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Moderating effect of gross family income on the association between demographic indicators and active commuting to work in Brazilian adults

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ABSTRACT

Objective. To investigate the moderating effect of gross family income on the association between demographic indicators and active commuting to work in Brazilian adults.

Methods. Secondary analysis of the survey "Lifestyle and leisure habits of industry workers" (n = 46,981), conducted in 24 Brazilian states (2006–2008). Self-reported information was collected with a previously tested questionnaire. Crude and adjusted logistic regression models were applied to analyze the association between sociodemographic variables (sex, age, marital status, number of children, education, country area and company size) and active commuting to work in different strata of gross family income. To test the moderating effect, an interaction analysis was applied.

Results. The proportion of active commuters among low-, medium- and high-income workers was 40.7% (95%CI:40.0%;41.5%), 27.0% (95%CI:26.3;27.6%) and 11.1%, (95%CI:10.5%;11.7%), respectively. The moderating effect of gross family income was confirmed. Men were more likely (OR:1.22 95%CI:1.12;1.32) to commute actively than women among low-income individuals. Active commuting was less likely among older workers in low—(OR_{30-39}:0.90 95%CI: 0.83;0.98; $OR_{\geq 40}$: 0.76 95%CI: 0.68;0.85) and medium-income strata (OR_{30-39}:0.87 95%CI:0.80;0.95; $OR_{\geq 40}$:0.84 95%CI:0.76;0.93) and among married individuals in high-income strata (OR:0.72 95%IC:0.61;0.84). Adults with lower education (OR_{high}:10.80 95%CI:8.47;13.77), working in the south (OR_{high}:1.93 95%CI:1.53;2.44) and in small companies (OR_{low}:2.50 95%CI:2.28;2.74) were more likely to commute actively; however, the magnitude of these associations differed at each income strata.

Conclusion. There was an inverse association between gross family income and active commuting. Gross family income acts as a moderator of the association between demographic indicators and active commuting.

1. Introduction

The etiology of physical activity (PA) is complex(Bauman et al., 2012) and may vary depending on its domain (leisure, housework, occupational or commuting). (Bacchieri et al., 2005; Hallal et al., 2005; Macniven et al., 2012). As an example, the direction of the association between income and PA depends on which domain is taken into account. (Del Duca et al., 2009; Kruger et al., 2008). In this context, the literature consistently points out an inverse association between income and active commuting. (Bacchieri et al., 2005; Hallal et al., 2005; Macniven et al., 2012; Besser & Dannenberg, 2005; Agrawal & Schimek, 2007).

Given that consistent correlates of PA may be potential moderating variables, (Bauman et al., 2002), they can change associations of certain factors and their outcomes, impacting both the direction and the magnitude of these associations. (James & Brett, 1984; Lubans et al., 2012). Thus, the literature indicates the study of moderators of PA,(Bauman et al., 2012) in order to better understand the magnitude and significance of the associations of PA, with some variables of interest according to certain subgroups.(Bauman et al., 2002) Some authors have used this strategy to study PA.(Carlson et al., 2014; Tucker-Seeley et al., 2009) As an example, Carlson et al. (2014) found that income moderates the relationship between safety in the neighborhood and practice of PA, since this pattern differs among groups with different levels of income.

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Active commuting is an important way to incorporate PA into a daily routine (Merom et al., 2005); it contributes to preventing chronic diseases(HOU et al., 2004) and can be used as a strategy to promote workers' health. (Tassitano et al., 2013). Thus, implementing changes in the mode of commuting can be an important public health measure,(Duncan et al., 2010) considering the reality of the majority of the adult population that needs to commute to the workplace on a daily basis. However, guiding efforts to promote effective interventions requires understanding not only the pattern of sociodemographic indicators associated with active commuting in different income strata, but also whether the magnitude of association differs among such groups. To address these questions, this study intends to investigate the moderating effect of gross family income in the relationship between demographic indicators and active commuting to work in Brazilian adults.

2. Methods

This study uses data from a national survey titled "Lifestyle and leisure habits of industry workers", conducted in 23 states and one federal district of Brazil between 2006 and 2008 (the period of collecting data was different for each state). The survey results from the partnership between the Industry Social Service (SESI) and the Research Center for Physical Activity and Health (NuPAF) of the Federal University of Santa Catarina.

In Brazil, industrial workers are considered those who work in the following sector's companies: mineral extraction, processing, industrial services of public utility and construction. According to SESI data, the target population comprised 670,326 workers. The criteria for sample size estimation included: 45% prevalence, 3% sampling error, 95% confidence interval, 1.5 design effect, and 20% increase for losses and refusals.

