Cross-Sectional Associations Between the Five Factor Personality Traits and Leisure-Time Sitting-Time: The Effect of General Self-Efficacy

Jeanette Frost Ebstrup, Mette Aadahl, Lene Falgaard Eplov, Charlotta Pisinger, and Torben Jørgensen

Background: Leisure-time sitting-time (LTST) is seen as a possible independent risk-factor for physical and mental health, but research on psychological determinants is sparse. Associations between sitting-time and the personality dimensions of neuroticism, extroversion, openness, agreeableness, and conscientiousness, and the role of general self-efficacy (GSE) were investigated. Methods: A population-based, cross-sectional study was conducted at the Research Centre for Prevention and Health, Denmark, in 2006–08. Men and women (N = 3471) aged 18 to 69, were randomly sampled in the suburbs of Copenhagen. The NEO Five-Factor Inventory, the General Self-Efficacy-Scale, and the Physical Activity Scale 2 were used. Results: Negative associations were found between LTST and extroversion, conscientiousness, and openness, while neuroticism showed a positive association ($R^2 = .13$). The associations with agreeableness became significantly positive, when GSE was included. All 5 associations were mediated by GSE, with mediation proportions between 23%–60%; but with modest effect sizes. Conclusions: These cross-sectional results indicate that personality traits and GSE could be considered as associates of LTST; but future longitudinal data are necessary to make causal statements and rule out alternative models fitting data.

Keywords: sedentary behavior, NEO-FFI, mediation, general population

The importance of regular physical activity for good health and long-term weight management is well-established and the benefits of a physically active lifestyle are universally recognized.1,2 In recent years a growing body of evidence has emerged suggesting that prolonged sitting is negatively associated with both physical and mental health independently of physical activity levels.3–11 It is emphasized that too much sitting is distinct from lack of exercise.12,13 In this paper we will refer to “sedentary behavior” being the same as “sitting-time” and distinct from physical activity (PA) of all intensities.

There has been consensus since the 1980s on adopting the Five Factor Model (FFM) of personality as the best comprehensive system of basic independent personality factors.14,15 The 5 higher order factors or dimensions are labeled neuroticism, extroversion, openness to experience, agreeableness, and conscientiousness. Psychological factors (eg, personality trait dimensions) have been studied and related to physical activity behavior.16–18 A meta-analysis17 concluded that extroversion and conscientiousness were positively associated, and neuroticism negatively associated, with PA. Openness and agreeableness were not associated with PA.

Besides being a risk factor for ill health, sitting-time is found to be independently associated with both all cause- and cardiovascular mortality.7 Understanding the association between personality and sitting-time may help us to identify possible risk factors for ill health mediated through prolonged sitting-time. This might thereby direct future causation studies, and in time, future prevention initiatives. To our knowledge, the relationship between personality and leisure-time sitting-time (LTST) has not previously been studied.

Although medium magnitude associations between personality traits and lifestyle behavior (eg, PA) are demonstrated, it is generally agreed that personality traits do not have an exclusively direct effect. These associations might work through or be mediated by social cognition factors, such as self-efficacy.19

Several studies have shown an association between exercise-self-efficacy and PA level.20,21 We argue that an association between personality and lifestyle behavior, including LTST might work, not only through task-specific self-efficacy (TSSE), but through more general social cognition factors such as general self-efficacy (GSE; Figure 1).
GSE, in contrast to TSSE, may explain a broader range of human behaviors and coping outcomes when the context is less specific. Understanding of GSE as a mediator in the relationship between the FFM personality traits and sitting-time could help interventionists target confidence-building in individuals at high risk of excessive sitting-time. However, GSE as a mediating factor between personality traits and LTST has not previously been tested.

Our main aim was to investigate the association between FFM personality traits and LTST. As mentioned above, we argue that these relations might work through more general social cognition factors, such as GSE, which is why our second aim was to investigate whether GSE would mediate any association. Given the novelty of this field of research, and since no previous literature on the personality-LTST relation was found, no a priori hypotheses were made. Instead we chose an exploratory approach that might guide future research.

Materials and Methods

Study Population

Health2006 is a population-based cohort examined at the Danish Research Centre for Prevention and Health in the period 2006–08 comprising male and female Danish citizens age 18–69, born in Denmark and living in 1 of 11 municipalities in the south-western part of Copenhagen. The study population was a random sample obtained from the Danish Central Personal Register, managed by the Ministry of Internal Affairs. A total of 7931 individuals were invited to be a part of the cohort; 3471 (43.8%) participated having given written consent (Ethics Committee: KA-2006 to 0011). All participants had a general health examination and completed a premailed questionnaire, addressing sociodemographic, mental health, PA and LTST issues.

