Association of leisure time and occupational physical activity with obesity and cardiovascular risk factors in Chile

Running title: Occupational and leisure physical activity and health

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Abstract

The aim of this study was to investigate the association between physical activity (PA), both occupational (OPA) and during leisure time (LTPA), with obesity and cardiovascular risk factors in Chilean adults. 5,157 participants from the Chilean National Health Survey 2009-2010 were included in this study. OPA and LTPA levels were assessed using the Global Physical Activity Questionnaire. The association between both PA with obesity and cardiovascular risk factors was determined using logistic regression. Our findings showed a significant trend between higher LTPA and lower odds for obesity (OR 0.64 [95% CI: 0.53; 0.76], central obesity 0.52 [0.44; 0.61]) and other cardiovascular risk factors including diabetes (OR: 0.72 [0.55; 0.94]), hypertension (OR: 0.59 [0.50; 0.71]) and metabolic syndrome (OR: 0.62 [0.50; 0.78]). In contrast, OPA was only associated with lower odds of diabetes (OR: 0.79 [0.65; 0.98]) and hypertension (0.85 [0.74; 0.98]). In conclusion, LTPA was associated with a lower risk of all major cardiovascular risk factors, whereas OPA was only associated with a lower risk of diabetes and hypertension.

Keywords: Occupational physical activity; Leisure physical activity, obesity; type 2 diabetes; hypertension.

Introduction

International physical activity (PA) guidelines recommend at least 150 minutes of moderate to vigorous PA or 75 minutes of vigorous PA weekly (WHO, 2010). However, 23% of the world's population is not active (House, 2013) and as a consequence, it is estimated that more than 5 million deaths occur as a result of physical inactivity every year. This makes physical inactivity the fourth largest cause of death due to cardiovascular diseases (CVDs) worldwide (Lee et al., 2012; Wen and Wu, 2012).

In occidental countries where individuals are at work for a large proportion of the day, a lack of time is viewed as one of the main barriers for achieving the PA guidelines. Although previous studies, mainly from developed countries, have shown an inverse association between PA and the development of cardiovascular diseases, mostly by examining leisure time PA (LTPA), there is conflicting evidence regarding the health benefits associated with occupational physical activity (OPA). Some evidence supports the protective effect of OPA on all-cause mortality and CVDs (Ku et al., 2018; Wang et al., 2010), whereas some studies have shown that OPA does not improve health, and could be detrimental (Pieter Coenen et al., 2018; Andreas Holtermann, Niklas Krause, Allard J. van der Beek, & Leon Straker, 2018; Krause, Brand, Arah, & Kauhanen, 2015). These contrasting health effects of LTPA and OPA constitute the so-called PA health paradox (Andreas Holtermann, et al., 2018).

With most of the existing evidence generated from developed countries, there is a need for generating evidence from middle and low-income countries, where OPA could contribute to an important proportion of the total PA achieved in these countries.

The rapid economic transition that Chile has experienced over the last four decades has produced important changes to the epidemiological scenario of the population. Currently, more than 70% of the adult population in Chile is overweight or obese, 12.3% have been diagnosed with diabetes, and 19.8% do not meet the physical activity recommendations

(>600 METs-min/week) (MINSAL, 2017), placing Chile at the top of the Latin American ranking for obesity and cardiovascular risk factors.

There is also existing evidence suggesting that the fast-economic transition that Chile has experienced has produced important changes in the lifestyle of the Chilean population, characterised by the adoption of extensive working hours (Barria P and Amigo C, 2006; Vio, Albala, & Kain, 2008). According to the latest report by the Organisation for Economic Co-operation and Development (OECD, 2018) in Chile, more than 75% percentage of the working population works more than 60 hours a week. However there is no evidence of levels of OPA in the population nor health benefits associated with OPA. Considering the extensive working hours of the population, OPA could contribute to an increase in PA levels and therefore decrease the prevalence of cardiovascular risk factors in Chile. The aim of this study, therefore, was to investigate the association between OPA and LTPA with obesity and cardiovascular risk factors in the Chilean adult population.

Methods

Study Design and Sample Population

This cross-sectional study included data collected from participants aged ≥18 years from the Chilean National Health Survey (CNHS) conducted during 2009-2010, and is a nationally representative sample of Chilean adults (MINSAL, 2010). The CNHS 2009-2010 aims to describe the health and lifestyle of the Chilean population and is conducted every six years and includes all regions and residence zones (urban and rural) of Chile. The sample size was calculated with a 20% relative sampling error to estimate a national prevalence of over 4%. One participant was randomly selected per household. The exclusion criteria were pregnant women as well as individuals who were unable to provide consent to take part in the study. Data collection was based in standardised protocols and conducted by trained nurses and staff during two measurement visits per participant. During these visits biological samples and socio-demographic, lifestyle, anthropometrical and physiological measures were taken (MINSAL, 2010). The response rate from the eligible population to the CNHS 2009-2010 was 95% (n= 5,412). Of these, 5,157 participants had full data available for PA levels and therefore were included in the current study.

The CNHS 2009-2010 was funded by the Chilean Ministry of Health and led by the Department of Public Health of the Pontificia Universidad Católica de Chile. The CNHS 2009-2010 was approved by the Ethics Research Committee of the Faculty of Medicine at the same university. All participants who participated in the CNHS provided written informed consent (MINSAL, 2010).

Data Collection

Weight was measured by a digital scale (Tanita HD-313®) and height with a height rod in their home, with participants not wearing shoes and in light clothing through standardized methods and by trained nurses or midwives, as described elsewhere (MINSAL, 2010). Body mass index (BMI) was calculated as weight/height^2 and classified using g the World Health Organization criteria (normal: 18.5 to 24.9 kg.m^{-2}; overweight: 25.0 to 29.9 kg.m^{-2}; obese: ≥30 kg.m^{-2} (WHO, 1998). Underweight individuals were not included in this study. Central obesity was defined as a waist circumference (WC) >88 cm for women and >102 cm for men (MINSAL, 2010).

