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The role of individual, household and area of residence factors on poor self-rated health in Colombian adults: a multilevel study

Efecto de condiciones individuales, del hogar y del área de residencia sobre la salud auto percibida en adultos colombianos: un estudio multinivel

Contextual, family and individual effects on poor self-rated health

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Introduction: Self-rated health is strongly associated with morbidity and mortality. It is largely influenced by individual factors but also by the social surroundings and the environment in which individuals live.

Objective: To investigate individual, household and locality factors associated with self-rated health in Colombian adults.

Materials and methods: We carried out a cross-sectional multilevel study using data from national databases on 19 urban localities and data on 37.352 individuals nested within 15.788 households from a population-based survey. Given the natural hierarchical structure of the data, the estimates of poor self-rated health in relation to individual, household and localities characteristics were obtained by fitting a three-level logistic regression.

Results: The adjusted multilevel logistic models showed that at individual level, higher odds of poor self-rated health were found among older adults, those from low socio-economic status, living without a partner, physically non-regular active and reporting morbidities. At the household-level, poor self-rated health was associated with households of low socioeconomic status, close to noise and factories, located in polluted and insecure areas. At the locality-level, only poverty was associated with poor self-rated health after adjustment for individual and household variables.

Conclusions: These results highlight the need of a more integrated framework when designing and implementing strategies and programs that aim to improve health conditions in urban populations in Latin America.

Key-words: Residence characteristics; social conditions; multilevel analysis; adult; Colombia.

Introducción. La salud auto-percibida se ha encontrado fuertemente asociada a la morbilidad y mortalidad. Ésta es influenciada principalmente por condiciones individuales, pero así mismo por características sociales y del ambiente en el cual las personas residen.

Objetivo. Investigar los factores individuales, del hogar y de la localidad asociados a la salud auto-percibida por adultos colombianos.

Materiales y métodos. Se llevó a cabo un estudio transversal. La información sobre 19 localidades urbanas fue obtenida de bases de datos nacionales, en tanto que los datos sobre 37.352 individuos anidados en 15.788 hogares fueron obtenidos a través de una encuesta de base poblacional. Dada la estructura jerárquica de los datos, las estimaciones del efecto de las variables individuales, del hogar y de la localidad sobre la auto percepción de salud fue obtenida a través de un modelo de regresión logística de tres-niveles.

Resultados. Los modelos multinivel ajustados mostraron que, a nivel individual, hay mayor chance de peor percepción de salud en adultos de mayor edad, bajo nivel socio-económico, que conviven sin compañero, físicamente inactivos y con morbilidades presentes. A nivel de hogar, peor percepción de salud estuvo asociada con pertenecer a familias de bajo nivel socioeconómico, en residencias ubicadas cerca de fábricas, áreas contaminadas, inseguras y de alto ruido. Finalmente, a nivel de localidad, después del ajuste por variables individuales y del hogar, residir en localidades pobres aumentó el chance de tener peor percepción de salud.

Conclusiones. Los resultados evidencian la necesidad considerar un marco conceptual más amplio en el momento de diseñar e implementar estrategias y

programas que apunten al mejoramiento de las condiciones de salud de las poblaciones urbanas en Latinoamérica.

Palabras clave: características residenciales; condiciones sociales; análisis multinivel; adulto; Colombia.

Self-rated health is an indicator of quality of life which refers to the self-perception of an individual's health status (1,2). Self-perception is a practical method for collecting information on individual health since entails only a single question – asking a subject to classify his or her health status (1). This information in turn is useful for planning, implementing and monitoring health initiatives and programs, as the self-perception of an individual's health has been found to be strongly associated with morbidity and mortality (3-8), a relationship that remains after adjusting for physical, sociodemographic and behavioural factors (3-8).

