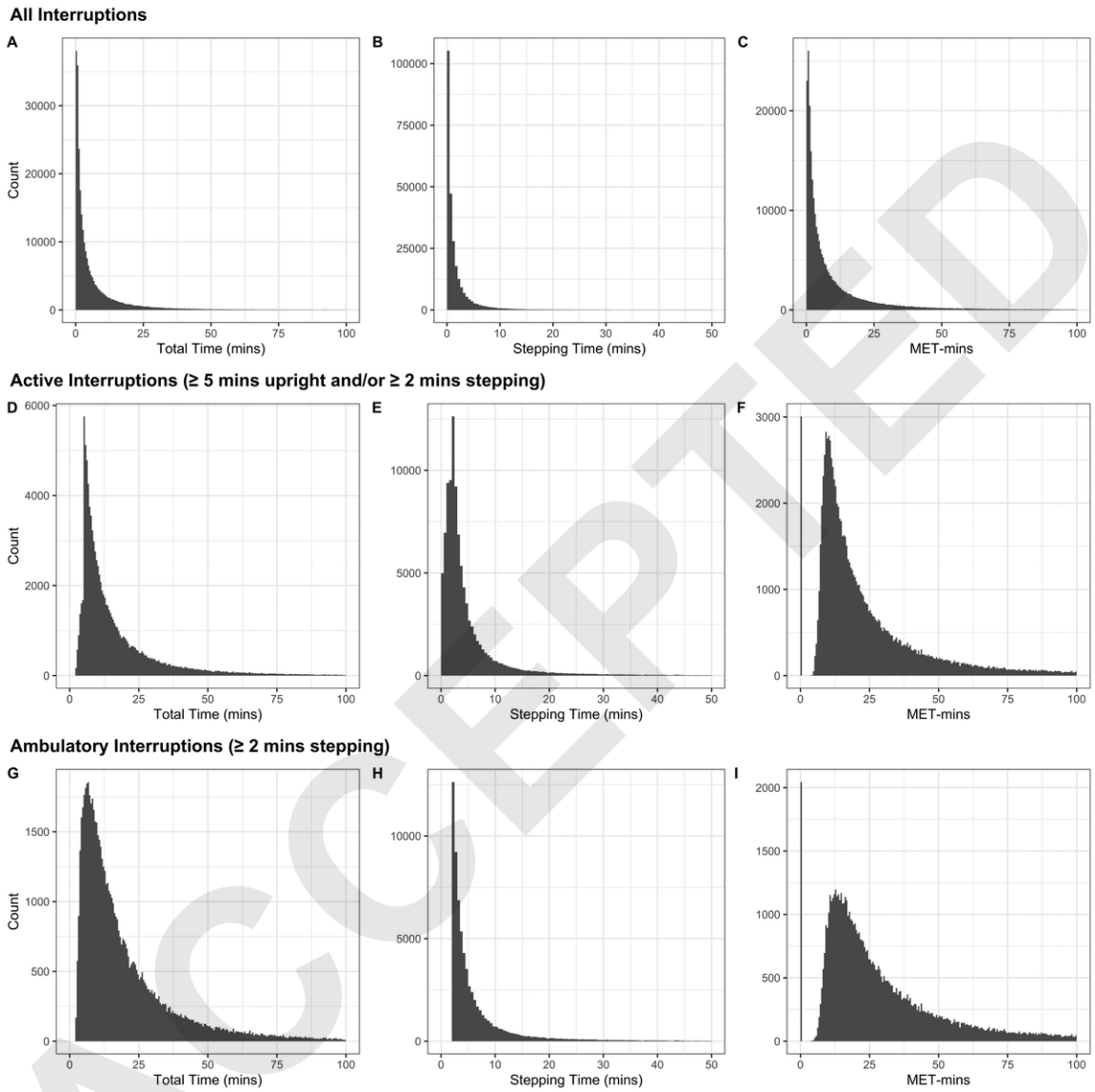

Table 1: Characteristics of included participants (n=727, AusDiab 2011-12)

Socio-demographic	
Age, *years*	58.5 ± 10.4
Men, *n (%)*	321 (44.2%)
Height, *cm*	169.2 ± 9.0
Ethnicity, *n (%)*	
Australia/New Zealand	596 (82.0%)
Other English Speaking	80 (11.0%)
Other non-English Speaking	51 (7.0%)
Married/defacto, *n (%)*	550 (76.4%)
Employment status, *n (%)*	
Full time	265 (36.5%)
Part time	154 (21.2%)
Retired	219 (30.1%)
Other not working/missing	89 (12.2%)
Gross Household Income, *n (%)*	
< $30k	108 (15.9%)
$30 to <60k	166 (24.5%)
$60 to <100k	150 (22.1%)
≥ $100k	254 (37.5%)
Behavioral	
Smoking status, *n (%)*	
Never smoker	407 (56.0%)
Ex-smoker	264 (36.3%)
Current smoker	51 (7.0%)
Unknown	5 (0.7%)
Medical/Biomarkers	
Menopause, *n (% of women)*	
Pre-menopausal/not sure	236 (32.6%)
Going through menopause	61 (8.4%)
Post-menopausal	427 (59.0%)
Weight, *kg*	79.3 ± 16.2
BMI, kg/m^2	27.7 ± 5.1
Waist circumference, *cm*	93.6 ± 14.0
Fasting plasma glucose, mmol/L	5.5 ± 1.0
2-hour plasma glucose, mmol/L [a]	5.7 ± 2.0
HbA_{1C}, % (mmol/mol) [b]	5.7 ± 0.6 (39.2 ± 6.2)

Table 1 shows mean ± SD or n (%).
[a] n= 692
[b] n=726

TABLE 2: Mean frequency of interruptions to sitting time in free living conditions among middle-aged and older Australian adults (n=727, AusDiab 2011-2012)