Type 2 diabetes, hypertension and metabolic syndrome were the cardiovascular risk factors evaluated. Blood pressure (BP) was measured by trained staff and derived from the mean of three readings recorded after 15 minutes rest. Hypertension was defined as a systolic BP ≥ 140 mmHg (SBP) and diastolic BP ≥ 90 mmHg (DBP), or if a participant was currently receiving treatment for hypertension (Chobanian et al., 2003). Type 2 diabetes was defined as fasting glucose ≥7.0 mmol.l^{-1} or if a participant reported current treatment for diabetes (ADA, 1997). The presence of metabolic syndrome was defined using the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATPIII) criteria (Alberti et al., 2009): Waist circumference >102 cm for men and> 88 cm for women; serum triglycerides >1.7 mmol.l^{-1}; HDL cholesterol: <1.03 mmol.l^{-1}; SBP ≥ 130 mm Hg or DBP ≥ 85 mm Hg; fasting glucose >5.6 mmol.l^{-1} or currently receiving treatment for diabetes. Each metabolic syndrome component was classified as either present or absent as per the above criteria. The number of metabolic syndrome components present for each participant was calculated to provide an ordinal measure of cardiometabolic health. The presence of 3 or more components was used to indicate the presence of metabolic syndrome (Alberti, et al., 2009).

Socio-demographic data were collected for all participants using nationally validated questionnaires, including age, sex, education level (primary, secondary or beyond secondary), monthly household income (low <480; middle 480 to 1250; high >1250 US dollars), and smoking status (non-smoker, ex-smoker or smoker). Dietary intake including fruit, vegetables and alcohol intake was measured using a food frequency questionnaire (MINSAL, 2010), whereas salt intake was estimated from urinary sodium excretion, using the Tanaka’s formula (MINSAL, 2010).

PA levels were determined using the Global Physical Activity Questionnaire version 2 (GPAQ v2) (WHO, 2009), which has been validated in Latin populations (Aguilar-Farias and Leppe Zamora, 2016; Bull, Maslin, & Armstrong, 2009; Hoos, Espinoza, Marshall, & Arredondo, 2012). The GPAQ was developed by WHO for PA surveillance in countries. It collects information on PA participation in three settings (or domains) and sedentary behaviour. These domains include activity at work, travel to and from places, and recreational activities (WHO, 2009). Participants were asked ‘Next I am going to ask you about the time you spend doing different types of PA in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate’.

Participants were asked then the following questions for OPA: ‘Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy loads, digging or construction work] for at least 10 minutes continuously?’ ‘In a typical week, on how many days do you do vigorous intensity activities as part of your work? How much time do you spend doing vigorous-intensity activities at work on a typical day? Similar questions were asked for different intensities of PA (moderate and vigorous). For LTPA the following instructions were given ‘The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure)’, then the following question were asked: ‘Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football,] for at least 10 minutes continuously? In a typical week, on how many days do you do vigorous intensity sports, fitness or recreational (leisure) activities? How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?’ similar questions were asked for moderate and vigorous intensity PA.

Total LTPA and OPA were defined as the sum of the time spent in moderate and vigorous intensity activities, as described in the GPAQ v2 questionnaire. A moderate-equivalent PA in minutes/week was derived and calculated as [moderate PA + (vigorous PA x 2)]. Vigorous PA time was multiplied by 2 as the energy expenditure of vigorous PA is double that of moderate physical activities. Physical inactivity was considered to be < 600 Metabolic Equivalent of Task, MET-min.week^{-1} energy expenditure as described previously (WHO, 2009). LTPA categories were defined as, low: <10 minutes, middle: 10-240 minutes, high: >240 minutes by week; and occupational PA categories as, low: <10 minutes, middle: 10-1,800 minutes, high: >1,800 minutes by week. The number of individuals in each category is uneven due to the large proportion of individuals who reported not partaking in any of these PA domains (3,822 for LTPA and 2,502 for OPA). Therefore, a higher number of individuals were allocated to the low PA category compared to those in the middle and higher categories. Cutoff points for other PA domains in minutes per week were defined as: Moderate LPA, low <10, middle 10-180 and high >180; Vigorous LPA, low <15, middle 15-200, high >200; moderate OPA was defined as low <10, middle 10-1,050, high >1,050 min/week; vigorous OPA was defined as low <10, middle 10-1,170, high >1,170.

Another domain included in the GPAQ v2 instrument is sitting time as a proxy of sedentary behaviour. To measure sitting time the following instruction was given ‘The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent [sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television], but do not include time spent sleeping’. Then the participants were asked: ‘How much time do you usually spend sitting or reclining on a typical day?’ (WHO, 2009). This question was validated in the Chilean population (Aguilar-Farias and Leppe Zamora, 2016).

Statistical Analysis

Statistical analyses were conducted in STATA 14 (StataCorp; College Station, TX), using survey-weighted values. Descriptive characteristics are presented as adjusted means with 95% Confidence Intervals (CI) for quantitative variables or as a proportion for categorical variables. The Shapiro-Wilk test was performed to test for the Normality of continuous variables. If the variable was found to be not Normally distributed, then it was presented with a median and its interquartile range.

Associations of LTPA categories (low, middle, high) with obesity and cardiovascular risk factors were investigated using logistic regression. The associations of OPA categories with obesity and cardiovascular risk factors were conducted in a similar way. Results are presented as means and 95% CI, and as odds ratios (OR) with 95% CI.

Analyses were adjusted for confounding variables such as age, sex, geographic area (urban, rural), education levels, income, smoking, sedentary behaviour, BMI and dietary intake (salt, alcohol, fruit and vegetable intake). A p-value lower than 0.05 was considered statistically significant in all analyses.

Results

The main characteristics of the participants by LTPA and OPA categories (low, middle and high) are summarised in Table 1 and Table 2, respectively. Individuals in the lowest LTPA category had a higher percentage of women, lived in an urban area, had a lower education level and income than individuals with high LTPA level. They had a higher BMI, WC, obesity, and central obesity. There was a higher prevalence of type 2 diabetes, hypertension and metabolic syndrome. However, individuals in the lowest LTPA category were less likely to smoke and consumed fewer fruit and vegetables than individuals in the highest category (Table 1).

