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## Urbanization and the Risk of Asthma Among Schoolchildren in the Palestinian Authority

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**Key words:** Asthma; Wheezing; Schoolchildren; Urban; Rural; ISAAC

### ABSTRACT

The aim of the present survey was to compare the prevalence of symptoms suggestive of asthma in boys and girls aged 6–7 and 13–14 years in a rural and an urban area in the West Bank. For this purpose, the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire was issued to 970 schoolchildren in the two regions. The response rate was 92.2%. The prevalences of ever wheezing in the urban and rural areas were 16.4% and 12.0%, respectively ( $p < 0.05$ ); the 12-month prevalences of wheezing were 10.5% and 5.5%, respectively ( $p < 0.05$ ); the prevalences of more severe wheeze were 4.5% and 1.7%, respectively ( $p < 0.05$ ); and prevalences of diagnosed asthma were 4.2% and 2.8%, respectively ( $p = \text{NS}$ ). When controlling for age by stratification, the significant association between prevalence rates and place of residence persisted in the 13–14-year age group. These results also show that the prevalence of asthma among Palestinian children is moderately high in comparison with that reported from developing countries, but lower than those reported from Western countries. This survey, the first epidemiological survey on asthma in the West Bank, demonstrates a marked difference between

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urban and rural areas. The findings emphasize the need for further study of the environmental determinants of the disease among Palestinian children.

## INTRODUCTION

Asthma is one of the most common diseases of childhood, causing substantial morbidity (1). There is considerable concern that the prevalence of asthma and its severity are increasing all over the world (2–5). Although the factors responsible for this increase are uncertain, there has been speculation that changes in lifestyle and urbanization in industrialized countries may be responsible (6).

Prevalence studies using the same methods are essential for the understanding of the international epidemiology of asthma in children. Hence, a standardized protocol has been developed for the International Study of Asthma and Allergies in Childhood (ISAAC) (7). Thus, it is possible to compare asthma prevalence within and between countries, and to assess future trends in the prevalence and severity of the disease. Results of ISAAC project phase 1 have shown that there is a wide variation in the prevalence of recent wheeze worldwide ranging from 1.6% to 36.8% (8). The highest 12-month prevalences of asthma were found in the United Kingdom, Australia, New Zealand, and Republic of Ireland, followed by most centers in North America. The lowest prevalence rates were from centers in several Eastern European countries, Indonesia, Greece, China, Taiwan, Uzbekistan, India, and Ethiopia. Large variations in asthma prevalence rates within countries were also evident in India, Ethiopia, Italy, and Spain. A recent study from Brazil (9) reported moderately high prevalence rates in Sao Paulo, a heavily industrialized metropolitan area. Identifying risk factors that explain these variations is one goal of the ISAAC project (7).

Unfortunately, few data are available from Arab countries. Results have shown that prevalence rates were moderately high in Kuwait and Lebanon and moderately low in Oman, Algeria, and Morocco (8). To date, the burden of asthma and wheezing illness on Palestinian schoolchildren in the Palestinian Authority,

West Bank region, is still unknown. Detection of an urban–rural difference in the prevalence of a disease within a homogeneous population, i.e., Palestinian Arabs, clearly points to the action of different environmental factors in the two regions. This may enhance further research into differences between these communities with respect to lifestyle, diet, and other environmental factors.

The aim in the present study was to compare the prevalence of asthma and its severity among schoolchildren aged 6–7 and 13–14 years in urban and rural areas of the West Bank.

## METHODS

This survey was carried out in late March 1998 after the approval of the Palestinian Ministries of Health and Education.

### Study Population

Target age groups were 6–7- and 13–14-year-old schoolchildren. The sample was drawn from the city of Ramallah (population 80,000) and the village of Anin (population 2800). These two regions are believed to differ from each other with respect to some factors of interest. In Ramallah it is believed that there may be some increasing levels of air pollution from motor vehicles due to the area's rapid growth. The population in Ramallah is heterogeneous due to the high rate of internal migration from other parts of the West Bank to the city. Anin's population is highly inbred and consanguineous marriage is common.

### Sample Selection

#### RURAL SAMPLE

In Anin village there are only two schools, one for males and the other for females. All schoolchildren from Anin in the first, second,

eighth, and ninth grades were included in the sample. A total of 300 questionnaires were distributed in Anin.

#### URBAN SAMPLE

From the list of eight public schools in Ramallah, two male schools and two female schools were selected at random. All children in the first, second, eighth, and ninth grades (6–7 and 13–14 years old) at each school were invited to participate in the survey. A total of 670 questionnaires were distributed in the Ramallah schools. With this sample size, it is possible to detect a difference of 4% with a power of 80% at an  $\alpha$  level of 5%.

