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Childhood Abuse and Adult Onset Asthma among Peruvian Women

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Abstract**Objective**

Childhood abuse has been found to be associated with adult-onset asthma; however, this association has not been studied in low and middle income countries with a high burden of gender-based violence, including childhood abuse. We examined the odds of asthma diagnosed at age 18 or older in relation to history of physical and sexual abuse among Peruvian pregnant women.

Methods

This cross-sectional study collected demographic characteristics, history of abuse and asthma diagnoses from 3081 pregnant women. Logistic regression procedures estimated adjusted odds ratios and 95% confidence intervals (aOR,[95%CI]) for asthma diagnoses in relation to abuse.

Results

Overall, 71% of women reported a history of abuse (<18 years), and asthma was diagnosed among 2.6% of cohort participants. The prevalence of physical only, sexual only and both physical and sexual childhood abuse was 38%, 8% and 25%, respectively. History of physical only (1.16,[0.63-2.17]), sexual only (2.11,[0.92-4.84]) or both physical and sexual childhood abuse (1.75,[0.94-3.29]) were positively associated with increased odds of asthma, although the associations were not statistically significant in the multivariate analysis. However, the odds of asthma increased with increasing numbers of abuse events ($p_{\text{trend}}=0.01$). Women who reported ≥ 3 abuse events had an increased odds of asthma (1.88,[1.06-3.34]).

Conclusion

Our results do not provide convincing evidence that childhood abuse is associated with asthma among pregnant Peruvian women; however, we were able to demonstrate that an increased number of abuse events are associated with asthma. Further research is required to better understand the effects of abuse on asthma.

Introduction

The long-term consequences of adverse childhood experiences, including exposure to maltreatment, abuse and household dysfunction, were studied in several populations around the world. [1-6] Exposure to childhood adversity has been found to be associated with poor health during adulthood manifesting in the leading causes of adult morbidities, such as coronary heart disease [2-5, 7], stroke [3], diabetes [3-5, 7, 8], migraine [4, 9], chronic fatigue [4], psychiatric disorders [3, 10], and asthma [3-5, 11]. Asthma is a chronic inflammatory disease of the airways that can develop during childhood or adulthood causing significant burden and reduced quality of life. [12] According to the most recent Global Burden of Disease Study undertaken in 2008-2010, the number of people predicted to have asthma is 334 million worldwide. [13] Although asthma is most often discussed as a childhood illness, 8.6% of adults experience asthma symptoms with only 4.5% with a formal diagnosis. [13] Adult-onset asthma is associated with animal hypersensitivity, allergen hypersensitivity, rhinitis, age, family history and occupational exposure to irritants. [12] Historically, asthma studies were primarily conducted in high-income countries; however, asthma disproportionately affects low and middle income countries due to rapid urbanization. [13, 14] The prevalence of asthma among Peruvian adults is 14.5% in Lima compared to 7.4% of adults in the United States.[14, 15]

Some studies have documented associations between childhood abuse and adult-onset asthma [4, 16, 17] with varying theories about the mechanistic pathway. Some investigators theorize that stress during childhood can lead to alterations in the immune system and airways undergoing maturation or those early life stressors can lead to poor health behaviors and susceptibility to asthma. [16, 18] The association between childhood abuse and adult-onset asthma has not been

studied in low and middle income countries where there is a high burden of gender-based violence, including childhood abuse. Peru is an example of a low and middle income country that experiences a high prevalence of childhood abuse, including both physical and sexual abuse. [19] Abuse is a perpetual cycle because victims of childhood abuse have been found to have a greater likelihood of re-experiencing adulthood abuse. [20] Prior studies have found that childhood abuse among pregnant women in Peru is associated with poor perinatal and mental health outcomes. [21] These adverse childhood events may be associated with other medical sequelae manifesting in adulthood. Therefore, we conducted the present study to examine the extent to which history of physical and sexual childhood abuse is associated with adult-onset asthma among pregnant women in Peru. We suspect that children who experienced abuse, particularly those who had multiple abuse events, will be associated with adult-onset asthma.

Methods

Study population

The population for this cross-sectional study was drawn from the participants of the Pregnancy Outcomes, Maternal and Infant Study (PrOMIS) cohort, which was initially designed to study the relationship between maternal socio-behavioral characteristics and perinatal health outcomes by interviews conducted from 2012 to 2014. The study population consists of women who attended the prenatal care clinic at the Instituto Nacional Materno Perinatal in Lima, Peru, which is the main health institution for maternal perinatal referral operated by the Ministry of Health of Peru.