[Table 1 near here]

Regarding OPA, individuals in the lowest category were more likely to be women, older, and a high percentage lived in urban areas. Furthermore, they had a higher prevalence of central obesity, physical inactivity, sedentary behaviour, type 2 diabetes and hypertension than individuals with a high OPA level. However, they were less likely to smoke and consumed less salt and alcohol than individuals in the highest category (Table 2).

[Table 2 near here]

When the associations of LTPA tertiles with obesity and other cardiovascular risk factors were assessed, a significant trend of decreasing odds of obesity and other cardiovascular risk factors was found (Figures 1 and 3). The odds of being overweight, obese or having central obesity were 44%, 46% and 48% lower by one category higher for total LTPA, respectively (Figure 1). Similar trends were observed between obesity outcomes and moderate or vigorous LTPA (Figure 1). Although, there was a significant trend of a reduction of the odds for diabetes, hypertension and metabolic syndrome by 28%, 41% and 38%, respectively, with higher levels of total LTPA, these associations were explained mostly by vigorous but not moderate intensity LTPA. With the exception of hypertension, there were no associations between moderate intensity LTPA and diabetes and metabolic syndrome (Figure 3), whereas vigorous intensity LTPA was significantly associated with 45%, 47% and 48% lower odds for diabetes, hypertension and metabolic syndrome (Figure 3).

[Figure 1 and 3, near here]

Despite the observed benefits of LTPA on obesity outcomes, OPA was not significantly associated with any of these outcomes (Figure 2). Regarding cardiovascular risk factors, higher levels of OPA were significantly associated with 21% and 15% lower odds of type 2 diabetes and hypertension, respectively (Figure 4). When the association between different intensities of OPA were explored in detail, moderate but not vigorous intensity OPA was associated with lower odds of hypertension, whereas vigorous but not moderate intensity OPA was associated with lower odds for diabetes (Figure 4). There was no evidence of a significant association between OPA and metabolic syndrome (Figure 4).

[Figure 2 and 4, near here]

Discussion

The main findings of this study suggest that both OPA and LTPA are associated with lower odds of type 2 diabetes and hypertension. However, total LTPA was also associated with lower odds of obesity, central obesity and the development of metabolic syndrome. These benefits were independent of major confounding factors such as age, sex, geographic area and diet. Therefore, new policies promoting both LTPA and OPA could contribute to the reduction of the current prevalence of physical inactivity in the Chilean population as well as tackle the health burden associated with obesity and cardiovascular risk factors including diabetes, hypertension and metabolic syndrome.

In comparison with previous studies, our findings agree with evidence from prospective studies such as the PURE study, which reported the association of health outcomes with leisure and non-leisure PA in 17 high, middle and low incomes countries (Lear et al., 2017). This study reported that higher levels of LTPA were associated with a lower risk of mortality and cardiovascular events. In other words, moderate (150 to 750 minutes) to high (>750 minutes) levels of PA per week are associated with the lowest risk for all-cause and CVD mortality (Lear, et al., 2017). Currently, the Chilean population is far from achieving this goal, at least no without the correct public health policies that promote and facilitate the incorporation of PA in both leisure and occupational settings.

Regarding LTPA, the beneficial effects in cardiovascular risk and the development of obesity have been shown widely in the literature (Bell et al., 2014; Honda et al., 2015; Oshio, Tsutsumi, & Inoue, 2016; Zhao et al., 2014). Improvement of glycaemic control, total cholesterol and HDL cholesterol are some of the positive effects that interventions with LTPA have demonstrated too (Ilanne-Parikka et al., 2010). In terms of cardiovascular diseases, a meta-analysis of 76,699 participants showed a negative linear association between LTPA and the incidence of metabolic syndrome. Moreover, the risk of metabolic syndrome was reduced by 10% in those individuals that performed at least 150 minutes/week (Zhang et al., 2017). Likewise, a meta-analysis of 296,395 participants suggested that high levels of LTPA could reduce the incidence of type 2 diabetes by between 22% and 39%, whereas moderate levels might do so by 11% to 30% (Huai et al., 2016). In a Latin American context, evidence suggests that lower levels of LTPA (< 1 MET/minute/week) were associated with a higher risk of hypertension in Mexican adults (Medina et al., 2018). Although mortality was not an outcome examined in this study, previous research has demonstrated the inverse association between mortality and PA, with LTPA being strongly associated with a lower risk for all-cause and cause-specific mortality (Arem et al., 2015; Lahti, Holstila, Lahelma, & Rahkonen, 2014; Zhao, et al., 2014). Arem et al. identified that individuals who performed between three and ten times the minimum PA recommendation could decrease their all-cause mortality risk by 39%. This research supports some baseline characteristics from our study, since those individuals who performed higher LTPA in Arem et al.'s study, were younger and had a lower BMI and fewer comorbidities than those who do not perform lower levels of LTPA (Arem, et al., 2015).

Although there is conflictive evidence, there are studies to suggest that OPA could provide health benefits (Honda, et al., 2015; Gang Hu et al., 2007; Gang Hu, Tuomilehto, Borodulin, & Jousilahti, 2007; Huang et al., 2017; Medina, et al., 2018; Wang, et al., 2010). Our study provides evidence of a modest association between OPA and diabetes and hypertension. However, we also reported a lack of association of OPA with obesity and metabolic-syndrome. This lack of association may be explained by confounding factors, as body weight and BMI do not fully account for a body's composition and therefore it is possible that active individuals at work may have more lean mass and not necessarily be obese. However, it could also be related to unmeasured confounding factors.