Figure 1 --- Hypothesis model of associations between Five Factor Model (FFM) personality traits and leisure-time sitting-time (LTST).

Note. path c = the total effect between the FFM personality traits (independent variable) and LTST (outcome variable); path b = the impact of GSE (mediator variable) on LTST; path a = the association between the FFM personality traits (independent variable) and GSE; social factors = occupational education and employment.

Measures

NEO-PI-R. The NEO Personality Inventory Revised (NEO-PI-R) is an instrument originally developed in 1978 as the NEO Inventory, measuring neuroticism, extroversion and openness to experience. In 1985 it was broadened with 2 new domains (agreeableness and conscientiousness) and published as the NEO-PI-R.\textsuperscript{14,15} The NEO-PI-R, designed to put the FFM into practice, is a hierarchical measure of personality, founded in the 5 well-established factors or domains listed above.

In the current study we used a short form—the NEO-FFI—consisting of a 60-item scale, with 12 questions defining each of the 5 broad domains. The domain of neuroticism describes a chronic tendency to feel tense, worried, and irritable and is also called “emotional stability.” The extroversion domain encompasses the tendency to be vigorous, active, and involved with the world around oneself. Openness to experience is the tendency to be imaginative, creative, and aesthetically sensitive. The domain of agreeableness includes several traits relating to relationships with others (eg, cooperative, considerate, and empathetic). The fifth domain—conscientiousness—encompasses the capacity of behavioral and cognitive control. Conscientious individuals are responsible, attentive, and careful.\textsuperscript{23}

The Danish version of NEO-FFI\textsuperscript{24} used in the current study showed internal consistency, as measured by Cronbach’s alpha, ranging from 0.70–0.85 for the 5 domains (Table 1). Every item in NEO-FFI—a typical one would be “I often try new and foreign foods”—is allocated on a Likert scale to 1 of 5 options, ranging from “totally disagree” to “totally agree.” The scoring-manual of the updated and revised NEO-FFI-3 recommends exclusion of observations if more than 9 items are missing; we chose a more conservative approach for this older version of the NEO-FFI excluding observations if 7 or more of the 12 items were missing. The number of excluded observations
Table 1  Characteristics of the Sample in the Health2006 Study—3471 Individuals Age 18–69 Years

<table>
<thead>
<tr>
<th>Variable</th>
<th>Descriptive statistics</th>
<th>Pearson's correlation coefficients $r$ (bivariate)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>Mean</td>
</tr>
<tr>
<td>1. Sex, = male</td>
<td>1553 (44.74)</td>
<td></td>
</tr>
<tr>
<td>2. Employment status, = employed</td>
<td>2520 (73.77)</td>
<td></td>
</tr>
<tr>
<td>3. Occupational education, $\geq$ 4 years</td>
<td>454 (13.68)</td>
<td></td>
</tr>
<tr>
<td>4. Age, years</td>
<td>3471 (100.00)</td>
<td>49.36</td>
</tr>
<tr>
<td>5. Neuroticism, score-range 12–60</td>
<td>3221 (92.80)</td>
<td>28.44</td>
</tr>
<tr>
<td>6. Extroversion, score-range 12–60</td>
<td>3221 (92.80)</td>
<td>42.86</td>
</tr>
<tr>
<td>7. Openness, score-range 12–60</td>
<td>3220 (92.77)</td>
<td>38.16</td>
</tr>
<tr>
<td>8. Agreeableness, scores 12–60</td>
<td>3222 (92.83)</td>
<td>46.03</td>
</tr>
<tr>
<td>9. Conscientiousness, score-range 12–60</td>
<td>3221 (92.80)</td>
<td>45.77</td>
</tr>
<tr>
<td>10. General self-efficacy, score-range 10–40</td>
<td>3215 (92.62)</td>
<td>29.62</td>
</tr>
<tr>
<td>11. Leisure-time sitting-time, hours/week</td>
<td>3423 (98.62)</td>
<td>24.35</td>
</tr>
<tr>
<td>12. Moderate-to-vigorous physical activity,</td>
<td>3443 (99.19)</td>
<td>4.85</td>
</tr>
</tbody>
</table>

Abbreviations: $\alpha$, Cronbach's alpha; SD, standard deviation.

* $P < .0001$. 
differed among the 5 personality dimensions, leaving 3020 individuals with an openness-score, 3021 persons with neuroticism-, extroversion- and conscientiousness-scores, and 3022 persons with an agreeableness-score. The total raw-score for each dimension is derived by summing up responses across 12 items—replacing missing items with mean score values of answered items—and making a total score of between 12–60 points.

