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Psychosocial risk factors and asthma among adults in Puerto Rico

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Abstract

Objective: Asthma and psychosocial stressors are common among Puerto Rican adults living in the United States. We estimated the prevalence of current asthma, and examined potential psychosocial risk factors and current asthma, among adults in Puerto Rico.

Methods: Cross-sectional study of 3,049 Puerto Ricans aged 18–64 years living in Puerto Rico between May 2014 and June 2016. A structured interview was conducted to obtain information on demographics, lifestyles, mental disorders, and respiratory health. Current asthma was defined as self-reported physician-diagnosed asthma and still having asthma. Two-sample t tests (for continuous variables) or chi-square tests (for categorical variables) were used in bivariate analyses. Multivariable logistic regression was used to examine psychosocial risk factors and current asthma.

Results: The estimated prevalence of current asthma was 10.2%. In a multivariable analysis, exposure to violence (odds ratio [OR] for each 1-point increment in a validated scale=1.14, 95% confidence interval [CI]=1.07 to 1.21) and a lifetime history of at least one suicide attempt (OR=3.01, 95% CI=1.80 to 5.01) were significantly associated with current asthma, independently of major depressive disorder. Moreover, a lifetime history of at least one suicide attempt was associated with co-existing asthma and chronic obstructive pulmonary disease (i.e. asthma-COPD overlap syndrome or ACOS (OR=9.05, 95% CI=3.32–24.67).

Conclusions: Our findings suggest that asthma is a major health problem among adults in Puerto Rico, with psychosocial risk factors playing a significant role on asthma and ACOS.

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Conception and study design: Y-Y.H., G.C. and J.C.C.; Data analysis and interpretation: Y-Y.H., E.F., J.C.C., drafting of the manuscript for intellectual content: Y-Y.H., E.F., G.C., and J.C.C. All authors approved the final version of the manuscript prior to submission. </author_notes>

Declaration of Interest:

Dr. Celedón has received materials from Merck (inhaled steroids) and Pharmavite (vitamin D and placebo tablets) to provide medications at no cost to participants in two NIH-funded studies unrelated to the current report. The other authors report no conflicts of interest.

Addressing chronic stressors and mental illness should be part of comprehensive strategies to reduce asthma burden in this population.

Keywords

exposure to violence; asthma; suicide attempt; Puerto Rico

INTRODUCTION

Asthma disproportionately affects certain racial or ethnic minority groups. In the United States (U.S.), the prevalence of self-reported current asthma among adults is higher in Puerto Ricans (13.6%) than in non-Hispanic blacks (9.1%), non-Hispanic whites (6.9%) or Mexicans and Mexican Americans (5.3%)(1); this finding is not explained by place of birth or age at migration to the mainland U.S.(2) Moreover, mortality from asthma is higher in Puerto Ricans than in members of other racial or ethnic groups in the U.S.(3, 4)

Ethnic disparities in asthma are caused by complex interactions among hereditary, socio-economic, environmental, and behavioral factors (5). Psychosocial stressors such as major depressive disorder, generalized anxiety disorder, and exposure to violence have been associated with asthma (6–10) and worse asthma outcomes (11, 12). Growing evidence supports a role for psychosocial stressors and asthma in Puerto Rican children (13, 14) but very few studies have assessed potential determinants or psychosocial risk factors for asthma in Puerto Rican adults.

In this report, we aimed to first estimate the prevalence of current asthma, and then assess the relation between potential psychosocial risk factors and current asthma among adults in Puerto Rico. Because recent findings suggest that co-existing asthma may explain why the prevalence of chronic obstructive pulmonary disease (COPD) is higher in Puerto Rican adults than in adult members of other Hispanic subgroups (2), we had as a secondary aim to examine the association between potential risk factors and concurrent asthma and COPD (asthma-COPD overlap syndrome, ACOS) in Puerto Ricans.

METHODS

Study population.