Participants	n	Number of interruptions per day			Number of interruptions per hour of sitting		
		All	Active [a]	Ambulatory [b]	All	Active [a]	Ambulatory [b]
All	727	55.0 ± 21.9	20.3 ± 6.9	14.0 ± 5.4	6.5 ± 2.7	2.5 ± 1.1	1.7 ± 0.9
Gender		*p=0.754*	***p=0.049***	*p=0.856*	***p=0.010***	***p<0.001***	***p=0.003***
Men	321	55.3 ± 20.0	19.8 ± 6.1	14.0 ± 5.1	6.2 ± 2.4	2.3 ± 0.9	1.6 ± 0.8
Women	406	54.8 ± 23.2	20.7 ± 7.4	14.0 ± 5.7	6.7 ± 2.9	2.6 ± 1.2	1.8 ± 0.9
Age		***p=0.003***	***p<0.001***	***p<0.001***	***p<0.001***	***p<0.001***	***p<0.001***
<45 years	72	57.4 ± 16.6	21.1 ± 5.2	14.9 ± 4.7	6.8 ± 2.0	2.6 ± 1.0	1.8 ± 0.8
45-65 years	448	56.9 ± 23.3	21.0 ± 7.2	14.6 ± 5.4	6.8 ± 2.9	2.6 ± 1.1	1.8 ± 0.9
≥65 years	207	50.1 ± 19.2	18.7 ± 6.4	12.3 ± 5.4	5.7 ± 2.3	2.2 ± 1.0	1.5 ± 0.8
Diabetes status		***p=0.007***	***p<0.001***	***p<0.001***	***p<0.001***	***p<0.001***	***p<0.001***
Normoglycemic	585	56.2 ± 22.9	20.9 ± 7.2	14.4 ± 5.6	6.7 ± 2.8	2.6 ± 1.1	1.8 ± 0.9
Prediabetes	89	50.4 ± 15.6	18.4 ± 4.3	12.8 ± 3.9	5.7 ± 1.9	2.1 ± 0.8	1.5 ± 0.6
Diabetes	53	50.0 ± 17.1	17.5 ± 5.5	10.9 ± 4.4	5.4 ± 1.9	2.0 ± 0.9	1.3 ± 0.7
Body Mass Index		***p<0.001***	***p<0.001***	***p<0.001***	***p<0.001***	***p<0.001***	***p<0.001***
<25 kg/m^2	235	59.5 ± 27.8	21.7 ± 8.5	15.0 ± 6.4	7.2 ± 3.4	2.7 ± 1.3	1.9 ± 1.0
25 – 30 kg/m^2	310	54.3 ± 19.4	20.3 ± 6.1	14.0 ± 5.0	6.5 ± 2.5	2.5 ± 1.0	1.7 ± 0.9
≥ 30 kg/m^2	182	50.4 ± 14.8	18.7 ± 5.3	12.6 ± 4.4	5.5 ± 1.8	2.1 ± 0.9	1.4 ± 0.7

Table 2 shows mean ± SD and p for difference between groups from linear regression models, with linearized variance estimation for the stratified (state) multistage sampling (cluster = Australian Diabetes Lifestyle and Obesity study [AusDiab] testing center). Bold denotes p<0.05

[a] ≥5 min upright and/or ≥2 min stepping

[b] ≥2 min stepping

TABLE 3: Average characteristics (duration, stepping time and MET-duration) of interruptions to sitting time in free-living conditions performed by middle aged and older Australian adults (n=727, AusDiab) [a]

Attribute	Statistic	All interruptions	Active interruptions (≥5 min upright and/or ≥2 min stepping)	Ambulatory interruptions (≥2 min stepping)
Duration *(minutes)*	Mean (95% CI) [b]	7.6 (7.5, 7.8)	17.9 (17.6, 18.3)	21.4 (20.9, 21.9)
	SD[b]	16.4	23.5	24.1
	Geometric mean (95% CI) [b]	2.7 (2.7, 2.8)	12.5 (12.3, 12.6)	14.7 (14.5, 15.0)
	50^{th} (25^{th}, 75^{th}) percentile [c]	2.7 (0.9, 7.8)	10.9 (6.8, 20.3)	14.0 (8.0, 25.8)
Stepping Time *(minutes)*	Mean (95% CI) [b]	2.2 (2.1, 2.3)	5.1 (5.0, 5.2)	6.9 (6.7, 7.1)
	SD [b]	5.3	7.9	8.9
	Geometric mean (95% CI) [b]	0.5 (0.4, 0.5)	2.6 (2.6, 2.7)	4.8 (4.7, 4.9)
	50^{th} (25^{th}, 75^{th}) percentile [c]	0.8 (0.3, 2.0)	2.8 (1.7, 5.2)	4.0 (2.7, 7.1)
MET-duration *(MET-minutes)*	Mean (95% CI) [b]	13.0 (12.5, 13.6)	30.6 (29.5, 31.7)	38.7 (37.2, 40.2)
	SD [b]	30.1	44	49.2
	Geometric mean (95% CI) [b]	4.7 (4.6, 4.8)	21.1 (20.8, 21.4)	27.6 (27.1, 28.1)
	50^{th} (25^{th}, 75^{th}) percentile [c]	4.3 (1.4, 12.6)	17.5 (11.0, 32.6)	23.8 (14.7, 42.9)

Table 3 shows mean (95% CI), standard deviation (SD), geometric mean, and 50% (25th, 75th) percentiles of the characteristics of interruptions to sitting time in free living conditions.

[a] n = 1 who had no ambulatory interruptions excluded from estimates for ambulatory interruptions

[b] Linearized variance estimation (each interruption nested within individual within Australian Diabetes Lifestyle and Obesity Study [AusDiab] testing center cluster)

[c] Cluster bootstrap (each interruption nested within individual within AusDiab testing center cluster)

TABLE 4: Mean duration, stepping time and MET-duration of interruptions by age, gender, diabetes status and BMI in middle aged and older Australian adults (AusDiab 2011-12)

