



## Clustering of risk behaviors for chronic noncommunicable diseases: A population-based study in southern Brazil

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### ABSTRACT

**Objective.** The purpose of this study was to investigate the prevalence and identify factors associated with simultaneous risk behaviors for chronic noncommunicable diseases in adults in a southern capital in Brazil.

**Method.** A cross-sectional, population-based study was carried out with 1720 adults in Florianópolis, Brazil. The simultaneous occurrence of tobacco smoking, abusive drinking, inadequate or unhealthy diet, and physical inactivity during leisure was assessed. The independent variables were demographic and socio-economic characteristics.

**Results.** Only 8.3% of the respondents did not have any of these factors, whereas the simultaneous occurrence of two or more risk behaviors was 59.4%. The simultaneous presence of four risk behaviors (3.4%) was 220% higher of what would be expected by combining the individual prevalence of these factors (1.5%). The likelihood of individuals having two or more risk behaviors simultaneously was greater in young men, with black skin color, living without a partner, with lower household *per capita* income, and lower education.

**Conclusion.** It is necessary to implement programs that reduce the risk behaviors for chronic noncommunicable diseases among adults in Brazil, especially between young men with low education and income.

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### Introduction

The four major risk factors for changeable chronic noncommunicable diseases (CNCDS) are tobacco smoking, alcohol consumption, unhealthy eating habits, and physical inactivity (World Health Organization, 2002, 2009; Yusuf et al., 2004). More worrisome than the exposure to one risk factor is the simultaneous exposure to more than one of these behaviors (Yusuf et al., 2004). Thus, evaluating aggregate health risk factors facilitates (Poortinga, 2007): i) the identification of the health risk factors that influence the occurrence of other factors; ii) the evaluation of the negative effect on health caused by simultaneous exposure, which is higher than the sum of the effects of exposure to each factor alone, suggesting that the health effects of lifestyle risk factors are multiplicative rather than additive; and iii) the promotion of health programs based on actions oriented to modify simultaneous behaviors because this strategy has shown to be more effective than those based on isolate behaviors.

The lack of studies in Latin America on this subject also makes it difficult to detect the most common behavior patterns and the

groups that are more susceptible to developing unhealthy habits, thus limiting any possible intervention to reduce the exposure to these risks. This work aimed to identify the prevalence and the sociodemographic factors associated with the simultaneous presence of chronic noncommunicable diseases risk behaviors in adults in a capital city in southern Brazil.

### Methods

EpiFloripa, a population-based cross-sectional study was performed in Florianópolis, southern Brazil, from September 2009 to January 2010 ([www.epifloripa.ufsc.br](http://www.epifloripa.ufsc.br)). The city has 421,203 inhabitants and ranks highest in terms of social and health indicators compared to other Brazilian capitals (Brazilian Institute of Geography and Statistics, 2009).

Sampling was conducted in two phases (Höfelmann et al., 2012). In the first phase, 420 urban census tracts were stratified by deciles of household income being systematically drawn 63 tracts (sampling fraction equal to seven), totaling six tracts in each decile. In the second phase, the sampling units were households. The number of inhabited households ranged from 61 to 810 (coefficient of variation, 32%), and 18 were systematically chosen at random in each of the geographical units (average of 1.78 adults per domicile) or 32 adults in each census tract.

The sample size for prevalence ( $n = 1820$ ) was calculated assuming a target population of 249,530 adults aged between 20 and 59, a prevalence of 50% for the outcome (to maximize the number of individuals), sample error

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of 3.5 p.p., confidence level of 95%, design effect of 2.0 (because of clustering sample) and percentage of non-answers of 10%. Because of the multiple objectives of the EpiFloripa study (to evaluate diverse health outcomes) (Höfelmann et al., 2012), the sample size was increased to 2016 individuals. A posteriori we calculated the minimum odds ratio (OR) detectable with this sample, considering a range of exploratory variable factors (exposures) and the cluster of risk factors (outcome = 50%). For exposure prevalence higher than 5% the study is able to detect OR higher than 1.32 (risk) or lower than 0.76 (protection) for exposure prevalence higher than 5%, adopting an alpha of 5% and power of 80%.

The home visits included the administration of a face-to-face questionnaire applied with the use of a personal digital assistant. Thirty-five interviewers were intensively trained prior to field work; the questionnaire pre-testing was performed on 35 adults. The pilot study included almost 100 adults living close to the research headquarters and in two census tracts not included in the sample.

A short version of the questionnaire (10 questions) was administered through a telephone interview to 15% of the whole sample ( $n=248$ ) for quality control, with kappa and intra class correlation coefficient values ranging from 0.6 to 0.9.

The dependent variable was the simultaneity of health-risk behaviors: tobacco smoking, abusive alcohol consumption, poor eating habits, and physical inactivity. A score ranging from 0 (no risk behavior) to 4 (four simultaneous risk behaviors) was generated.

Smoking was assessed as nonsmoker, former smoker, or current smoker. For the purposes of the analysis, the “nonsmoker” and “former smoker” categories were grouped and considered not of risk to health. The *Alcohol Use Disorders Identification Test* was administered to identify people with problematic use of alcohol (no = score from 0 to 7; yes = score  $\geq 8$ ) (Lima et al., 2005). This tool allows identifying people who are at risk of alcohol abuse, harmful use and dependence (Lima et al., 2005). Physical activities and eating habits were assessed by means of the questionnaire used in the Surveillance of Risk Factors and Protection for Chronic Diseases Through Telephone Inquiries (VIGITEL), Brazil (Florindo et al., 2009; Jaime et al., 2009). Adults who reported not practicing physical activity during leisure or practicing less than once a week for the three months preceding the interview were considered physically inactive (Florindo et al., 2009). The subjects who reported consuming fruits and vegetables  $<5$  days a week were considered as having an inadequate diet (Jaime et al., 2009).

