The Associations between Area of Residence, Sexual Violence Victimization, and Asthma Episodes among US Adult Women in 14 States and Territories, 2005–2007

Robert M. Bossarte, Monica H. Swahn, and Ekta Choudhary

ABSTRACT *Gaps in understanding of how area-based differences in exposure to violence are associated with asthma prevalence may limit the development of effective prevention programs and the identification of risk for asthma episodes. The current investigation examines the associations between sexual violence victimization and asthma episodes among US adult women across three different metropolitan settings. The association between sexual assault victimizations and asthma attacks in the past year was examined using data from the 2005, 2006, and 2007 Behavioral Risk Factor Surveillance System surveys. Cross-sectional analyses were based on adult women with current asthma ($n=4,099$). Multivariate logistic regression models were used to identify associations between four categories of sexual violence victimization and asthma episodes across three categories of metropolitan and non-metropolitan settings. Our findings show that unwanted touching, attempted unwanted intercourse, forced unwanted intercourse, and any sexual violence victimization (touching, attempted intercourse, or forced intercourse) were significantly associated with asthma episodes ($OR_{adj}=3.67$, 95% CI, 1.76–7.69; $OR_{adj}=1.77$, 95% CI, 1.32–2.37; $OR_{adj}=2.24$, 95% CI, 1.64–3.05, and $OR_{adj}=1.93$, 95% CI, 1.47–2.53, respectively). While no significant differences in the associations between asthma episodes and metropolitan status were found, a significant interaction between non-metropolitan areas and attempted sexual intercourse was identified ($OR_{adj}=0.53$, 95% CI, 0.29–0.96). Sexual victimization appears to be an important, but understudied, correlate of asthma morbidity among adult women in the USA, suggesting that additional research is needed to better understand the associations between sexual violence, psychological distress, and asthma.*

KEYWORDS *Metropolitan, Sexual violence, Asthma, Prevention*

INTRODUCTION

An estimated 7% of US adults have asthma,¹ making asthma a critical clinical and public health problem.² Rising trends in asthma have been associated with exposure to community stressors, such as violence, in cross-sectional studies.^{3–5} Studies on youth in urban settings have found links between mental health, exposure to violence, and asthma morbidity or hospitalization.^{4,6–8} One recent researcher also

Bossarte is with the Department of Psychiatry, University of Rochester, Rochester NY, USA; Swahn is with the Institute of Public Health, Georgia State University, Atlanta, GA, USA; Choudhary is with the Department of Community Medicine, West Virginia University, Morgantown, WV, USA and with the Injury Control Research Center, West Virginia University, Morgantown, WV, USA.

Correspondence: Robert M. Bossarte, Department of Psychiatry, University of Rochester, 300 Crittenden Blvd, Box PSYCH, Rochester, NY 14262, USA. (E-mail: rhossarte@gmail.com)

found a synergistic effect between traffic-related air pollution and asthma among children that were exposed to violence in an urban setting.⁹

Some existing researchers have indicated that exposures to interpersonal or domestic violence are likely important risk factors for asthma episodes for both children and adults.^{7,10} However, few researchers have reported on the association between exposures to violence and asthma among adults, and they have focused primarily on non-US populations.^{10,11} One small study of US women and men did not find an association between sexual assaults and asthma.¹² However, the absence of a significant association may be explained in part by sample characteristics such as higher levels of socioeconomic status.¹³

The relationships between asthma and emotion are well established.^{14–16} An extensive review of existing research on the relationships between asthma and emotion have concluded that increasing asthma severity has been associated with psychological conditions such as depression, anxiety, and panic disorders and concluded that existing studies have been limited by a reliance on samples derived from patients of pulmonary clinics or those with more severe asthma.¹⁶ Studies of the relationships between asthma morbidity and experiences associated with increased stress using data from nationally representative samples of US adults could enhance existing knowledge of the relationships between stress exposures and asthma morbidity.

Previous research has identified urban, suburban, and rural differences in the associations between feelings of personal safety and interpersonal violence victimization and asthma episodes among school age youth.⁷ Despite reported differences in the associations between exposure to violence and asthma morbidity among youth in urban and rural settings,⁷ the associations between different forms of violence and asthma prevalence among US adults across places of residence has not yet been documented. The current investigation examines the associations between increasingly severe sexual violence victimization (unwanted touching, attempted sexual intercourse, and forced sexual intercourse) and asthma episodes among US adult women across three different metropolitan settings.