	n [a]	Duration (minutes)			Stepping Time (minutes)			Met-Duration (MET-minutes)		
		All	Active [b]	Ambulatory [c]	All	Active [b]	Ambulatory [c]	All	Active [b]	Ambulatory [c]
Gender		***p=0.004***	***p<0.001***	***p<0.001***	*p=0.361*	*p=0.322*	*p=0.328*	*p=0.330*	***p=0.050***	***p=0.044***
Men	321	7.2 (6.9, 7.6)	17.3 (16.6, 17.9)	20.4 (19.5, 21.3)	13.0 (12.2, 13.8)	31.3 (29.6, 33.0)	39.1 (36.8, 41.5)	2.3 (2.2, 2.4)	5.4 (5.2, 5.6)	7.2 (6.9, 7.5)
Women	406	8.0 (7.7, 8.2)	18.4 (17.9, 18.9)	22.3 (21.5, 23.0)	13.1 (12.5, 13.6)	30.1 (28.9, 31.3)	38.4 (36.7, 40.0)	2.2 (2.1, 2.2)	4.9 (4.7, 5.0)	6.7 (6.5, 6.9)
Age		*p=0.061*	*p=0.108*	***p=0.010***	*p=0.493*	*p=0.158*	*p=0.946*	*p=0.897*	***p=0.042***	*p=0.842*
< 45 years	72	7.4 (6.8, 8.1)	17.4 (16.0, 18.9)	20.1 (18.7, 21.5)	13.5 (12.5, 14.5)	31.8 (29.4, 34.1)	39.2 (36.1, 42.2)	2.2 (2.0, 2.4)	5.1 (4.7, 5.5)	6.7 (6.3, 7.2)
45–65 years	448	7.6 (7.4, 7.8)	17.9 (17.5, 18.3)	21.3 (20.8, 21.8)	13.0 (12.4, 13.6)	30.7 (29.3, 32.0)	38.5 (36.7, 40.3)	2.2 (2.1, 2.3)	5.1 (5.0, 5.3)	6.9 (6.7, 7.1)
≥ 65 years	207	7.9 (7.5, 8.2)	18.2 (17.6, 18.8)	22.3 (21.3, 23.3)	13.0 (12.3, 13.6)	30.1 (28.8, 31.3)	39.0 (37.3, 40.7)	2.2 (2.1, 2.3)	5.0 (4.8, 5.2)	7.0 (6.7, 7.2)
Diabetes status		*p=0.419*	*p=0.202*	*p=0.859*	*p=0.222*	*p=0.079*	*p=0.951*	*p=0.056*	***p=0.001***	*p=0.273*
Normoglycemic	585	7.7 (7.5, 7.9)	18.0 (17.6, 18.3)	21.4 (20.9, 21.9)	13.2 (12.7, 13.7)	30.8 (29.7, 32.0)	38.8 (37.2, 40.4)	2.2 (2.2, 2.3)	5.1 (5.0, 5.3)	6.9 (6.7, 7.1)
Pre-diabetes	89	7.6 (6.9, 8.3)	18.0 (16.9, 19.2)	21.7 (20.2, 23.2)	13.0 (11.4, 14.5)	30.8 (27.7, 33.9)	38.9 (35.2, 42.6)	2.3 (2.1, 2.4)	5.3 (5.0, 5.6)	7.1 (6.8, 7.4)
Diabetes	53	6.9 (6.2, 7.5)	16.7 (15.7, 17.7)	20.8 (19.4, 22.2)	11.3 (9.9, 12.7)	27.4 (24.4, 30.5)	36.8 (32.8, 40.9)	1.9 (1.7, 2.1)	4.5 (4.0, 5.0)	6.7 (6.0, 7.3)
Body Mass Index		*p=0.057*	*p=0.756*	*p=0.823*	***p=0.024***	*p=0.295*	*p=0.270*	*p=0.354*	***p=0.005***	*p=0.114*
< 25 kg/m^2	235	7.4 (7.1, 7.6)	17.5 (17.0, 17.9)	20.8 (20.0, 21.6)	12.7 (12.1, 13.4)	30.2 (28.8, 31.6)	38.0 (36.0, 40.0)	2.2 (2.1, 2.3)	5.1 (4.9, 5.3)	6.8 (6.6, 7.1)
25–30 kg/m^2	310	7.8 (7.5, 8.1)	18.2 (17.6, 18.8)	21.7 (20.9, 22.5)	13.3 (12.6, 14.0)	31.1 (29.5, 32.7)	39.3 (37.1, 41.4)	2.3 (2.2, 2.4)	5.3 (5.1, 5.5)	7.1 (6.8, 7.3)
≥ 30 kg/m^2	182	7.8 (7.3, 8.2)	18.1 (17.2, 18.9)	21.9 (20.8, 23.0)	13.1 (12.2, 14.0)	30.3 (28.6, 32.0)	38.8 (36.6, 41.0)	2.1 (2.0, 2.3)	4.8 (4.5, 5.1)	6.7 (6.3, 7.0)

Table 4 shows marginal mean (95% CI) from linear mixed model, with random intercept for cluster (AusDiab testing centre) and participant (repeated measures). Significant differences at p<0.05 are bolded.

[a] n = 1 (woman, 45–56 years, normoglycaemic, < 25 kg/m^2) who had no ambulatory interruptions absent from models of ambulatory interruptions

[b] Interruptions ≥5 min upright and/or ≥2 min stepping time

[c] interruptions ≥2 min stepping time

Supplemental Table 1: Range of Characteristics of included participants (n=727, AusDiab 2011-12)

Socio-demographic	Min, Max
Age, *years*	36, 89
Height, *cm*	147.0, 193.5
Weight, *kg*	42.2, 152.3
BMI, kg/m^2	16.8, 58.0
Waist circumference, *cm*	58.3, 141.8
Fasting plasma glucose, mmol/L	3.6, 15.4
2-hour plasma glucose, mmol/L [a]	1.7, 23.4
HbA_{1C}, % (mmol/mol) [b]	4.8, 11.3 (29, 100)

Table 1 shows min, max with linearized variance estimation for the stratified (state) multistage sampling (cluster = AusDiab testing center).

[a] n= 692

[b] n=726

SUPPLEMENTAL TABLE 2: Correlations of measures of interruptions with each other, with time use in sitting and active behaviors, and with sitting accumulation in middle aged and older adults (n=727, AusDiab 2011-12)

