The influence of housing characteristics on leisure-time sitting. A prospective cohort study in Danish adults

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ABSTRACT

Objective. Built environmental attributes have been studied in relation to domestic time spent sedentary. An indoor behaviour has thus been linked to an outdoor setting. Yet, attributes of the actual domestic environment may also influence the time spent sedentary at home. Therefore, the aim was to examine if housing characteristics were cross-sectionally and prospectively related to leisure-time sitting in adults.

Methods. In the Danish Health2006 cohort, 2308 adults were followed for 5 years. At baseline, subjects self-reported housing characteristics (habitat type, habitat surface area and household size), moderate-to-vigorous physical activity (MVPA) and socio-demographic factors. Leisure-time sitting was self-reported at baseline and 5-year follow-up. Multiple linear regression was used to assess cross-sectional and prospective associations.

Results. At baseline habitat surface area and household size were inversely associated with leisure-time sitting ($p < 0.01$). Living in an apartment was associated with higher leisure-time sitting compared to living in a house ($p < 0.01$). Household size was a predictor of 5-year leisure-time sitting ($p < 0.01$), after adjustment for confounders and the other housing characteristics.

Conclusions. Habitat type, habitat surface area and household size were associated with leisure-time sitting in adults, while especially household size was a predictor of leisure-time sitting five years later. The findings highlight the importance of home-environmental attributes when targeting a reduction in sedentary behaviours.

Introduction

In westernized countries today, the home environment offers increased opportunities for sedentary behaviour, also known as "sitting time" (Sedentary Behaviour Research Network, 2012). Time spent at home is increasingly becoming time spent sitting (watching television, using a computer or other remote devices, playing electronic games etc.). The American Time Use Survey (ATUS, 2014) and the most recent OECD data (2011) report that on an average day watching TV account for more than half of leisure-time in those aged 15 and older (ATUS, 2014; OECD, 2014). The potential health effects induced by prolonged sitting may be substantial, as recent evidence show negative associations with biomarkers, all-cause mortality, fatal and non-fatal cardiovascular disease, type 2 diabetes, metabolic syndrome and possibly certain types of cancer, regardless of moderate-to-vigorous physical activity level (Owen, 2012; Rezende et al., 2014). Sedentary behaviour during leisure-time has in particular been found deleterious to health

markers in adults (Pereira et al., 2012; Rezende et al., 2014; Rhodes et al., 2012; Saidj et al., 2013, 2014). Accordingly, sedentary behaviour is currently considered a major public health challenge (Ng and Popkin, 2012), and it is therefore notably relevant to identify any correlates or predictors of leisure-time sitting.

In the past decade, built environmental attributes (Bauman et al., 2012; Owen, 2012), including land-use mix, green areas, and neighbourhood walkability, have been related to domestic time spent sitting (Kikuchi et al., 2013; Storgaard et al., 2013; Sugiyama et al., 2007; Timperio et al., 2012; Van Dyck et al., 2012; Veitch et al., 2011). Meanwhile, studying the relationship between leisure-time sitting and built environmental attributes is basically relating an indoor behaviour (sitting at home) to an outdoor setting (e.g., walkability of the neighbourhood), which constitutes an indirect relationship. Yet, attributes of the actual domestic environment could also influence the time spent sedentary at home. Studies on the home environment in relation to sedentary behaviour have focussed on electronic device ownership and location of the devices (e.g., TV in bedroom) (Kaushal and Rhodes, 2014). As outlined in the behavioural framework by Owen et al. (2014), sedentary behaviour may be influenced by

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numerous environmental settings, including the home environment, and housing characteristics such as dwelling-type (Owen et al., 2014). So far, no other studies in adults have examined this potential relationship between housing characteristics and leisure-time sitting. Therefore the purpose of this study was to examine if housing characteristics are cross-sectionally and longitudinally related with leisure-time sitting in adults.

Material and methods

Health2006 cohort

The Health2006 study was conducted in 2006 with a follow-up five years later. The participants in the baseline Health2006 cohort were drawn as a random sample from the background population aged 18–69 yrs, living in 11 municipalities in the south-western part of suburban Copenhagen. A total of 3471 individuals (response rate 44.7%) entered the study and participated in the health examination, which took place in 2006–08 (Thuesen et al., 2014). In 2011–12, participants in the baseline Health2006 were invited to a 5-year follow-up examination including essentially the same study protocol. A total of 3405 were eligible for invitation (21 had emigrated and 45 died), and 2308 (68.6%) agreed to participate and were re-examined between November 2011 and 2012. All participants gave written informed consent before taking part in the study, which was approved by the ethics committee of the Capital Region of Denmark, Copenhagen (KA20060011 and H-3-2011-081).

Housing characteristics

Housing characteristics included habitat type, habitat surface area and household size, all assessed at baseline. Participants correspondingly reported which kind of housing they live in (apartment/house/townhouse/other, categorized as apartment or house (house and townhouse was combined as they showed similar associations with leisure-time sitting)), number of square metres (sqm) in their residence (less than 70 sqm/70–110 sqm/more than 110 sqm), and number of persons living in their residence (open-ended numerical, categorized into 1 person, 2 persons, 3–4 persons, ≥5 persons).