Self-rated health is influenced by individual factors such as sex, age, race, ethnicity, education levels, wealth, and employment status (1,9-13). In addition, factors that are common among groups of people like social surroundings and the environment in which individuals live play a role on the self-perception of individuals' health (14-23) It is important to mention that the term contextual or neighbourhood effects involves two distinct aspects: structural and social. Structural characteristics refer to the physical and the natural environment of the place where individuals live. They are measured through socio-demographic characteristics of communities such as poverty, family structure, unemployment and the availability of neighbourhood resources such as education, employment, transportation, health care provision, grocery shopping and recreational services (24). Social characteristics refers to the social-organizational processes or collective aspects of community life that may influence resident behaviours (19), such as networks, social control, social cohesion, norms of social support, perceptions of violence and collective efficacy (25). For instance, studies that have examined the influence of

neighbourhood-level factors on self-rated health indicate that neighbourhood-level deprivation, lower socioeconomic status, poor quality of the physical residential environment and transport, drug misuse, rubbish on the streets, feeling unsafe and dissatisfaction with green space are associated with fair to poor self-rated health (3,17,26-30).

The mechanisms between contextual factors and poor self-rated health are not clear. Some authors suggest that residential neighbourhood problems may constitute source of chronic stress, which may increase the risk of poor perceived health (3,31). Documenting contextual factors that may contribute to modify adult health perception is important for the design and implementation of effective prevention strategies and interventions. A better understanding is needed on how group and individual factors interrelate in predicting self-rated individual health. In general, researchers interested in neighbourhood influences have not properly taken into account the role of individual and family influences, just as researchers interested in individual and family influences have generally not adequately considered the role of neighbourhood influences. Therefore, the development of conceptual frameworks that are able to incorporate various levels of analysis are needed, as well as a rigorous focus on the analysis of potential mechanisms. Failing to specify an appropriate theoretical framework may lead to misleading conclusions. A common approach to study the relation between multiple levels is called multilevel design, which comes with a hierarchical model that allows integrating independent variables from different levels of analysis (32-35).

There are relatively few studies in Latin American using an approach that considers simultaneously how individual and contextual aspects contribute to

self-rated health status (1,16,36). Even more scarce are studies that describe these associations in Colombia, especially in the city of Bogota which is considered one of the Latin America's largest metropolitan areas. The understanding of these associations may prove to be relevant in the light of the current Colombian Public Health Plan (*Plan Decenal de Salud*) and the Sustainable Development Goals (SDGs) which promote healthy life and well-being for all (SDG 3) and inclusive, safe, resilient and sustainable cities and human settlements (SDG 11). Therefore, this study aimed to examine the relationships between poor self-rated health and individual, family and locality factors in Colombian adults living in Bogota. In particular, attention focuses on the effects of locality structural and social conditions on adult poor self-rated health. To explore these relationships, we used a developed theory of the conceptual model that link locality characteristics to poor self-rated health, and multilevel models to evaluate the evidence that locality conditions affect adult poor self-rated health as well as interact with individual and family factors to produce it. To our knowledge, this is the first study that explores contextual effects and self-rated health in adults in a Colombian urban context.

Materials and methods

Design and study population

Bogotá is the capital city of Colombia with a population of 7,467,000 inhabitants; of which, 99% live in the urban area. The city is divided geographically and administratively into 20 localities. This analysis uses data from the Multipurpose Survey performed in Bogotá in 2011 obtained from the archive of the National Administrative Department of Statistics (Departamento Administrativo Nacional de Estadística, DANE) (37). The survey is a population-based study which

aimed to collect data about social, economic and living conditions of the population residing in 19 Bogotá´s localities (excluding Sumapaz since this was a semi-rural area). This study involved a probabilistic clustered sample, stratified by socioeconomic status; where observational units were households and non-institutionalized individuals. Sample parameters used for sample estimation were: 5% relative standard error, 95% confidence level and prevalence of main health indicators of 10%. A detailed account of the methods of this population survey is provided elsewhere (37,38). For our analyses, we used a cross-sectional design where individuals aged 20 years old and older who completed the interview and have information on their self-rated health were included. These survey data have a natural hierarchy structure with 37,352 individuals nested within 15,788 households nested within 19 urban localities.

Study variables

A wide range of demographic and socio-economic information about individual and household's conditions was collected through a questionnaire. Self-rated health variable was collected on a scale of 1 to 4: 'Very good', 'Good', 'Poor', 'Very poor'. Previous studies have suggested that self-rated heath is a reliable indicator of individual´s current health with high predictive validity (39). In order to be able to compare the results with the existing literature, the original categories were recoded into a binary outcome: 0 for very good and good, and 1 for poor or very poor.