Workers of both sexes participated in the draw (the sample was not stratified by workplace sectors). The final sample consisted of 52,774 workers, selected in two stages. In the first stage, companies were randomly selected, according to the distribution of employees in large companies (≥500), medium (100–499) and small (<100). In the second stage, the number of workers were randomly selected, considering the proportionality necessary to ensure the representativeness of company size (large, medium and small). For the purpose of data collection, workers were divided into small groups (three to 15 participants) and answered a previously validated questionnaire (Barros & Nahas, 2001) with 58 questions, under the supervision of SESI professionals and service providers. The questionnaire was carried out by officials of the SESI or hiring companies specializing in research. Before the collecting, the local coordinators and applicators were trained and a guide about the procedures of the application was given to them. The outcome variable (active commuting) was assessed by the question: "On most days of the week, how do you commute to work?" The possible answers were: on foot, by bike, bus, and car/motorcycle. Those who reported walking or cycling were grouped to represent the active commuters group. Socio-demographic and economic variables (age, sex, marital status, education, number of children, region of the country and company size) were categorized as shown in Table 1. The moderator variable (gross family income) was divided in three different strata: low-income (≤600BRL), medium-income (601 to 1,500BRL) and high-income (>1,500BRL). The values are based on the minimum wage at the time in which the survey was conducted. Thus, the minimum wage corresponding to 2005 was 300BRL (the time of construction of the questionnaire) and changed in 2006 (350BRL), 2007 (380BRL) and 2008 (415BRL), according to the adjustment of the annual minimum wage.

The study was approved by the Ethics Committee of the Federal University of Santa Catarina, Brazil (Review No 306/2005 and 009/2007). All workers were informed that the participation in the research was voluntary and that all information was confidential. In addition, SESI, partner institution in the survey, authorized the secondary analysis of data.

2.1. Statistical analyses

Descriptive statistics were used to characterize the sample according to active commuting and independent variables according to economic status. Initially, it was verified, by the Wald's test, if there was a difference between the prevalence of active commuting considering each stratum of gross family income. A decrease in the prevalence of active commuting was observed as gross family income increased ($p < 0.001$). With that, we decided to analyze if the relationship between demographic and socioeconomic variables were different, when considering each stratum of gross family income. In this way, an interaction analysis was performed (product term).

Analyses were performed using the statistical software Stata® Standard Edition, version 13.0 for Microsoft® Windows™ (Stata Corp LP, United States). In order to observe the prevalence for active commuting among each category of the variables, we used binary logistic regression analysis (crude and adjusted) to estimate the odds ratios (OR) with their respective confidence intervals (95% CI). The crude analysis was performed taking into account the dependent variable and each one of the independent variables. Thus, it was possible to verify the crude odds for each association tested. In the adjusted analysis, all independent variables (sex, age, marital status, number of children, education, country area, and company size) were included simultaneously. The associations were considered statistically significant when it achieved a significance level of 0.05 ($p < 0.05$) and there was no overlap of the 95% CI. These criteria were combined because the sample size was very large, with high power for all tested associations.

3. Results

The study response rate was 90.6%, representing a total of 47,886 workers. Those who did not report sex were excluded ($n = 409$). Another 496 workers did not report their gross family income. Of the 46,981 participants with complete data, 32.1%, 41.4% and 26.5% were classified as low-, medium- and high-income, respectively. In all income strata there was a higher prevalence of male workers, younger, with high school education, married, with at least one child, and belonging to the northeast. In the low-income group, there was a higher prevalence of workers in medium-sized companies, while in the medium- and high-income group, there was a higher prevalence of workers in large companies (Table 1).

The prevalence of active commuting was lower in higher with increasing income strata, since 40.7% (95% CI: 40.0%; 41.5%), 27.0% (95% CI: 26.3; 27.6%) and 11.1% (95% CI: 10.5%, 11.7%) of low-, medium- and high-income workers, respectively, reported commuting actively to work.

In the crude analysis (Table 2), the association of active commuting with the independent variables differed in each income stratum. Men were more likely to engage in active commuting, but the odds ratio showed a decrease across the income stratum (OR_{low}: 1.48; OR_{medium}: 1.29; OR_{high}: 1.26). Older workers were more likely to engage in active commuting in low ($OR_{30\text{-}39}$: 1.09 95%CI: 1.01;1.17) and medium stratum ($OR_{\geq 40}$: 1.14 95%CI: 1.05;1.24), and less likely in high-income stratum ($OR_{30\text{-}39}$: 0.81 95%CI: 0.70;0.93 and $OR_{\geq 40}$: 0.83 95%CI: 0.73;0.95). Those who are married and have one or more children had a greater odds ratio for active commuting in lower (respectively: OR: 1.19 CI95%: 1.11;1.27 and OR: 1.23 CI95%: 1.15;1.32,) and medium income (respectively: OR: 1.22 CI95%: 1.14;1.30 and OR: 1.18 CI95%: 1.11;1.27) and the opposite was verified in the high-income strata (respectively: OR: 0.84 95%IC: 0.75;0.94 and OR: 0.85 CI95%: 0.76;0.95).

In all strata, there was an inverse association between education and active commuting, which greater odds ratio in the lower level of education (OR_{low}: 2.64 CI95%: 2.02;3.45, OR_{medium}: 5.99 CI95%: 5.03;7.13 and OR_{high}: 9.56 CI95%: 7.69;11.90). The greater odds of active commuting was among those from the north (OR_{low}: 2.21 CI95% 1.92;2.34) and