Leisure-time sitting

Leisure-time sitting was self-reported at baseline and at 5-year follow-up using the Physical Activity Scale 2 (PAS2) (Andersen et al., 2010). The sitting time questions have not been specifically validated. However, the PAS2 questionnaire is a revised version of the Physical Activity Scale (PAS) (Aadahl and Jørgensen, 2003), which has been validated against diaries, accelerometer and VO$_2$Max (Aadahl and Jørgensen, 2003; Aadahl et al., 2007). The construct validity of PAS2, tested by cognitive interviewing, has shown superior structure to PAS (Andersen et al., 2010). In PAS2, participants reported time spent in weekly leisure-time physical activity and daily leisure-time sedentary pursuits. Leisure-time sitting (hours/day) was derived as a continuous variable from the question: "In your leisure time, how many hours and minutes per day do you spend watching TV, sitting quietly, reading, and listening to music or the like?".

Co-variates

Information on sex, age (categorized into young adults (18–39 years), middle-aged adults (40-59 years) and older adults (≥60 years)), education level (basic = ≤1 year of vocational training, short = 1–3 years of vocational training, and long-term = >3 years vocational training), having a partner (yes/no), having children (yes/no) (regardless whether the children live at home or not), self-assessed social position (upper/middle/lower) and working status (working/not working) was retrieved at baseline. Working status included all full- or part-time and voluntary work, irrespective of working hours. Self-rated health (very good/good/poor) was assessed at follow-up. Self-reported leisure-time moderate-to-vigorous physical activity (MVPA) (h/week) at baseline and follow-up was derived from the PAS2 questionnaire (Andersen et al., 2010), and used as a continuous variable.

Study sample

From a total sample of 2308 Health2006 participants, 2128 were included in the analyses. Reasons for exclusion of participants were missing data on leisure-time sitting at baseline and/or follow-up (N = 49, 2.2%) or covariates (N = 129, 5%). Two participants were also excluded because of functional limitations.

Statistical analysis

Statistical analyses of baseline housing characteristics and leisure-time sitting were performed using multiple linear regression analysis models. Basic models included the co-variates sex, age (included as continuous variable), education, working status and MVPA, all retrieved at baseline. In fully adjusted models, the other housing characteristics were adjusted for, to account for possible interrelation between the housing variables. The longitudinal relationships between baseline housing characteristics and 5-year leisure-time sitting were explored in basic and fully adjusted multiple linear regression analysis models, including baseline leisure-time sitting as a co-variate. Only participants with complete data were included in analyses. Leisure-time sitting was log transformed; results were back transformed and appear on the multiplicative scale. We used F tests to test for the associations between each housing characteristic and leisure-time sitting, computed while controlling for all other covariates in the model; p-values <0.05 were considered statistically significant. No sex-interactions were found hence models are presented for men and women combined. Interactions between each housing characteristics and with age, education, working status and self-rated health, respectively, were also tested. For sensitivity purposes, possible residual socioeconomic confounding was explored by further adjustment for, and test of interaction with, self-assessed social position. Due to multiple testing, interactions with co-variates (other than sex) were considered of statistical relevance at p < 0.01. Statistical analyses were performed with software package SAS 9.3 (SAS Institute, Cary, NC, USA).

Results

Descriptive data of the study population are shown in Table 1.

Those not attending follow-up were sitting more during leisure-time at baseline (mean of non-responders: 3.68 h/d, compared with mean of responders: 3.38 h/d), were less physically active (mean of non-responders: 4.66 h/week, compared with mean of responders: 4.98 h/week), more likely to live in a apartment (35.8% of non-responders compared to 24.9% of responders), in a surface area <70 sqm (15.8% of non-responders compared to 8% of responders), and were more likely to be living alone (18.8% of non-responders compared to 12.9% of responders). Their self-rated health was more likely to be poor (12.7% of non-responders compared to 6.6% of responders), and they were more likely to assess their social position as low (5.9% of non-responders compared to 2.9% of responders). Regarding socio demography, those not attending follow-up were more likely to be younger, 18-39 yrs (27.9% vs. 20.1%), not to have a partner (27.6% vs. 19.5%), have no children (22.8% vs. 16.9%), have a basic vocational education (24.7% vs. 15.7%) and not to be working (28.3% vs. 22.0%) (data not shown).

Results from adjusted analyses of the cross-sectional associations between housing characteristics and leisure-time are shown in Table 2.

For habitat type, those living in apartments had significantly higher leisure-time sitting compared to those living in houses (est: 1.16, p < .0001; i.e., someone living in an apartment had 1.16 times more leisure-time sitting per day, compared to someone living in a house). This association became just insignificant when adjusted for both habitat surface area and household size (p:.0505, cf. full model). For habitat surface area, those living in a small surface area had significantly higher leisure-time sitting compared to those living in bigger surface area (est: 1.23 for <70 sqm vs. > 110 sqm, p < .0001). This association remained significant in the fully adjusted model (est: 1.09 for <70 sqm vs. > 110 sqm, p: .0079). For household size, irrespective of adjustments, the association with leisure-time was statistically significant, with a trend of increased leisure-time sitting with decreasing household size number (est: 1.26 for 1 person vs. 5 + persons household, in the fully adjusted model, p < .0001).

Results from adjusted analyses of the longitudinal associations between housing characteristics and 5-year leisure-time sitting are shown in Table 3.