The following individual characteristics were also taken from the questionnaire and included in the analysis as independent variables: gender (male, female), age (20-29, 30-39, 40-49, 50-59, ≥60), schooling (<=5, 6-11, >11 years with

passing), marital status (with or without a partner), mainly working last week (yes/no), regular physical activity (yes/no), morbidities (none, one-two, or three or more of the following morbidities: cardiovascular diseases, respiratory diseases, kidney diseases, digestive diseases, arthritis, diabetes, malign tumours, mental diseases or asthma/allergies). At the household-level, we explored the effect of household socio-economic status (low, middle, high), household location within a noisy area (yes/no), an area with contamination problems (yes/no), an insecurity area (yes/no), close to rubbish dumps (yes/no), close to factories (yes/no), presence of illicit drug markets (yes/no).

Data on locality's socioeconomic characteristics were taken from official national datasets reported by the National Administrative Department of Statistics (DANE) (37,40). At the locality-level, we included: 1) quartiles of Gini coefficient to measure level of income inequality in the localities, which takes values between 0 and 1. The lowest quintile represents more equal localities and the highest quintile more unequal localities. 2) quartiles of poverty: which measures the proportion of residents with disadvantaged life conditions related to schooling, employment, access to health services and housing). Localities were categorized into quintiles, with the lowest quintile comprising the richest group of localities and the highest quintile comprising the poorest localities (40). 3) homicide rate (per 100,000 inhabitants), 4) percentage of population perceiving a decrease in security of their locality, and, 5) population density defined as the number of residents within the locality per square meter (m^2).

Conceptual model

The analysis was based on a hierarchical conceptual model which not only considered a proposed hierarchy of causal relationships but also used a criteria

for selecting variables that goes beyond purely statistical considerations (41). At the individual-level, the most distal determinants were age and gender, schooling, marital status and working. The second level included the effects of physically active and morbidities. At the household-level, we included the effects of socio-economic status, and household's location characteristics (close to a noisy area, area with pollution problems, insecurity area, close to rubbish dumps, close to factories and close to illicit drugs markets. Finally, at the locality-level, we examined the distal effect of locality´s social conditions -Gini coefficient and poverty-; which in turn may have a direct influence on the variables at the second level, the effects of homicide rate, percentage of population perceiving an increase in insecurity of their locality, and, population density.

Analytical procedures: hierarchical analysis with multilevel logistic model

Estimates of poor self-rated health in relation to individual, household and locality characteristics and their respective 95% confidence intervals were obtained by fitting a logistic random intercepts model with fixed coefficients. It has a three-level structure with individuals at level-1, households at level-2 and localities at level-3:

$$y_{ijk} = \beta_0 + \beta_1 x_{ijk} + \beta_2 x_{jk} + \beta_3 x_k + u_{0jk} + v_{0k} \quad (1)$$

where, y_{ijk} is the poor self-rated health condition for individual *i* in the household *j* within the locality *k*. The log-probability of poor self-rated health for all individuals in all- localities is represented by β_0. The individual, household and locality variables are represented by x_{ijk}, x_{jk} and x_k and their regression coefficients by β_1, β_2 and β_3 respectively. These are transformed to odds ratios for easier comparison. Finally, the household and locality -level random effects

are represented by u_{0jk} and v_{0k} measuring household and locality differences conditioned to the variables that are specified in the model. These are assumed to come from a normal distribution, with their respective variances, $\sigma_v^2 \text{and } \sigma_u^2$ expressed on a logit scale. The level-1 unexplained variance, σ_e^2, assumes a Bernoulli distribution because of the binary nature of the response. To indicate the percentage of variance due to differences between localities, the intraclass correlation coefficient was estimated using the ratio of the locality-level variance and the total variance. Moreover, in order to better quantify the localities effects and to provide a better understanding of their size, locality-level variance is transformed to a Median Odds Ratio (MOR) (42). This is done by translating the locality-level variance into an odds ratio which quantifies the variation between localities by conceptually randomly choosing and comparing any two individuals from two different localities. It can be interpreted as the increased risk of poor self-rated health that, on average, an individual would have if s/he moves to another locality with higher risk of poor health (43). It is estimated as:

$$MOR = \exp(0{,}95\sqrt{(2 * \sigma_{v0}^2)} * 0{,}6745 \qquad (2)$$

where 0.6745 is the 75th percentile of the cumulative distribution function of the standard Normal distribution. The uncertainty interval of the MOR (Bayesian confidence intervals) was derived from the monitoring chain of the MCMC estimates and from the above equations (44).