As part of the population-based study “Need assessment study of mental health and substance use disorders and service utilization among adult population of Puerto Rico”, adults aged 18 to 64 years were recruited from randomly selected households in Puerto Rico, from May 2014 to June 2016 (15). The main purpose of this study was to estimate the prevalence of mental illness and its sociodemographic and behavioral determinants among the adult population in Puerto Rico. Because asthma and COPD are known to be common among Puerto Rican adults living in the U.S. mainland (2), as a secondary goal, data on asthma and COPD were collected to examine whether mental health determinants were associated with respiratory diseases in this population.

The sample of the study is a household probability sample of adults living in the Puerto Rico (excluding the islands of Vieques and Culebra). The island territory was first stratified by

eight health regions defined by the Puerto Rico Health Insurance Administration. Households were selected by a multistage cluster sampling design. Primary sampling units were the Census Block Groups (CBG) from the 2010 U.S. Census. In the first stage, a CBG was made with probability proportional to size (number of adults in the target age group). The sampling frame was ordered by urban and rural Block Groups. The second selection stage consisted of a random selection of one block within each selected CBG. In the third and final stage, a segment of approximately 20 to 40 occupied household units (OHUs) was randomly selected within each block. A household was eligible if at least one resident was an adult aged 18 to 64 years, who spoke Spanish and did not have any cognitive impairment. Of 4,436 selected households, 3,654 (82.4%) contained at least one eligible respondent. No substitution of other persons living in the same household was permitted. Of the 3,654 eligible subjects 3,062 (83.8%) completed the study interviews.

Interviews were conducted by trained interviewers at the respondents' home. After excluding 13 participants with missing information on asthma, 3,049 adults were included in the current analysis. Written informed consent was obtained from every participant, and parental consent was also obtained for participants aged 18–20 years. The study was approved by the Institutional Review Board of the University of Puerto Rico (San Juan, Puerto Rico).

Study procedures.

Study participants completed a structured interview that included questions on sociodemographic characteristics, health behaviors and mental disorders, and asthma and COPD. Current asthma was defined by a positive answer to both following questions: "Have you ever been told by a doctor or other professional that you have asthma?" and "Do you still have asthma?" Participants who answered "no" to both questions were selected as controls. Physician-diagnosed COPD or emphysema was defined by a positive answer to the question: "Has a doctor ever told you that you had COPD or emphysema?". Participants who reported having both current asthma and physician-diagnosed COPD were identified as having ACOS.

Sociodemographic characteristics included in the study were age, gender, highest education level (high school/General Equivalency Diploma [GED] or less, some college or technical or vocational school, completed 4-year college or higher), monthly family income (< \$1,000, \$1,000–2,999, \$3,000), private or employer-based health insurance (yes or no), employment status (employed full-time, employed part-time, unemployed [unemployed and looking for work], not in the workforce [retired, homemaker, never worked, unemployed and not looking for work, students], and marital status [married, never married, separated or divorced or widowed]). Height and weight were measured to the nearest centimeter and kilogram, and body mass index (BMI) was calculated as kg/m². Physical activity was defined by the frequency of being physically active (i.e. walking lightly, running skates, riding bicycles, dancing, swimming, playing basketball or lifting weights) for at least an hour (never, 1–3 days/week, 4 days/week). Smoking status was defined as "never", "occasional/former" or "current". Pack-years of cigarette smoking were calculated by multiplying the number of packs of cigarettes smoked per day by the number of years the

person smoked. Exposure to violence was ascertained using a validated questionnaire that assesses both ever witnessed and direct victimization for five specific events: (a) shoving, punching or kicking; (b) knife attacks; (c) shootings; (d) hearing gunshots; and (e) witnessing verbal abuse of their family members (16, 17). The survey also accounts for event circumstance information, including events occurring more than once. A summary score (ranging from 0 to 15) from the exposure to violence questionnaire was used for data analysis.

Major depressive disorder in the prior 12 months, generalized anxiety disorder in the prior 12 months, and lifetime (ever) history of at least one suicide attempt were assessed by The World Health Organization World Mental Health Composite International Diagnostic Interview Spanish version 21 (WHO WMH-CIDI V21)(18). The WMH-CIDI is a standardized diagnostic interview designed to assess current (in the past 12 months) and lifetime mental disorders according to the definitions and criteria of the Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV)(19). The original WMH-CIDI instrument was translated and adapted by a bilingual team for use among Spanish-speaking populations using a comprehensive process guided by a conceptual model that focused on cross-cultural equivalence in five dimensions (semantic, content, technical, criterion, and conceptual equivalence) following a cultural adaptation model described in detail elsewhere (20). We used this same method for the translation of the new items added to version 21 of the WMH-CIDI.