DATA AND ANALYTIC METHODS

Data Source

Analyses used data from the 2005, 2006, and 2007 Behavioral Risk Factor Surveillance System (BRFSS) surveys. BRFSS collects data from nationally representative samples of non-institutionalized US adults age 18 years and older in all 50 states and US territories.¹⁷ The median response rate among participating states was 51.1%, 51.4%, and 50.6% in 2005, 2006, and 2007, respectively.¹⁸

In 2005, 11 states or territories administered the optional adult asthma history and sexual violence modules. In 2006, only three states used both modules. In 2007, two states and one US territory used both modules. One state collected data on both modules in all 3 years, and two states collected data from both modules in 2005 and 2007, resulting in a total of 14 states over the study period. The current analyses include women who were told that they had asthma after the age of 10 years and reported still having asthma at the time of the interview ($n=4\ 831$).

Sexual Violence

Categories of sexual violence victimization included *unwanted touching* (past 12 months), *attempted unwanted intercourse* (lifetime), and *forced unwanted*

intercourse (lifetime) after the woman said no or without her consent. Respondents reporting any of these three categories of sexual violence victimization were combined to form a fourth category comprised of those reporting any form of lifetime sexual victimization.

Asthma and Demographic Characteristics

Participants were asked at least two questions about asthma: (1) “Have you ever been told by a doctor, nurse, or other health professional that you have asthma?” and (2) “During the past 12 months, have you had an episode of asthma or an asthma attack?” Participants reporting a history of asthma were also asked about the age of diagnosis and current asthma status. The outcome variable was having an asthma attack in the previous year.

Demographic measures included age, race, and education. Potential confounders included current cigarette smoking (past 30 days), physical exercise (past 30 days), self-perceived health status, frequency of social or emotional support, body mass index, number of routine health visits for asthma (past 12 months), and use of preventative asthma medications (past 30 days). A three-category measure of metropolitan status was constructed including metropolitan statistical area (MSA) center, MSA county (outside the center-city and inside a suburban county), and non-MSA categories.

Analysis

Chi-square tests of independence were calculated to identify statistically significant differences in the prevalence of asthma attacks and sexual violence victimization among participants from MSA center, MSA county, and non-MSA areas. Multivariate logistic regression models were calculated to identify the associations between sexual violence victimization and asthma attacks. Records with data missing for one or more of the study variables were omitted from the analytic sample. This reduced the sample size by 732 cases, resulting in a final analytic sample of 4,099 records. All estimates are based on records with complete data for all measures and were calculated using SAS (version 9.2) statistical software (SAS Institute, Cary, NC, USA). All analyses were weighted to adjust for non-response and sampling procedures.

RESULTS

The mean age among all women was 43.8 years, 64.2% (unweighted $n=2,521$) had attended at least some college, 80.7% (unweighted $n=3,371$) were non-Hispanic white, 7.9% (unweighted $n=314$) were non-Hispanic African-American, 4.6% (unweighted $n=128$) reported some other non-Hispanic racial category, 2.5% (unweighted $n=118$) reported being multiracial non-Hispanic, and 4.3% (unweighted $n=168$) reported a Hispanic ethnicity. Among all participants, 37.7% lived in the center city of a MSA, 41.9% lived outside of the center city but within a MSA, and 20.4% lived in non-MSA areas (Table 1). Chi-square analyses identified statistically significant differences in the prevalence of attempted forced sexual intercourse ($\chi^2=16.62$, $p=0.02$) and any sexual violence victimization intercourse ($\chi^2=11.48$, $p=0.04$).

Bivariate regressions identified statistically significant associations between asthma and all four measures of sexual violence (not shown). In fully adjusted multivariate models, victims of unwanted physical touching (past 12 months) were

TABLE 1 MSA/non-MSA differences in asthma attacks and sexual violence victimization among adult women reporting asthma, 2005–2007

	All areas % (95% CI), n = 4,099	MSA Center % (95% CI), n = 1,522	MSA % (95% CI), n = 1,319	Non-MSA % (95% CI), n = 1 258
Asthma attack	56.62 (53.92–59.32)	56.58 (52.47–60.70)	54.93 (50.24–59.63)	60.15 (55.25–65.05)
Unwanted touching	4.05 (2.60–5.50)	4.19 (1.93–6.45)	4.35 (1.68–7.02)	3.18 (1.39–4.97)
Attempted intercourse	25.29 (22.75–27.83)	26.86 (23.17–30.54)	26.18 (21.47–30.91)	20.54 (16.80–24.27)
Sexual intercourse	20.57 (18.25–22.88)	22.95 (19.21–26.69)	18.45 (14.48–22.41)	20.50 (16.57–24.43)
Any victimization	31.00 (28.36–33.65)	33.45 (29.46–37.44)	30.64 (25.86–35.43)	27.21 (22.97–31.44)

