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Associação da percepção de problemas na vizinhança e renda de setor censitário com autoavaliação negativa de saúde em adultos: uma abordagem multinível

Asociación de la percepción de problemas en barrios y renta de las circunscripciones censales con la autoevaluación negativa de salud en adultos: un enfoque multinivel

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Abstract

Neighborhood problems constitute sources of chronic stress that may increase the risk of poor self-rated health. The associations of census tract level income and perceived neighborhood problems with self-rated health were examined in Florianópolis, Santa Catarina State, Brazil (1,720 adults). Odds ratios (OR) and their 95% confidence intervals (95%CI) of poor self-rated health were estimated through multilevel models. Residents in census tracts in the lower and intermediate tertiles of income reported poorer health than those in the highest tertile. OR of reporting poorer health was 2.44 (95%CI: 2.35-2.54) in the higher tertile of social disorder (adjusting for mental health). The chances of reporting the poorer health with neighborhood problems ranged from 1.07 (95%CI: 1.03-1.11) to 2.02 (95%CI: 1.95-2.10) for the higher tertile of social disorder (physical health) and physical problem (health-related variables). Perceived neighborhood problems were independently associated with poor health. The perception of a neighborhood among its residents should be considered by health policymakers.

Housing; Residence Characteristics; Socioeconomic Factors; Urban Health

Resumo

Problemas na vizinhança representam fontes de estresse crônico que podem aumentar o risco de autoavaliação de saúde negativa. A associação entre renda do setor censitário e problemas na vizinhança com a autoavaliação de saúde foi examinada em Florianópolis, Santa Catarina, Brasil (1.720 adultos). Razões de chance e seus intervalos de 95% de confiança (IC95%) de autoavaliação de saúde negativa foram estimados por meio de modelos multiníveis. Residentes em setores censitários de renda baixa e intermediária referiram pior saúde do que aqueles do tercil mais elevado. A razão de chance de referir pior saúde foi de 2,44 (IC95%: 2,35-2,54) no tercil com mais problemas de desordem social na vizinhança (ajustando para saúde mental). A chance de referir pior saúde com problemas na vizinhança variou de 1,07 (IC95%: 1,03-1,11) a 2,02 (IC95%: 1,95-2,10) para o tercil mais elevado de desordem social (saúde física) e problemas físicos na vizinhança (relacionados à saúde). A percepção de problemas na vizinhança foi independentemente associada à pior saúde, e deve ser considerada por aqueles que elaboram as políticas.

Habitação; Distribuição Espacial da População; Fatores Socioeconômicos; Saúde Urbana

Introduction

Self-rated health represents a multidimensional construct that encompasses physical, mental, and social wellbeing. This variable consistently predicts morbidity [1], use of clinical services, health deterioration, and mortality, even after adjusting for other covariates [2], and reflects the cumulative impact of manifested and subclinical diseases [3].

Associations between self-rated health and measures of socioeconomic status are well established [4,5]. Individuals from lower socioeconomic position groups experience worse health and present higher rates of deterioration of their health over the course of their lives when compared with those who belong to wealthier groups [5,6].

There has been growing interest in the study of the association between the characteristics of places in which people live and health, over and above the impact of individual-level factors. People living in more deprived neighborhoods tend to have poorer health than those in wealthier ones [7,8,9] and some of these findings have been supported by longitudinal studies [10].

Neighborhood problems constitute sources of chronic stress that may increase the risk of poor health [7]. Communities with lower income, particularly in urban areas, often experience higher levels of crime, unemployment and violence all of which may be sources of chronic stress. Previous studies have demonstrated that residing in neighborhoods perceived to be characterized by social disorder and socioeconomic disadvantages is associated with higher levels of depression [11], hopelessness [12], distress, and more broadly, a poorer assessment of overall health [13]. These communities may also encounter higher levels of environmental stressors, such as noxious chemicals and pollution, which may have health implications [14]. The neighborhood also impacts on health through access to resources related to diet and physical activity including access to healthy foods, environments suitable for walking and recreational facilities. An alternative, and particularly important, pathway is to examine the impact of community factors, including stressors, on health, since they occur throughout the course of people's lives and can be transferred across generations for those living in poorer communities [7].

Few studies examining perceived neighborhood aspects and self-rated health have been published with data from low- or medium-income countries [15]. It is important to investigate the impact of neighborhood characteristics on health in such countries. Macintyre et al. [16] (p. 128) noted "*a more differentiated picture has tended to emerge, in which rather than there being one single, universal 'area effect on health' there appear to be some area effects on some health outcomes, in some population groups, and in some types of areas*".