Statistical analysis

All analyses were conducted using the SAS SURVEY procedure in SAS 9.3 software (SAS Institute Inc, Cary, NC), to account for the multistage, multi-cluster design used in the survey sampling frame. Sampling weights, stratification, and clusters were incorporated into the analysis to correct for unequal probabilities of sample selection and obtain proper estimates and standard errors. In addition, a post-stratification weight was applied, which corrects for non-response and adjusts the sample to the known population distributions of age and gender. Two-sample t tests (for continuous variables) or chi-square tests (for categorical variables) were used in bivariate analyses of current asthma. Logistic regression was used for the multivariable analysis of psychosocial risk factors (exposure to violence, major depressive disorder, and lifetime history of at least one suicide attempt) and current asthma. Because of their well-established association with asthma, all models included age, gender, monthly family income, and overweight or obesity. Other covariates considered for inclusion in the multivariable models included employment status, marital status, type of health insurance, smoking status, pack-years of cigarette smoking, and physical activity. These additional covariates remained in the final models if they were associated with current asthma at $P < 0.05$ or if they changed the effect estimate (i.e. the odds ratio, OR) by at least 10% (21). To reduce potential misclassification of COPD as current asthma, we repeated the multivariable analysis of current asthma after stratification by smoking status (ever-smoked vs. never smoked). A separate multivariable analysis was also conducted to identify potential determinants of ACOS among study participants.

RESULTS

During the study period (2014–2016), the overall prevalence of current asthma among Puerto Rican adults aged 18–64 years was 10.2%. The main characteristics of the study participants are presented in Table 1. The average age of participants were 40.3 years and 52.4% were female. Compared to adults without current asthma (n=2,737), those with current asthma (n=312) were more likely to be: older, female, unemployed or not in the workforce, separated or divorced or widowed, obese, and less physically active. Compared to adults without current asthma, those with current asthma were also more likely to have lower family monthly income and a higher BMI, to have been exposed to violence, to have current wheeze, and to have major depressive disorder in the prior year and a lifetime history of at least one suicide attempt. A total of 30 adults (8.1% of those with current asthma) also reported to have been diagnosed with both asthma and COPD or emphysema (i.e. had ACOS). There were no other significant differences between adults with and without current asthma.

The results of the multivariable analysis of asthma are shown in Table 2. After adjustment for age, gender, overweight or obesity, smoking status, pack-years of smoking, physical activity, and indicators of socioeconomic status (monthly family income and employment), ever exposure to violence (OR=1.16, 95% CI=1.10, 1.23, Model 1), current major depressive disorder (OR=1.56, 95% CI=1.07, 2.27, Model 2), and a lifetime history of at least one suicide attempt (OR=3.92, 95% CI=2.42, 6.36, Model 3) were each significantly associated with increased odds of current asthma. In a multivariable model simultaneously including exposure to violence, major depressive disorder, and a lifetime history of at least one suicide attempt (Model 4), ever exposure to violence (OR=1.14, 95% CI=1.07, 1.21) and having ever attempted suicide (OR=3.01, 95% CI=1.80, 5.01) were each significantly associated with increased odds of current asthma, independently of current major depressive disorder and other covariates. The observed associations between psychosocial factors and current asthma were consistent in both men and women (Supplemental Table 1). Moreover, similar results were found among those adults who reported ever having had asthma (see Supplemental Table 2).

To reduce potential misclassification of COPD as asthma, we repeated the multivariable analysis of current asthma after stratification by smoking status (Table 3). Among adults who never smoked, ever exposure to violence (OR=1.12, 95% CI=1.04, 1.20) and a lifetime history of at least one suicide attempt (OR=3.72, 95% CI=1.59, 8.73) were each associated with increased odds of current asthma, independently of having had major depressive disorder in the prior year (**Model 1**). Similar findings were obtained in the multivariable analysis of ever (occasional/former or current) smokers (**Model 2**).