There is some limited evidence suggesting that OPA may be detrimental for your health (Oppert et al., 2006; Wagner et al., 2002).These contrasting health effects of LTPA and OPA constitute the so-called PA health paradox. In fact, Holtermann et al. highlighted that Danish workers with a moderate or high level of OPA presented an increased risk of long-term sickness absence at work in comparison to those with low OPA. By contrast, those with moderate to high LTPA showed a positive effect over long-term sickness absence in comparison to those in the lowest tertile of LTPA (Holtermann, Hansen, Burr, Sogaard, & Sjogaard, 2012). A recent meta-analysis, conducted in 193,196 individuals, showed that males with high levels of OPA had an 18% higher risk of all-cause mortality in comparison to those with lower levels (P. Coenen et al., 2018). Some of the main reasons that may explain this paradox are summarised in a recent review by Holtermann et al., who suggested that OPA may be characterised by its long duration and therefore low intensity, which could be insufficient to produce real health benefits. Another, hypothesis is based on elevated heart rate during prolonged periods of OPA. Having a high heart rate for prolonged periods of time has been associated with a high risk of cardiovascular outcomes (Holtermann, et al., 2012; A. Holtermann, N. Krause, A. J. van der Beek, & L. Straker, 2018). Occupational activities, such as lifting items or standing for prolonged periods of time are associated with a higher blood pressure which, in turn, has been associated with adverse cardiovascular health outcomes (Holtermann, et al., 2012; A. Holtermann, N. Krause, A. J. van der Beek, & L. Straker, 2018). However, we should also consider measurement errors and unmeasured factors that could confound the evidence regarding the true association between health outcomes and leisure or occupation PA.

Although PA is a simple and low-cost strategy to decrease the burden of non-communicable diseases (Brown, Winters-Stone, Lee, & Schmitz, 2012; Jakicic, 2009; Lee, et al., 2012), 48.5% and 74.1% of the Chilean population in our study had lower levels of OPA and LTPA, respectively. In this context, without the right policies that support modification in the work environment to promote physical activity, increasing OPA may not be feasible. On the other hand, LTPA could be a more feasible way of increasing overall levels of PA in the population. However a high proportion of the Chilean population does not achieve the recommended 150 minutes of PA a week due to lack of time or lack of motivation. Therefore, another potential solution could be active commuting. Currently, 40.5% of the Chilean population lives in the capital and as a result of a high population densitiy, individuals commute on average more than 40 minutes per day (INE, 2017). Therefore, increasing PA by engaging in active commuting when travelling from home to work and vice versa, could be a feasible option of increasing overall PA at a population level on top of occupational or leisure PA. Moreover, important health benefits associated with active commuting have been reported for the Chilean population (Garrido-Méndez et al., 2017; Steell et al., 2017) but also for other developed countries (Carlos A. Celis-Morales et al., 2017; G. Hu et al., 2002; Oja et al., 2011; Wang, et al., 2010).

Strength and limitations

This study has several strengths and limitations. The CNHS 2009-2010 is a nationally representative sample of the adult Chilean population. In addition, the inclusion of a wide range of health, demographic and behavioural variables in the dataset allowed for a comprehensive adjustment for the effects of confounding factors. However, the self-reported information used to determine PA may limit data accuracy and subsequently moderate the results (C. A. Celis-Morales et al., 2012). Overestimation or underestimation may have occurred when participants self-report their daily PA levels. Moreover, as with all observational studies, the use of cross-sectional data does not permit the assessment of any cause and effect of the associations described, and there is the possibility of reverse causality and residual confounding. Finally, results about cardiovascular risk factors may be confounded by occupational stress or other factors, which were not measured in the CNHS.

In conclusion, this work supports the importance of performing PA, both at work or during leisure time as a tool to decrease cardiovascular risk factors. Certainly, these findings could help to define and implement public health policies aiming to promote and facilitate both LTPA and OPA in the Chilean population.

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Figures

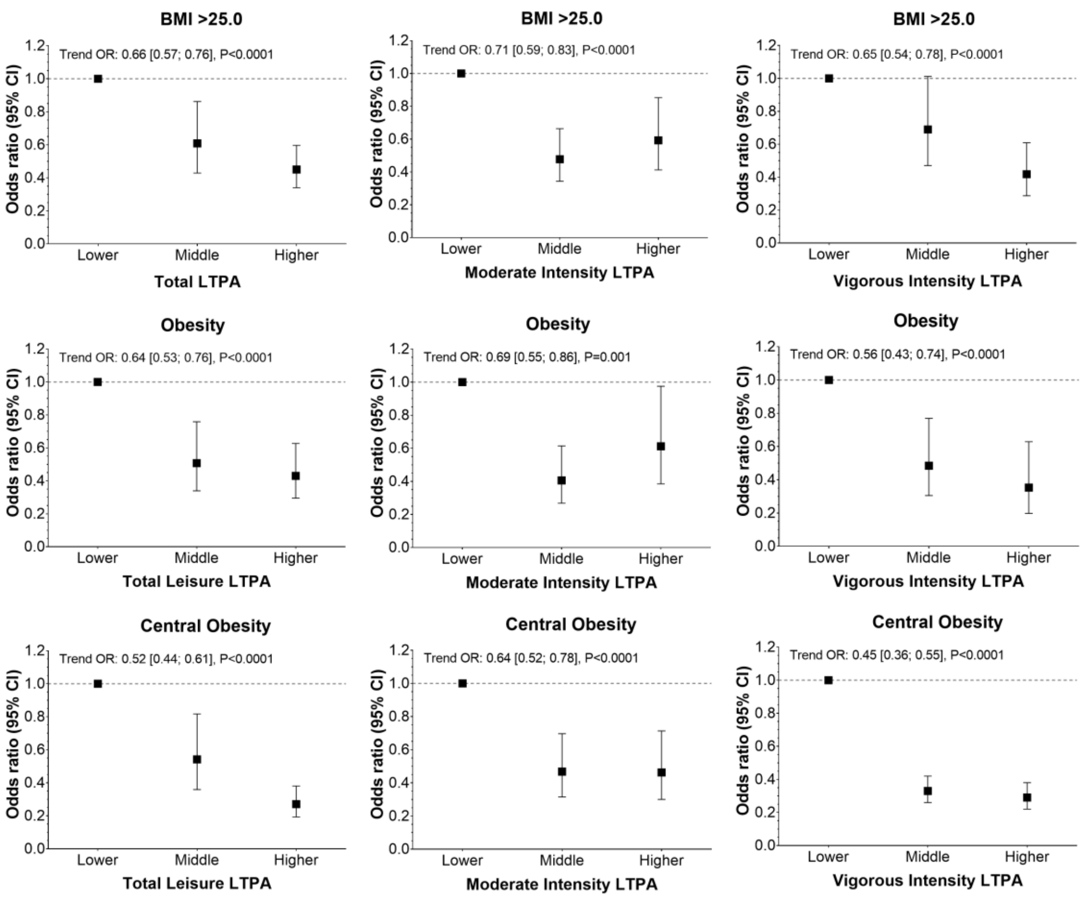

Figure 1. Associations between leisure time physical activity and obesity-related traits