Florianópolis is located in Southern Brazil with a population of about 400,000 inhabitants and a Gini Index of 0.40, which is lower that the country average (0.54) [17]. However, it still has striking social inequalities, and around 14% of the population lives in poor housing conditions, distributed in 171 areas of poverty [18]. Furthermore, in the last ten years, the rates of violent death have been increasing [19]. Thus, this study aimed to evaluate the association between self-rated health and perceived neighborhood problems, and tested if it remains after adjustment for potential socioeconomic, demographic, health-related behaviors, and health status confounders at the individual level.

Data and methods

Data were derived from the baseline examination of a population-based cohort study called *EpiFloripa*, which was carried out in Florianópolis, from September 2009 to January 2010 (http://www.epifloripa.ufsc.br). The city is the capital of the state of Santa Catarina, with a population of 421,240 inhabitants. The sample size was calculated considering the following parameters: prevalence (50%), 95% confidence level, a sample error of 3.5 percentage points, a design effect of 2 because of the cluster sample design, and the addition of 25% to compensate for refusals (n = 2,016 adults).

We selected 60 of the 420 urban census tracts of the city. All 420 urban census tracts of the city were ranked according to the average monthly income of the head of the family [20]. The census tracts were classified into income deciles. Six tracts were randomly selected from each decile. All the selected census tracts were visited by the fieldwork team, and all occupied houses were enumerated. In order to reduce the variability in the number of households across tracts, some tracts were split and others were aggregated, taking into consideration their income decile and geographic localization. This process resulted in 63 census tracts with 16,755 eligible households. Within each census tract, we systematically selected 18 occupied households.

Eligibility and exclusion criteria

All adults aged 20-59 years, who were residents in the selected houses, were eligible to participate.

Individuals who were unable to answer the questionnaire or faced physical or cognitive impairments were excluded. Anthropometric and blood pressure measurements were not obtained from pregnant women. Women who had delivered a baby within the past six months were excluded.

Losses criteria

We attempted to find all eligible adults in their home on at least four occasions, with at least one visit on weekends and another in the evening.

Data collection

Before initiating data collection, the questionnaire was pilot tested among individuals (n = 100) who were not study participants. All 35 interviewers were trained prior to the fieldwork.

Outcome

Self-rated health was assessed by the question "*Would you rate your health in general as: very good, good, fair, poor, or very poor*". Participants were grouped into those who reported very good or good *versus* fair, poor, and very poor health [21].

Individual-level covariates

The individual covariates included sex, age (years), educational attainment (12 years or more of formal education, 9-11 years, 5-8 years, or 0-4 years), monthly *per capita* income in Brazilian Reals – BRL (US$ 1.0 = BRL 1.7 during the period of data gathering), race/self-reported skin color (white, brown, and black), duration of living in the neighborhood (years, tertiles), body mass index (BMI), smoking status, alcohol abuse, and physical activity.

Anthropometric measurements followed the recommendations of Lohman et al. [22]. Body weight was measured twice. The measurements were made using a portable scale (GA.MA Italy Professional, modelo HCM 5110 M) with a capacity of 150kg, which was calibrated before the training and fieldwork. For the measurement, the individuals wore light clothes. Height was measured twice using a stadiometer made specifically for the study, with an inelastic measuring tape. During the measurement, the individuals were barefoot and in the Frankfurt position, without any adornments and with shoulders, gluteal muscles, and heels touching the wall, and feet placed side by side. Individual height was considered as the average between the two measurements. Observer reliability measures were calculated as recommended by Gore et al. [23].

Current smoking status was assessed using the categories of no smoker and former smoker (no), and current smoker (yes). The *Alcohol Use Disorder Identification Test* (AUDIT) was used to identify persons with hazardous and harmful patterns of alcohol consumption [24]. Physical activities were assessed according to the leisure-time domain (individuals who did not practice any physical activity during leisure time or who practiced it less than once a week in the three months preceding the interview) [25].

Common mental disorders were assessed by the *Self-Reporting Questionnaire* (SRQ-20) [26]. Alcohol use, and mental disorders were included as continuous variables.

Persons with chronic diseases were defined as those who indicated they had back pain, arthritis, fibromyalgia, cancer, diabetes, asthma, hypertension, cardiovascular disease, chronic kidney disease, depression, schizophrenia, tuberculosis, tendinitis, cirrhoses and stroke diagnosed by a physician or health professional [27].

Census tract level variables

We used the tertiles of the household head mean monthly per capita income from the 2000 Brazilian census (http://www.ibge.gov.br) for each of the 63 census tracts.

