








Prevalence of self-reported asthma in adults in the Brazilian Amazon: a population-based cross-sectional study

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TO THE EDITOR:

The prevalence of asthma among adults is poorly known, especially in vulnerable regions, such as the Brazilian Amazon.⁽¹⁾ The objective of this study was to estimate the prevalence of self-reported asthma in adults living in the metropolitan area of Manaus, Brazil, in 2015.

We included individuals ≥ 18 years of age. We used a multistage probability cluster sampling design: stage 1, census tracts (random sampling); stage 2, households (systematic sampling); and stage 3, individuals (random sampling, based on age and sex quotas).⁽²⁾ Experienced interviewers collected data at participant households.

The prevalence of self-reported asthma was assessed by the Brazilian Portuguese version of the European Community Respiratory Health Survey, a cutoff score ≥ 4 being used.⁽³⁾ Individual variables included sex (male/female), age group (18-24, 25-34, 35-44, 45-59, or ≥ 60 years), marital status (married, separated, divorced, widowed, or single), level of education (college education or higher, high school education, middle school education, no formal education), socioeconomic class (A/B, C, or D/E, with A being the wealthiest and E being the poorest), health insurance (yes/no), use of health services in the last 12 months (visit to a physician, visit to a dentist, or hospitalization), place of residence (in the city of Manaus itself or in other cities within the metropolitan area of Manaus), chronic disease (COPD, depression, hypertension, diabetes, or hypercholesterolemia), and self-perception of health status (very good, good, fair, poor, or very poor).

All variables were evaluated by descriptive statistics with 95% CIs. Poisson regression with robust variance was used in order to estimate prevalence ratios (PRs) for asthma by independent variable. All of the variables showing $p < 0.20$ in the bivariate analysis were included in the multivariate analysis. Multicollinearity was assessed by the variance inflation factor (VIF), variables with a VIF > 10 being removed. All analyses were performed with the Stata statistical software package, version 14.2 (StataCorp LP, College Station, TX, USA), the complex sampling design being accounted for (using the `svy` command).

All participants gave written informed consent. The study protocol was approved by the Research Ethics Committee of the Federal University of Amazonas (Protocol no. 974,428).

Of the 4,001 study participants, 523 (13.1%; 95% CI, 12.0-14.1) were found to have asthma. Half of the participants were women, single, and in good health. Most were in the 18- to 44-year age bracket, had visited a physician in the previous 12 months, and resided in the city of Manaus (Table 1).

After adjustment, the prevalence of asthma was found to be significantly higher in women (PR, 1.84; 95% CI, 1.52-2.22), individuals living in the city of Manaus (PR, 1.70; 95% CI, 1.23-2.37), individuals with COPD (PR, 2.45; 95% CI, 1.93-3.10), individuals with depression (PR, 1.52; 95% CI, 1.20-1.93), individuals with hypertension (PR, 1.39; 95% CI, 1.16-1.68), individuals with hypercholesterolemia (PR, 1.33; 95% CI, 1.12-1.65), individuals in fair health (PR, 2.26; 95% CI, 1.51-3.38), individuals in poor health (PR, 3.30; 95% CI, 2.11-5.15), and individuals in very poor health (PR, 2.66; 95% CI, 1.54-4.63). None of the variables had a VIF > 10 .

Although information bias resulting from self-report might limit the validity of our findings, clinical testing for asthma was beyond the scope of our study. Nevertheless, we employed a questionnaire that has been validated for the assessment of asthma in adults. Environmental factors were not assessed in this study and can be risk factors for asthma symptoms.⁽⁴⁾ Given that only individuals who were at home at the time of data collection were included in the study, it is possible that selection bias influenced the results.