Data presented as adjusted odd ratios and 95% confidence intervals (OR [95% CI]). Trend ORs indicate the dose-response odd ratio equivalent to moving up one category across leisure-time physical activity levels (total PA, moderate and vigorous intensity). Analyses were adjusted for age, sex, geographic area (urban, rural), education levels, income, smoking, sedentary behaviour and dietary intake (salt, alcohol, fruit and vegetables intake).

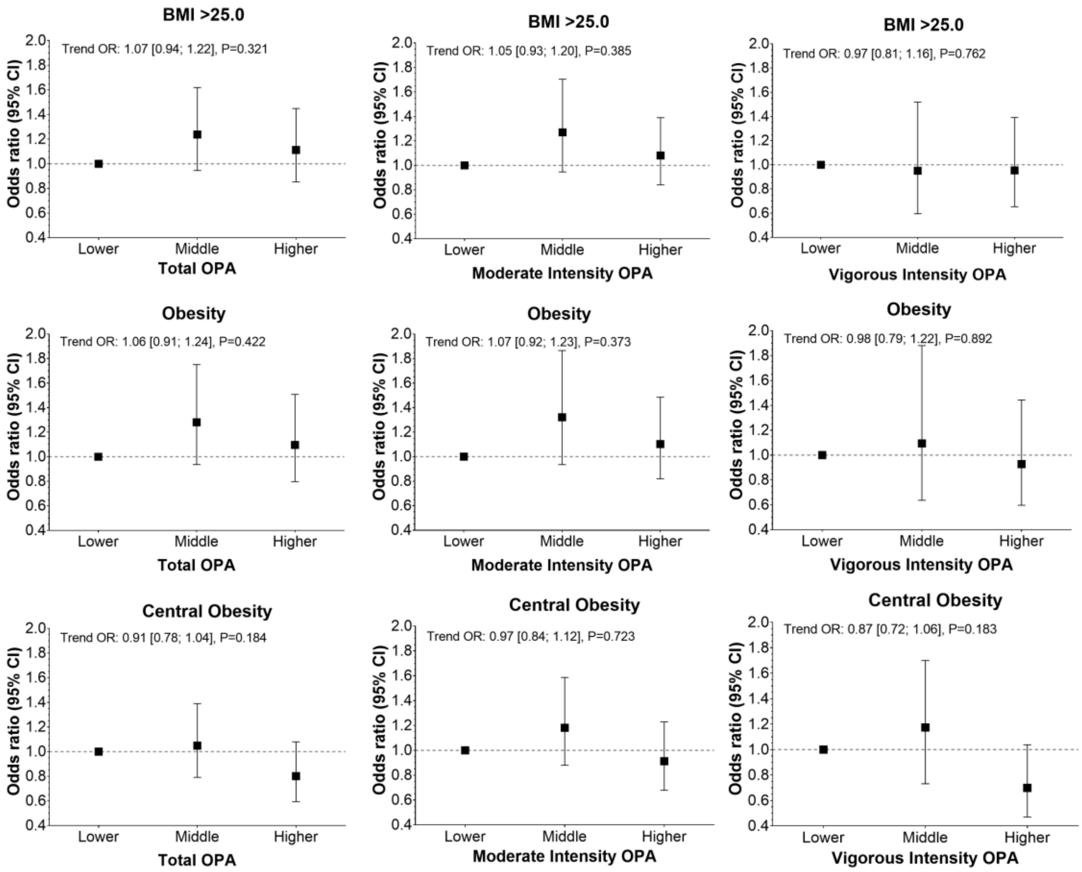

Figure 2. Associations between occupational physical activity and obesity-related traits. Data presented as adjusted odd ratios and 95% confidence intervals (OR [95% CI]). Trend ORs indicate the dose-response odd ratio equivalent to moving up one category across occupational physical activity levels (total PA, moderate and vigorous intensity). Analyses were adjusted for age, sex, geographic area (urban, rural), education levels, income, smoking, sedentary behaviour and dietary intake (salt, alcohol, fruit and vegetables intake).