**General Self-Efficacy.** General self-efficacy (GSE) is measured using a 10-item scale which was reduced in 1981 from the original 20-item scale developed by Jerusalem and Schwarzer in 1979. This GSE-10 item scale has since been adapted for 28 languages, including Danish. The scale is found to be highly reliable and stable, and to form only 1 global dimension; in this study Cronbach’s alpha was 0.90 (Table 1). GSE reflects a generalization across various domains of functioning in which people judge their efficacy, and their belief in their competence to tackle novel or challenging tasks, in a broad range of demanding situations.

People with high self-efficacy choose to perform more challenging tasks, set themselves higher goals, are more persistent, and recover more quickly in the face of setbacks. It is a 1-dimensional global construct, with a basic belief which is inherent in all individuals. The 10 items—a typical one is “thanks to my resourcefulness, I can handle unforeseen situations”—are allocated on a Likert scale of 4 options ranging from “not at all true” to “exactly true.” The total GSE score is derived by summing up responses across the 10 items—replacing missing items with mean score values of answered items—and making a total score between 10–40. Following the manual, observations with fewer than 7 out of 10 items answered were excluded, leaving 3215 individuals with a GSE-score.

**Leisure-Time Sitting-Time.** To measure sitting-time we used the Physical Activity Scale 2 (PAS 2). PAS 2 is a self-reported questionnaire, originally developed as PAS 1 in 2003, with a recall period of any nonspecified week. It measures PA as number of average daily hours and minutes of sleep [0.9 metabolic equivalents (METs)], TV-viewing or other sedentary leisure activities (1.0 METs), sedentary work (1.5 METs), standing or walking work (2.0 METs), heavy physical work (5.0 METs), and cycling or walking to and from work (4.0 METs). Furthermore, the numbers of weekly hours and minutes of leisure time: light (3 METs), moderate (5 METs), and vigorous (6 METs) intensity activity, are recorded.5,31 Questions concerning daily time spent on sedentary leisure behavior (eg, sitting, TV-viewing, reading) were multiplied by 7, and the numbers of hours and minutes per week were then converted to decimal numbers of hours; the resultant variable, “sitting-time,” was treated as a continuous variable (hours per week) in the models.

**Covariates.** Gender and age were measured. Data on occupational education or training beyond basic school education (eg, elementary school and college) were based on a 4-point scale: 1) none (eg, semiskilled worker), 2) brief education up to 1 year (eg, bus driver), 3) medium education between 1 and 4 years (eg, nurse), and 4) higher education more than 4 years (eg, medical doctor, psychologist). In addition, we included employment on a 3-point scale (“employed,” “previously employed,” “never employed”).

**Statistics**

The SAS 9.2 edition was used for all the analyses. For descriptive statistics and bivariate correlations (Table 1) we used Pearson’s correlations. We began the study by conducting multiple linear regression analyses following the diagram in Figure 1 in order to 1) investigate the association between FFM personality traits and sitting-time and 2) test the hypothesis that GSE would mediate the associations. We examined path c, the total effect of the FFM personality traits (independent variable) on sitting-time [outcome variable(s)]; path b, the impact of GSE (mediator variable) on sitting-time; and path a, the association between the FFM personality traits (independent variable) and GSE (Table 2). We then estimated the indirect or mediating effect of GSE by multiplying the effect of path a by that of path b. To handle a potential skew in the distribution we used resampling (bootstrapping) to derive means of the product (a × b) and to estimate asymmetric confidence limits, using the values that mark the upper and lower 2.5% of the bootstrap distribution.

Thirdly, we estimated the mediation proportion—how large a proportion of the total effect of FFM personality traits on sitting-time is mediated through GSE. The algorithm used was mediation proportion = [(a × b) + c]. All associations were adjusted for age and gender, and path b was further conditioned by social factors and the personality domain in question. All models of sitting-time were fitted by using age squared. Likewise we tested the 5 personality dimensions and GSE for linearity (1% significance level) and tested for interaction between the FFM personality traits and gender. Because of the bootstrapping technique in analyzing the mediating effect we used complete case analysis (N = 3038). To estimate the substantive effect size of the associations we used the R-squared value of the regression, which is the fraction of the variation in the dependent variable that is accounted for by the independent variable (Table 2).