Group-level variables

Neighborhood characteristics were assessed using a questionnaire that included 16 items, adapted from the study by Ellaway et al. [28]. For each item the response options were none, some or many problems (related to the specific item) in the neighborhood. For analysis, those options were codded as zero, one, or two, respectively. Considering the changes made in the questionnaire, analyses with factorial analysis were performed to group perceived neighborhood items [29]. After factor analysis using polychoric transformation, with orthogonal rotation, items were grouped into two scales: physical problems (garbage, uneven pavements, unpleasant smells, air, water or ground pollution, lack of a safe place for children to play, speeding cars, and lack of urban transport), and social disorder problems (vandalism, burglaries, assaults, murders, drug use, unsafe walking after dark, bad reputation, and problems with the police). Factor loadings, assessment of scale internal consistency, and theoretical considerations oriented the variable grouping process. Cronbach's alpha was calculated to measure the internal consistency of the scales, which was 0.67 and 0.81 for physical and social disorder problems, respectively. These

constructs explained 79% of the variance of the investigated items [29].

The neighborhood-level scales used in the analysis derived from empirical Bayesian estimates through three-level models [30,31,32]. Level 1 corresponded to item responses within individuals, Level 2 corresponded to persons nested within the neighborhoods, and, Level 3 corresponded to neighborhoods. The intra-neighborhood correlations (ICC) observed were 0.28 and 0.27 for physical problems and social disorder problems, respectively. The neighborhood reliability was 0.95 and 0.96 for physical and social disorder problems, respectively. The scales generated after three-level multilevel analysis were divided into tertiles for analysis [29].

Census tracts were used as proxy for neighborhoods. Census tracts include a mean of 300 households and were defined by the official agency of population data and statistics in Brazil [20].

Data quality control

Data quality control consisted of applying a short version of the questionnaire (10 questions) through a telephonic interview with 15% of the whole sample (n = 248). Kappa statistics and intraclass correlation coefficient were calculated to assess reliability.

Statistical analysis

Univariate and bivariate analyses were performed, taking the complex sample into account (weighted and clustered sample). Multilevel logistic regression models with a random intercept for each tract were used to assess associations of neighborhood characteristics and the odds of fair, poor, and very poor health (henceforth referred to as poor health). Adjustment variables were included in sequential sets [33]. We performed analysis separated for neighborhood perceived physical and social disorder scales. Additionally analyses with all items of the instrument were done. The first model included census tract level income and length of time residing in the same neighborhood. After that, we added all perceived neighborhood problems (group-level variable) – scores generated through previous three level multilevel analysis. In the third model, we added individual demographic variables (gender, age and skin color). In Model 4, we also included individual socioeconomic variables (income, educational attainment), and in Model 5, health-related behaviors (smoking, alcohol abuse, and physical activity) were included. The sixth model included additional physical health risk factors (BMI, chronic diseases), and, finally, the seventh model included mental health (common mental disorder). For the dimensions of neighborhood perceived physical and social disorders problems, the last three models were performed. Furthermore, analysis with both scales were performed separately for males and females. Version 12.0 of the Stata software (Stata Corp., College Station, U.S.A.) was used to perform these analyses. Multilevel models were weighted, and model fit was evaluated using the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC).

Ethical issues

The research project was submitted to and approved by the Ethics Committee of Research in Human Subjects of the Federal University in Santa Catarina (n. 351/08). Consent for interviews and for anthropometric and blood pressure measurements and examinations was obtained prior to the study.

Results

The response rate of the survey was 85.3% (1,720 adults), with a mean of 26.5, ranging from 10 to 40 per neighborhood. Over half of the sample (55.5%) was female, the mean age of the sample was 38.1 years, and 89.9% were white. The mean duration of living in the same neighborhood was 13.4 years. Most of the subjects were nonsmokers and did not abuse alcohol, had normal weight and at least one self-reported chronic disease (Table 1).

The prevalence of poor self-rated health was 18.8% (95%CI: 15.9-21.7%). Residents of census tracts in the lower and intermediate income tertile reported poorer health than those in the highest tertile after adjustment for length of time in the neighborhood (Table 2, Model 1, OR = 2.32; 95%CI: 2.24-2.41 and OR = 1.45; 95%CI: 1.40-1.51, for the lowest and intermediate neighborhood income categories, respectively). These associations were largely unchanged after adjustment for demographic characteristics and neighborhood problems (Table 2, Model 3). They were sharply reduced but remained statistically significant after adjustment for individual socioeconomic characteristics. Further adjustment for physical health status (BMI and chronic conditions variables slightly weakened these associations; Table 3), OR = 1.12 (95%CI: 0.98-1.06) and OR = 1.02 (95%CI: 0.98-1.06), respectively.