The 13–14-year-old children completed a standardized ISAAC written questionnaire, translated into Arabic, in the schools. A similar written questionnaire, modified for completion by parents/guardians, was delivered to the parents/guardians of the 6–7-year-old children through the schools (7). A questionnaire was sent to every child who was absent. After the questionnaire was collected, nonresponders were issued a second questionnaire.

A person who was fluent in both English and Arabic translated the ISAAC questionnaire into Arabic. The translated questionnaire was tested in a group of teenagers and necessary modifications were made before the study was carried out.

To evaluate the severity of recent wheeze in different strata, a severity score (10) for wheezing was constructed. One point was assigned for the presence of wheezing in the last 12 months. One, 2 or 3 points were assigned for increasing frequency of wheezing attacks (1–3, 4–12, and >12 episodes per year, respectively). One or 2 points were assigned for reporting night awakening with wheezing (less than one or greater than one episode per week, respectively), and 1 point for the occurrence of speech-limiting attacks. On the basis of this score, wheezing severity was graded as absent (0 points), mild (1–3 points), or more severe (4–7 points). All questions in this survey refer to symptoms in the last 12 months except for the questions on “wheezing ever” and “asthma ever.”

#### Data Analysis

Responses were coded and entered into a computer. The SPSS program was then used to calculate frequency distributions, and cross-tabulations, and to calculate  $\chi^2$ , odds ratios (OR), and adjusted ORs.

#### RESULTS

A total of 970 questionnaires were distributed in Ramallah and Anin. A total of 894 questionnaires were completed with an overall response rate of 92.2%. Table 1 shows characteristics of children who participated in the survey.

The prevalence of wheezing symptoms and asthma ever by gender, age group, and place of residence is summarized in Table 2. There was no significant association between the rates and gender or age except that the older age group had a significantly higher rate of exercise wheeze than the younger age group (OR = 3.5, 95% confidence interval [CI] 2.2–5.7). The prevalence rates were significantly higher in Ramallah than in Anin for all symptoms except for asthma ever, where the difference did not reach statistical significance.

Three-quarters of all those complaining of recent wheeze had three or less attacks per year (Table 3), and 7.9% complained of more than 12 attacks per year. A total of 57.9% complained of wheezing that disturbed their sleep and 22.4% had at least one wheezing attack during the last 12 months that was severe enough to limit their speech. Overall, the prevalence of more severe symptoms in the Ramallah schoolchildren was significantly higher than in the Anin schoolchildren (4.5% vs. 1.7%,  $p < 0.05$ ). There was no significant variation in severity of wheezing symptoms across sex or age strata.

When controlling for age by stratification, the significant association between prevalence rates and place of residence persisted in the 13–14-year-old age group except for prevalence of asthma ever, but the association failed to reach statistical significance in the 6–7-year-old age group except for “night dry cough” (Table 4). This might be due to the decreased

**Table 1.** Age, Sex, and Place of Residence of Children Who Participated in the Survey

|          | 6-7 YEAR OLD | 13-14 YEAR OLD | TOTAL |
|----------|--------------|----------------|-------|
|          | N (%)        | N (%)          |       |
| Ramallah |              |                |       |
| Males    | 149 (47)     | 165 (53)       | 314   |
| Females  | 134 (47)     | 151 (53)       | 285   |
| Total    | 283 (47)     | 316 (53)       | 599   |
| Anin     |              |                |       |
| Males    | 111 (74)     | 39 (26)        | 150   |
| Females  | 99 (68)      | 46 (32)        | 145   |
| Total    | 210 (71)     | 85 (29)        | 295   |

power of the study to detect a real difference when stratified analysis was done.

## DISCUSSION

The main finding of this survey is the presence of a positive association between wheezing illness and its severity with urbanization. This difference is consistent with previous studies conducted in developing and developed countries (11-13). Increased levels of air pollution are associated with increased frequency and severity of exacerbation of wheezing attacks among subjects with asthma (14), but it is not certain that high levels of air pollution are responsible for the observed variation

in asthma prevalence within and among countries (14,15).