TABLE 2 Associations between asthma episodes and sexual violence victimization controlling for demographic factors and potential confounders, 2005–2007 (n = 4,099)

	Unwanted touching, OR _{Adj.} (95% CI)	Attempted intercourse, OR _{Adj.} (95% CI)	Forced intercourse, OR _{Adj.} (95% CI)	Any victimization, OR _{Adj.} (95% CI)
Age	0.99 (0.99–1.00)	0.99 (0.98–1.00)	0.99 (0.99–1.00)	0.99 (0.99–1.00)
Race				
African-American, Non-Hispanic	0.69 (0.47–1.01)	0.73 (0.50–1.06)	0.72 (0.50–1.04)	0.72 (0.49–1.05)
Other, Non-Hispanic ^a	0.94 (0.49–1.81)	1.04 (0.53–2.02)	0.98 (0.52–1.87)	1.04 (0.54–1.99)
Multiple-Race, Non-Hispanic	0.88 (0.50–1.54)	0.84 (0.47–1.51)	0.94 (0.52–1.70)	0.84 (0.47–1.51)
Hispanic	0.96 (0.6101–1.55)	0.97 (0.60–1.58)	0.95 (0.60–1.52)	0.95 (0.59–1.54)
Education (some college or more)	1.23 (0.97–1.56)	1.18 (0.93–1.51)	1.21 (0.95–1.54)	1.17 (0.92–1.50)
Current cigarette smoking (any)	1.15 (0.88–1.50)	1.09 (0.83–1.44)	1.07 (0.81–1.41)	1.09 (0.82–1.43)
BMI				
Overweight	0.83 (0.63–1.11)	0.83 (0.62–1.11)	0.81 (0.60–1.08)	0.82 (0.62–1.10)
Obese	1.07 (0.80–1.42)	1.01 (0.75–1.34)	1.00 (0.75–1.34)	1.01 (0.75–1.35)
Exercise (any in past 30 days)	1.00 (0.75–1.33)	0.99 (0.74–1.31)	0.97 (0.73–1.30)	0.98 (0.73–1.30)
Routine health visits for asthma	1.91 (1.49–2.43)	1.91 (1.50–2.45)	1.93 (1.51–2.47)	1.91 (1.49–2.44)
Use of preventive asthma medications	1.98 (1.54–2.54)	2.01 (1.56–2.59)	1.98 (1.54–2.55)	2.03 (1.57–2.62)
Emotional support (always or usually)	0.92 (0.70–1.20)	0.96 (0.73–1.26)	0.96 (0.73–1.27)	0.99 (0.75–1.30)
Health status (good–excellent)	0.72 (0.55–0.94)	0.71 (0.54–0.92)	0.76 (0.58–0.99)	0.73 (0.56–0.95)
MSA county	0.95 (0.74–1.24)	0.96 (0.74–1.25)	0.98 (0.75–1.28)	0.97 (0.74–1.26)
Non-MSA	1.17 (0.87–1.57)	1.20 (0.89–1.62)	1.18 (0.88–1.59)	1.21 (0.90–1.26)
Victimization				
Unwanted touching	3.67 (1.76–7.69)	–	–	–
Attempted unwanted intercourse	–	1.77 (1.32–2.37)	–	–
Forced unwanted intercourse	–	–	2.24 (1.64–3.05)	–
Any victimization	–	–	–	1.93 (1.47–2.53)

BMI body mass index

^aIncludes Asian, Native Hawaiian, American Indian, and Alaskan Native. Statistically significant associations in bold. Reference groups are white, high school education or less, non-smoker, normal or underweight, no exercise in past 30 days, no routine health visits for asthma, no preventive asthma medications, emotional or social support available rarely or never, fair or poor health status, and MSA Center areas

nearly four times more likely ($OR_{adj.}=3.67$, 95% CI, 1.76–7.69) to report an asthma episode in the past 12 months when compared to women reporting no unwanted touching (Table 2). Similarly, victims of attempted intercourse ($OR_{adj.}=1.77$, 95% CI, 1.32–2.37), victims of forced intercourse ($OR_{adj.}=2.24$, 95% CI, 1.64–3.05), and victims of any form of sexual violence ($OR_{adj.}=1.93$, 95% CI, 1.47–2.53) were significantly more likely to report an asthma episode than women reporting no sexual assault victimization. The strongest association between sexual violence and asthma attacks was observed for those reporting unwanted touching in the last 12 months, followed by forced sexual intercourse and attempted sexual intercourse. When combined into a single victimization category, those reporting any of the three forms of sexual violence included in this study were nearly twice as likely to report an asthma attack in the past 12 months when compared to women who had reported no sexual victimization.

