Relationship of Basic Military Trainee Emergency Department Visits for Asthma and San Antonio Air Quality

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ABSTRACT

The U.S. Air Force conducts basic military training (BMT) in San Antonio, TX, an area with occasionally adverse air quality. Many individuals from the BMT population are evaluated for asthma symptoms. The relationship of air quality with these symptoms has not been studied in this population. This study examines the correlation of several air quality indicators in relation to emergency department (ED) visits for asthma from the BMT population. The variables studied were basic trainee ED visits for asthma, the 8-hour air quality index (AQI) for ozone, and the 24-hour AQI for particulate matter <2.5 μm for the San Antonio metropolitan area, daily pollen and fungal spore counts, and daily high temperature. The ED visits were obtained by retrospective review of medical records. Basic trainees reporting asthma symptoms often are referred to the allergy/immunology department for evaluation. The ED visits for only those patients who were later formally diagnosed with asthma were correlated also with the air quality indicators. Pearson correlation coefficients were calculated for all data pairs. There were 149 ED visits meeting inclusion criteria for the period of time studied (328 days). Forty-one percent of the basic trainees seen in the ED for asthma symptoms were later formally diagnosed with asthma in the allergy/immunology department. There was no significant correlation between basic trainee ED visits for asthma and the selected air quality indicators. Air quality does not significantly correlate with the occurrence of ED visits for asthma from the BMT population. (Allergy and Asthma Proc 26:463–467, 2005)

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The U.S. Air Force provides basic military training (BMT) to ~43,000 recruits every year at Lackland Air Force Base in San Antonio, TX. Individuals with a history of asthma are excluded from BMT in the Air Force. Nevertheless, many basic trainees present with symptoms consistent with asthma during BMT. Trainee health (the primary care clinic for BMT) refers these patients to Wilford Hall Medical Center, also located at Lackland Air Force Base, for evaluation. Over 750 trainees are evaluated annually in the Wilford Hall Medical Center allergy/immunology department for symptoms consistent with asthma.

There are studies that show a link between air quality and asthma symptoms, but the exact role of various pollutants or other variables is unclear. Experimental studies have shown a decrement in lung function during exposure to ozone. One study exposed asthmatic patients to ozone at rest and found a nonsignificant trend to decreased lung function in only

one lung function parameter, the maximum expiratory flow rate at 50% of vital capacity, when compared with exposure to air.[1] Two of the studies[2,3] exposed both asthmatic and nonasthmatic patients to ozone during exercise and found significantly greater decrement in lung function in the asthmatic groups compared with the nonasthmatic groups.

Other studies have examined emergency department (ED) visits or hospital admissions for asthma with respect to several air quality indicators. A study in Cincinnati found a significant association between pediatric ED visits and admissions for asthma with pollen and particulate matter (PM) levels but not with ozone or fungal spore levels.[4] An Israeli study found positive correlations between pediatric ED visits for asthma and nitrogen oxides and sulfur dioxide levels and also with high barometric pressure, but a negative correlation with ozone levels.[5] A New Jersey study found a significant correlation between ozone levels and ED visits for asthma only when temperature was controlled for in a multiple regression analysis.[6]

Another study examined the correlation of ozone and PM < 2.5 μm with regard to symptom scores and rescue medication use.[7] The authors found that ozone levels were associated with increased symptoms and rescue medication use in asthmatic children who were users of maintenance medication, even when ozone levels did not exceed current Environmental Protection Agency (EPA) standards. Finally, during the 1996 Summer Olympic Games in Atlanta, investigators found that changes in commuting patterns led to lower ozone levels that were associated with fewer pediatric acute care visits and hospitalizations for asthma.[8]

San Antonio is in nonattainment with the Clean Air Act under the 8-hour air quality index (AQI) standard for ozone (Air quality health alert plan. Available at: http://www.sanantonio.gov/ENVIRO/EMD/pdf/2001AirQualityAlertPlan.pdf; accessed May 23, 2004; A look at air quality, ozone pollution, and the San Antonio region. Available at: http://www.aacog.dst.tx.us/air/WhatWeDo/ALook.htm; accessed May 23, 2004). Ozone is the most significant pollutant in San Antonio and ozone exceeded healthy levels during the study period.

Given concern about the adverse effects of ozone on public health, media in San Antonio broadcast air quality warnings based on EPA standards (Guideline for reporting of daily air quality—air quality index. EPA-454/R-99-010, July 1999. Available at www.epa.gov/ttn/oarpg/t1/memoranda/rg701.pdf; May 23, 2004). Many public school systems (including those in San Antonio) alter outdoor physical activity for children based on air quality indicators. Currently, physical training during BMT is altered according to the heat index but not according to other air quality indicators.

The primary objective of this study is to determine the correlation between several air quality indicators in San Antonio with ED visits for asthma from the BMT population at Lackland Air Force Base. Secondary objectives are to determine how many of the basic trainees who were evaluated in the ED for asthma symptoms went on to be formally diagnosed with asthma in the allergy/immunology department and then to determine the relationship of air quality with ED visits for asthma for only those trainees who were formally diagnosed with asthma. There are no other studies identified that evaluate air quality's association with asthma symptoms in a population of military recruits.

METHODS

This study retrospectively examined data for the period of October 1, 2001–August 24, 2002 and was approved by the Wilford Hall Medical Center Institutional Review Board. This period included the summer "ozone season" and also included computerized data on asthma evaluations in the allergy/immunology department. The selected air quality variables were the 8-hour AQI for ozone and the 24-hour AQI for PM < 2.5 μm for the San Antonio metropolitan area, daily pollen and fungal spore counts, and the daily high temperature.

Ozone and PM data were obtained from the Texas Commission on Environmental Quality (TCEQ) website (Texas Commission on Environmental Quality. Available at: http://www.tnrcc.state.tx.us/cgi-bin/monops/psi_rpt; accessed May 23, 2004). There are several TCEQ monitoring stations in the San Antonio metropolitan area, but no station was adjacent to Lackland Air Force Base; therefore, the AQI for each pollutant was used rather than raw measurements of the pollutants. AQI values are calculated for each individual pollutant at each individual station, and then the highest AQI value of each pollutant for a given metropolitan area is reported daily (personal communication, Bryan Lambeth, PE, TCEQ Monitoring Operations Division). An explanation of the generation of AQI values has been published elsewhere (Guideline for reporting of daily air quality—air quality index (AQI). EPA-454/R-99–010, July 1999. Available at: http://www.epa.gov/ttn/oarpg/t1/memoranda/rg701.pdf; accessed May 23, 2004). For the 8-hour air quality standard, the peak running average for the 8 hours after midnight is reported and the 24-hour air quality standard represents the average as sampled from midnight to midnight (TCEQ. Available at: http://www.tnrcc.state.tx.us/cgi-bin/monops/psi_rpt; accessed May 23, 2004). The highest 8-hour AQI for ozone observed during the study period was 164, which corresponded to an ozone concentration of 110 ppb.

Pollen and mold spore data were provided by Sylvana Research, San Antonio, TX (Paul H. Ratner, M.D., unpublished data, 2003) Pollen and mold spores were collected using an Allergenco MK-III instrument (Environmental Monitoring Systems, Charleston, SC) located in north central San Antonio in a partially developed residential neighborhood. Counts are taken every 2 hours for 10 minutes, 24 hours a day, excluding holidays, and the highest count for