It is advisable that path a and path b should be of equal magnitude, not to lose power in mediation analyses. Since we aim to relate global measures to human behavior and because of the expected strong correlation of the FFM personality traits and GSE (path a)—this equal correlation size of path a and path b is not obvious, which is why a large sample size is used to strengthen the analyses.36
### Table 2  Associations of the Five Factor Model Personality Traits, Leisure-Time Sitting-Time (LTST) and General Self-Efficacy; Both Genders, Age 18–69 Years

<table>
<thead>
<tr>
<th>Effect (^b)</th>
<th>(N = 3038^c)</th>
<th>(\beta)</th>
<th>95% CI</th>
<th>SE</th>
<th>(R^2) (path c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism—LTST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Path c—Neuroticism-LTST (confounder controlled total effect)</td>
<td></td>
<td>0.15*</td>
<td>0.09, 0.21</td>
<td>0.03</td>
<td>0.13</td>
</tr>
<tr>
<td>Path a—Neuroticism-GSE</td>
<td></td>
<td>-0.37*</td>
<td>-0.39, -0.35</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Path b—GSE-LTST</td>
<td></td>
<td>-0.25*</td>
<td>-0.34, -0.15</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>Extroversion—LTST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Path c—Extroversion-LTST (confounder controlled total effect)</td>
<td></td>
<td>-0.25*</td>
<td>-0.31, -0.19</td>
<td>0.03</td>
<td>0.14</td>
</tr>
<tr>
<td>Path a—Extroversion-GSE</td>
<td></td>
<td>0.38*</td>
<td>0.36, 0.40</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Path b—GSE-LTST</td>
<td></td>
<td>-0.15*</td>
<td>-0.25, -0.06</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>Openness—LTST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Path c—Openness-LTST (confounder controlled total effect)</td>
<td></td>
<td>-0.17*</td>
<td>-0.24, -0.10</td>
<td>0.04</td>
<td>0.13</td>
</tr>
<tr>
<td>Path a—Openness-GSE</td>
<td></td>
<td>0.24*</td>
<td>0.21, 0.27</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Path b—GSE-LTST</td>
<td></td>
<td>-0.23*</td>
<td>-0.31, -0.15</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>Agreeableness—LTST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Path c—Agreeableness-LTST (confounder controlled total effect)</td>
<td></td>
<td>0.02</td>
<td>-0.06, 0.10</td>
<td>0.04</td>
<td>0.12</td>
</tr>
<tr>
<td>Path a—Agreeableness-GSE</td>
<td></td>
<td>-0.06*</td>
<td>-0.10, -0.03</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Path b—GSE-LTST</td>
<td></td>
<td>-0.26*</td>
<td>-0.34, -0.18</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>Conscientiousness—LTST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Path c—Conscientiousness-LTST (confounder controlled total effect)</td>
<td></td>
<td>-0.28*</td>
<td>-0.35, -0.20</td>
<td>0.04</td>
<td>0.13</td>
</tr>
<tr>
<td>Path a—Conscientiousness-GSE</td>
<td></td>
<td>0.43*</td>
<td>0.41, 0.46</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Path b—GSE-LTST</td>
<td></td>
<td>-0.18*</td>
<td>-0.27, -0.09</td>
<td>0.05</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: \(\beta\), regression coefficient; CI, confidence limit; \(R^2\), effect size; SE, standard error.

* \(P < .0001\).

\(^a\) All effects are conditioned on gender and age; \(^b\) path b is additionally conditioned on occupational education, employment, and the personality domain in question; \(^c\) complete case varied between 3037 and 3039 for each domain of personality traits.

### Results

#### Descriptive Statistics

The results in this study are based on 3471 men (44.7%) and women aged 18–69 with a mean age of 49.4 years. 13.7% of participants had 4 or more years of occupational education and 73.8% of the participants were employed. Average leisure-time per week spent in sitting behavior was 24.4 hours, and in moderate-to-vigorous PA was 4.9 hours (Table 1). The bivariate population correlation (Pearson’s \(r\)) between FFM personality factors and GSE in this study varied from small to large (ie, from 0.11–0.51), with negative associations between neuroticism and GSE (–0.51), and between agreeableness and GSE (–0.11; Table 1).

#### Results of Regression Analyses

Results from the multivariable linear regression analyses are shown in Table 2 and the mediation analyses in Table 3. We found a significant positive total effect (c) between neuroticism and LTST and a significant negative total effect (c) with extroversion, openness and conscientiousness (see Table 2). No significant total effect (c) was seen with agreeableness. The substantive effect size of the associations—measured as the coefficient of determination \(R^2\)—was moderate; meaning that between 12%–14% of the variation in the values of sitting-time is explained by its linear relationship with the observed values of the 5 personality dimensions in this cross-sectional model. In analyses of mediation, we found significant indirect effects through GSE (see Table 3); positive for
neuroticism (mediation proportion 60%) and negative for extroversion (mediation proportion 23%), openness (mediation proportion 33%), and conscientiousness (mediation proportion 28%). Testing the indirect effect (a \times b) of GSE on agreeableness, made the association significantly positive, indicating GSE as a mediating variable. The mediation proportion was not calculated.

