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Urban–rural differences in the prevalence of allergen sensitization and self-reported rhinitis in the elderly population

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ABSTRACT

Background: Urbanization is frequently associated with allergic conditions during childhood; however, the literature lacks studies on the association between allergies and degree of urbanization in the elderly population.

Objective: To determine how the degree of urbanization affects the prevalence of allergic sensitization and self-reported rhinitis symptoms in elderly community populations.

Methods: The study population consisted of 1,311 elderly subjects identified from 2 community population cohort datasets who were divided into 3 groups according to the degree of urbanization (urban, semirural, and rural) where they resided. Current rhinitis symptoms were assessed using a questionnaire. Sensitization to inhalant allergen was measured using skin prick tests for 9 common allergens.

Results: Sensitization to inhalant allergen showed a positive correlation with degree of urbanization (urban 17.2%, semirural 9.8%, rural 6.0%; *P* for trend <.001), with a significant correlation observed between house dust mite allergens and degree of urbanization. Self-reported rhinitis symptoms were mostly nonallergic, but showed a positive correlation with degree of urbanization (urban 26.8%, semirural 18.2%, rural 11.5%; *P* for trend <.001). Self-reported rhinoconjunctivitis also correlated with urbanization. Correlations between self-reported allergic conditions and urbanization remained statistically significant in multivariate logistic regression tests.

Conclusion: The present analyses found significant correlations between degree of urbanization with self-reported rhinitis symptoms and sensitization to inhalant allergen in the elderly population. These findings warrant further investigation of the roles that urban factors play in the development of elderly rhinitis and allergen sensitization.

Introduction

During the past century, there have been dramatic changes in the population and health profile. Global life expectancy at birth nearly doubled from 34.1 years in 1913 to 66.6 years in 2001.[1] Increases in life expectancy have been attributed to advances in hygiene and medicine, thus decreasing communicable diseases. However, this has been accompanied by a paradoxical increase in non-communicable diseases, including allergies.[2] Because increases in the prevalence of

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allergies cannot be explained by genetic factors alone, other factors have been explored. The hygiene hypothesis proposes that hygiene and the environment in which individuals live are associated with an increased prevalence of allergies.[3]

Urbanization results from different environmental changes, including medical advances, improvements in hygiene, better socioeconomic conditions, Westernized lifestyles, loss of biodiversity, and increased air pollution. It has been frequently associated with increased risks of allergies in children and young adults[4–13]; however, effects of urbanization on elderly populations have rarely been examined.

Although the elderly population is expected to double by 2030[14] and the burden of allergic conditions in the elderly appears to be substantial,[15–18] the pathophysiology of allergies in the elderly population remains unclear. In a previous study,[19] the authors found a high prevalence of self-reported rhinitis (25.6%) and inhalant allergen sensitization (17.2%) in an urban elderly population; however, this was not clearly explained by host factors, including comorbidities. Because allergic conditions can be influenced by environmental factors, the authors hypothesized that allergies in the elderly could be associated with urban environments. To test this hypothesis, the authors used cohorts from urban and rural communities to assess the effects of urbanization degree on the prevalence of allergic conditions in the elderly.

Methods

Study Population

Data for analyses were collected using a cross-sectional survey drawn from 2 populations of community-dwelling elderly people. The sample of elderly people from the urban community was drawn from the Korean Longitudinal Study on Health and Aging.[20] This cohort originally consisted of 1,000 elderly adults living in one of the largest metropolitan cities, Seongnam, South Korea. Random samples were prepared from a roster of 61,730 elderly residents using computer-generated random sampling. They were invited to participate by letter and telephone. Of the original participants, 147 subjects did not undergo skin prick tests. Thus, the present analysis includes 853 subjects who completed the relevant questionnaire and skin prick tests.

The sample of elderly people from rural or semirural communities was drawn from the Changwon–Sancheong population cohort study,[21] which originally recruited 1,116 adults (≥30 years old) living in Changwon or Sancheong, South Korea. These cities are predominantly agricultural; however, the region of Buk-meon in Changwon is defined as semirural, and Shinan-meon in Sancheong is considered rural. Random distribution of information sheets and contact were used to recruit participants; a total of 1,116 adult subjects were recruited from a target population of 17,474 residents (616 subjects from 5,526 Sancheong residents and 500 subjects from 11,968 Changwon residents). In the present analysis, all elderly adults ($n = 458$; ≥65 years old) from this cohort were included.