Following the hierarchical conceptual model, the analysis consisted of a sequence of six models of growing complexity. The first model was a null model or model without covariates. The second model included the effect of individual-level most distal determinants (age and gender, schooling, marital status and working). The third model included the effects of physically active and

morbidities. The fourth model explored the effect of household conditions (socio-economic status, and household's location characteristics). Finally, in the last model, we examined the effect of Gini coefficient and poverty, followed by the effect of percentage of population perceiving an increase in insecurity of the locality, and, population density.

We used chi-squared tests, adopting a significance level of 20% to identify potential confounders. This pre-specified cut-off value has proven to better identified the presence of confounding effects that using a cutoff of 0.05 (45,46). Chi-squared test for heterogeneity was used for the analysis of nominal variables. For ordinal variables, such as the neighbourhood variables – for which we hypothesized dose-response effects, linear trend test was used. Given that there are only 19 urban localities on which to characterise localities-differences and, to estimate the effect of a number of associated factors, models are estimated with full Bayesian procedures which allow the exact estimation of the parameters (44).

In addition, to validate the results of the random effects model, this multilevel logistic model was re-specified as a fixed effects model and the DIC index was used to choose between the fixed and random effects approach, where the model with the lower DIC was preferred as a trade-off between complexity and fit (47). Both methods give similar point estimates, but the DIC index indicate a better performance for the multilevel method (data no shown). Furthermore, the results presented in the results correspond to the multilevel regression analysis. Analyses were carried out using MLwiN v2.31 statistical software package using the *runmlwin* command (48), with full Bayesian MCMC methods with minimally informative priors. Following the good-practice recommendations of Draper

(49), a burn-in of 500 iterations was used, with monitoring for a further 50,000 iterations.

Analyses were based on publicly available data from a national survey and official national datasets. Ethics procedures were the responsibility of the institutions that commissioned, funded, or administered the surveys/data collection.

Results

Table 1 describes individuals, households and localities´ characteristics. More than half of respondents were women, 48% were aged 20 to 39 years old, a third had more than 11 years of schooling, two thirds had a partner and 67% reported to have a job during the previous week. In relation to their health conditions, around a fifth of the individuals reported being physically active, and 60% reported not suffering from morbidities. Most of the households were located in middle and low socioeconomic status areas. A third of them were located in areas with noise, contamination and insecurity problems, close to rubbish dumps, industries and illicit drugs markets. On average, localities had a population density of 181 inhabitants/m^2, a homicide rate of 42 homicides per 100.000 inhabitants, 45% of their residents perceived an increase in insecurity, a Gini coefficient at the lowest inequality quartile of 0.39 and at the highest of 0.55. Among poorer localities, at least 22% of their population lives in poverty. The prevalence of poor self-rated health in the population was 24% (95% confidence intervals: 21%; 26%). We found strong evidence of variation on the prevalence of poor self-rated health among localities ($p<0.001$). Figure 1 shows the scale of the differences, plotting the distribution of localities according to intervals of the prevalence of poor self-rated health; which were predicted from

the null model using the simulation-based procedures of the MLwiN Customised predictions (50). The differential prevalences show that individuals in Northern Bogota have better self-rated health than those from the Southern Bogota.
The locality-level variance of 0.09 translates to a MOR of 1.31 (95%CI: 1.16; 1.42), which suggest significant differences between localities. For instance, if an individual move from a locality with low prevalence of poor self-rated health to one with high prevalence, his/her individual odds is around 31% greater than if s/he stays in a lower risk locality.

Table 2 shows the prevalence of poor self-rated health according to the independent variables. Crude analysis showed that individuals older than 60 years old had around 65% higher odds of perceiving poor self-rated health compared to those aged 20-29 years. Having less than five years of education increased five times the odds of poor self-rated health compared to those with 11 years or more. Similarly, women, people without a partner, without a job during the previous week, physically inactive and suffering three or more morbidities had much higher odds for poor self-rated health when compared to their reference categories. In addition, people who resides in households from low socioeconomic status areas, located in noisy areas, with contamination and insecurity problems, close to rubbish dumps, factories and illicit drugs markets showed a greater odd for poor self-rated health when comparing with their reference categories. Similarly, localities with low inequality, high poverty level, high rate of homicides and high population density showed greater odds for poor self-rated health. Insecurity level of localities was not associated with self-rated health.