Next, we assessed potential determinants and psychosocial factors of ACOS (Table 4). In a multivariable analysis, older age, female gender, and a higher BMI were each significantly associated with ACOS (**Model 1–Model 4**). Ever exposure to violence (OR=1.21, 95% CI=1.01, 1.45, Model 1), current major depressive disorder (OR=2.56, 95% CI=1.02, 6.44, Model 2), and lifetime history of at least one suicide attempt (OR=12.79, 95% CI=4.92, 33.22, Model 3) were each associated with increased odds of ACOS. In a multivariable

analysis including all three psychosocial factors, a lifetime history of at least one suicide attempt (OR=9.05, 95% CI=3.32, 24.67) was significantly associated with nine-fold increased odds of ACOS, independently of ever exposure to violence and having had major depressive disorder in the prior year (Model 4).

DISCUSSION

In this population-based study, ever exposure to violence, current major depressive disorder, and lifetime history of at least one suicide attempt were each significantly associated with current asthma and ACOS among Puerto Rican adults. In this study population, older age, females, higher BMI, were also significantly associated with ACOS. To our knowledge, this is the first report of an association between a history of suicide attempts and current asthma in Puerto Rican adults.

Our estimated prevalence of current asthma among adults in Puerto Rico (10.2%) is lower than that recently reported for Puerto Rican adults 40 years and older in the U.S. mainland (15.3%)(2), which may be explained by differences in the participants' age range and healthcare access across studies. However, current asthma was more common in adults in Puerto Rico than in members of any other Hispanic subgroup who participated in a recent large study in the U.S. (e.g., current asthma was reported in 3.4% of Mexicans or Mexican Americans).(2)

We and others have shown that major depression and depressive symptoms are associated with current asthma or new-onset asthma among adults in the U.S. mainland(10, 22). Major depressive disorder has been reported to occur in ~14% of Puerto Rican adults(15), and we have previously shown that children born to mothers who have co-existing asthma and major depression are at risk of asthma(23). Independent of major depressive disorder, a lifetime history of at least one suicide attempt (which is correlated with more severe depression)(24) was associated with both current asthma and ACOS in our study. Severe depression may lead to dysfunction of the hypothalamic-pituitary-adrenocortical (HPA) axis and the autonomic nervous system (ANS), resulting in persistent secretion of cortisol and catecholamines, down-regulation of glucocorticoid and β_2 -adrenergic receptors, abnormal immune responses and increased airway inflammation (25, 26), and -ultimately- increased risk of asthma or reduced response to asthma treatment in adults (18). Alternatively, we cannot exclude the possibility that current asthma or ACOS increases the risk of suicide ideations in adults (e.g., due to reduced quality of life)(27–29) in this cross-sectional study. Our findings merit replication in longitudinal studies of Puerto Rican adults and other disadvantaged groups.

We previously reported that exposure to violence at the individual or community level is associated with asthma in Puerto Rican children (30, 31). Indeed, growing evidence suggests that exposure to violence influences the pathogenesis of asthma through chronic psychosocial stress (32). Potential causal mechanisms for stress-related asthma include alterations in the HPA axis and the ANS, and changes in the methylation and expression of genes that regulate behavioral, autonomic, neuroendocrine, and immunologic responses to stress (33). Exposure to violence may also lead to adoption of coping behaviors such as

smoking or restricted outdoor activities, which can cause or worsen asthma (34). We now show that exposure to violence is associated with current asthma in Puerto Rican adults, without significant effect modification by gender Supplemental Table 2). Strategies and policies that aim to reduce exposure to violence and to counsel victims of violence should be considered as part of asthma prevention and control programs in Puerto Rico.