People living in areas with higher levels of neighborhood problems (physical and social disorder scales) reported worse health than those

Table 1

Selected characteristics of the study sample. Florianópolis, Santa Catarina State, Brazil, 2009.

Variables	Total (%) (N = 1,720)	Male (%) (n = 761)	Female (%) (n = 959)
Demographic			
Gender			
Male	44.5	-	-
Female	55.5	-	-
Race/Skin color			
White	89.9	88.5	91.0
Brown	5.7	7.5	4.2
Black	4.4	4.0	4.8
Age groups (years)			
20-29	32.7	34.8	31.0
30-39	22.9	22.8	22.9
40-49	25.0	23.7	26.0
50-59	19.4	18.6	20.1
Tertiles of neighborhood residence time (years)			
0.00-5.00	37.4	39.3	36.0
5.01-16.50	29.7	30.2	29.4
16.51-59.00	32.8	30.5	34.7
Socioeconomic			
Tertile of family per capita income			
Lower	32.6	29.9	34.7
Intermediate	33.3	34.4	32.4
Higher	34.1	35.7	32.9
Educational attainment (years)			
12 and more	43.9	43.0	44.6
9-11	33.4	34.5	32.5
5-8	14.0	13.7	14.2
0-4	8.8	8.8	8.7
Occupational status			
Non manual	65.1	60.2	69.0
Manual	27.6	32.2	23.9
Other	7.3	7.6	7.1
Health-related behaviors			
Alcohol abuse			
No	81.5	70.4	90.4
Yes	18.5	29.6	9.6
Current smoking			
No	80.8	78.6	82.5
Yes	19.2	21.4	17.6
Leisure physical activity			
Active	46.9	46.3	58.6
Inactive	53.1	53.7	41.4
Health status			
Body mass index (kg/m²)			
< 25.0	52.8	47.9	56.9
25.0-29.9	31.4	37.5	26.4
≥ 30.0	15.8	14.7	16.7

(continues)

Table 1 (continued)

Variables	Total (%) (N = 1,720)	Male (%) (n = 761)	Female (%) (n = 959)
Health status			
Minor psychiatric disorder			
No	85.3	92.6	79.5
Yes	14.7	7.5	20.5
Chronic diseases			
No	35.9	41.0	31.7
Yes	64.2	59.0	68.3
Self-rated health			
Positive	81.2	84.8	78.3
Negative	18.8	15.2	21.7

Table 2

Odds ratios of poor self-rated health, associated with census tract level income and neighborhood problem scales. Florianópolis, Santa Catarina State, Brazil, 2009.

	Model 1 [OR (95%CI)]	Model 2 [OR (95%CI)]	Model 3 [OR (95%CI)]	Model 4 [OR (95%CI)]	Model 5 [OR (95%CI)]	Model 6 [OR (95%CI)]	Model 7 [OR (95%CI)]
Census tract income							
Higher	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate	1.45 (1.40-1.51)	1.39 (1.33-1.45)	1.52 (1.46-1.59)	1.07 (1.03-1.12)	1.08 (1.03-1.13)	1.00 (0.96-1.05)	1.01 (0.97-1.05)
Lower	2.32 (2.24-2.41)	2.27 (2.19-2.36)	2.41 (2.32-2.51)	1.21 (1.15-1.26)	1.19 (1.14-1.25)	1.11 (1.06-1.15)	1.09 (1.04-1.13)
All neighborhood problems *							
Lower		1.00	1.00	1.00	1.00	1.00	1.00
Intermediate		1.30 (1.27-1.34)	1.41 (1.36-1.45)	1.49 (1.44-1.54)	1.54 (1.49-1.59)	1.55 (1.63-1.75)	1.40 (1.35-1.45)
Higher		1.47 (1.43-1.52)	1.56 (1.51-1.61)	1.66 (1.61-1.72)	1.71 (1.65-1.78)	1.69 (1.49-1.60)	1.17 (1.13-1.22)
AIC	165343.6	164750.8	157257.8	146018.5	143306.5	131073.9	118683.5
BIC	165370.8	164797.9	157312.3	146083.6	143380.8	131165.5	118780.2

95%CI: 95% confidence interval; AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion; OR: odds ratio.