As a counterpoint to our results regarding sitting-time, although we found almost negligible regression coefficients (data not shown), we did find a significant negative total effect (c) between neuroticism and moderate-to-vigorous PA, and a significant positive total effect (c) with extroversion and conscientiousness (R² = 5%–7%). No significant total effect (c) was seen with openness and agreeableness. We found significant indirect effects through GSE: negative for neuroticism, and positive for extroversion, openness, agreeableness, and conscientiousness. In none of the regression analyses regarding sitting-time or PA did gender act as an effect moderator.

### Discussion

Four out of the five personality dimensions were conclusively found to be moderately associated with LTST with a correlating ability of approximately 13%. In all cases the effect was mediated by GSE, and 23%–60% of the total effect can be explained in this model by GSE. According to results for this model although cross-sectional it seems that for each point-score of neuroticism the weekly sitting-time increases by 0.16 hours (approximately 10 minutes); conversely, it decreases by up to 0.28 hours (approximately 15 minutes) for each point-score of conscientiousness. It could be argued though, that the large variability in the responses for sitting-time is prone to memory bias. The self-report of weekly sitting-time in a nonspecified week is based on general memories of behavior and more prone to recall bias than memories of the behavior of a specific week. With the reservation for causal statements, and with emphasis on preventing LTST, these results seem to show that the
greatest associations with the weekly time spent on sitting behavior are the extroversion- and conscientiousness score, which is explained to some extent by a positively correlated GSE-level.

In Social Cognitive Theory perceived self-efficacy is viewed as more task-specific and refers to personal action-control or agency which influences how people think, feel and act. The present authors agree with Bandura that perceived self-efficacy should be conceptualized in a task- or domain-specific manner when investigating specific volitional behaviors (eg, PA). By contrast, when speaking of less specific and less task-oriented behaviors (eg, sitting-time), perceived self-efficacy identified at a more general level of functioning and measured by the general self-efficacy scale (GSES) may mediate the effect of personality traits. The conceptualization of a generalized sense of self-efficacy aims at dealing with personality traits. The conceptualization and social cognitive variables have been established. GSE is found to correlate negatively with negative affect and positively with positive affect, optimism, self-esteem, future orientation, self-regulation, and life satisfaction. In a meta-analytic review of studies examining the correlation between FFM personality factors and GSE, Judge et al. estimated a population correlation of approximately 0.62 between neuroticism and GSE, and small to large correlations (ie, from 0.05–0.58) between GSE and each of the other FFM factors, the largest positive associations being found with conscientiousness and extraversion. Although GSE seemed to mediate in part the relationship between FFM personality traits and sitting-time, with mediation proportions up to 60%, it should be kept in mind that the total effects were very modest. Still, lifestyle intervention could be tailored to fit the individual according to his/her mental fitness—resilience or vulnerability—taking personality and general self-efficacy into account. The barrier for lifestyle change for the highly neurotic individual with very low self-efficacy may indicate that cognitive therapy intervention aiming at increasing self-efficacy could be beneficial in the first instance. Future studies investigating the effects of interventions on GSE in reducing LTST should be considered.

It has been argued that a potential effect moderator of the relationship between personality traits and PA and perhaps sitting-time could be the gender of the participants; however, in accordance with a recent study from 2010, our results indicate that this was not the case. To our knowledge this is the first time that a link between personality and LTST has been investigated and tested from a social cognition perspective. Furthermore, the strength of this study lies in the large random and age-diverse sample of a general population which increases the capacity to conduct mediation analyses and the general validity of the results. The participation rate was 43.8%; former analyses of nonresponders in surveys comparable to ours showed lower socioeconomic status and educational attainment among nonresponders and age and sex distributions among responders tending to greater age and larger proportions of women. We were not able to compare exposure or outcome variables between responders and nonresponders. Self-reporting bias of both exposure and outcome, as well as both residual confounding and nondisposed indirect associations, could be an issue. Another weakness of this study is the cross-sectional design which makes causal inference inappropriate, but justifies generation of hypotheses of potential psychological determinants of LTST.

Although these results need to be replicated in other studies, this study indicates that psychological factors of personality trait dimensions and GSE associate with lifestyle in terms of LTST. Likewise, this study indicates that coping ability might mediate the relationship between global psychological measures and human behavior. Future studies in longitudinal data might rule out alternative models with other potential predictors and mediators.

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References


