

## Prevalence and trend of self-reported asthma and other allergic disease symptoms in Morocco: ISAAC Phase I and III

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### SUMMARY

**BACKGROUND:** The prevalence of asthma and other allergic diseases is increasing in many parts of the world.

**OBJECTIVE:** To determine the prevalence of asthma, rhinoconjunctivitis and skin allergy symptoms in Morocco as part of the International Study of Asthma and Allergic Diseases in Children (ISAAC).

**METHODS:** The survey was conducted using the standardised method of ISAAC Phase III in four centres in Morocco—Casablanca, Marrakech, Ben Slimane and Boulmane—with respectively 1777, 1689, 1008 and 1254 13–14-year-old schoolchildren participating. A comparison of the results with ISAAC Phase I was carried out in two centres.

**RESULTS:** The prevalence of self-reported symptoms of

wheeze in the last 12 months (6.4–16.2%), nasal symptoms (27.9–52.8%), rhinoconjunctivitis (8.8–28%) and eczema (13.3–20.2%) varied between centres, and were highest in Casablanca, the largest city in Morocco. Significant increases in almost all symptoms were found in the two centres of Casablanca and Marrakech between ISAAC Phase I and Phase III.

**CONCLUSION:** Morocco could be classified as a country with an intermediate burden of asthma (between 10% and 15%) and other allergic disorders. The prevalence of these symptoms has increased in the past 5 years.

**KEY WORDS:** asthma; self-reported symptoms; Morocco; ISAAC III

THE FIRST epidemiological studies of schoolchildren using a standardised questionnaire were conducted in Morocco in 1986.<sup>1</sup> These studies demonstrated that the prevalence of self-reported asthma based on the question ‘Have you ever had asthma?’ was higher than expected for a developing country in two large cities in Morocco: Casablanca (5.1%) and Rabat (3.3–5.3%).

Three centres in Morocco participated in Phase I of the International Study of Asthma and Allergies in Childhood (ISAAC) and the results on asthma prevalence, rhinitis and eczema were published.<sup>2–5</sup> The prevalence of asthma in a sample of children aged 13–14 years based on the answer to the question ‘Have you ever had asthma?’ was 12% in Casablanca and 6% in Rabat, higher than those reported in 1986.<sup>1</sup> However, the results between the two studies could not be compared, as different age groups were studied using different protocols.

In ISAAC Phase III, prevalence data were collected in a standardised manner using a similar methodology to that in Phase I,<sup>6</sup> allowing the time trend of symp-

tom prevalence to be determined and involving more countries and centres, thus enabling the preparation of a more comprehensive ‘world map’ of the prevalence of asthma and allergic disorders. This is a report of the prevalence and severity of asthma symptoms collected by both written and video questionnaires, and of the prevalence of rhinoconjunctivitis and skin allergy obtained using the written questionnaire in four centres of Morocco that participated in ISAAC Phase III. The changes in prevalence of various symptoms between the two phases were also compared in the two centres that took part in both phases.

### MATERIAL AND METHODS

The study population consisted of a sample of schoolchildren age 13–14 years recruited in four centres of Morocco. The choice of the four centres was based on the interests of investigators in each region and the fact that these regions have significantly different environments. With a population of 3.6 million, Casablanca is the largest city and the economic capital of

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Morocco; it is a port of the Atlantic Ocean with a high population density and industrialisation, and high levels of humidity and air pollution. Marrakech has 2 million inhabitants and is an important site for tourism as it is an oasis in the Moroccan desert with plantations and trees. It has a dry climate and very hot summer. Ben Slimane is a city with a population of 1.5 million, with a Mediterranean climate, and Boulmene is a village located in a typical rural area, with 173 000 inhabitants and a continental climate. Two centres, Casablanca and Marrakech, took part in both the Phase I and Phase III studies. Both centres carried out Phase I in December 1995; Casablanca carried out Phase III in October 2001 and Marrakech in February 2002.

## METHODS

The surveys in these four centres were conducted following the ISAAC Phase III methodology described elsewhere, which is similar to that of Phase I.<sup>7</sup> The ISAAC written questionnaire includes questions on past and current wheezing episodes, wheezing frequency, sleep disturbance, speech limitation during attacks, exercise-induced wheezing and persistent cough unrelated to respiratory infections. Other questions concern the presence and severity of allergic rhinoconjunctivitis and atopic eczema. The video questionnaire includes questions after projection of a short video showing difficulty in breathing and other asthma symptoms at rest and after exercise.

The ISAAC questionnaires were translated into Arabic and back-translated to English in accordance with ISAAC guidelines.

A two-stage cluster sampling procedure was used to recruit schoolchildren according to the ISAAC protocol. For the first stage, a random sample of schools was selected from a list of all schools in the area. For the second stage, schools were asked to select classes from two levels where 13–14 year olds were predominant. All students in the selected classes were eligible to participate in the survey and completed the written questionnaire first, followed by the video questionnaire, during one class period. The survey administration procedures were designed to protect the students' privacy by assuring that participation was anonymous and voluntary. Double entry of the data was done by local researchers in each centre and sent to the ISAAC International Data Centre for validation.

### Definitions

Variables referred to a positive response to various questions in the ISAAC questionnaire. Variables labelled '12 months' referred to the occurrence of symptoms in the last 12 months, while variables labelled 'ever' referred to ever having the symptoms. Severe wheeze was defined as attacks of wheeze severe enough to interfere with speech in the last 12 months.