Model 1: census tract level income and length of time residing in neighborhood; Model 2: census tract level income, length of time residing neighborhood and neighborhood problems; Model 3: census tract level income, length of time residing in neighborhood and demographic variables (age, gender, skin color); Model 4: census tract level income, length of time residing in neighborhood, demographic (age, gender, skin color) and socioeconomic (income, schooling) variables; Model 5: census tract level income, length of time residing in neighborhood, demographic (age, gender, skin color), socioeconomic (income, schooling) and health related variables (physical activity, smoking, alcohol use); Model 6: census tract level income, length of time residing in neighborhood, demographic variables (age, gender, skin color), socioeconomic (income, schooling), health related variables (physical activity, smoking, alcohol use) and physical health status variables (body mass index and chronic disease); Model 7: census tract level income, length of time residing in neighborhood, demographic variables (age, gender, skin color), socioeconomic (income, schooling), health related variables (physical activity, smoking, alcohol use), physical health status (body mass index and chronic disease) and mental health status (common mental disorders).

* Both physical and social disorder problem scales.

living in areas with less problems, even after adjustment for neighborhood income, demographic characteristics, and socioeconomic factors (Table 2, Model 4, OR = 1.66; 95%CI: 1.61-1.72 and OR = 1.49; 95%CI: 1.44-1.54). These associations were slightly weakened only after adjustment for mental health variables (OR = 1.40; 95%CI: 1.35-1.45 and OR = 1.17; 95%CI: 1.13-1.22 for intermediate and highest tertile, respectively).

Table 3 shows separately the results of similar analyses including neighborhood problems related to physical and social disorders (adjusted

Table 3

Odds ratios of poor self-rated health associated with census tract level income and perceived neighborhood physical problems and neighborhood social disorder scale. Florianópolis, Santa Catarina State, Brazil, 2009.

	Model 1 [OR (95%CI)]	Model 2 [OR (95%CI)]	Model 3 [OR (95%CI)]	Model 1 [OR (95%CI)]	Model 2 [OR (95%CI)]	Model 3 [OR (95%CI)]
Census tract income						
Higher	1.00	1.00		1.00	1.00	
Intermediate	1.01 (0.97-1.06)	0.97 (0.93-1.01)	0.98 (0.94-1.02)	1.10 (1.05-1.15)	1.02 (0.98-1.06)	1.00 (0.96-1.04)
Lower	1.09 (1.04-1.15)	1.04 (0.99-1.08)	1.05 (1.01-1.09)	1.21 (1.15-1.26)	1.12 (1.07-1.16)	1.07 (1.02-1.12)
Physical problems						
Lower	1.00	1.00	1.00			
Intermediate	1.87 (1.80-1.93)	1.69 (1.63-1.75)	1.44 (1.39-1.49)			
Higher	2.02 (1.95-2.10)	1.81 (1.74-1.88)	1.23 (1.19-1.28)			
AIC	14,2610.7	13,0854.2	11,8624.8			
BIC	14,2692.0	13,0945.8	11,8721.5			
Social disorder problems						
Lower				1.00	1.00	1.00
Intermediate				1.09 (1.05-1.13)	1.23 (1.18-1.27)	1.19 (1.15-1.24)
Higher				1.41 (1.37-1.46)	1.43 (1.38-1.48)	1.07 (1.03-1.11)
AIC				14,3869.7	13,1592.4	11,8889.4
BIC				14,3951.0	13,1684.0	11,8986.0

95%CI: 95% confidence interval; AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion; OR: odds ratio.
Model 1: census tract level income, length of time residing in neighborhood, demographic variables (age, gender, skin color), socioeconomic (income, schooling) and health related variables (physical activity, smoking, alcohol use); Model 2: census tract level income, length of time residing in neighborhood, demographic variables (age, gender, skin color), socioeconomic (income, schooling), health related variables (physical activity, smoking, alcohol use) and physical health status (body mass index and chronic disease); Model 3: census tract level income, length of time residing in neighborhood, demographic variables (age, gender, skin color), socioeconomic (income, schooling), health related variables (physical activity, smoking, alcohol use), physical health status (body mass index and chronic disease) and mental health status (common mental disorders).

for census tract income and covariates). In general perceived neighborhood physical problems were more strongly associated with self-rated health than the perceived social disorder problems (OR for lowest and middle tertiles after adjustment for sociodemograhic characteristics 1.97 and 1.82 for physical problems and 1.40 and 1.08 for social disorders problems). In both cases adjustment for mental health slightly reduced the associations although they still remained statistically significant.

The women in the intermediate tertile of neighborhood perceived physical problems had always higher odds of reporting poor health than men: in the fully adjusted model (Model 3) results were 1.65 and 1.21 for women and men, respectively. However, on the higher tertile of physical problems the chances of reporting poor health were quite similar in both genders (Table 4).