Cigarette smoking, a known risk factor for asthma or asthma severity, is particularly common among Puerto Ricans (e.g., 28.5% of Puerto Rican adults are current smokers)(35). In our study, indicators of socioeconomic status (SES) were not significantly associated with asthma in Puerto Rican adults, likely because environmental (e.g., cigarette smoking) and behavioral (e.g., chronic stress or depression) factors correlated with poverty or race/ethnicity underlie previously observed associations (36). Our finding of an association between obesity and asthma or ACOS is consistent with our prior results in Puerto Rican children (37), and those of other studies worldwide (38). Plausible mechanisms for this association include mechanical alterations of the airways and lung parenchyma, and alterations in immune responses and metabolic function (39). Consistent with our results, obesity has also been associated with COPD (40) and ACOS (41) in other populations. Since obesity is highly prevalent among Puerto Rican adults and children (37), implementing measures to prevent obesity in early childhood and reduce obesity in adulthood should be part of a comprehensive plan to address asthma in Puerto Ricans.

The present study has considerable strengths, including a high response rate (83.8%) among eligible subjects, a study sample representative of adults living in Puerto Rico, in-person interview of study participants, and the ability to examine several psychosocial factors for asthma and ACOS. We also acknowledge several study limitations. First, we cannot exclude residual confounding by unmeasured variables including allergic sensitization, housing conditions, air pollution, and dietary or nutrient intake. Second, we cannot examine temporal relationships due to the cross-sectional study design, and thus we cannot exclude “reverse causation” as an explanation for some of our findings (e.g., current asthma or ACOS leading to reduced physical activity). However, use of current asthma as our main outcome (instead of ever asthma) could decrease the possibility that asthma presented before exposure to psychosocial risk factors. Third, asthma and COPD diagnoses were based on self-report. We lack medical record validation or lung function measures, and thus misclassification of COPD as asthma and under-diagnosis of asthma or COPD (and thus ACOS) is possible. However, our results for asthma were similar in analysis stratified by smoking status. Fourth, the number of subjects with ACOS was small, and thus our findings in this small subgroup must be cautiously interpreted. Nonetheless, our results for ACOS were generally consistent with what has been reported in other racial or ethnic groups (42). Finally, our findings might not be generalizable to Puerto Rican adults who have immigrated to the U.S. mainland.

CONCLUSION

In summary, we report that asthma is a major public health among adults living in Puerto Rico, while also identifying potentially modifiable risk factors. Our findings highlight the importance of addressing psychosocial stressors and mental illness, promoting healthy weight and preventing tobacco use to reduce the high asthma burden in Puerto Rican adults.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Characteristics of study participants by current asthma

Characteristics	All adults (n=3,049)	No asthma (n=2,737)	Current asthma (n=312)
Age	40.3 ± 0.6	40.1 ± 0.6	41.9 ± 0.8 [†]
18–25 years	721 (18.5)	674 (19.2)	47 (12.3) [†]
26–45 years	963 (43.0)	864 (42.7)	99 (45.7)
45–64 years	1365 (38.4)	1199 (38.0)	166 (42.0)
Female gender	1765 (52.4)	1533 (50.6)	232 (68.1) [‡]
Education			
High school	969 (31.0)	859 (30.7)	110 (33.6)
Some college	1045 (33.8)	930 (33.3)	115 (37.9)
College and above	1016 (35.2)	932 (36.0)	84 (28.5)
Monthly family income			
< \$1000	1461 (45.0)	1285 (44.1)	176 (52.5) [†]
\$1000–2999	964 (34.4)	874 (34.8)	90 (30.7)
\$3000	544 (20.6)	503 (21.1)	41 (16.6)
No private or employer-based health insurance	362 (13.1)	313 (12.8)	49 (15.8)
Employment			
Full time	947 (35.4)	876 (36.5)	71 (26.3) [‡]
Part time	423 (14.0)	386 (14.1)	37 (13.0)
Unemployed	415 (13.1)	364 (12.7)	51 (17.0)
Not in workforce	1264 (37.5)	1111 (36.8)	153 (43.7)
Marital status			
Married	1020 (35.2)	920 (35.5)	100 (32.7) [‡]
Never married	1302 (42.1)	1194 (42.7)	108 (37.1)
Separated/divorced/widowed	726 (22.7)	622 (21.8)	104 (30.3)
Body mass index (BMI) categories	28.1 ± 0.2	28.0 ± 0.2	29.7 ± 0.5 [‡]
Normal weight (BMI < 25)	1003 (34.0)	928 (34.6)	75 (28.4) [‡]
Overweight (BMI 25–29.9)	957 (34.6)	861 (34.8)	96 (32.7)
Obesity (BMI ≥ 30)	859 (31.4)	740 (30.6)	119 (38.9)
Physical activity			
Never	1075 (35.5)	937 (34.7)	138 (42.7) [†]
1–3 days/week	746 (24.5)	682 (25.2)	64 (19.1)
4 days/week	1226 (40.0)	1117 (40.2)	109 (38.3)
Smoking status			
Never	2084 (67.4)	1869 (67.2)	215 (69.1)
Occasional/Former smoker	505 (17.3)	456 (17.7)	49 (13.8)
Current smoker	459 (15.4)	411 (15.2)	48 (17.1)
Pack-years of cigarette smoking	4.7 ± 0.6	4.7 (0.7)	5.0 (1.6)