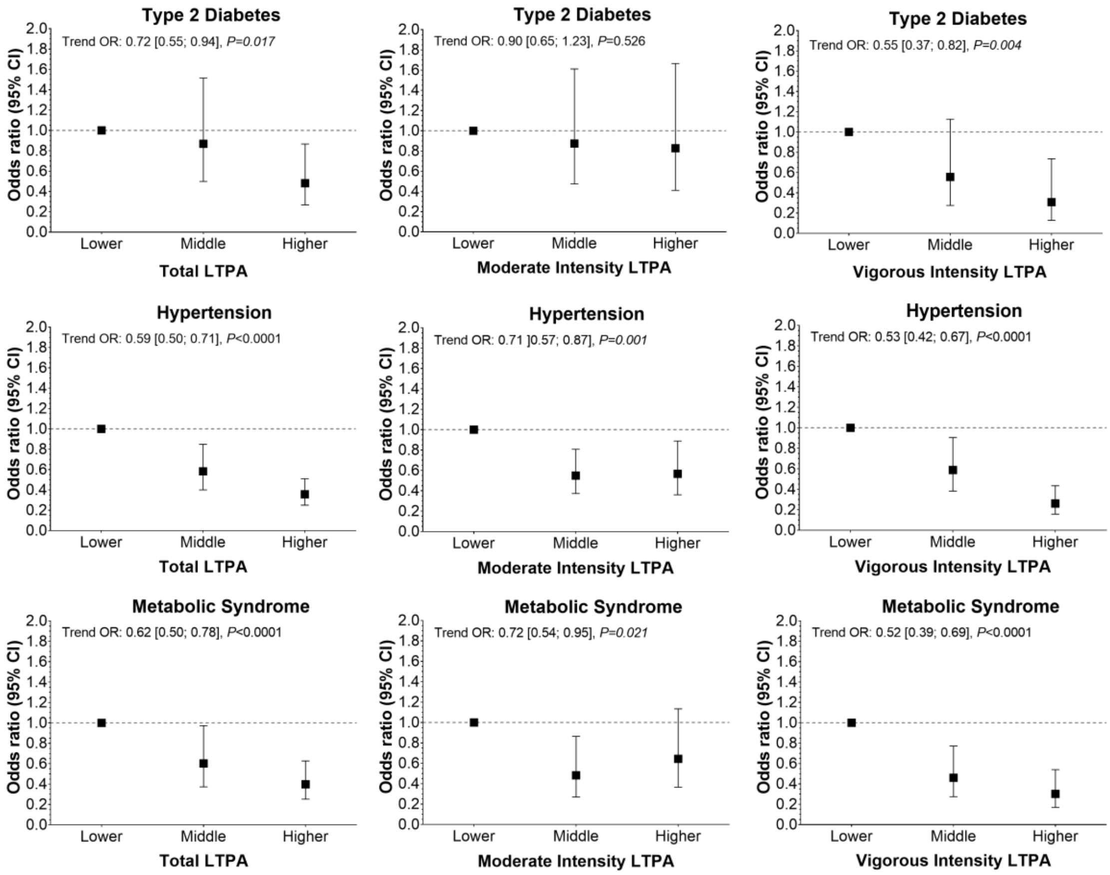

Figure 3. Associations between leisure time physical activity and cardiovascular risk factors.

Data presented as adjusted odd ratios and 95% confidence intervals (OR [95% CI]). Trend ORs indicate the dose-response odd ratio equivalent to moving up one category across leisure-time physical activity levels (total PA, moderate and vigorous intensity). Analyses were adjusted for age, sex, geographic area (urban, rural), education levels, income, smoking, sedentary behaviour, BMI and dietary intake (salt, alcohol, fruit and vegetables intake).

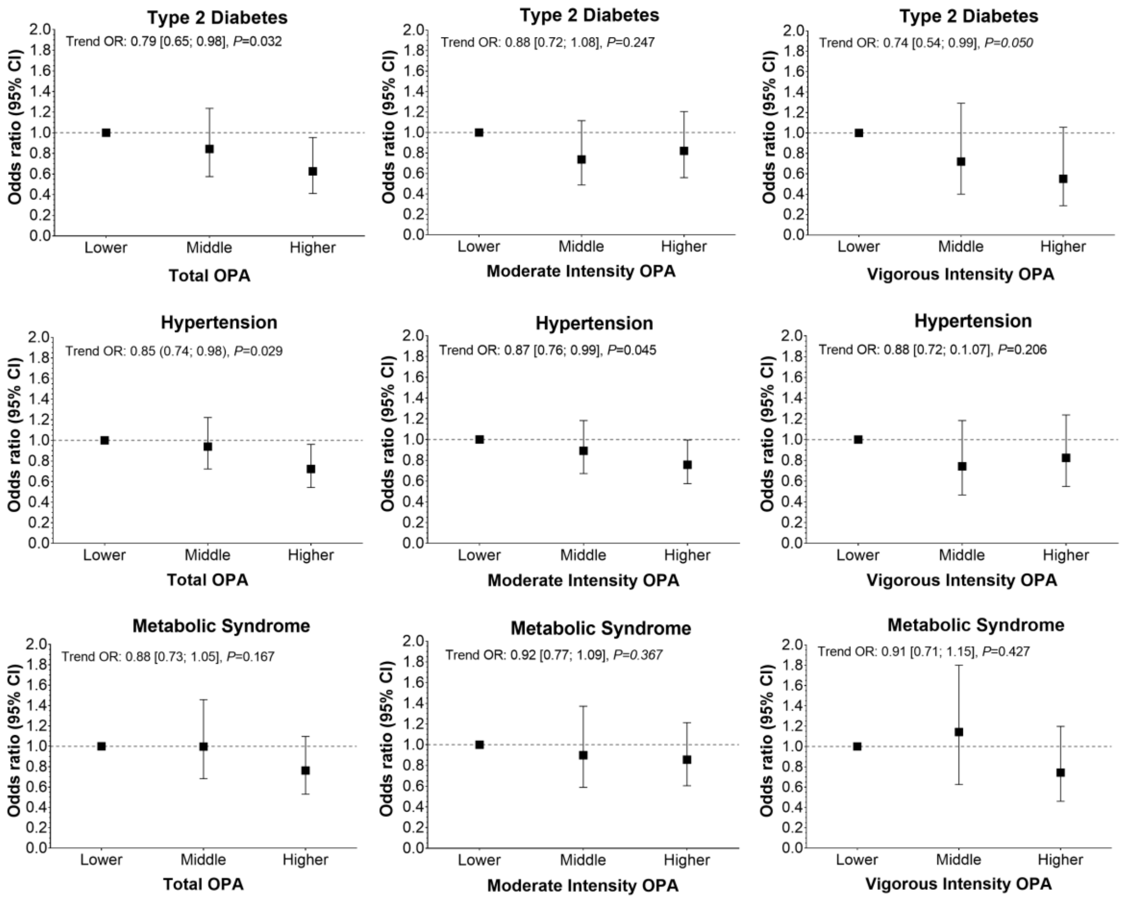

Figure 4. Associations between occupational physical activity and cardiovascular risk factors.