In the last model, men that reported a higher level of perceived neighborhood social disorder problems had better self-rated health than those in the lower and intermediate tertile of problems. In women, the positive association between neighborhood social disorder problems and poorer health remained, although with closer odds in intermediate and higher tertiles of problems, than in previous adjusted models (Table 5).

In each of the investigated models, the AIC and BIC values exhibited an important reduction for all the scales analyzed (Tables 2, 3 and 4).

Discussion

This study investigated how perceived neighborhood problems and census tract level income are associated with self-rated health, after controlling for sociodemographic, health-related behaviors, and physical and mental health status variables using the data from a Brazilian city, Florianópolis. Despite all the adjustments, the association between self-rated health and perceived neighborhood problems remained statistically significant for the scales of both physical and social disorder problems. In some models,

Table 4

Odds ratios of poor self-rated health associated with census tract level income and perceived neighborhood physical problems by gender. Florianópolis, Santa Catarina State, Brazil, 2009.

	Males			Females		
	Model 1 [OR (95%CI)]	Model 2 [OR (95%CI)]	Model 3 [OR (95%CI)]	Model 1 [OR (95%CI)]	Model 2 [OR (95%CI)]	Model 3 [OR (95%CI)]
Census tract income						
Higher	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate	1.21 (1,13-1.28)	1.10 (1.03-1.17)	1.19 (1.11-1.27)	0.92 (0.87-097)	0.90 (0.85-0.95)	0.87 (0.82-0.91)
Lower	1.12 (1.05-1.20)	1.18 (1.01-1.26)	1.20 (1.11-1.28)	1.06 (1.00-1.13)	0.92 (0.87-0.97)	0.95 (0.90-1.00)
Physical problems						
Lower	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate	1.62 (1.54-1.72)	1.39 (1.31-1.47)	1.21 (1.14-1.29)	2.00 (1.91-2.10)	1.82 (1.74-1.91)	1.65 (1.57-1.73)
Higher	2.13 (2.02-2.25)	1.77 (1.67-1.87)	1.27 (1.19-1.34)	1.91 (1.82-2.00)	1.81 (1.72-1.90)	1.26 (1.20-1.33)
AIC	54,817.85	51,158.36	47,836.15	86,631.42	78,045.33	68,905.69
BIC	54,882.29	51,231.78	47,913.95	86,699.12	78,122.02	68,986.81

95%CI: 95% confidence interval; AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion; OR: odds ratio.
Model 1: census tract level income, length of time residing in neighborhood, demographic variables (age, gender, skin color), socioeconomic (income, schooling) and health related variables (physical activity, smoking, alcohol use); Model 2: census tract level income, length of time residing in neighborhood, demographic variables (age, gender, skin color), socioeconomic (income, schooling), health related variables (physical activity, smoking, alcohol use) and physical health status (body mass index and chronic disease); Model 3: census tract level income, length of time residing in neighborhood, demographic variables (age, gender, skin color), socioeconomic (income, schooling), health related variables (physical activity, smoking, alcohol use), physical health status (body mass index and chronic disease) and mental health status (common mental disorders).

Table 5

Odds ratios of poor self-rated health associated with census tract level income and perceived neighboorhod social disorder problems by gender. Florianópolis, Santa Catarina State, Brazil, 2009.

	Males			Females		
	Model 1 [OR (95%CI)]	Model 2 [OR (95%CI)]	Model 3 [OR (95%CI)]	Model 1 [OR (95%CI)]	Model 2 [OR (95%CI)]	Model 3 [OR (95%CI)]
Census tract income						
Higher	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate	1.36 (1.28-1.45)	1.18 (1.11-1.26)	1.27 (1.19-1.36)	0.97 (0.92-1.03)	0.94 (0.89-0.99)	0.86 (0.82-0.91)
Lower	1.29 (1.21-1.38)	1.29 (1.21-1.38)	1.25 (1.17-1.34)	1.11 (1.05-1.18)	0.96 (0.91-1.01)	0.94 (0.89-0.99)
Social disorder						
Lower	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate	1.19 (1.13-1.26)	1.29 (1.22-1.36)	1.10 (1.04-1.17)	1.00 (0.95-1.04)	1.16 (1.10-1.21)	1.31 (1.25-1.38)
Higher	1.04 (0.98-1.10)	1.08 (1.01-1.34)	0.82 (0.77-0.87)	1.67 (1.60-1.74)	1.74 (1.67-1.82)	1.37 (1.31-1.48)
AIC	55531.47	51446.1	47787.2	86928.8	78165.1	69139.17
BIC	55595.87	51519.48	47864.96	86996.51	78241.8	69220.29

