



Exposure to gun violence and asthma among children in Puerto Rico



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Summary

Background and objectives: Although community violence may influence asthma morbidity by increasing stress, no study has assessed exposure to gun violence and childhood asthma. We examined whether exposure to gun violence is associated with asthma in children, particularly in those reporting fear of leaving their home.

Methods: Case-control study of 466 children aged 9–14 years with (n = 234) and without (n = 232) asthma in San Juan, Puerto Rico. Lifetime exposure to gun violence was defined as hearing a gunshot more than once. We also assessed whether the child was afraid to leave his/her home because of violence. Asthma was defined as physician-diagnosed asthma and wheeze in the prior year. We used logistic regression for the statistical analysis. All multivariate models were adjusted for age, gender, household income, parental asthma, environmental tobacco smoke, prematurity and residential distance from a major road.

Results: Cases were more likely to have heard a gunshot more than once than control subjects (n = 156 or 67.2% vs. n = 122 or 52.1%, P < 0.01). In a multivariate analysis, hearing a gunshot more than once was associated with asthma (odds ratio [OR] = 1.8, 95% confidence interval [CI] = 1.1–1.7, P = 0.01). Compared with children who had heard a gunshot not more than once and were not afraid to leave their home because of violence, those who had heard a gunshot more than once and were afraid to leave their home due to violence had 3.2 times greater

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odds of asthma (95% CI for OR = 2.2–4.4, $P < 0.01$).

Conclusions: Exposure to gun violence is associated with asthma in Puerto Rican children, particularly in those afraid to leave their home. Stress from such violence may contribute to the high burden of asthma in Puerto Ricans.

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Introduction

Asthma is the most common chronic disease of childhood in the United States (U.S.). In this country, asthma causes 46.7 million school, work and activity days lost per year [1]. For unclear reasons, there is marked racial or ethnic variability in asthma morbidity. Compared with non-Hispanic whites, Puerto Ricans and African Americans have greater morbidity from asthma [2].

Puerto Ricans are often exposed to violence in their communities [3–5]. Moreover, current evidence suggests that Puerto Ricans are particularly susceptible to developing psychosocial stress after exposure to violent events [6,7]. For example, Puerto Ricans were more likely to have post-traumatic stress disorder (PTSD) symptoms or panic attacks after September 11th of 2001 than members of other ethnic groups [6]. Increased stress resulting from exposure to violent or traumatic events (such as physical or sexual abuse) may partly explain the high burden of childhood asthma in Puerto Ricans [5,8].

The U.S. has the highest rate of firearm-related deaths of all industrialized countries [9]. The recent and highly publicized mass shootings in Newtown, CT; Aurora, CO; Oak Creek, WI; and Tucson, AZ, have raised concerns about harmful effects of firearms. Fatal and nonfatal firearm violence not only poses a serious threat to public safety, but may have detrimental effects on both psychiatric and somatic health [10].

We previously reported that exposure to violence at the individual or community level is associated with asthma in Puerto Rican children [5,8]. On the basis of these findings, we hypothesized that exposure to gun violence (a severe form of violence) affects asthma risk in Puerto Rican children. Moreover, we hypothesized that this detrimental effect is worse in children expressing fear related to violence. To test these hypotheses, we examined exposure to gun violence and asthma in 466 Puerto Rican children with ($n = 234$) and without ($n = 232$) asthma living in San Juan (Puerto Rico).

Methods

Subject recruitment

From March of 2009 to June of 2010, children in San Juan (PR) were chosen from randomly selected households, as previously described [11]. In brief, households in metropolitan San Juan were selected using a multistage probability sample design [11]. Primary sampling units (PSUs) were randomly selected neighborhood clusters based on

the 2000 U.S. census, and secondary sampling units were randomly selected households within each individual PSU. A household was eligible if ≥ 1 resident was a child 6–14 years old. Of the 7073 eligible households, 6401 (91%) were contacted. Of these 6401 households, 1111 had at least one child who met inclusion criteria: age 6–14 years, four Puerto Rican grandparents (to ensure Puerto Rican descent) and residence in the same household for at least one year. Of these 1111 households, 438 (39.4%) had ≥ 1 eligible child with asthma (a case, defined as having physician-diagnosed asthma and at least one episode of wheeze in the prior year). From these 438 households, one child with asthma was selected (at random if there was more than one such child). Similarly, only one child without asthma (a control subject, defined as having neither physician-diagnosed asthma nor wheeze in the prior year) was randomly selected from the remaining 673 households. In an effort to reach a target sample size of ~ 700 children (which would give us $\geq 90\%$ power to detect an odds ratio ≥ 2 for exposures with a prevalence $\geq 25\%$), we attempted to enroll a random sample ($n = 783$) of these 1111 children. Parents of 105 (13.4%) of these 783 children refused to participate or could not be reached, leaving 678 study participants (351 cases and 327 control subjects). There were no significant differences in age, gender, or area of residence between eligible children who did ($n = 678$) and did not ($n = 105$) agree to participate. Of the 678 study participants, 472 were aged 9 years and older, and thus eligible to complete a questionnaire on exposure to violence; 466 (98.7%) of these 472 children completed this questionnaire and are included in the current analysis (see below).

Study procedures

Study participants completed a protocol that included questionnaires and collection of blood samples. The child's mother completed a questionnaire on the child's respiratory and general health, which was used to obtain information about demographics, socioeconomic status, family history, and exposure to environmental tobacco smoke (ETS) [12]. Exposure to violence was ascertained using a modified version of the Survey of Children's Exposure to Community Violence (ETV), which was designed for children older than 8 years [13]. Children ages 9 years and older completed this ETV Survey and another questionnaire on perceived neighborhood safety, and were thus included in this analysis [14–16]. The ETV survey specifically measures both witnessing 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 primary caregiver (see Table E1 in the

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