Characteristics	All adults (n=3,049)	No asthma (n=2,737)	Current asthma (n=312)
Current wheeze	337 (10.7)	114 (3.9)	223 (69.9) [‡]
Physician-diagnosed COPD or emphysema	40 (1.07)	10 (0.3)	30 (8.1) [‡]
Exposure to violence, ever ^a	3.5 ± 0.1	3.5 ± 0.1	4.1 ± 0.2 [‡]
Generalized anxiety disorder	167 (5.2)	142 (4.9)	25 (7.6)
Major depressive disorder	306 (9.7)	253 (9.1)	53 (14.9) [‡]
Suicide attempt, ever	96 (2.8)	66 (2.1)	30 (9.0) [‡]

Results are shown as mean ± standard error (SE) for continuous variables, and as N (%) for binary variables. COPD, chronic obstructive pulmonary disease

^aPer each 1-point increment in the exposure to violence scale.

[‡]P<0.05

[‡]P<0.01 comparison between adults with and without current asthma

Table 2.

Multivariable analysis of psychosocial factors and current asthma

	Model 1	Model 2	Model 3	Model 4
Variables	Odds Ratio, 95% confidence interval			
Age	1.01 (0.99, 1.02)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.01 (0.99, 1.02)
Female gender	2.40 (1.73, 3.35) [‡]	1.93 (1.40, 2.66) [‡]	1.90 (1.37, 2.62) [‡]	2.31 (1.67, 3.19) [‡]
Body mass index (BMI) categories				
Normal weight (BMI < 25)	1.0	1.0	1.0	1.0
Overweight (BMI 25–29.9)	1.19 (0.83, 1.73)	1.25 (0.86, 1.80)	1.27 (0.88, 1.83)	1.21 (0.83, 1.76)
Obesity (BMI ≥ 30)	1.68 (1.18, 2.40) [‡]	1.70 (1.19, 2.42) [‡]	1.69 (1.18, 2.42) [‡]	1.71 (1.18, 2.46) [‡]
Smoking status				
Never	1.0	1.0	1.0	1.0
Occasional/former smoker	0.72 (0.49, 1.05)	0.80 (0.55, 1.17)	0.77 (0.52, 1.12)	0.70 (0.48, 1.02)
Current smoker	1.01 (0.65, 1.57)	1.25 (0.81, 1.93)	1.13 (0.72, 1.78)	0.97 (0.62, 1.52)
Pack-years of cigarette smoking	1.00 (0.98, 1.03)	1.00 (0.98, 1.03)	1.00 (0.98, 1.03)	1.00 (0.98, 1.03)
Physical activity				
Never	1.0	1.0	1.0	1.0
1–3 days/week	0.62 (0.42, 0.92) [‡]	0.65 (0.44, 0.96) [‡]	0.66 (0.45, 0.97) [‡]	0.64 (0.43, 0.95) [‡]
4 days/week	0.80 (0.57, 1.12)	0.84 (0.60, 1.18)	0.87 (0.61, 1.22)	0.83 (0.59, 1.18)
Exposure to violence, ever ^a	1.16 (1.10, 1.23)[‡]	-	-	1.14 (1.07, 1.21)[‡]
Major depressive disorder	-	1.56 (1.07, 2.27)[‡]	-	1.15 (0.75, 1.75)
Suicide attempt, ever	-	-	3.92 (2.42, 6.36)[‡]	3.01 (1.80, 5.01)[‡]

All models adjusting for monthly family income and employment

^aPer each 1-point increment in the exposure to violence scale.[‡]P<0.05[‡]P<0.01

Table 3.