95%CI: 95% confidence interval; AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion; OR: odds ratio.
Model 1: census tract level income, length of time residing in neighborhood, demographic variables (age, gender, skin color), socioeconomic (income, schooling) and health related variables (physical activity, smoking, alcohol use); Model 2: census tract level income, length of time residing in neighborhood, demographic variables (age, gender, skin color), socioeconomic (income, schooling), health related variables (physical activity, smoking, alcohol use) and physical health status (body mass index and chronic disease); Model 3: census tract level income, length of time residing in neighborhood, demographic variables (age, gender, skin color), socioeconomic (income, schooling), health related variables (physical activity, smoking, alcohol use), physical health status (body mass index and chronic disease) and mental health status (common mental disorders).

the strength of association between the variables was even reinforced.

These findings confirm previous studies about the relationship between perceived neighborhood problems and self-rated health [34,35,36]. Poortinga et al. [35] found that neighborhood quality, neighborhood disorder, and deprivation had the strongest associations with poor health at the neighborhood level [35]. Among older adults in Bogotá, Colombia, Parra et al. [37] observed that perceived neighborhood characteristics, such as safety from traffic and having safe parks, were positively associated with self-rated health.

The perception of neighborhood problems may affect health through different pathways, including individual socioeconomic levels, demographic variables, as well as adopting health-related behaviors, and psychosocial and health status variables [38]. Cumulative and compounding aspects of local environments that heighten feelings of insecurity and anxiety may be mechanisms that affect health through the living environment [39]. The impact of neighborhood conditions on health is likely to be modified by individual-level characteristics that make them more vulnerable to adverse neighborhood conditions, while others may have the personal and financial resources that allow them to overcome deficiencies or hazards in their neighborhoods [14].

In the *EpiFloripa* study population, the adjustment for demographic, socioeconomic, and health-related behaviors increased the strength of association between perceived neighborhood physical problems and self-rated health. Areas with poorer quality residential environments may affect health by limiting opportunities for physical activity, such as walking, playing and sports, or through the increase in stress from threatening environmental cues [36]. In fact, unhealthy behaviors, such as smoking [40], alcohol abuse, physical inactivity, and poor food patterns, may be part of an individual's response to a stressful neighborhood [14]. In most of the previous studies, the association between perceived neighborhood problems and health are substantially attenuated when controlling for individual and collective socioeconomic status [35], similar to those observed in relation to census tract level income in the *EpiFloripa* study population. This suggests that individual socioeconomic variables were important co-variables in association between self-rated health and neighborhood income.

In the studied population, those groups who perceived higher levels of physical problems in the neighborhood, showed reduced association between the variables, after adjusting for health status and minor psychiatric disorders. Furthermore, after adjustment for health status variables, the association in the group with higher tertiles of neighborhood problems was lower than that observed in the intermediate tertile. This might probably indicate that the association between self-rated health and perceived neighborhood problems in the group with the highest tertile of problems can be influenced by physical and mental health status co-variables. In fact, residing in a disadvantaged neighborhood may be associated with barriers to the management of a chronic condition. People with chronic conditions can find more problems in managing undesirable neighborhood characteristics, and have more difficulties in finding adequate treatment [41].

On the social disorder scale, an association between self-rated health and perceived neighborhood problems was even reinforced after adjustment for individual socioeconomic levels. This may reflect as overreaction to criminality and physical security in Brazilian high-income groups, since violence-related mortality rates are higher in low-income people [15].

Wen et al. [38] pointed out that the perceived neighborhood environment on health are partially explained by the psychosocial factors of loneliness, depression, hostility and stress, but not by perceived social supports or social networks. In our study, individual characteristics influenced the association between neighborhood perceived problems and self-rated health, in different magnitudes and in some analyses, the association was inverted among investigated variables. After adjusting for mental health variables, the association clearly decreased. In a Japanese study, it was observed that when controlling for personality traits, the odds for reporting poor health in response to negative neighborhood assessments declined, but remained highly significant [13].

Ross & Mirowsky [42] found that residents of disadvantaged neighborhoods have worse health (worse self-reported health and physical functioning and more chronic conditions) than those of more advantaged neighborhoods. The association was entirely mediated by perceived neighborhood disorders and the resulting fear, and not by the limitation of outdoor physical activities. The daily stress associated with living in a neighborhood where danger, trouble, crime and incivility are common appeared to be damaging to health.

Beyond the cross-sectional implications of our findings, it is important to take into account the several reinforcing mechanisms that explain the processes through which neighborhood physical and social disorder problems could contribute to health and health inequalities [14].