The prevalence of self-reported asthma in the present study was similar to the prevalence of asthma in the Brazilian adult population (12.4%) as assessed by the World Health Survey questionnaire in a multicountry study.⁽⁵⁾ In contrast, the 2013 Brazilian National Health Survey found a low prevalence of self-reported physician-diagnosed asthma (4.4%), a finding that might be due to the fact that no screening tool was used for outcome assessment.⁽⁶⁾

In a cross-sectional study based on household surveys conducted in Brazil in 2003, 2008, and 2013, the prevalence of asthma was consistently higher in women,⁽¹⁾ as was the case in our study. This might be explained by biological differences, such as sex hormones and increased bronchial hyperresponsiveness, and social factors, such as different perceptions of airflow obstruction and medication compliance.⁽⁷⁾ In addition, women seek medical attention and self-report health conditions more often than do men.⁽²⁾

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Table 1. Characteristics of the study participants and corresponding adjusted prevalence ratios for asthma (with 95% CIs) in the metropolitan area of Manaus, Brazil, in 2015 (N = 4,001).

Variable	n	%	PR (95% CI)	p
Sex				< 0.001
Male	1,888	47.2	1.00	
Female	2,113	52.8	1.84 (1.52-2.22)	
Age group, years				0.189
18-24	838	20.9	1.00	
25-34	1,152	28.8	0.83 (0.65-1.06)	
35-44	843	21.1	0.88 (0.68-1.15)	
45-59	772	19.3	0.71 (0.53-0.93)	
≥ 60	396	9.9	0.74 (0.53-1.03)	
Marital status				0.033
Married	1,409	35.2	1.00	
Separated	157	3.9	0.82 (0.53-1.26)	
Divorced	103	2.6	0.35 (0.17-0.72)	
Widowed	159	4.0	0.96 (0.70-1.31)	
Single	2,173	54.3	0.76 (0.64-0.90)	
Level of education				0.679
College or higher	158	4.0	1.00	
High school	1,903	47.5	1.07 (0.67-1.69)	
Middle school	649	16.2	1.12 (0.69-1.82)	
Elementary school or lower	1,291	32.3	0.98 (0.62-1.56)	
Socioeconomic class				0.026
A/B (the wealthiest)	629	15.7	1.00	
C	2,285	57.1	0.96 (0.73-1.22)	
D/E (the poorest)	1,087	27.1	1.19 (0.91-1.57)	
Health insurance				0.150
Yes	523	13.0	1.00	
No	3,478	87.0	1.22 (0.93-1.61)	
Use of health services in the last 12 months ^a				
Physician	3,066	76.6	1.13 (0.92-1.39)	0.247
Dentist	1,435	35.9	^a b	^a b
Hospitalization	273	6.8	1.22 (0.96-1.54)	0.099
Place of residence				0.001
In other cities within the metropolitan area of Manaus	522	13.2	1.00	
In the city of Manaus itself	3,479	86.9	1.70 (1.23-2.37)	
Chronic disease ^a				
COPD	99	2.5	2.45 (1.93-3.10)	< 0.001
Depression	214	5.4	1.52 (1.20-1.93)	0.001
Hypertension	787	19.7	1.39 (1.16-1.68)	< 0.001
Diabetes	245	6.2	0.78 (0.59-1.02)	0.073
Hypercholesterolemia	596	14.9	1.33 (1.12-1.65)	0.002
Health status				< 0.001
Very good	471	11.9	1.00	
Good	2,175	54.3	1.34 (0.90-1.98)	
Fair	1,108	27.7	2.26 (1.51-3.38)	
Poor	193	4.9	3.30 (2.11-5.15)	
Very poor	54	1.4	2.66 (1.54-4.63)	

PR: prevalence ratio. ^aThe absence of this variable was used as reference for PR calculation. ^bNot included in the adjusted analysis (p = 0.234 in the bivariate analysis).