	Interruptions, n/day			Interruptions, n/h sitting		
Outcome	**All**	**Active** [a]	**Ambulatory** [b]	**All**	**Active** [a]	**Ambulatory** [b]
Interruptions						
All, n/day	1.000	-	-	-	-	-
Active, n/day	**0.594 (0.538, 0.651)**	1.000	-	-	-	-
Ambulatory, n/day	**0.484 (0.428, 0.540)**	**0.856 (0.839, 0.873)**	1.000	-	-	-
All, n/ h sitting	**0.738 (0.700, 0.775)**	**0.789 (0.759, 0.818)**	**0.693 (0.657, 0.730)**	1.000	-	-
Active, n/ h sitting	**0.303 (0.239, 0.366)**	**0.856 (0.833, 0.879)**	**0.765 (0.737, 0.794)**	**0.796 (0.770, 0.822)**	1.000	-
Ambulatory, n/ h sitting	**0.282 (0.223, 0.340)**	**0.796 (0.765, 0.826)**	**0.897 (0.881, 0.914)**	**0.741 (0.713, 0.770)**	**0.925 (0.913, 0.937)**	**1.000**
Time use (min/day)						
Awake device wear	**0.254 (0.184, 0.323)**	**0.229 (0.163, 0.296)**	**0.224 (0.156, 0.292)**	**0.039 (-0.037, 0.115)**	**0.001 (-0.070, 0.073)**	**0.037 (-0.037, 0.111)**
Sitting	**0.111 (0.042, 0.180)**	**-0.437 (-0.514, -0.361)**	**-0.427 (-0.486, -0.369)**	**-0.527 (-0.601, -0.454)**	**-0.803 (-0.851, -0.755)**	**-0.755 (-0.792, -0.717)**
Prolonged sitting	**-0.304 (-0.379, -0.230)**	**-0.591 (-0.653, -0.530)**	**-0.541 (-0.597, -0.486)**	**-0.780 (-0.830, -0.729)**	**-0.804 (-0.846, -0.762)**	**-0.756 (-0.794, -0.718)**
Standing	-0.034 (-0.093, 0.024)	**0.515 (0.469, 0.561)**	**0.404 (0.367, 0.442)**	**0.483 (0.435, 0.531)**	**0.763 (0.734, 0.792)**	**0.655 (0.625, 0.686)**
Stepping	**0.228 (0.157, 0.299)**	**0.550 (0.489, 0.611)**	**0.760 (0.713, 0.807)**	**0.494 (0.427, 0.560)**	**0.586 (0.529, 0.644)**	**0.750 (0.711, 0.789)**
MVPA stepping	**0.159 (0.105, 0.213)**	**0.222 (0.168, 0.276)**	**0.298 (0.241, 0.355)**	**0.199 (0.145, 0.253)**	**0.194 (0.134, 0.253)**	**0.265 (0.204, 0.325)**
Light stepping	**0.210 (0.140, 0.280)**	**0.556 (0.497, 0.615)**	**0.760 (0.714, 0.805)**	**0.500 (0.445, 0.556)**	**0.608 (0.559, 0.658)**	**0.765 (0.730, 0.800)**
Light	0.026 (-0.039, 0.092)	**0.585 (0.534, 0.637)**	**0.553 (0.513, 0.593)**	**0.544 (0.493, 0.595)**	**0.813 (0.782, 0.845)**	**0.769 (0.744, 0.795)**
Time use (min/16 h awake)						
Sitting	0.025 (-0.040, 0.090)	**-0.559 (-0.618, -0.499)**	**-0.543 (-0.590, -0.496)**	**-0.573 (-0.632, -0.513)**	**-0.858 (-0.894, -0.823)**	**-0.817 (-0.842, -0.792)**
Prolonged sitting	**-0.357 (-0.426, -0.288)**	**-0.644 (-0.695, -0.593)**	**-0.590 (-0.635, -0.544)**	**-0.801 (-0.844, -0.759)**	**-0.818 (-0.854, -0.783)**	**-0.772 (-0.804, -0.740)**
Standing	**-0.093 (-0.147, -0.039)**	**0.466 (0.414, 0.519)**	**0.355 (0.313, 0.396)**	**0.485 (0.435, 0.535)**	**0.776 (0.741, 0.810)**	**0.657 (0.624, 0.689)**
Stepping	**0.187 (0.113, 0.260)**	**0.519 (0.449, 0.589)**	**0.734 (0.682, 0.785)**	**0.503 (0.434, 0.571)**	**0.604 (0.546, 0.662)**	**0.766 (0.726, 0.807)**

MVPA stepping	**0.141 (0.084, 0.199)**	**0.208 (0.152, 0.263)**	**0.283 (0.226, 0.341)**	**0.201 (0.142, 0.260)**	**0.198 (0.136, 0.259)**	**0.266 (0.205, 0.326)**
Light stepping	**0.168 (0.099, 0.237)**	**0.527 (0.459, 0.595)**	**0.735 (0.679, 0.791)**	**0.510 (0.448, 0.572)**	**0.628 (0.577, 0.679)**	**0.783 (0.747, 0.819)**
Light	-0.037 (-0.101, 0.028)	**0.540 (0.481, 0.599)**	**0.509 (0.467, 0.552)**	**0.554 (0.498, 0.610)**	**0.839 (0.805, 0.873)**	**0.785 (0.759, 0.811)**
Sitting patterns [c]						
Usual bout duration, min	**-0.591 (-0.653, -0.530)**	**-0.626 (-0.684, -0.568)**	**-0.556 (-0.612, -0.499)**	**-0.832 (-0.872, -0.793)**	**-0.654 (-0.704, -0.604)**	**-0.620 (-0.673, -0.567)**
Alpha	**0.559 (0.506, 0.612)**	**0.628 (0.572, 0.685)**	**0.571 (0.516, 0.626)**	**0.822 (0.781, 0.863)**	**0.678 (0.639, 0.718)**	**0.651 (0.610, 0.693)**
Mean upright period, min	**-0.602 (-0.642, -0.562)**	**0.158 (0.083, 0.232)**	**0.172 (0.110, 0.235)**	**-0.057 (-0.120, 0.007)**	**0.472 (0.414, 0.530)**	**0.435 (0.380, 0.490)**

SUPPLEMENTAL TABLE 2 shows Spearman's correlations with 95% CI from cluster bootstrap (cluster = Australian Diabetes Lifestyle and Obesity Study [AusDiab] testing center). **Bold denotes p<0.05** Shading indicates strong correlations (absolute value 0.8–1).

[a] active ≥5 min upright and/or ≥2 min of stepping

[b] ambulatory ≥ 2 min of stepping

[c] measures as reported in Bellettiere et al. (Bellettiere et al., 2017) and Chastin et al. (Chastin et al., 2015). Lower values of usual bout duration and higher values of alpha denote a more interrupted sitting pattern, while longer mean upright period indicates longer periods of time elapse between bouts of sitting.

SUPPLEMENTAL TABLE 3: Number of interruptions per day: differences by age, gender, diabetes status and BMI in middle aged and older Australian adults (AusDiab 2011-12)