Data presented as adjusted odd ratios and their respective 95% confidence intervals (OR [95% CI]). Trend ORs indicate the dose-response odd ratio equivalent to moving up one category across occupational physical activity levels (total PA, moderate and vigorous intensity). Analyses were adjusted for age, sex, geographic area (urban, rural), education levels, income, smoking, sedentary behaviour, BMI and dietary intake (salt, alcohol, fruit and vegetables intake).

Table 1. Cohort characteristics by leisure time physical activity categories

Characteristics	**Low PA <10 min/week**	**Middle PA 10-240 min/week**	**High PA >240 min/week**
Socio-demographic			
Sample, n	3,822	558	777
Sex, female, %	59.3 (56.3; 62.2)	40.5 (33.7; 47.8)	30.2 (25.5; 35.3)
Age (years), median			
Age group, %	49 (35; 63)	40 (28; 53)	33 (22; 47)
<25 years	15.4 (13.5; 17.6)	22.9 (17.4; 29.4)	43.6 (37.8; 49.5)
25-44 years	36.4 (33.5; 39.4)	47.8 (40.2; 55.5)	33.6 (28.5; 39.2)
45-64 years	32.5 (29.9; 35.2)	24.2 (19.0; 30.3)	19.0 (14.7; 24.2)
≥65 years	15.7 (13.9; 17.6)	5.1 (3.3; 7.8)	3.8 (2.2; 6.4)
Geographic area, %			
Urban	85.2 (83.5; 86.8)	89.3 (84.2; 92.9)	92.3 (88.7; 94.9)
Education, %			
Up to primary (< 8 years)	23.5 (21.3; 25.8)	10.0 (6.7; 14.8)	7.2 (5.1; 10.2)
Up to secondary (< 12 years)	55.6 (52.6; 58.4)	58.4 (50.4; 65.9)	59.2 (53.3; 64.8)
Beyond secondary	20.9 (18.5; 23.7)	31.6 (24.2; 39.9)	33.6 (28.2; 39.4)
Income, %			
Low	51.7 (48.7; 54.6)	48.1 (40.7; 55.6)	40.0 (34.2; 46.0)
Middle	36.7 (33.8; 39.6)	33.0 (26.8; 39.8)	41.7 (35.9; 47.8)
High	11.6 (9.8; 13.9)	18.9 (13.9; 25.1)	18.3 (13.9; 23.7)
Anthropometric			
Weight (kg), median	70.2 (61.0; 80.2)	71.2 (62.0; 81.0)	70.0 (61.3; 80.0)
BMI (kg.m^{-2}), median	27.7 (24.7; 31.2)	26.5 (23.8; 29.6)	25.9 (23.3; 29.1)
WC (cm), median	92.0 (84.0; 101.0)	89.0 (81.0; 97.8)	87.0 (78.5; 96.0)
Central obesity, %	43.4 (40.5; 46.3)	42.1 (34.7; 49.8)	34.2 (28.9; 39.9)
BMI categories, %			
Normal weight (18.5-24.9 kg.m^{-2})	29.5 (26.8; 32.3)	40.7 (33.3; 48.5)	48.1 (42.1; 54.0)
Overweight (25.0-29.9 kg. m^{-2})	41.6 (38.7; 44.6)	40.9 (33.3; 49.0)	35.2 (30.0; 40.8)
Obese (≥30.0 kg. m^{-2})	28.9 (26.4; 31.5)	18.4 (14.0; 23.8)	16.7 (12.8; 21.5)
Lifestyle			
Commuting physical activity (MET.h.week^{-1}), median	12.9 (0; 51.4)	30.0 (10.0; 60.0)	50.0 (11.4; 96.4)
Total LTPA (MET.h.week^{-1}), median	0	132.5 (90.0; 180.0)	574.0 (393.0; 980.0)
Moderate LTPA (min.day^{-1}), median	0	60.0 (0; 120.0)	150.0 (0; 400.0)
Vigorous LTPA (min.day^{-1}), median	0	0 (0; 60.0)	180.0 (60.0; 360.0)
Total OPA (MET.h.week^{-1}), median	0 (0; 1,680)	405.0 (0, 2,250)	150.0 (0; 1,800)
Moderate OPA (min.day^{-1}), median	0 (0; 1,080)	120.0 (0; 1,260)	0 (0; 900)
Vigorous OPA (min.day^{-1}), median	0	0	0
Sitting time (hr.day^{-1}), median	3.0 (1.5; 4.5)	2.5 (1.5; 5.0)	3.0 (1.8; 5.0)
Physical inactivity, %	28.3 (25.8; 30.9)	7.3 (4.0; 12.8)	0
F&V intake (g.day^{-1}), median	171.4 (114.3; 274.3)	182.8 (114.3; 308.6)	202.8 (125.7; 320.0)
Salt intake (g.day^{-1}), median	9.5 (8.1; 11.2)	9.3 (8.0; 11.1)	9.3 (7.8; 10.9)
Alcohol intake (g.day^{-1}), median	27.6 (16.1; 55.2)	30.5 (16.1; 55.6)	32.2 (16.1; 67.3)
Smoking Status, %			
Never	38.7 (36.0, 41.5)	30.8 (24.6; 37.7)	34.1 (28.9; 39.8)
Ex-smoker	24.6 (22.2; 27.3)	20.6 (15.8; 26.4)	18.5 (14.3; 23.6)

Current smoker	36.6 (33.8; 39.5)	48.6 (41.0; 56.3)	47.4 (41.6; 53.2)
Health status			
Metabolic syndrome, %	34.9 (31.0; 39.0)	23.4 (16.4; 32.2)	17.1 (12.4; 23.2)
Type 2 diabetes, %	11.1 (9.5; 13.0)	8.0 (5.0; 12.6)	4.6 (2.8; 7.6)
Hypertension, %	31.7 (29.0; 34.4)	19.4 (14.6; 25.2)	13.4 (10.2; 17.4)
SBP (mmHg), median	124.7 (112.3; 141.3)	122.0 (110.5; 134.5)	118.3 (110.0; 128.7)
DBP (mmHg), median	75.3 (68.7; 83.3)	75.3 (68.3; 83.3)	73.3 (66.3; 81.0)

Data presented as medians with interquartile ranges for continuous variables or %s with its 95% confidence interval (CI) for categorical variables.