While the percentage of participants reporting an asthma episode was higher in non-MSA areas, no significant differences in the associations between area of residence and asthma attacks in the last 12 months were identified in the logistic regression models. However, a statistically significant interaction term for attempted forced sexual violence intercourse and residence in a non-MSA area was significantly associated with lower odds of an asthma attack ($OR_{adj.}=0.53$, 95% CI, 0.29–0.96). Thus, women who were victims of unwanted attempted sexual intercourse and reported living in non-MSA areas were less likely to report an asthma attack during the last 12 months when compared to victims of sexual violence in MSA center and MSA county areas. No other significant interactions between area of residence and sexual violence were identified.

In addition to measures of sexual violence victimization, increasing age and self-reported health status of good or better were associated with statistically significant reductions in the odds of an asthma attack. Both routine health visits for asthma and use of preventive asthma medications were associated with statistically significant increases in the odds of an asthma episode in the 12 months prior to survey participation (Table 2).

DISCUSSION

Our findings are consistent with previous analyses of victims of domestic violence and show that sexual victimization may also be an important stressor for asthma episodes.^{10,11} Paradoxically, the association between sexual violence and asthma attacks was strongest for women reporting unwanted physical touching when compared to attempted and completed sexual intercourse. However, it is possible that the limitation of events to the past 12 months resulted in the identification of a stronger association than incidents that may have occurred in a more distant past. Consistent with the associations identified in this study, previous analyses have identified an exacerbation in asthma symptoms in the time period immediately following a stressful life event that decreases over time.¹⁹ Despite the unexpected strength of the association between unwanted touching and asthma attacks, forced sexual intercourse was associated with greater odds of reporting an asthma attack when compared to attempted sexual intercourse.

Exposure to violence and other psychosocial stressors have emerged as critical risk factors in studies of both children and adults. The authors of one recent study of asthma in children suggested that future research should consider socially patterned susceptibility and the potential synergistic effects among these factors to better

understand asthma etiology.⁹ The findings of this study support the proposed link between psychosocial stress and asthma morbidity and identifies an interaction between area of residence and asthma episodes. Victims of sexual violence in our study were significantly more likely to report routine health care visits and preventive medication use to control their asthma, which suggests that sexual violence may be associated with greater asthma morbidity. Access to, and utilization of, primary care for asthma may be an important mechanism for reducing morbidity among victims of sexual violence.

The findings in this report are subject to several limitations. First, the results of this study may not generalize to those that were not captured by the sampling frame or chose not to participate. Second, histories of asthma episodes and sexual victimization were self-reported and subject to reporting bias, particularly under-reporting.^{20,21} The data do not permit an assessment of the temporal ordering between sexual victimization and asthma episodes. The data also do not allow for the consideration of factors such as seasonality and allergen sensitization that may be associated with asthma morbidity. The analyses do not consider many potential mediators and moderators that may link stressors such as sexual victimization with asthma.^{4,22} Finally, the smaller samples of women living outside of MSA Center areas may have affected our ability to identify statistically significant relationships.

Researchers have emphasized the importance of expanding asthma research to include factors beyond the physical environment and modifiable factors other than allergen sensitization.^{23–25} Moreover, there is growing support for integrated biopsychosocial approaches for asthma research, prevention, and control.²⁶ The identification of a significant interaction effect between attempted unwanted sexual intercourse and asthma attacks suggests that local environment may modify the relationships between sexual victimization and asthma morbidity. Efforts to implement research activities and prevention programs that increase knowledge of the relationships between local social-psychological environments and asthma and target the reduction of violence may reduce asthma morbidity and could contribute to a better understanding of the associations between psychosocial stressors and chronic disease.