Participant characteristic		n [a]	All Interruptions		Active Interruptions (≥5 min upright and/or ≥2 min stepping)		Ambulatory Interruptions (≥2 min stepping)	
			Difference (95% CI)	p	Difference (95% CI)	p	Difference (95% CI)	p
Gender (unadjusted)	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	-0.8 (-3.7, 2.1)	0.585	0.9 (0.0, 1.8)	**0.05**	0.1 (-0.7, 0.8)	0.859
Gender [b]	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	-1.1 (-3.9, 1.8)	0.458	0.8 (-0.1, 1.7)	0.085	0.0 (-0.8, 0.8)	0.947
Gender [c]	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	-1.3 (-4.0, 1.5)	0.349	0.7 (-0.2, 1.6)	0.109	-0.1 (-0.9, 0.7)	0.802
Age (unadjusted)	< 45 years	72	0 (referent)	***0.006***		***<0.001***		***<0.001***
	45–65 years	448	-0.5 (-4.0, 2.9)	0.758	-0.1 (-1.4, 1.1)	0.812	-0.3 (-1.3, 0.8)	0.591
	≥ 65 years	207	-7.2 (-12.2, -2.2)	0.006	-2.5 (-4.0, -1.1)	0.001	-2.6 (-3.9, -1.3)	<0.001
Age [b]	< 45 years	72	0 (referent)	***0.006***	0 (referent)	***<0.001***	0 (referent)	***<0.001***
	45–65 years	448	-0.6 (-4.1, 2.9)	0.725	-0.1 (-1.3, 1.2)	0.894	-0.3 (-1.3, 0.8)	0.597
	≥65 years	207	-7.3 (-12.3, -2.3)	0.005	-2.4 (-3.9, -1.0)	0.001	-2.6 (-3.9, -1.3)	<0.001
Age [c]	<45 years	72	0 (referent)	***0.008***	0 (referent)	***<0.001***	0 (referent)	***<0.001***
	45–65 years	448	-0.3 (-3.8, 3.3)	0.881	0.0 (-1.3, 1.4)	0.951	-0.2 (-1.3, 0.9)	0.755
	≥65 years	207	-6.9 (-11.9, -1.8)	0.009	-2.3 (-3.8, -0.8)	0.004	-2.5 (-3.8, -1.1)	<0.001
Diabetes status	Normoglycaemia	585	0 (referent)	***0.006***	0 (referent)	***<0.001***	0 (referent)	***<0.001***
(unadjusted)	Prediabetes	89	-5.7 (-9.8, -1.5)	0.009	-2.4 (-3.5, -1.3)	<0.001	-1.6 (-2.5, -0.7)	<0.001
	Diabetes	53	-6.2 (-10.6, -1.8)	0.007	-3.4 (-4.5, -2.3)	<0.001	-3.5 (-4.6, -2.4)	<0.001
Diabetes status [b]	Normoglycaemia	585	0 (referent)	***0.013***		***<0.001***		***<0.001***
	Prediabetes	89	-4.9 (-8.9, -0.8)	0.019	-1.9 (-2.9, -0.8)	<0.001	-1.3 (-2.1, -0.4)	0.005
	Diabetes	53	-5.3 (-9.6, -1.0)	0.017	-3.0 (-4.0, -1.9)	<0.001	-3.1 (-4.1, -2.2)	<0.001

Diabetes status [c]	Normoglycaemia	585	0 (referent)		0 (referent)		0 (referent)	
	Prediabetes	89	-3.5 (-7.6, 0.7)	0.097	-1.4 (-2.5, -0.3)	0.014	-0.8 (-1.7, 0.1)	0.072
	Diabetes	53	-3.8 (-8.6, 1.1)	0.127	-2.5 (-3.6, -1.3)	<0.001	-2.7 (-3.7, -1.6)	<0.001
Body Mass Index	< 25 kg/m^2	235	0 (referent)	***<0.001***	0 (referent)	***<0.001***	0 (referent)	***<0.001***
(unadjusted)	25–30 kg/m^2	310	-4.8 (-9.6, 0.1)	0.055	-1.3 (-3.0, 0.3)	0.109	-0.9 (-2.2, 0.3)	0.135
	≥ 30 kg/m^2	182	-8.9 (-12.5, -5.2)	<0.001	-2.9 (-4.2, -1.7)	<0.001	-2.4 (-3.4, -1.4)	<0.001
Body Mass Index [c]	< 25 kg/m^2	235	0 (referent)	***<0.001***	0 (referent)	***<0.001***	0 (referent)	***<0.001***
	25–30 kg/m^2	310	-4.7 (-9.3, 0.0)	0.051	-1.1 (-2.7, 0.5)	0.181	-0.8 (-2.0, 0.4)	0.174
	≥ 30 kg/m^2	182	-8.6 (-12.3, -4.9)	<0.001	-2.7 (-4.0, -1.5)	<0.001	-2.3 (-3.3, -1.3)	<0.001

SUPPLEMENTAL TABLE 3 shows coefficient 95% confidence interval from linear mixed model, with random intercepts for cluster (AusDiab testing center) and participant (repeated measures)

[a] n = 1 (woman, 45–56 years, normoglycaemic, < 25 kg/m^2) who had no ambulatory interruptions absent from models of ambulatory interruptions

[b] model includes age and gender

[c] model includes age (<45 / 45–65 / ≥65 years), gender (men / women), and Body Mass Index (< 25 / 25–30 / ≥ 30 kg/m^2)

SUPPLEMENTAL TABLE 4: Number of interruptions per hour of sitting: differences by age, gender, diabetes status and BMI in middle aged and older Australian adults (AusDiab 2011-12)

		n	**All Interruptions**		**Active Interruptions (≥5 min upright and/or ≥2 min stepping)**		**Ambulatory Interruptions (≥2 min stepping)**	
			Difference (95% CI)	p	Difference (95% CI)	p	Difference (95% CI)	p
Gender (unadjusted)	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	0.5 (0.1, 0.8)	**0.016**	0.3 (0.2, 0.5)	**<0.001**	0.2 (0.1, 0.3)	**0.003**
Gender [b]	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	0.4 (0.0, 0.8)	**0.035**	0.3 (0.2, 0.5)	**<0.001**	0.2 (0.0, 0.3)	**0.014**
Gender [c]	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	0.4 (0.0, 0.7)	**0.047**	0.3 (0.2, 0.5)	**<0.001**	0.1 (0.0, 0.3)	**0.021**
Age (unadjusted)	<45	72	0 (referent)	***<0.001***	0 (referent)	***<0.001***	0 (referent)	***<0.001***
	45-65	448	0.0 (-0.6, 0.5)	0.887	0.0 (-0.3, 0.2)	0.893	0.0 (-0.3, 0.2)	0.711
	≥65	207	-1.1 (-1.7, -0.6)	<0.001	-0.4 (-0.7, -0.2)	0.003	-0.4 (-0.6, -0.2)	0.001
Age [b]	<45	72	0 (referent)	***<0.001***	0 (referent)	***<0.001***	0 (referent)	***<0.001***
	45-65	448	0.0 (-0.5, 0.5)	0.987	0.0 (-0.2, 0.3)	0.944	0.0 (-0.2, 0.2)	0.805
	≥65	207	-1.1 (-1.7, -0.5)	<0.001	-0.4 (-0.6, -0.1)	0.005	-0.4 (-0.6, -0.2)	0.002
Age [c]	<45	72	0 (referent)	***<0.001***	0 (referent)	***<0.001***	0 (referent)	***<0.001***
	45-65	448	0.1 (-0.5, 0.6)	0.821	0.0 (-0.2, 0.3)	0.816	0.0 (-0.2, 0.2)	0.951
	≥65	207	-1.0 (-1.6, -0.4)	0.002	-0.4 (-0.6, -0.1)	0.015	-0.4 (-0.6, -0.1)	0.006
Diabetes status (unadjusted)	Normoglycemia	585	0 (referent)	***<0.001***	0 (referent)	***<0.001***	0 (referent)	***<0.001***
	Prediabetes	89	-1.0 (-1.4, -0.5)	<0.001	-0.4 (-0.6, -0.2)	<0.001	-0.3 (-0.4, -0.1)	<0.001
	Diabetes	53	-1.2 (-1.7, -0.8)	<0.001	-0.6 (-0.8, -0.4)	<0.001	-0.5 (-0.7, -0.3)	<0.001
Diabetes status [b]	Normoglycemia	585	0 (referent)	***<0.001***	0 (referent)	***<0.001***	0 (referent)	***<0.001***