Table 2. Cohort characteristics by occupational physical activity categories

Characteristics	Low <10 min/week	Middle 10-1800 min/week	High >1800 min/week
Socio-demographic			
Sample, n	2,502	1,431	1,224
Sex, female, %	53.9 (50.2; 57.6)	57.5 (52.5; 62.4)	40.0 (35.6; 44.2)
Age (years), median	47 (30; 64)	47 (33; 61)	43 (32; 53)
Age group, %			
<25 years	25.7 (22.7; 29.0)	19.9 (16.5; 23.8)	16.7 (13.2; 20.8)
25-44 years	32.6 (29.0; 36.3)	35.8 (31.1; 40.7)	47.9 (43.2; 52.6)
45-64 years	25.6 (22.7; 28.7)	32.3 (28.1; 36.8)	30.3 (26.4; 34.6)
≥65 years	16.1 (13.8; 18.7)	12.0 (9.8; 14.7)	5.1 (3.7; 7.0)
Geographic area, %			
Urban	88.1 (85.8; 90.0)	89.0 (86.5; 91.1)	83.1 (79.8; 86.0)
Education, %			
Up to primary (< 8 years)	19.1 (16.7; 21.9)	18.2; 15.4; 21.4)	18.3 (15.2; 21.8)
Up to secondary (< 12 years)	49.2 (45.5; 52.8)	59.9 (55.2; 64.4)	65.4 (60.9; 69.7)
Beyond secondary	31.7 (28.0; 35.6)	21.9 (18.0; 26.4)	16.3 (13.0; 20.3)
Income, %			
Low	47.6 (44.0; 51.3)	49.2 (44.4; 54.1)	51.1 (46.4; 55.8)
Middle	36.2 (32.7; 39.8)	39.1 (34.4; 43.9)	36.3 (31.8; 41.1)
High	16.2 (13.6; 19.2)	11.7 (8.8; 15.3)	12.6 (9.4; 16.5)
Anthropometric			
Weight (kg), median	70.0 (60.6; 80.0)	70.0 (60.5; 79.0)	73.0 (64.0; 83.0)
BMI (kg.m^{-2}), median	27.1 (24.1; 30.6)	27.5 (24.5; 30.5)	27.4 (24.5; 30.8)
WC (cm), median	91.0 (82.0; 100.0)	91.0 (82.0; 99.0)	92.0 (84.0; 100.0)
Central obesity, %	40.4 (36.8; 44.0)	40.0 (35.2; 45.0)	45.3 (40.8; 50.0)
BMI categories, %			
Normal weight (18.5-24.9 kg.m^{-2})	36.8 (33.2; 40.5)	31.8 (27.4; 36.5)	33.8 (29.2; 38.7)
Overweight (25.0-29.9 kg. m^{-2})	38.8 (35.2; 42.6)	40.8 (36.0; 45.7)	42.4 (37.8; 47.1)
Obese (≥30.0 kg. m^{-2})	24.4 (21.5; 27.5)	27.4 (23.6; 31.7)	23.8 (20.4; 27.8)
Lifestyle			
Commuting physical activity (MET.h.week^{-1}), median	10.0 (0; 51.4)	25.7 (0; 60.0)	29.3 (0; 70.0)
Total LTPA (MET.h.week^{-1}), median	0	0 (0; 120)	0 (0; 120)
Moderate LTPA (min.day^{-1}), median	0	0	0
Vigorous LTPA (min.day^{-1}), median	0	0	0
Total OPA (MET.h.week^{-1}), median	0	720 (300; 1,260)	3,240 (2,520; 4,500)
Moderate OPA (min.day^{-1}), median	0	600 (210; 1,200)	2,100 (840; 2,730)
Vigorous OPA (min.day^{-1}), median	0	0	60 (0; 1,800)
Sitting time (hr.day^{-1}), median	3.0 (2.0; 6.0)	2.6 (1.5; 4.0)	2.0 (1.0; 3.0)
Physical inactivity, %	46.4 (42.7; 50.0)	0	0
F&V intake (g.day^{-1}), median	171.4 (114.3; 274.3)	182.8 (114.3; 297.1)	171.4 (114.3; 285.7)
Salt intake (g.day^{-1}), median	9.3 (7.8; 11.0)	9.4 (8.0; 11.1)	9.7 (8.4; 11.4)
Alcohol intake (g.day^{-1}), median	27.7 (16.1; 53.2)	27.8 (16.1; 53.2)	37.3 (16.1; 79.2)
Smoking Status, %			
Never	38.8 (35.4; 42.3)	39.7 (35.2; 44.3)	29.9 (26.0; 34.1)
Ex-smoker	23.6 (20.7; 26.9)	22.6 (18.8; 26.8)	22.2 (18.7; 26.3)

Current smoker	37.6 (34.0; 41.3)	37.8 (33.2; 42.6)	47.8 (43.2; 52.6)
Health status			
Metabolic syndrome, %	30.3 (26.0; 35.0)	31.3 (24.9; 38.4)	27.5 (22.6; 33.1)
Type 2 diabetes, %	10.6 (8.6; 13.1)	9.4 (7.2; 12.1)	7.6 (5.7; 10.0)
Hypertension, %	27.3 (24.1; 30.6)	27.1 (23.5; 31.1)	24.8 (20.9; 29.2)
SBP (mmHg), median	123.3 (111.7; 139.7)	122.7 (111.3; 139.3)	122.0 (111.7; 135.3)
DBP (mmHg), median	74.7 (68.0; 82.7)	74.7 (68.0; 82.0)	76.0 (68.3; 84.0)

Data presented as medians with interquartile ranges for continuous variables or %s with its 95% confidence interval (CI) for categorical variables.