The independent variables were sex; age in completed years (20–29, 30–39, 40–49, and 50–59); self-reported skin color (Brazilian Institute of Geography and Statistics, 2011), classified as white or light- or dark-skinned black (results of those who reported yellow skin or indigenous were not presented in the tables because of their low frequency (2.2%) but were included in adjusted analyses); household *per capita* income, in Brazilian currency (R\$), was collected according to household monthly gross income (1st tertile = up to R\$ 566.9, 2nd tertile = R\$ 567.0–1300.0, and 3rd tertile = R\$ 1300.1–33,333.0). Successfully completed schooling years (0–4, 5–8, 9–11, and  $\geq 12$ ), marital status (married or with partner, and unmarried or without partner), and occupation in most of his/her life (nonmanual and manual activities) (Szreter, 1984). People who have never worked, students, housewives and those who did not answer the question were considered as missing ( $n=119$ ).

Chi-square tests for heterogeneity and linear trend were performed to assess the groups' differences. To evaluate the most frequent risk behavior combinations, the ratio between the observed and expected (O/E) prevalence was calculated for each possible combination, as described by Schuit et al. (2002). The observed prevalence was identified in our sample. The expected prevalence was calculated by multiplying the individual probabilities of each risk factor based on their occurrence in the study population. Therefore, it was possible to investigate which combinations were above or below the expectation, assuming that the risk factors occur independently in the population under study (Schuit et al., 2002).

To identify the associated factors with the dependent variable “simultaneity,” we used the polytomous logistic regression, using the multinomial logit model (Hamilton and Seyfrit, 1993), with estimates of odds ratio (OR), and respective 95%CI, with no health-risk behavior as the reference category. Additionally, we tested any possible interactions of different socioeconomic and demographic variables on simultaneity of risk factors. All analyses were performed using Stata 11.0 (STATA Corp. College Station, Texas USA), considering the design effect and the sampling weight.

The study was approved by the ethics committee on Human Research of the Federal University of Santa Catarina (no. 351/08).

## Results

We analyzed 1720 adults (response of 85.3%), with a mean age of 38.1 years ( $\pm 11.6$  years). More than half of the sample were female and younger than 40 years, and most of them self-reported as white (Table 1). The mean household income and years of school education was R\$ 866.7 and 11 years, respectively. More than two thirds of the samples had nonmanual occupation.

We observed that nearly 20% of the subjects were smokers, and a similar proportion had abusive alcohol consumption, 81.2% had poor eating habits, and slightly more than half did not practice regular physical activities during leisure. Men showed higher prevalence of smoking, problematic alcohol consumption, and unhealthy diet when compared with women. On the other hand, women were more physically inactive than men. The dark-skinned black subjects were more inactive than the white and light-skinned blacks. The individuals without a partner showed higher prevalence of abusive use of alcohol and inadequate diet than those living with a partner. Among the latter, physical inactivity was more frequent. There were direct association between age and the prevalence of smoking and physical inactivity. On the other hand, abusive drinking and unhealthy diet were more frequent among young adults. The study also showed an inverse association between household income and education in relation to smoking, inadequate diet, and physical inactivity, whereas abusive drinking was more prevalent among those with higher household *per capita* income and higher education (Table 1).

The expected prevalence for the four risk behaviors was 1.5%, but 3.4% presented the four risk behaviors simultaneously, which represents an increase of 220% of what would be expected randomly (O/E ratio = 2.2). Regarding the simultaneity of the three risk factors, the most common was the combination of smoking, unhealthy diet, and physical inactivity (7.2%). However, the simultaneous presence of smoking, abusive drinking, and unhealthy diet (2.6%) is relevant because it was 90% higher than what would be expected if the factors were independent. As for the simultaneous occurrence of two risk behaviors, the most prevalent was the simultaneous exposure to unhealthy diet and physical inactivity during leisure (30.6%) (Table 2).

Only 8.2% of the subjects did not have any factor, 32.2% had one risk factor, 42.0% had two, 14.2% had three, and 3.4% had four risk behaviors (Table 3).

The likelihood of adults having one risk behavior when compared with those without any risk factor almost doubled for men and in the subjects aged 20 to 29 years. The likelihood of individuals having two or three risk factors simultaneously, when compared with the reference group was approximately two times higher among men, younger adults, and the poorer and four times higher among those with low educational background. The odds of adults having four risk factors simultaneously was almost 10 times higher among men, more than four times among the black individuals and those with lower education, and nearly three times higher among those without a partner and those who fall in the poorest income bracket. None of the tested interactions were statistically significant (Table 3).

## Discussion

This study has as novelty of studying health disparities and processes within a developed and service-industry oriented city such as Florianópolis, within the context of a fast-developing nation such as Brazil. Three major findings can be highlighted. First, the occurrence of the studied risk behaviors in the population is high: 91.8% of the adults in Florianópolis reported at least one risk factor for CNCD. Second, the behavior pattern that indicated a greater increase than that expected at random was the simultaneous occurrence of the four risk factors. Finally, the most vulnerable groups to the simultaneous occurrence of two or more risk behaviors for CNCDs were identified: young

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