	Prediabetes	89	-0.7 (-1.1, -0.3)	0.003	-0.3 (-0.5, -0.1)	0.005	-0.2 (-0.3, -0.1)	0.004
	Diabetes	53	-1.0 (-1.5, -0.6)	<0.001	-0.5 (-0.6, -0.3)	<0.001	-0.4 (-0.6, -0.3)	<0.001
Diabetes status [c]	Normoglycemia	585	0 (referent)	***0.027***	0 (referent)	***0.002***	0 (referent)	***<0.001***
	Prediabetes	89	-0.4 (-0.9, 0.1)	0.091	-0.2 (-0.4, 0.0)	0.075	-0.1 (-0.3, 0.0)	0.11
	Diabetes	53	-0.7 (-1.2, -0.2)	0.012	-0.4 (-0.6, -0.2)	<0.001	-0.4 (-0.5, -0.2)	<0.001
Body Mass Index (unadjusted)	< 25 kg/m^2	235	0 (referent)	***<0.001***	0 (referent)	***<0.001***	0 (referent)	***<0.001***
	25–30 kg/m^2	310	-0.7 (-1.3, -0.1)	0.032	-0.2 (-0.4, 0.0)	0.097	-0.1 (-0.3, 0.0)	0.143
	≥ 30 kg/m^2	182	-1.6 (-2.1, -1.1)	<0.001	-0.5 (-0.7, -0.3)	<0.001	-0.4 (-0.6, -0.3)	<0.001
Body Mass Index [c]	< 25 kg/m^2	235	0 (referent)	***<0.001***	0 (referent)	***<0.001***	0 (referent)	***<0.001***
	25–30 kg/m^2	310	-0.5 (-1.1, 0.0)	0.068	-0.1 (-0.3, 0.1)	0.306	-0.1 (-0.3, 0.1)	0.338
	≥ 30 kg/m^2	182	-1.5 (-2.0, -1.0)	<0.001	-0.5 (-0.7, -0.3)	<0.001	-0.4 (-0.6, -0.2)	<0.001

SUPPLEMENTAL TABLE 4 shows coefficient 95% confidence interval from linear mixed model, with random intercepts for cluster (AusDiab testing center) and participant (repeated measures)

[a] n = 1 (woman, 45–56 years, normoglycaemic, < 25 kg/m^2) who had no ambulatory interruptions absent from models of ambulatory interruptions

[b] model includes age and gender

[c] model includes age (<45 / 45–65 / ≥65 years), gender (men / women), and Body Mass Index (< 25 / 25–30 / ≥ 30 kg/m^2)

SUPPLEMENTAL TABLE 5: Mean duration of each interruption (min): differences by age, gender, diabetes status and BMI in middle aged and older adults (AusDiab 2011-12)

Participant characteristic		n [a]	**All Interruptions**		**Active Interruptions (≥5 min upright and/or ≥2 min stepping)**		**Ambulatory Interruptions (≥2 min stepping)**	
			Difference (95% CI)	p	Difference (95% CI)	p	Difference (95% CI)	p
Gender	Men	321	0 (referent)		0 (referent)		0 (referent)	
(unadjusted)	Women	406	0.21 (0.08, 0.35)	**0.003**	0.97 (0.59, 1.35)	**<0.001**	1.83 (1.18, 2.48)	**<0.001**
Gender [b]	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	0.23 (0.09, 0.36)	**0.002**	1.00 (0.63, 1.36)	**<0.001**	1.89 (1.27, 2.52)	**<0.001**
Gender [c]	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	0.23 (0.10, 0.37)	**0.001**	1.00 (0.64, 1.37)	**<0.001**	1.91 (1.29, 2.52)	**<0.001**
Age (unadjusted)	< 45	72	0 (referent)	*0.061*	0 (referent)	*0.108*	0 (referent)	***0.010***
	45–65	448	0.00 (-0.15, 0.16)	0.952	0.19 (-0.39, 0.76)	0.514	0.45 (-0.32, 1.22)	0.244
	≥ 65	207	0.16 (-0.06, 0.38)	0.149	0.54 (-0.17, 1.25)	0.130	1.34 (0.38, 2.31)	0.008
Age (years) [b]	< 45	72	0 (referent)	***0.047***	0 (referent)	*0.053*	0 (referent)	***0.001***
	45–65	448	0.03 (-0.13, 0.19)	0.734	0.27 (-0.31, 0.85)	0.348	0.59 (-0.19, 1.36)	0.134
	≥ 65	207	0.20 (-0.03, 0.42)	0.089	0.67 (-0.04, 1.37)	0.063	1.58 (0.63, 2.53)	0.002
Age (years) [c]	< 45	72	0 (referent)	*0.056*	0 (referent)	*0.055*	0 (referent)	***0.002***
	45–65	448	0.02 (-0.13, 0.17)	0.795	0.27 (-0.31, 0.84)	0.350	0.58 (-0.19, 1.35)	0.136
	≥ 65	207	0.19 (-0.04, 0.41)	0.108	0.66 (-0.04, 1.36)	0.064	1.57 (0.63, 2.51)	0.002
Diabetes status	Normoglycemia	585	0 (referent)	*0.419*	0 (referent)	*0.202*	0 (referent)	*0.859*
(unadjusted)	Prediabetes	89	-0.05 (-0.27, 0.17)	0.644	-0.16 (-0.68, 0.37)	0.549	-0.22 (-1.05, 0.60)	0.587
	Diabetes	53	-0.16 (-0.40, 0.08)	0.174	-0.48 (-1.01, 0.04)	0.071	-0.12 (-1.00, 0.76)	0.783
Diabetes status [b]	Normoglycemia	585	0 (referent)	*0.373*	0 (referent)	*0.264*	0 (referent)	*0.939*
	Prediabetes	89	-0.03 (-0.24, 0.18)	0.748	0.01 (-0.55, 0.58)	0.504	0.09 (-0.76, 0.94)	0.831
	Diabetes	53	-0.18 (-0.43, 0.07)	0.146	-0.48 (-1.06, 0.09)	0.020	-0.12 (-1.09, 0.84)	0.795
Diabetes status [c]	Normoglycemia	585	0 (referent)	*0.203*	0 (referent)	*0.250*	0 (referent)	*0.932*
	Prediabetes	89	-0.08 (-0.29, 0.13)	0.447	-0.02 (-0.58, 0.54)	0.940	0.04 (-0.82, 0.90)	0.923
	Diabetes	53	-0.23 (-0.48, 0.02)	0.069	-0.52 (-1.11, 0.08)	0.089	-0.17 (-1.16, 0.82)	0.728
BMI	< 25 kg/m^2	235	0 (referent)	*0.057*	0 (referent)	*0.756*	0 (referent)	*0.823*
classification [a]	25–30 kg/m^2	310	0.12 (-0.01, 0.25)	0.080	0.15 (-0.26, 0.56)	0.472	0.16 (-0.53, 0.86)	0.638
	≥ 30 kg/m^2	182	0.19 (0.03, 0.34)	0.017	0.12 (-0.35, 0.59)	0.608	0.21 (-0.53, 0.96)	0.565