Trained research personnel recruited women in prenatal waiting areas by determining their interest and eligibility for study participation. Eligible women included those who were 16

weeks' gestation or less, initiated prenatal care prior to 16 weeks' gestation, were 18 years and older, could speak and read Spanish. A total of 3372 eligible women were interviewed using a structured questionnaire during February 2012 to July 2014. Interviews were conducted during the first prenatal care visits at the hospital in private rooms specifically designed for the study. Women missing information about childhood abuse (n=76) or about asthma (n=41) were excluded. A total of 3081 women remained for analysis. The institutional review boards of the Instituto Nacional Materno Perinatal in Lima, Peru, and the Harvard T.H. Chan School of Public Health Office of Human Research Administration, Boston, MA, approved all study procedures.

Diagnosis of asthma

Women were assessed for the diagnosis of asthma by responding to the question: "Did a doctor ever tell you that you have asthma?" If the respondent answered, "yes" to the initial asthma diagnosis question they were asked the follow-up question: "How old were you, when a doctor first told you that you had asthma?" For the present analysis, we excluded all participants that reported an asthma diagnosis before age 18 in order to ensure that childhood abuse exposure preceded asthma diagnosis.

Childhood abuse assessment

We used the Childhood Physical and Sexual Abuse Questionnaire to ascertain information about participants' experience with physical and sexual abuse during childhood. [9,16] We used a set of eight questions adapted from the Centers for Disease Control and Prevention Adverse Childhood Experiences Study to ask participants about their childhood abuse histories. [16] Respondents were considered to have experienced physical childhood abuse if she reported that she was hit, kicked, beaten often and/or her life was seriously threatened before the age of 18

years. Respondents were considered to have experienced sexual childhood abuse if she reported that an older person touched her, she was made to touch someone else in a sexual way, or intercourse was attempted or completed before the age of 18 years. Those who responded “no” to both physical and sexual childhood abuse questions were categorized as “no abuse.” Those who only responded “yes” to physical abuse questions were categorized as “physical abuse only.” Those who only responded “yes” to sexual abuse questions were categorized as “sexual abuse only.” Those who responded “yes” to physical abuse questions and “yes” to sexual abuse questions were categorized as “both physical and sexual abuse.” In addition, the number of childhood abuse events was assessed using a summation of the individual abuse questions that created numerical categories: 0, 1, 2, 3, 4, 5, 6, 7, and 8. The number of childhood abuse events were aggregated into four categories: 0, 1, 2, and 3-8.

Other covariates

Other collected information pertaining to maternal sociodemographic and medical characteristics include age, body mass index, ethnicity, marital status, reproductive history, education, employment, difficulty paying for basics, difficulty paying for medical care, as well as smoking and alcohol consumption. Age was measured continuously and in the following categories: 18-19, 20-29, 30-34, ≥ 35 years. An early pregnancy body mass index (based on measured weight and height during the study visit) was categorized into <18.5 , 18.5-24.9, 25-29.9, and ≥ 30.0 kg/m². Level of education was categorized as ≤ 6 , 7-12, and ≥ 12 completed years of schooling. The remaining covariates were binary variables: ethnicity (mestizo vs. other), marital status (married/living with partner vs. other), nulliparous (yes vs. no), planned pregnancy (yes vs. no),

employment (yes vs. no), difficulty paying for basics (yes vs. no), difficulty paying for medical care (yes vs. no), ever smoke (yes vs. no), and ever alcohol consumption (yes vs. no).

Statistical analysis

We assessed the association between maternal characteristics and history of childhood abuse using Chi-square tests, Fisher's exact tests and one-way analysis of variance (ANOVA). Logistic regression procedures were used to estimate maximum likelihood odds ratios (OR) and 95% confidence intervals (CI) for adult-onset asthma diagnosis in relation to categories of childhood abuse (i.e., no abuse, physical abuse only, sexual abuse only, and both physical and sexual abuse). We also estimated the odds of adult-onset asthma diagnosis in relation to number of childhood abuse events experienced. We adjusted for potential confounding covariates using *a priori* information from a study assessing childhood abuse and adult-onset asthma in the Black Women's Health Study.[16] The final multivariable logistic regression model included age, body mass index, difficulty paying for basics, education, as well as smoking and alcohol consumption. Multivariable logistic regression procedures were also used to estimate the trend for odds of adult-onset asthma diagnosis in relation to the number of childhood abuse events. Reported *p*-values are 2-tailed with an alpha level set to 0.05. All statistical analyses were performed using SAS 9.4 (SAS Institute, Cary, NC, USA).