Adjusted analyses were carried out according to the hierarchical levels described in Methods. After adjustment, the odds of poor self-rated health for people older than 50 years old remained higher when compared to those aged 20-19 years old. The association with years of education, no having a partner, no having a job, being physically inactive and suffering three or more morbidities also remained significant. The association of residing in poor households, located in areas with noise, contamination and security problems, and close to factories and illicit drugs markets was virtually unaltered by adjustment. We found a dose-response relationship between locality poverty and odds of poor self-rated health. Otherwise, the association of gender, household close to rubbish dumps, Gini coefficient, homicide and population density with poor self-rated health disappeared after adjustment (table 2).
In the adjusted model, the between- locality variance has decreased to 0,004. This equates to a MOR of 1.06 (95%CI: 1,00; 1,11). This means that after considering the effects of individuals, household and localities characteristics there is no unexplained differences between localities. This result is also shown by the adjusted ICC, which had a value of 0.048% in the final model.

Discussion

We examined the effect of context- and individual-related variables on poor self-rated health in Colombian adults living in a metropolitan area. Our results confirm that characteristics of individuals, household and place of residence influence individual health perception.

We found greater odds of poor self-rated health in individuals aged 50 year or older, those with lower education, those without partner, or without employment, physically non-regular active individuals, and those that reported more than

three morbidities. After adjusting for individual characteristics, household characteristics were also associated with poor self-rated health. Low socioeconomic households located in areas with problems of noise, pollution, neighbourhood insecurity, or household located near factories or illicit drugs markets showed greater odds of poor self-rated health. In addition, localities with higher proportion of poverty showed greater odds of poor self-rated health independent of individual and household factors. These findings are consistent with other studies which have shown strong associations between physical conditions of place of residence and individual health (3,16,17,21,32,51). In general, poorer areas usually present characteristics that are unfavourable to good health such as an inadequate healthcare network, absence of areas for practicing physical activities, a poorly organized physical environment (accumulated garbage, dirtiness, pollution, noise, overcrowding), deficient basic sanitation, transportation and education, insufficient levels of social cohesion and participation and greater exposure to violence (16-18,23,32,51).

A main methodological limitation of studies that investigate context-related characteristics is the definition of the geographic area whose characteristics may be relevant to the specific health outcome being studied (18). As we were interested in studying the association between physical environment and structural characteristics of the place of residence and perceived health, the geographically administrative definition of localities was relevant to us. We think this validates the individual perception of these areas to a certain extent as the localities are previously defined political-administrative units, and therefore, a natural grouping for the respondents. The greatest advantage of using this geographical unit as the level of analysis is the feasibility of obtaining variables

measured at that level. The main disadvantage is that such a grouping may not reflect the true context in which individuals are exposed to contextual risks. An additional limitation concerns study design. Studies with a cross-sectional design are limited to identifying associations rather than causal relationships and reverse causality may exist especially with individual level variables. For instance, it can be argued that both individuals reported poorer health because they are unemployed or are unemployed because of limitations of their poor health. Therefore, longitudinal studies are important to confirm the associations reported here. In addition, we cannot rule out the possibility of residual confounding in our associations for potential confounding factors that were not collected such as individual income or wealth, and for the lack of precision in certain measurements such as socioeconomic characteristics such as education and employment status.

Stratified analyses exploring sex differences may have been important in previous studies as they showed that women report worse self-reported health and use health services more than do men (16,52). Those findings are important as they suggest that women might benefit more from better health services or suffer more due to a lack of them in a wealthy or poor area, respectively. However, we did not find differences according to sex in our results (Data available under request). Additional analyses exploring conflicting findings among studies in relation to sex differences are needed.