BMI	< 25 kg/m^2	235	0 (referent)	***0.023***	0 (referent)	*0.283*	0 (referent)	*0.294*
classification [c]	25–30 kg/m^2	310	0.15 (0.03, 0.28)	0.020	0.31 (-0.08, 0.70)	0.116	0.47 (-0.16, 1.11)	0.140
	≥ 30 kg/m^2	182	0.20 (0.05, 0.34)	0.009	0.19 (-0.24, 0.62)	0.381	0.37 (-0.32, 1.05)	0.285

SUPPLEMENTAL TABLE 5 shows coefficient 95% confidence interval from linear mixed model, with random intercepts for cluster (AusDiab testing center) and participant (repeated measures)

[a] n = 1 (woman, 45–56 years, normoglycaemic, < 25 kg/m^2) who had no ambulatory interruptions absent from models of ambulatory interruptions

[b] model includes age and gender

[c] model includes age (<45 / 45–65 / ≥65 years), gender (men/ woman), and Body Mass Index (< 25 / 25–30 / ≥ 30 kg/m^2)

SUPPLEMENTAL TABLE 6: Mean stepping time of each interruption: differences by gender, age, diabetes status and BMI in middle aged and older adults (AusDiab 2011-12)

Participant characteristic		n	**All Interruptions**		**Active Interruptions (≥5 min upright and/or ≥2 min stepping)**		**Ambulatory Interruptions (≥2 min stepping)**	
			Difference (95% CI)	p	Difference (95% CI)	p	Difference (95% CI)	p
Gender (unadjusted)	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	0.02 (-0.02, 0.07)	0.329	-0.16 (-0.31, 0.00)	0.051	-0.12 (-0.24, 0.00)	**0.045**
Gender [b]	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	0.02 (-0.02, 0.07)	0.337	-0.17 (-0.33, -0.01)	**0.041**	-0.12 (-0.24, 0.00)	**0.046**
Gender [c]	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	0.02 (-0.03, 0.07)	0.381	-0.19 (-0.35, -0.02)	**0.026**	-0.13 (-0.25, -0.01)	**0.028**
Age (unadjusted)	<45	72	0 (referent)	0.897	0 (referent)	**0.042**	0 (referent)	0.842
	45–65	448	-0.01 (-0.08, 0.05)	0.654	-0.03 (-0.32, 0.26)	0.815	0.02 (-0.17, 0.21)	0.827
	≥65	207	-0.01 (-0.08, 0.06)	0.803	-0.23 (-0.55, 0.08)	0.140	-0.02 (-0.23, 0.19)	0.876
Age [b]	<45	72	0 (referent)	0.913	0 (referent)	**0.038**	0 (referent)	0.797
	45–65	448	-0.01 (-0.08, 0.05)	0.704	-0.05 (-0.33, 0.24)	0.733	0.01 (-0.17, 0.19)	0.902
	≥65	207	-0.01 (-0.08, 0.07)	0.883	-0.25 (-0.57, 0.06)	0.106	-0.03 (-0.24, 0.17)	0.759
Age [c]	<45	72	0 (referent)	0.921	0 (referent)	**0.049**	0 (referent)	0.793
	45–65	448	-0.01 (-0.08, 0.05)	0.734	-0.03 (-0.32, 0.25)	0.803	0.02 (-0.17, 0.21)	0.846
	≥65	207	0.00 (-0.08, 0.07)	0.927	-0.24 (-0.55, 0.08)	0.141	-0.02 (-0.24, 0.19)	0.826
Diabetes status (unadjusted)	Normoglycemia	585	0 (referent)	0.056	0 (referent)	**0.001**	0 (referent)	0.273
	Prediabetes	89	0.01 (-0.06, 0.08)	0.720	0.09 (-0.10, 0.29)	0.344	0.04 (-0.12, 0.21)	0.592
	Diabetes	53	-0.08 (-0.13, -0.02)	0.011	-0.56 (-0.83, -0.28)	<0.001	-0.20 (-0.47, 0.07)	0.141
Diabetes status [b]	Normoglycemia	585	0 (referent)	0.050	0 (referent)	**0.002**	0 (referent)	0.316
	Prediabetes	89	0.02 (-0.06, 0.09)	0.644	0.09 (-0.13, 0.30)	0.425	0.01 (-0.16, 0.19)	0.867

	Diabetes	53	-0.08 (-0.13, -0.02)	0.009	-0.54 (-0.81, -0.27)	<0.001	-0.21 (-0.48, 0.07)	0.137
Diabetes status [c]	Normoglycemia	585	0 (referent)	0.089	0 (referent)	**0.004**	0 (referent)	0.349
	Prediabetes	89	0.02 (-0.05, 0.10)	0.536	0.19 (-0.04, 0.42)	0.097	0.06 (-0.11, 0.23)	0.493
	Diabetes	53	-0.07 (-0.13, -0.01)	0.030	-0.45 (-0.74, -0.17)	0.003	-0.17 (-0.45, 0.11)	0.232
Body Mass Index	< 25 kg/m^2	235	0 (referent)	0.354	0 (referent)	**0.005**	0 (referent)	0.114
(unadjusted)	25–30 kg/m^2	310	-0.02 (-0.06, 0.03)	0.395	-0.06 (-0.24, 0.13)	0.533	0.08 (-0.07, 0.23)	0.299
	≥ 30 kg/m^2	182	-0.04 (-0.11, 0.02)	0.151	-0.36 (-0.57, -0.16)	0.001	-0.10 (-0.30, 0.09)	0.277
Body Mass Index [c]	< 25 kg/m^2	235	0 (referent)	0.423	0 (referent)	**0.006**	0 (referent)	0.151
	25–30 kg/m^2	310	-0.02 (-0.06, 0.03)	0.487	-0.08 (-0.26, 0.10)	0.391	0.06 (-0.10, 0.22)	0.436
	≥ 30 kg/m^2	182	-0.04 (-0.11, 0.02)	0.181	-0.37 (-0.58, -0.16)	0.001	-0.12 (-0.31, 0.08)	0.232