Results

Sociodemographic characteristics of the study participants are presented in **Table 1**. Of the 3081 participants, the mean age was 28.4 years (standard deviation, SD, 6.3 years). Nearly 71% of study participants reported a history of physical or sexual abuse in childhood (<18 years of age). Approximately 2.6% of participants were diagnosed with adult-onset asthma. The prevalence of

childhood physical only, sexual only and both physical and sexual abuse was 38%, 8% and 25%, respectively. Study participant characteristics according to adult-onset asthma diagnosis are described in **Table 1**. The mean age of participants who reported adult-onset asthma was 31.6 years (SD 5.7) compared with 28.3 years (SD 6.3, $p=0.01$) for those who did not. Adult-onset asthma compared to no adult-onset asthma women had 21% vs. 29% no childhood abuse, 32% vs. 39% physical only, 14% vs. 8% sexual only, and 33% vs. 25% both physical and sexual abuse ($p=0.03$). The mean number of different childhood abuse events was 2.33 (SD 1.66) in participants with adult-onset asthma and 1.98 (SD 1.82) in participants without adult-onset asthma ($p=0.08$). Women with adult-onset asthma had a statistically significant higher prevalence of lifetime abuse than women without adult-onset asthma ($p=0.02$). The remaining sociodemographic covariates were not statistically different according to adult-onset asthma diagnosis. Study participants with varying childhood abuse exposures were statistically different in age ($p<0.01$), parity ($p<0.01$), planned pregnancy ($p=0.03$), difficulty paying for basics ($p<0.01$) and medication ($p<0.01$), alcohol history ($p<0.01$) and lifetime abuse ($p<0.01$). The association between childhood abuse history and adult-onset asthma is presented in **Table 2**. In unadjusted analyses, maternal history of childhood sexual abuse (OR=2.52; 95% CI 1.16-5.45) and history of both physical and sexual childhood abuse (OR=1.90; 95% CI 1.03-3.51) were found to be statistically significantly associated with increased odds of adult-onset asthma. However, these associations were attenuated and were no longer statistically significant after adjustments for confounding variables. For this multivariate analysis, compared with women who did not experience any childhood abuse, those who experienced childhood sexual abuse had 2.1-fold increased odds of adult-onset asthma (aOR=2.11; 95% CI 0.92-4.84), however the

association did not reach statistical significance. The corresponding odds for adult-onset asthma was 1.75 for women who experienced both physical and sexual abuse in childhood (aOR=1.75; 95% CI 0.94-3.29) as compared with women who experienced no childhood abuse. History of physical abuse alone in childhood was weakly and non-statistically significantly associated with adult-onset asthma in both unadjusted and adjusted analyses. We observed evidence of a positive linear trend in risk of adult-onset asthma with increasing numbers of childhood abuse events ($p_{\text{trend}} = 0.01$). As shown in the bottom panel of **Table 2**, women who reported experiencing ≥ 3 childhood abuse events, as compared with those who did not experience any childhood abuse had an increased odds of adult-onset asthma (OR=1.97; 95% CI 1.12-3.46). This association remained statistically significant after adjustments for confounding variables (aOR=1.88; 95% CI 1.06-3.34).

Discussion

Asthma is considered the 14th most burdensome disease in the world in terms of extent of duration and disability and therefore poses a global public health concern. [13] The results of our study provide some evidence suggestive of an association between history of childhood abuse with adult-onset asthma. Associations were particularly evident among women who reported multiple abuse events. Overall, findings from our study are generally consistent with reports from prior studies. [3, 5, 11, 16, 22-24] In their multi-country cross-sectional survey of adults (N=18 303) Scott and colleagues reported that physical abuse during childhood was associated with an increased risk of adult-onset asthma (HR=1.92; 95% CI 1.32-2.81), and the authors noted that risk increased with number of abuse events. [5] Recently, Coogan et al in their study of the Black Women's Health Study (N=28 456) reported a 1.24-fold increased risk of adult-onset