To understand the multifaceted nature of poorest perceived health, multilevel conceptual models are needed to explain the interplay of risk factors at different levels. This study implements an integrated theoretical framework that not only combines individual and contextual theories of poor health but also arranges the

variables on a logical temporal order, guiding the adjusted analysis and as a consequence improving the estimations of the effects of the characteristics of localities, family and individuals on poor self-perception of health. Our study showed an association between context-related variables and self-rated health status in a Colombian urban population. Further studies will be required to confirm the associations reported here, using different populations (e.g. rural, other Colombian geographical regions or Latin American metropolitan areas), study design or health-related outcomes. These findings suggest that health policies and interventions that aim to improve the people health and quality of life should include integral and multisector initiatives according to the needs of the population living in specific area. Area-based strategies should take into account concerted approaches, ensuring a focus on context-related variables rather than on individual-level strategies alone. Implementing these area-based strategies in Colombia might prove to be a promising way towards the achievement of the SDGs and the Colombian Public Health Plan. To date, no study in Colombia has simultaneously considered the effect of locality, family and individual factors on adult health perception. Indeed, such approach has had limited use in low- and middle-income countries. Therefore, we hope our paper contributes to the understanding of these associations in an urban area in Colombia, and these findings could be to inform policies and support the design of interventions to improve the health and well-being of individuals living in urban environment.

Conflict of interest

There are no conflicts of interest.

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Table 1. Studied population according to individual, household and locality characteristics. Bogotá, Colombia, 2011

Variable	n	%
Individual level (n=37,352)		
Gender		
Male	16.846	45,10
Female	20.506	54,90
Age		
20-29	9.681	25,92
30-39	8.155	21,83
40-49	7.475	20,01
50-59	5.824	15,59
≥60	6.217	16,64
Schooling (years with passing)		
<=5	10.575	29,13
6-11	13.644	37,58
> 11	12.088	33,29
Marital status		
With a partner	24.53	65,67
Without a partner	12.822	34,33
Working		
Yes	25.127	67,27
No	12.225	32,73
Regular physical activity		
Yes	7.939	21,25
No	29.413	78,75
Morbidities		
0	22.48	60,18
1-2	12.735	34,09
>=3	2.137	5,72
Household level (n=15,788)		
Socio-economic status		
Low	6.829	43,30
Middle	7.974	50,50
High	780	4,90
Located within a noisy area		
Yes	6.269	39,70
No	9.515	60,30
Located within an area with contamination problems		
Yes	7.517	47,60
No	8.269	52,40
Located within an area with insecurity problems		

Variable	n	%
Yes	12.095	76,60
No	3.696	23,40
Close to rubbish dump		
Yes	2.047	13,00
No	13.741	87,00
Close to factories		
Yes	3.426	21,70
No	12.362	78,30
Close to drug markets		
Yes	4.403	27,90
No	11.385	72,10
Locality level (n=19)		
Gini coefficient		
Quartile 1	5	0,39
Quartile 2	4	0,42
Quartile 3	5	0,48
Quartile 4	5	0,55
Population in poverty (%)		
Quartile 1	6	5,61
Quartile 2	5	10,30
Quartile 3	4	16,00
Quartile 4	4	21,90
Mean (SD) homicide rate x 100.000	42,35 (36,35)	
Mean (SD) of population perceiving an increase in the insecurity (%)	45,05 (7,65)	
Mean (SD) population density (m^2)	180,72 (56,41)	

SD: Standard Deviation
m^2: Squared Meter

Table 2. Prevalence, crude and adjusted analysis of the association between individual, household, and locality-related variables and poor or very poor health. Bogotá D.C. Colombia. 2011.