SUPPLEMENTAL TABLE 6 shows coefficient 95% confidence interval from linear mixed model, with random intercepts for cluster (AusDiab testing center) and participant (repeated measures)

[a] n = 1 (woman, 45–56 years, normoglycaemic, < 25 kg/m^2) who had no ambulatory interruptions absent from models of ambulatory interruptions

[b] model includes age and gender

[c] model includes age (<45 / 45–65 / ≥65 years), gender (men/ woman), and Body Mass Index (< 25 / 25–30 / ≥ 30 kg/m^2)

SUPPLEMENTAL TABLE 7: Mean estimated energy expenditure (MET-min) of each interruption: differences by age, gender, diabetes status and BMI in middle aged and older adults (AusDiab 2011-12)

Participant characteristic		n [a]	All Interruptions		Active Interruptions (≥5 min upright and/or ≥2 min stepping)		Ambulatory Interruptions (≥2 min stepping)	
			Difference (95% CI)	p	Difference (95% CI)	p	Difference (95% CI)	p
Gender (unadjusted)	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	0.10 (-0.12, 0.33)	0.358	-0.27 (-0.82, 0.28)	0.323	0.53 (-0.55, 1.60)	0.327
Gender [b]	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	0.10 (-0.13, 0.34)	0.368	-0.30 (-0.85, 0.25)	0.277	0.54 (-0.53, 1.60)	0.315
Gender [c]	Men	321	0 (referent)		0 (referent)		0 (referent)	
	Women	406	0.12 (-0.11, 0.35)	0.303	-0.30 (-0.85, 0.25)	0.271	0.57 (-0.50, 1.63)	0.287
Age (unadjusted)	< 45 years	72	0 (referent)	0.493	0 (referent)	0.158	0 (referent)	0.946
	45-65 years	448	-0.11 (-0.37, 0.14)	0.372	-0.15 (-1.12, 0.83)	0.761	0.05 (-1.39, 1.50)	0.941
	≥ 65 years	207	-0.05 (-0.41, 0.31)	0.784	-0.64 (-1.77, 0.49)	0.256	0.18 (-1.34, 1.70)	0.811
Age [b]	< 45 years	72	0 (referent)	0.513	0 (referent)	0.136	0 (referent)	0.913
	45-65 years	448	-0.10 (-0.37, 0.16)	0.429	-0.17 (-1.14, 0.80)	0.721	0.09 (-1.36, 1.54)	0.899
	≥ 65 years	207	-0.03 (-0.41, 0.34)	0.865	-0.68 (-1.80, 0.44)	0.228	0.25 (-1.27, 1.77)	0.742
Age [c]	< 45 years	72	0 (referent)	0.475	0 (referent)	0.136	0 (referent)	0.923
	45-65 years	448	-0.12 (-0.37, 0.14)	0.360	-0.17 (-1.14, 0.80)	0.725	0.07 (-1.36, 1.51)	0.920
	≥ 65 years	207	-0.05 (-0.43, 0.32)	0.768	-0.68 (-1.81, 0.45)	0.231	0.22 (-1.28, 1.73)	0.766
Diabetes status (unadjusted)	Normoglycemia	585	0 (referent)	0.222	0 (referent)	0.079	0 (referent)	0.951
	Prediabetes	89	-0.01 (-0.39, 0.37)	0.957	0.30 (-0.59, 1.19)	0.504	0.21 (-1.11, 1.53)	0.750
	Diabetes	53	-0.35 (-0.74, 0.03)	0.071	-1.24 (-2.28, -0.21)	0.020	0.01 (-1.64, 1.66)	0.993
Diabetes status [b]	Normoglycemia	585	0 (referent)	0.224	0 (referent)	0.089	0 (referent)	0.864
	Prediabetes	89	0.01 (-0.37, 0.38)	0.970	0.32 (-0.59, 1.22)	0.482	0.36 (-0.97, 1.69)	0.590

	Diabetes	53	-0.36 (-0.74, 0.03)	0.072	-1.18 (-2.21, -0.15)	0.026	0.04 (-1.63, 1.71)	0.964
Diabetes status [c]	Normoglycemia	585	0 (referent)	0.096	0 (referent)	0.093	0 (referent)	0.931
	Prediabetes	89	-0.07 (-0.43, 0.28)	0.677	0.32 (-0.58, 1.22)	0.479	0.24 (-1.06, 1.53)	0.711
	Diabetes	53	-0.45 (-0.84, -0.06)	0.024	-1.18 (-2.23, -0.13)	0.028	-0.08 (-1.73, 1.56)	0.918
Body Mass Index	< 25 kg/m^2	235	0 (referent)	**0.024**	0 (referent)	0.295	0 (referent)	0.270
(unadjusted)	25–30 kg/m^2	310	0.23 (0.03, 0.42)	0.022	0.47 (-0.16, 1.09)	0.137	0.85 (-0.25, 1.94)	0.126
	≥ 30 kg/m^2	182	0.35 (0.09, 0.61)	0.011	0.14 (-0.68, 0.96)	0.728	0.83 (-0.42, 2.09)	0.187
Body Mass Index [c]	< 25 kg/m^2	235	0 (referent)	**0.014**	0 (referent)	0.313	0 (referent)	0.194
	25–30 kg/m^2	310	0.25 (0.06, 0.44)	0.010	0.46 (-0.16, 1.09)	0.141	0.96 (-0.14, 2.06)	0.085
	≥ 30 kg/m^2	182	0.36 (0.10, 0.62)	0.007	0.16 (-0.66, 0.98)	0.692	0.90 (-0.32, 2.11)	0.145

SUPPLEMENTAL TABLE 7 shows coefficient 95% confidence interval from linear mixed model, with random intercepts for cluster (AusDiab testing center) and participant (repeated measures)

[a] n = 1 (woman, 45–56 years, normoglycaemic, < 25 kg/m^2) who had no ambulatory interruptions absent from models of ambulatory interruptions

[b] model includes age and gender

[c] model includes age (<45 / 45–65 / ≥65 years), gender (men/ women), and Body Mass Index (< 25 / 25–30 / ≥ 30 kg/m^2)