asthma among women who experienced any childhood abuse compared with women with no abuse during childhood (incident rate ratio (IRR) =1.24; 95% CI 1.06-1.45). Coogan also reported that exposure to physical abuse during childhood is associated with 1.26-fold increased risk of adult-onset asthma (IRR=1.26; 95% CI 1.07–1.49) while there was no evidence of increased risk of adult-onset asthma among those who reported childhood sexual abuse only (IRR=1.15; 95% CI 0.88–1.49) compared with the referent group (women with no abuse during childhood). [16] The discordance between our study findings and those of others could be due to a low statistical power from our small numbers of adult-onset asthma due to both, a decreased disease prevalence or undiagnosed cases. Future studies that investigate the relation between childhood abuse and adult-onset asthma are warranted because of the body of evidence suggesting an association among distinctly different populations.

Some caveats should be considered when interpreting our study findings. Our data is susceptible to misclassification of participants' medical histories. We did not have information pertaining to the participants' family history of asthma and environmental descriptors. In addition, our study results should be interpreted with caution given the relatively small number of adult-onset asthma cases. However, the study participants were at a young age and may have not yet had the opportunity to develop asthma in adulthood. Despite these limitations, our findings are generally consistent with reports from other cohorts and extend the extant literature by demonstrating associations of adult-onset asthma with frequent childhood abuse events in a LMIC population. Several mechanisms have been proposed to explain observed associations of adverse childhood experiences with increased risks of adult-onset asthma. Early life stressors are associated with

increased risks of adverse health behaviors such as smoking and alcohol abuse, which may contribute to increased asthma risk. [18] Alternatively, prior studies have reported associations of adverse childhood experiences with a myriad of chronic disorders including ischemic heart disease [2-5, 7], diabetes [3-5, 7, 8], obesity [2, 25], and respiratory disorders [3-5, 11, 18] which may contribute to increased risks of asthma. Finally, mouse models illustrate histopathological inflammatory changes of the respiratory tract when exposed to stressors. The mice demonstrated stress-induced narrowed airways and goblet cell hyperplasia, which are known features of human asthma pathogenesis. [26, 27] Regardless of the pathophysiologic processes involved, a small but growing literature supports the thesis that adversity during childhood, particularly, childhood physical and sexual abuse, may be associated with chronic lung disorders including adult-onset asthma. [18]

In conclusion, our study is the first to examine the association between exposures to childhood abuse specifically and adult-onset asthma in a LMIC setting. The high burden of childhood abuse in Peru and other LMIC settings makes studying the long-term health consequences of childhood adversity a highly important global public health priority. [19] Further research is required to better understand factors that buffer or mitigate lasting health effects of early life adversity, including childhood abuse, on adult-onset asthma and other chronic conditions.

Key Findings

Our study demonstrated a positive linear trend in risk of adult-onset asthma and increasing number of childhood abuse events. When adjusting for known confounders, women who reported ≥ 3 childhood abuse events have 1.9-fold increased odds of adult-onset asthma compared to women who did not experience childhood abuse.

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Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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Childhood Physical and Sexual Abuse

<i>Sometimes parents or other adults hurt children. While you were growing up, that is, during your first 18 years of life, how often did a parent, step-parent, or adult living in your home:</i>	Never	Once, twice	Some-times	Often	Very often
1. Actually push, grab, shove, slap you, or throw something at you?	1	2	3	4	5
2. Hit you so hard that you had marks or were injured?	1	2	3	4	5
3. Act in a way that made you afraid that you might be physically hurt?	1	2	3	4	5

<i>Some people, while growing up in their first 18 years of life, had a sexual experience with an <u>adult or someone at least five years older than themselves</u>. These experiences may have involved a relative family</i>	Yes	No
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<i>friend or stranger. During the first 18 years of life, did an adult or older relative, family friend or stranger ever:</i>		
4. Touch or fondle your body in a sexual way?	1	2
5. Have you touch their body in a sexual way?	1	2
6. Attempt to have any type of sexual intercourse (oral, anal, or vaginal) with you?	1	2
7. Actually have any type of sexual intercourse with you (oral, anal, or vaginal) with you?	1	2

* Felitti, V.J., Anda, R.F., Nordenberg, D. Williamson, D.F., Spitz, A.M., Edwards, V., Koss, M.P., Marks, J.S. 1998. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. Am J Prev Med 14(4):245-258.