	Crude analysis			Adjusted analysis**	
Variable	Prevalence	OR (CI 95%)	p-value	OR (CI 95%)	p-value
Individual level					
Gender			0,002		0,2
Male	24,05	Reference		Reference	
Female	26,43	1,08 (1,03 ; 1,14)		1,03 (0,98 ; 1,09)	
Age			<0,001		<0,001*
20-29	22,21	Reference		Reference	
30-39	18,12	0,85 (0,78 ; 0,93)		0,78 (0,72 ; 0,85)	
40-49	22,96	1,04 (0,96 ; 1,13)		1,05 (0,97 ; 1,13)	
50-59	29,38	1,28 (1,18 ; 1,40)		1,33 (1,23 ; 1,44)	
≥60	38,88	1,65 (1,52 ; 1,80)		1,46 (1,35 ; 1,59)	
Schooling (years with passing)			<0,001		<0,001*
<=5	43,35	4,89 (4,38 ; 5,45)		3,75 (3,49 ; 4,03)	
6-11	23,36	1,95 (1,76 ; 2,16)		1,87 (1,74 ; 2,01)	
> 11	13,33	Reference		Reference	
Marital status			<0,001		<0,001
With a partner	22,48	Reference		Reference	
Without a partner	30,87	1,62 (1,49 ; 1,75)		1,27 (1,20 ; 1,34)	
Working			<0,001		<0,001
Yes	17,99	Reference		Reference	
No	40,51	3,19 (2,94 ; 3,46)		2,38 (2,25 ; 2,51)	
Regular physical activity			<0,001		<0,001
Yes	21,15	Reference		Reference	
No	26,5	1,25 (1,14 ; 1,37)		1,41 (1,32 ; 1,51)	
Morbidities			<0,001		<0,001*
0	11,46	Reference		Reference	
1-2	41,85	5,65 (5,16 ; 6,19)		5,00 (4,72 ; 5,31)	
>=3	73,33	22,93 (19,11 ; 27,51)		17,02 (15,17;19,08)	
Household level					
Socio-economic status			<0,001		<0,001*
Low	30,03	2,90 (2,28 ; 3,70)		2,21 (1,78 ; 2,74)	
Middle	22,67	2,05 (1,62 ; 2,59)		1,75 (1,42 ; 2,14)	
High	8,71	Reference		Reference	

	Crude analysis			Adjusted analysis**	
Variable	Prevalence	OR (CI 95%)	p-value	OR (CI 95%)	p-value
Located within a noisy area			<0,001		<0,001
Yes	28,53	1,32 (1,22 ; 1,43)		1,12 (1,06 ; 1,19)	
No	23,27	Reference		Reference	
Located within an area with contamination problems			<0,001		<0,001
Yes	27,95	1,29 (1,20 ; 1,40)		1,15 (1,08 ; 1,22)	
No	23,00	Reference		Reference	
Located within an area with insecurity problems			<0,001		<0,001
Yes	27,47	1,53 (1,39 ; 1,69)		1,20 (1,12 ; 1,30)	
No	17,98	Reference		Reference	
Close to rubbish dumps			<0,001		0,889
Yes	31,57	1,31 (1,17 ; 1,47)		1,01 (0,93 ; 1,09)	
No	24,42	Reference		Reference	
Close to factories			0,01		
Yes	27,81	1,53 (1,39 ; 1,69)		1,14 (1,06 ; 1,22)	<0,001
No	24,65	Reference		Reference	
Close to drug markets			<0,001		<0,001
Yes	30,87	1,53 (1,39 ; 1,69)		1,18 (1,11 ; 1,26)	
No	23,24	Reference		Reference	
Locality level					
Gini coefficient			0,004		0,588*
Quartile 1	29,72	1,73 (1,26 ; 2,39)		1,27 (0,97 ; 1,65)	
Quartile 2	25,05	1,36 (0,96; 1,91)		1,08 (0,93 ; 1,27)	
Quartile 3	25,33	1,39 (1,00 ; 1,91)		1,09 (0,94 ; 1,28)	
Quartile 4	19,79	Reference		Reference	
Population in poverty (%)			<0,001		0,003*
Quartile 1	18,84	Reference		Reference	
Quartile 2	25,54	1,50(1,18 ; 1,92)		1,31 (1,12 ; 1,52)	
Quartile 3	27,64	1,68 (1,30 ; 2,18)		1,25 (1,06 ; 1,47)	
Quartile 4	30,61	1,96 (1,51 ; 2,53)		1,36 (1,15 ; 1,61)	
Mean (SD) homicide rate x 100.000		1,00 (1,00 ; 1,01)	0,04	1,00 (0,99 ; 1,00)	0,476
Mean (SD) of population perceiving an increase in the insecurity (%)		1,01 (0,98 ; 1,02)	0,57	0,99 (0,97 ; 1,01)	0,771
Mean (SD) population density (m^2)		1,00 (1,00 ; 1,01)	0,01	0,99 (0,96 ; 1,00)	0,570

* Wald test for linear trend

** Adjusted for all variables in the same level or in higher levels with p<0.2

SD: Standard Deviation

CI: Confidence Interval

Figure 1. Predicted prevalence of poor health by locality of residence. Bogotá-Colombia, 2011