Degree of urbanization (urban, semirural, and rural) was calculated from different indices in the 2005 Population and Housing Census database, including total population, density of population, total number of houses, density of housing, and proportion of apartment housing.[22] In 2005, the total population in the city of Seongnam was 934,984 with a population density of 6,592 persons/km^2; in Buk-meon, the total population was 11,334 with a density of 153.9 persons/km^2; in Shinan-meon, the population was 5,219 with a density of 72.3 persons/km^2. Total housing and housing density per unit area showed similar trends, with Seongnam having 200,322 houses and a density of 1,412 houses/km^2 compared with 4,005 houses in Buk-meon (54 houses/km^2) and 2,104 houses (29 houses/km^2) in Shinan-meon. The proportion of apartment housing was 59.8% in Seongnam, 29.9% in Buk-meon, and 22.8% in Shinan-meon. The extent of urbanization also was assessed by the degree of farming activity of the elderly participants in each area (0.23%, 48.7%, and 62.6%, respectively).

All these participants were fully informed of the study protocols and provided written statements of informed consent. The study protocols were approved by the institutional review board of Seoul National University Bundang Hospital (Seongnam, Korea) and the National Cancer Center (Goyang, Korea).

Questionnaires

Interviews were conducted by research nurses who had experience in conducting surveys with elderly persons. Allergic symptoms were defined using the structured questionnaire that was previously validated in Korean and used in adult population surveys.[23,24] A positive response to the question, “Have you experienced sneezing or a runny or blocked nose without a cold in the past 12 months?,” indicated current self-reported rhinitis, whereas current self-reported rhinoconjunctivitis was indicated by a positive response to the follow-up question, “Has this nose problem been accompanied by itchy or watery eyes?” Current wheeze was defined by a positive response to the question, “Have you had a wheezing or whistling in the chest during the past 12 months?” The subjects who reported neither current rhinitis nor wheeze were defined as asymptomatic subjects. Current farming was defined as positive if the subjects answered that they were engaged in agricultural jobs at the time of the survey. Comorbidity was assessed using a structured questionnaire with items asking, “Have you been diagnosed with or treated for a specific disease by a physician in the past 12 months?”

Allergen Skin Tests

Inhalant allergen skin prick tests were performed to assess IgE sensitization resulting from different common inhalant allergens. The participants were instructed to discontinue medications for at least 7 days before skin testing under the guidance of their physicians, such as antihistamines, benzodiazepines, tricyclic antidepressants, or over-the-counter drugs for common colds, as described previously.[25] Sensitization to inhalant allergen was defined by a positive skin test response to at least 1 allergen, as previously described.[25] The following allergens were assessed: *Dermatophagoides farinae, Dermatophagoides pteronyssinus,* dog epithelia, *Blattella germanica,* tree pollen mixture 1 (alder, hazel, poplar, elm, and willow), tree pollen mixture 2 (birch, beech, oak, and plane tree), grass pollen mixture (velvet grass, orchard grass, rye grass, timothy grass, Kentucky blue grass, and meadow grass), mugwort, and ragweed (Allergopharma, Reinbeck, Germany). Positive (1 mg/mL of histamine) and negative (0.9% sodium chloride) controls also were tested. Positive skin reactivity was determined by an allergen-to-histamine wheal size ratio of at least 1. An atopy index was calculated by counting the total number of sensitized allergens.[26] Based on skin prick tests, rhinitis was classified as rhinitis with allergic sensitization or rhinitis without allergic sensitization.

Statistical Analyses

Continuous variables were presented as mean ± SD, and categorical variables were described as frequency (percentage). Continuous data were analyzed with *t* tests or 1-way analysis of variance, and nonparametric data were analyzed using Mann-Whitney *U* or Kruskal-Wallis tests. Categorical data were evaluated by χ^2 tests. Logistic regression analyses were performed to evaluate the associations between urbanization and allergic parameters. In multivariate logistic regression models, confounders included demographic factors (age, sex, smoking, body mass index, and current farming) and any variables with a *P* value less than .10