REFERENCES

1. Akinbami L. *Asthma Prevalence: Health Care Use and Mortality: United States, 2003–2005*. Bethesda, MD: National Center for Health Statistics; 2006.
2. Mannino D, Home D, Akinbami L, Moorman J, Gwynn C, Redd S. *Surveillance for Asthma—United States 1980–1999*. Atlanta, GA: Centers for Disease Control and Prevention; 2002.
3. Federal Interagency Forum on Child and Family Statistics. *America's Children: Key National Indicators of Well-being*. Washington, DC: US Government Printing Office; 2001.
4. Wright R, Mitchell H, Visness C, et al. Community violence and asthma morbidity: the inner city asthma study. *Am J Public Health*. 2004;94(4):625–632.
5. Wright R, Steinbach S. Violence: an unrecognized environmental exposure that may contribute to greater asthma morbidity in high risk inner-city populations. *Environ Health Perspect*. 2001;9(10):1085–1089. doi:10.2307/3454965.
6. Weil C, Wade S, Mauman L, Lynn H, Mitchell H, Lavigne J. The relationship between psychosocial factors and asthma morbidity in inner city children with asthma. *Pediatrics*. 1999;104(6):1274–1280. doi:10.1542/peds.104.6.1274.
7. Swahn M, Bossarte R. The associations between victimization, feeling unsafe and asthma episodes among US high school students. *Am J Public Health*. 2006;96(5):802–804. doi:10.2105/AJPH.2005.066514.

8. Jeffrey J, Sternfeld I, Tager R. The association between childhood asthma and community violence, Los Angeles County, 2000. *Public Health Rep.* 2006;121:720–728.
9. Clougherty J, Levy J, Kubzansky L, et al. Synergistic effects of traffic-related air pollution and exposure to violence on urban asthma etiology. *Environ Health Perspect.* 2007;115(8):1140–1146.
10. Loxton D, Schofield M, Hussain R, Mishra G. History of domestic violence and physical health in midlife. *Violence Against Women.* 2006;12:715–731. doi:10.1177/1077801206291483.
11. Subramanian S, Ackerson L, Suramanyam M, Wright R. Domestic violence is associated with adult and childhood asthma prevalence in India. *Int J Epidemiol.* 2007;36:569–579. doi:10.1093/ije/dym007.
12. Stein M, Barrett-Connor E. Sexual assault and physical health: findings from a population-based study of older adults. *Psychosom Med.* 2000;62:838–843.
13. Pleis J, Lethbridge-Cujku M. *Summary Health Statistics for U.S. Adults: National Health Interview Survey, 2005.* Bethesda, MD: National Center for Health Statistics; 2006.
14. Lehrer PM. Emotionally triggered asthma: a review of research literature and some hypotheses for self-regulation therapies. *Appl Psychophysiol Biofeedback.* 1998;23:13–41. doi:10.1023/A:1022170028979.
15. Lehrer PM, Isenberg S, Hochron SM. Asthma and emotion: a review. *J Asthma.* 1993;30:5–21. doi:10.3109/02770909309066375.
16. Lehrer PM, Feldman J, Giardino N, Song H, Schmaling K. Psychological aspects of asthma. *J Consult Clin Psychol.* 2002;70:691–711. doi:10.1037/0022-006X.70.3.691.
17. CDC. *Health Risks in the United States: Behavioral Risk Factor Surveillance System.* Atlanta, GA: Centers for Disease Control and Prevention; 2007.
18. CDC. *Behavioral Risk Factor Surveillance Survey [online].* Available at <http://www.cdc.gov/brfss>. Accessed on January 18, 2008.
19. Sandberg S, Jarvenpaa S, Penttinen A, McCann DC. Asthma exacerbations in children immediately following a stressful life event. *Thorax.* 2004;59(12):1046–1051. doi:10.1136/thx.2004.024604.
20. Abbey A, Parkhill M, Koss M. The effects of frame of reference on responses to questions about sexual assault victimization and perpetration. *Psychol Women Q.* 2005;29(4):364–373. doi:10.1111/j.1471-6402.2005.00236.x.
21. Koss M. Detecting the scope of rape—a review of prevalence research methods. *J Interpers Violence.* 1993;8(2):198–222. doi:10.1177/088626093008002004.
22. Klennert M. Evaluating the effects of stress on asthma: a paradoxical challenge. *Eur Respir J.* 2003;22:574–575. doi:10.1183/09031936.03.00067903.
23. Sandel S, Wright R. When home is where the stress is: expanding the dimensions of housing that influence asthma morbidity. *Arch Dis Child.* 2006;91(11):942–948. doi:10.1136/adc.2006.098376.
24. Wisnivesky J, Sampson H, Berns S, Kattan M, Halm E. Lack of association between indoor allergen sensitization and asthma morbidity in inner-city adults. *J Allergy Clin Immunol.* 2007;120(1):113–120. doi:10.1016/j.jaci.2007.03.044.
25. Chen E, Miller G. Stress and inflammation in exacerbations of asthma. *Brain Behav Immun.* 2007;21:993–999.
26. Wright R, Rodriguez M, Cohen S. Review of psychosocial stress and asthma: an integrated biopsychosocial model. *Thorax.* 1998;53:1066–1074.