Multivariable analysis of current asthma, stratified by smoking status

	Never smokers	Ever smokers (occasional/former/current)
	Odds Ratio, 95% confidence interval	
Age	1.00 (0.99, 1.01)	1.01 (0.99, 1.03)
Female gender	2.11 (1.41, 3.15) [‡]	2.69 (1.53, 4.74) [‡]
Body mass index (BMI) categories		
Normal weight (BMI < 25)	1.0	1.0
Overweight (BMI 25–29.9)	1.48 (0.94, 2.32)	0.68 (0.35, 1.31)
Obesity (BMI ≥ 30)	2.00 (1.31, 3.05) [‡]	1.09 (0.56, 2.12)
Pack-years of cigarette smoking	-	1.01 (0.98, 1.03)
Physical activity		
Never	1.0	1.0
1–3 days/week	0.59 (0.37, 0.94) [‡]	0.76 (0.39, 1.49)
4 days/week	0.86 (0.56, 1.32)	0.76 (0.42, 1.38)
Exposure to violence, ever ^a	1.12 (1.04, 1.20)[‡]	1.18 (1.08, 1.30)[‡]
Major depressive disorder	0.98 (0.57, 1.70)	1.30 (0.70, 2.42)
Suicide attempt, ever	3.72 (1.59, 8.73)[‡]	2.43 (1.17, 5.02)[‡]

All models adjusting for monthly family income and employment

^aPer each 1-point increment in the exposure to violence scale.[‡]P<0.05^{‡‡}P<0.01

Table 4.

Multivariable analysis of psychosocial factors and asthma/COPD overlap syndrome (ACOS)

	Model 1	Model 2	Model 3	Model 4
Variables	Odds Ratio, 95% confidence interval			
Age	1.08 (1.05, 1.11)[‡]	1.07 (1.04, 1.11)[‡]	1.08 (1.04, 1.11)[‡]	1.08 (1.04, 1.12)[‡]
Female gender	4.58 (1.44, 14.54)[‡]	3.33 (1.18, 9.46)[‡]	3.08 (1.08, 8.82)[‡]	3.58 (1.27, 10.10)[‡]
Body mass index (BMI)	1.09 (1.04, 1.15)[‡]	1.10 (1.04, 1.16)[‡]	1.10 (1.04, 1.16)[‡]	1.10 (1.04, 1.16)[‡]
Smoking status				
Never	1.0	1.0	1.0	1.0
Occasional/former smoker	1.10 (0.40, 3.02)	1.29 (0.47, 3.54)	1.01 (0.33, 3.07)	0.99 (0.30, 3.04)
Current smoker	2.91 (0.87, 9.76)	3.56 (1.10, 11.53)[‡]	2.58 (0.83, 8.01)	2.38 (0.74, 7.70)
Pack-years of cigarette smoking	0.97 (0.88, 1.08)	0.98 (0.89, 1.08)	0.99 (0.91, 1.06)	0.98 (0.90, 1.07)
Physical activity				
Never	1.0	1.0	1.0	1.0
1–3 days/week	0.31 (0.06, 1.66)	0.34 (0.06, 1.94)	0.34 (0.06, 2.02)	0.34 (0.06, 1.92)
4 days/week	0.97 (0.43, 2.66)	1.07 (0.48, 2.35)	1.09 (0.46, 2.55)	1.10 (0.47, 2.55)
Exposure to violence, ever ^a	1.21 (1.01, 1.45)[‡]	-	-	1.13 (0.94, 1.34)
Major depressive disorder	-	2.56 (1.02, 6.44)[‡]	-	1.46 (0.45, 4.76)
Suicide attempt, ever	-	-	12.79 (4.92, 33.22)[‡]	9.05 (3.32, 24.67)[‡]

All models adjusting for monthly family income

^aPer each 1-point increment in the exposure to violence scale.[‡]P<0.05[‡]P<0.01