The positive association between asthma and urbanization remains to be explained. A recent study, comparing asthma prevalence in urban and rural areas of Kenyan school-children, found that family history of asthma and a shorter period of breast-feeding contributed to higher rates of asthma in urban children (16). However, recent trends in asthma epidemiology suggest that decreased rates of infection in more urbanized areas might be responsible for the increased rates of the disease in those areas (17). It is possible that the observed lower rate of wheezing among school-children in Anin is due to a higher rate of infection in early life because of lower standard

**Table 2.** Prevalence (%) and 95% Confidence Interval (CI) of Wheezing and Asthma by Gender, Age, and Place of Residence

|                    | N   | WHEEZE<br>EVER<br>% (CI) | RECENT<br>WHEEZE<br>% (CI) | ASTHMA<br>EVER<br>% (CI) | EXERCISE<br>WHEEZE<br>% (CI) | NIGHT DRY<br>COUGH<br>% (CI) |
|--------------------|-----|--------------------------|----------------------------|--------------------------|------------------------------|------------------------------|
| Total              | 894 | 15.0 (12.6-17.3)         | 8.9 (7.0-10.7)             | 3.8 (2.5-5.0)            | 10.6 (8.5-12.6)              | 16.0 (13.5-18.4)             |
| Gender             |     |                          |                            |                          |                              |                              |
| Females            | 429 | 12.6 (9.4-15.8)          | 8.3 (5.6-10.9)             | 2.6 (1.1-4.1)            | 11.6 (8.5-14.7)              | 13.7 (10.4-17.0)             |
| Males              | 464 | 16.9 (13.5-20.3)         | 9.4 (6.7-12.1)             | 4.9 (2.9-6.9)            | 9.6 (6.8-12.3)               | 17.9 (14.3-21.5)             |
| Age group          |     |                          |                            |                          |                              |                              |
| 6-7 years          | 493 | 16.8 (13.5-20.1)         | 9.1 (6.5-11.6)             | 4.1 (2.4-5.9)            | 5.4 (3.3-7.5)                | 14.6 (11.4-17.8)             |
| 13-14 years        | 401 | 12.7 (9.4-16.0)          | 8.6 (5.8-11.3)             | 3.3 (1.5-5.1)            | 16.7 (13.0-20.4)             | 17.6 (13.8-21.4)             |
| Place of residence |     |                          |                            |                          |                              |                              |
| Ramallah           | 599 | 16.4 (13.4-19.4)         | 10.5 (8.0-13.0)            | 4.2 (2.6-5.9)            | 13.6 (10.8-16.4)             | 19.9 (16.7-23.2)             |
| Anin               | 295 | 12.0                     | 5.5                        | 2.8                      | 4.3                          | 7.8                          |

**Table 3.** Prevalence (%) and 95% Confidence Interval (CI) of Wheezing Symptoms Severity by Gender, Age, and Place of Residence

|                    | TOTAL<br>RECENT<br>WHEEZE | FREQUENCY OF ATTACKS<br>PER YEAR |      |     | NIGHT<br>SYMPTOMS<br>PER WEEK |     | SPEECH-<br>LIMITING<br>WHEEZE | MILD<br>WHEEZE<br>% (CI) | MORE S<br>WHE<br>% (CI) |
|--------------------|---------------------------|----------------------------------|------|-----|-------------------------------|-----|-------------------------------|--------------------------|-------------------------|
|                    |                           |                                  |      |     |                               |     |                               |                          |                         |
|                    |                           | 1-3                              | 4-12 | >12 | <1                            | >1  |                               |                          |                         |
| all                | 8.9                       | 6.3                              | 1.5  | 0.7 | 3.0                           | 2.0 | 1.9                           | 4.7 (3.3-6.1)            | 3.5 (2.3-               |
| under              |                           |                                  |      |     |                               |     |                               |                          |                         |
| females            | 8.3                       | 5.2                              | 1.4  | 0.9 | 3.5                           | 1.2 | 2.4                           | 4.0 (2.2-5.9)            | 3.6 (1.8-               |
| males              | 9.4                       | 7.2                              | 1.5  | 0.4 | 2.4                           | 2.8 | 1.5                           | 5.3 (3.2-7.3)            | 3.5 (1.8-               |
| group              |                           |                                  |      |     |                               |     |                               |                          |                         |
| <7 years           | 9.1                       | 6.2                              | 1.9  | 0.4 | 3.9                           | 2.5 | 1.2                           | 5.0 (3.0-6.9)            | 3.7 (2.0-               |
| 3-14 years         | 8.6                       | 6.3                              | 1.0  | 1.0 | 1.8                           | 1.5 | 2.8                           | 4.3 (2.3-6.4)            | 3.3 (1.5-               |
| place of residence |                           |                                  |      |     |                               |     |                               |                          |                         |
| hamalla            | 10.5                      | 6.9                              | 2.0  | 1.0 | 3.4                           | 2.4 | 2.7                           | 5.1 (3.3-6.9)            | 4.5 (2.8-               |
| nin                | 5.5                       | 4.8                              | 0.3  | 0   | 2.1                           | 1.4 | 0.3                           | 3.8                      | 1.7-                    |