Table 1. Demographics characteristics of the study population according to asthma diagnosis (N = 3081)

Characteristics	All participants (N=3081)		No adult-onset asthma (N=3000)		Adult-onset asthma (N=81)		<i>p</i> -value ^a
	n	%	n	%	n	%	
Age (years) ^b	28.36 ± 6.32		28.27 ± 6.32		31.59 ± 5.67		<0.0001
Age (years)							
18-19	146	4.74	146	4.87	0	0.00	0.0007
20-29	1697	55.08	1665	55.50	32	39.51	
30-34	657	21.32	636	21.20	21	25.93	
≥35	580	18.83	552	18.40	28	34.57	
Body mass index ^c							
<18.5	57	1.85	55	1.83	2	2.47	0.0793
18.5-24.9	1451	47.10	1425	47.50	26	32.10	
25-29.9	1127	36.58	1091	36.37	36	44.44	
≥30.0	404	13.11	388	12.93	16	19.75	
Mestizo	2329	75.59	2268	75.60	61	75.31	0.9575
Married	2516	81.66	2451	81.70	65	80.25	0.7680
Nulliparous	1472	47.78	1439	47.97	33	40.74	0.3946
Planned pregnancy	1313	42.62	1280	42.67	33	40.74	0.7357
Education							
≤6	139	4.51	135	4.50	4	4.94	0.1934
7-12	1689	54.82	1651	55.03	38	46.91	
>12	1242	40.31	1204	40.13	38	46.91	
Employed	1414	45.89	1375	45.83	39	48.15	0.7420
Difficulty paying for basics	1509	48.98	1469	48.97	40	49.38	0.9711

	No Asthma (N=3000)		Asthma (N=81)				
Difficulty paying for medical care	1619	52.55	1573	52.43	46	56.79	0.6693
Ever smoke	614	19.93	602	20.07	12	14.81	0.3886
Alcohol consumption	1408	45.70	1364	45.47	44	54.32	0.3069
Childhood abuse							
No abuse	896	29.08	879	29.30	17	20.99	0.0298
Physical only	1185	38.46	1159	38.63	26	32.10	
Sexual only	237	7.69	226	7.53	11	13.58	
Both physical and sexual	763	24.76	736	24.53	27	33.33	
Number of different child abuse events ^b	1.98 ± 1.82		1.98 ± 1.82		2.33 ± 1.66		0.0801
Lifetime abuse							
No abuse	1959	63.58	1916	63.87	43	53.09	0.0242
Physical only	726	23.56	705	23.50	21	25.93	
Sexual only	114	3.70	112	3.73	2	2.47	
Both physical and sexual	271	8.80	256	8.53	15	18.52	

^a Categorical variable *p*-values were calculated using Chi-square test or Fisher's exact test;

continuous variable *p*-values were calculated using one-way ANOVA

^b Mean ± standard deviation

^c Early pregnancy body mass index

Percentages may add up to less than 100% due to missing data

Childhood abuse	n	%	n	%	Unadjusted OR (95%	Adjusted OR (95%
No abuse	879	29.30	17	20.99	Reference	Reference
Physical abuse	1159	38.63	26	32.10	1.16 (0.63 – 2.15)	1.16 (0.63 – 2.17)
Sexual abuse	226	7.53	11	13.58	2.52 (1.16 – 5.45) ^b	2.11 (0.92 – 4.84)
Both physical and sexual abuse	736	24.53	27	33.33	1.90 (1.03 – 3.51) ^b	1.75 (0.94 – 3.29)
Number of child abuse	n	%	n	%	Unadjusted OR (95%	Adjusted OR (95%
0	879	29.30	17	20.99	Reference	Reference
1	580	19.33	11	13.58	0.98 (0.46 – 2.11)	0.83 (0.37 – 1.89)
2	359	11.97	8	9.88	1.15 (0.49 – 2.70)	1.13 (0.48 – 2.67)
3+ ^c	1182	39.40	45	55.56	1.97 (1.12 – 3.46) ^b	1.88 (1.06 – 3.34)
					$p_{trend} < 0.01$	$p_{trend} = 0.01$

Table 2. Association between childhood abuse and adult-onset asthma in Peruvian women (N=3081)

Abbreviations: OR, odds ratio; CI, confidence interval

^a Adjusted for age, body mass index, difficulty paying for basics, education, smoking history and alcohol consumption history

^b Statistically significant at $\alpha=0.05$

^c 3+ refers to number of child abuse events ranging from three to eight