In the present study, the prevalence of asthma was found to be higher in individuals living in the city of Manaus itself than in those living in other cities within the metropolitan area of Manaus. In a cross-sectional

study conducted in Peru in the 2000-2008 period, the prevalence of asthma was investigated in two different settings and was found to be higher in urban Lima than in rural Tumbes (12% vs. 3%).⁽⁸⁾

Adults with asthma are likely to report other chronic conditions. In a meta-analysis comparing 117,548 patients with asthma and 443,948 controls without asthma, it was shown that asthma, diabetes, cardiovascular diseases, hypertension, psychiatric disorders, neurological disorders, cancer, and respiratory diseases other than asthma share several common risk factors, including smoking, obesity, and lack of physical activity.⁽⁹⁾ Given that asthma and COPD are both pulmonary diseases, there was a risk of collinearity between the two in our study. However, multicollinearity was ruled out by examining the VIF. In the present study, asthma was associated with worse health status, a finding that is consistent with those of a study showing severe problems related to symptoms, functional impairment, and quality of life in 167 asthma patients.⁽¹⁰⁾

In summary, over one tenth of adults living in the metropolitan area of Manaus have asthma, the prevalence of which was higher in women, individuals living in the city of Manaus itself, individuals with chronic conditions, and individuals with worse health status.

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AUTHOR CONTRIBUTIONS

Silva MT and Galvao TF designed the work, analyzed and interpreted the data, and critically revised the work for important intellectual content. Tiguman GMB analyzed and interpreted the data and drafted the work. Alencar RRRF and Penha AP analyzed and interpreted the data and critically revised the work for important intellectual content. All authors approved the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Santos FMD, Viana KP, Saturnino LT, Lazaridis E, Gazzotti MR, Stelmach R, et al. Trend of self-reported asthma prevalence in Brazil from 2003 to 2013 in adults and factors associated with prevalence. *J Bras Pneumol.* 2018;44(6):491-497. <https://doi.org/10.1590/s1806-37562017000000328>
2. Silva MT, Galvão TF. Use of health services among adults living in Manaus Metropolitan Region, Brazil: population-based survey, 2015. *Epidemiol Serv Saude.* 2017;26(4):725-734. <https://doi.org/10.5123/S1679-49742017000400005>
3. Andrade E. Validação do questionário de triagem de asma do inquérito de saúde respiratória da Comunidade Européia (ECRHS) na cidade de Manaus-AM [thesis]. Porto Alegre: Universidade Federal do Rio Grande do Sul; 2007.
4. Toskala E, Kennedy DW. Asthma risk factors. *Int Forum Allergy Rhinol.* 2015;5 Suppl 1(Suppl 1):S11-S16. <https://doi.org/10.1002/alr.21557>
5. To T, Stanojevic S, Moores G, Gershon AS, Bateman ED, Cruz AA, et al. Global asthma prevalence in adults: findings from the cross-sectional world health survey. *BMC Public Health.* 2012;12:204. <https://doi.org/10.1186/1471-2458-12-204>
6. Menezes AM, Wehrmeister FC, Horta B, Szwarwald CL, Vieira ML, Malta DC. Prevalence of asthma medical diagnosis among Brazilian adults: National Health Survey, 2013. *Rev Bras Epidemiol.* 2015;18 Suppl 2:204-213. <https://doi.org/10.1590/1980-5497201500060018>
7. Fuseini H, Newcomb DC. Mechanisms Driving Gender Differences in Asthma. *Curr Allergy Asthma Rep.* 2017;17(3):19. <https://doi.org/10.1007/s11882-017-0686-1>
8. Robinson CL, Baumann LM, Gilman RH, Romero K, Combe JM, Cabrera L, et al. The Peru Urban versus Rural Asthma (PURA) Study: methods and baseline quality control data from a cross-sectional investigation into the prevalence, severity, genetics, immunology and environmental factors affecting asthma in adolescence in Peru. *BMJ Open.* 2012;2(1):e000421. <https://doi.org/10.1136/bmjopen-2011-000421>
9. Su X, Ren Y, Li M, Zhao X, Kong L, Kang J. Prevalence of Comorbidities in Asthma and Nonasthma Patients: A Meta-analysis. *Medicine (Baltimore).* 2016;95(22):e3459. <https://doi.org/10.1097/MD.0000000000003459>
10. Peters JB, Rijssenbeek-Nouwens LH, Bron AO, Fieten KB, Weersink EJ, Bel EH, et al. Health status measurement in patients with severe asthma. *Respir Med.* 2014;108(2):278-286. <https://doi.org/10.1016/j.rmed.2013.11.012>