**Table 4.** Age-Specific Odds Ratios (OR) of Prevalence Rates (%) and 95% Confidence Interval (CI) of Wheezing Symptoms and Ever Asthma in Ramallah Compared to Anin by Age Group

|                   | 6-7 YEARS |      |               | 13-14 YEARS |      |                 | CRUDE <sup>a</sup><br>OR (CI) | AGE-ADJUSTED <sup>b</sup><br>OR (CI) |
|-------------------|-----------|------|---------------|-------------|------|-----------------|-------------------------------|--------------------------------------|
|                   | RAMALLAH  | ANIN | OR (CI)       | RAMALLAH    | ANIN | OR (CI)         |                               |                                      |
| Wheezing ever     | 18.5      | 14.4 | 1.3 (0.8-2.2) | 14.6        | 6.0  | 2.7 (1.0-7.0)   | 1.4 (1.0-2.2)                 | 1.6 (1.0-2.2)                        |
| Current wheeze    | 10.4      | 7.2  | 1.5 (0.8-2.9) | 10.6        | 1.2  | 10.0 (1.3-74.0) | 2.0 (1.1-3.6)                 | 2.2 (1.2-3.6)                        |
| Asthma ever       | 4.7       | 3.4  | 1.4 (0.5-3.6) | 3.9         | 1.2  | 3.3 (0.4-25.4)  | 1.6 (0.7-3.5)                 | 1.7 (0.7-3.5)                        |
| Exercise wheeze   | 6.0       | 4.6  | 1.3 (0.6-3.1) | 20.1        | 3.7  | 6.6 (2.0-21.8)  | 3.5 (1.9-6.6)                 | 2.8 (1.4-5.4)                        |
| Wheezing at night | 19.4      | 8.0  | 2.8 (1.5-5.0) | 20.5        | 7.1  | 3.3 (1.4-8.0)   | 3.0 (1.8-4.8)                 | 3.0 (1.8-4.8)                        |
| Wheezing at night | 5.1       | 4.8  | 1.1 (0.5-2.4) | 5.2         | 1.2  | 4.6 (0.6-35.3)  | 1.4 (0.7-2.8)                 | 1.5 (0.7-2.8)                        |
| Severe wheeze     | 4.7       | 2.4  | 2.0 (0.7-5.7) | 4.2         | 0    | <sup>b</sup>    | 2.7 (2.1-7.0)                 | <sup>b</sup>                         |

<sup>a</sup>Comparing overall rates in Ramallah to overall rates in Anin.  
<sup>b</sup>cannot be calculated because the frequency of one of the cells = 0.

of living conditions compared to those in Ramallah.

The present survey shows that the prevalence of asthma ever in the whole sample was 3.8%, whereas lifetime wheezing was 15% and recent wheeze 8.9%. A previous study of Arab children living in Israel reported that the prevalence of physician-diagnosed asthma was 4.2% (11). Another study of schoolchildren with similar characteristics in northern Jordan reported a prevalence rate of physician-diagnosed asthma of 4.3% (18). Collectively, the results of these studies are consistent with the recent report of the ISAAC steering committee, which shows that Arab countries have moderately low to moderately high prevalence rates of recent wheeze, compared to Western countries (8).

As expected from most studies in this age range (19), the present study shows that boys outnumbered girls in the prevalence of wheeze, but the association did not reach statistical significance. The results also show that there is no significant association between age and prevalence of wheezing except that the older age group reported a significantly higher rate of wheezing during or after exercise than the younger age group. The most likely explanation for this association is that parents are less aware of the presence of this symptom in their young children (20).

Surveys of past symptoms inevitably depend on recall, which may be reduced by considering only symptoms experienced in the previous year. Recall of symptoms is subject to uncertainty. One measure of this uncertainty is reliability. For the purpose of an assessment of the questionnaire's reliability, a second questionnaire was sent to 430 subjects 4–5 weeks after the first. Of those sent, 362 questionnaires were returned, with a response rate of 84.2%. The results of the reliability study demonstrated good agreement ( $\kappa$  coefficient  $> 0.60$ ) for all questions in both regions and for questionnaires completed by either parents or children. The only question with poor agreement was the question on speech-limiting wheeze for responses by parents or responses in Anin. This may be due to the low prevalence of this symptom in the population,

such that any disagreement will result in substantial change in  $\kappa$  value (21).

## CONCLUSIONS

There was a positive association between asthma and its severity with urbanization. This association was independent of age or gender of the child. The prevalence of recent wheeze and asthma ever in the total sample was 8.9% and 3.8%, respectively. These rates are moderately high in comparison with rates in developing countries, yet they are lower than the rates reported from developed countries. The ISAAC questionnaire had a good reliability in the studied population.

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