It has also been argued that individuals may select (or be selected into) their place of residence (or neighborhood) based on their health or predisposition to certain behaviors. For instance, mental illness may result in downward social mobility and may ultimately cause depressed persons to live in neighborhoods with greater physical disorders [14].

By using area-level aggregates of survey responses to characterize neighborhoods, respondents in each neighborhood are viewed as informants of the conditions in their area. Although this approach is useful, it has three limitations. One limitation is that reporting bias may create spurious associations between self-reported neighborhood conditions and self-reported health outcomes (source bias) [35]. The second limitation is that the neighborhood-level constructs are measured on the basis of reports made by individuals, and although individual reports are undoubtedly influenced by objective reality, they are also influenced by personal factors and perceptions, which may introduce measurement error [31]. To the extent that people's perceptions reflect reality, averaging responses across multiple persons within a neighborhood may reduce measurement error due to individual subjectivity [31,32]. Nevertheless, we cannot rule out that the observed association between neighborhood perceptions and self-rated health may be at least partly spurious, because these two self-reported measures are highly subjective [13]. The third limitation is related to the sample size, not designed to be representative of each census tract.

Furthermore, the ability to investigate gender differences in our study may not be high, mainly in some neighborhoods, with a small number of observations. The approach applied by us for building the scales values, the empirical Bayesian estimates, deals with the above-mentioned problem, because it allows for borrowing strengths across neighborhoods and reduces estimates for neighborhoods with few observations towards the overall mean [31,32].

Despite the limitations of the chosen approach, the associations between neighborhood problems and self-rated health were strong, and remained strong even after adjustment for all the investigated variables sets. However, longitudinal studies are required to chart the change over time and show whether a lag effect of the change in the local environment on health status exists [36]. Future studies can examine whether subjective perceptions are simply reflections of objective characteristics, or play their own role as mediators or possibly moderators [43]. Furthermore, other studies can collect neighborhood objective measures as systematic social observations, and use other methods to deal with those measures [44].

Finally, our findings confirm the strong association between self-rated health and perceived neighborhood problems, and this association was little reduced after adjusting for health status related variables. Furthermore, we noticed important gender interactions in the association of the variables. Neighborhood social disorder problems influenced women more than men with respect to self-rated health, while the physical problems scale had a similar impact on both genders, though was slightly more pronounced among men.

The features of the neighborhood environment are noted to be associated with self-rated health, and may act as indicators of important causal pathways that could provide a focus for public health intervention strategies. Operationalizing specific measures of the characteristics of local areas hypothesized to be important for living a healthy life provides a more focused approach than general measures of deprivation in the search for area effects [26]. Thus, more emphasis should be given to residents' perceptions of physical environmental factors in the formulation of local public health polices [45].

Resumen

Los problemas en barrios representan fuentes de estrés crónico que pueden aumentar el riesgo de autoevaluación de salud negativa. En la ciudad de Florianópolis, Santa Catarina, Brasil, se examinó la asociación entre la renta de las circunscripciones censales y los problemas en barrios con la autoevaluación de salud entre 1.720 adultos. Se estimaron las razones de momios (RM) y sus intervalos de confianza de un 95% de autoevaluación de salud negativa (IC95%) mediante modelos multiniveles. Los residentes en circunscripciones censales de renta baja e intermedia reportaron peor salud que aquellos del tercil más elevado. La razón de momios al informar peor salud fue un 2,44 (IC95%: 2,35-2,54) en el tercil con más problemas de desórdenes sociales en el barrio (ajustado para la salud mental). La posibilidad de informar una peor salud con problemas en el barrio varió de 1,07 (IC95%: 1,03-1,11) a 2,02 (IC95%: 1,95-2,10) para el tercil más elevado de desorden social (salud física) y problemas físicos en el barrio (relacionados con la salud). La percepción de problemas en el barrio se asoció independientemente a una salud peor, y debe ser considerada por aquellos que elaboran políticas.

Vivienda; Distribución Espacial de la Población; Factores Socioeconómicos; Salud Urbana

Contributors

D. A. Höfelmann participated in the study design, including data quality control, supervised the fieldwork activities, performed the multilevel analysis of the data, and was responsible for the study's analytic strategy. A. V. Diez Roux participated in the manuscript conception, helped with the analytic strategy, critically reviewed the manuscript and helped with statistical analysis. J. L. F. Antunes collaborated in the literature review, helped with the analytic strategy, and instructed multilevel analysis of the data. M. A. Peres participated in the study design, the study's analytic strategy, and in the conception and writing of the manuscript. All the authors have contributed to the writing of the article and reviewed the final version.

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