Data analysis was carried out using SPSS version 10 (SPSS Inc, Chicago, IL, USA). For the analysis of Phase III,  $\chi^2$  analysis and analysis of variance were conducted to compare the age and sex distribution of schoolchildren in the four centres as well as the prevalence of the various symptoms. A comparison of the prevalence of symptoms in the Phase I and Phase III studies was carried out for two centres, Casablanca and Marrakech, using  $\chi^2$  analysis and the per cent change in prevalence of selected symptoms per year was calculated.

### Ethics

The study was conducted by a university unit in each centre, under the auspices of the Ministries of Health and Education. Verbal consent was obtained from each student. The survey was also conducted to ensure the anonymity of the students.

## RESULTS

Only Casablanca and Marrakech took part in both Phase I and Phase III studies. In Phase III, 13 schools (52%) in Casablanca, 9 (24.3%) in Marrakech, 5 (100%) in Ben Slimane and 9 (100%) in Boulmene took part in the study. All children (100%) in the two classes of the same grade participated in all schools. Table 1 describes the study population, age and sex distribution and the month of data collection for Phase I and Phase III. The percentage excluded due to invalid or missing age was low (<2%) in all the centres, and was not significantly different within the centre. All other data presented in Table 1 are significantly different ( $P < 0.001$ ) between the four centres in Phase III. In Phase III, the proportion of children in the age group 13–14 years, the focus of the ISAAC protocol, was >95% for all four centres, and the proportion of males was higher in all centres (52–60%) except Marrakech (42%).

### Prevalence of self-reported asthma symptoms (written questionnaire) in Phase III

Table 2 reports the prevalence of self-reported asthma symptoms by centre. There were significant differences in all asthma symptoms between the centres. In general, the prevalence of all symptoms was highest in Casablanca and lowest in Marrakech, with the exception of 'asthma, ever', which was the same between these two urban centres (14.7% in Casablanca and 15.1% in Marrakech). 'Asthma ever' was present in 8.7% of schoolchildren in Ben Slimane and 13.9% in Boulmene. Severe wheeze (attacks of wheeze severe enough to interfere with speech in the last 12 months) was highest in Casablanca (3.9%) and Ben Slimane (3.7%).

Table 3 shows the prevalence of asthma symptoms and asthma severity from the video questionnaire. Similar significant variations ( $P < 0.001$ ) were found

**Table 1** Study populations, exclusions and age and sex distribution by centre

	Casablanca		Marrakech		Ben Slimane Phase III n (%)	Boulmane Phase III n (%)	P value*
	Phase I n (%)	Phase III n (%)	Phase I n (%)	Phase III n (%)			
Schools in the area	25	25	37	37	5	9	
Participating schools	12	13	5	7	5	9	
Responders	3184	1777	2900	1689	1008	1254	<0.001
Exclusions	6	33 (1.8)	4	12 (0.7)	7 (0.7)	11 (0.9)	
Invalid age	6 (0.2)	33 (1.8)	4 (0.1)	10 (0.6)	7 (0.7)	7 (0.5)	
Other reasons	0	0	0	2 (0.1)	0	4 (0.3)	
Month of data collection	October	October	January	February	November	February	
Included in the analysis	3178 (99.8)	1744 (98.1)	2896 (99.9)	1677 (99.3)	1001 (99.3)	1243 (99.1)	<0.001
Age, years							
12–13	2589 (81.5)	1183 (67.3)	2060 (71.1)	1000 (59.6)	677 (67.6)	803 (64.6)	<0.001
14–15	589 (18.5)	561 (32.2)	836 (28.9)	677 (40.4)	324 (32.4)	440 (35.4)	
Sex							
Male	1712 (53.9)	910 (52.2)	1429 (49.3)	703 (41.9)	581 (58.0)	742 (59.7)	<0.001
Female	1466 (46.1)	834 (47.8)	1467 (50.7)	974 (58.1)	420 (42.0)	501 (40.3)	

\* By  $\chi^2$  analysis comparing Phase III participants across four centres.

between the four centres for all asthma symptoms; the highest prevalence was found in Casablanca and the lowest in Boulmane. The prevalence of 'asthma, ever' from the written questionnaire could be compared with the reply to the video questionnaire question 'Has your breathing been like this at any time in your life' (variable—severe wheeze, ever) after watching the scene of a child with an attack of asthma. The prevalence of 'asthma, ever' obtained from the written questionnaire and 'severe wheeze, ever' obtained from the video questionnaire for Casablanca was 14.7% and 15.4%, Marrakech 15.1% and 11.1%, Ben Slimane 8.7% and 5.0% and Boulmane 13.9% and 7.1%, respectively.

#### Prevalence of self-reported nasal and eye symptoms in Phase III

Significant differences ( $P < 0.001$ ) were found for all nasal and eye symptoms between the four centres, and

were highest in Casablanca. The prevalence of nasal symptoms, ever, and hay fever were very high, and differed between the four centres from 27.8% to 52.8% and from 16.5% to 30.3%, respectively (Table 4).

#### Prevalence of self-reported skin symptoms in Phase III

The prevalence of skin symptoms also varied significantly ( $P < 0.001$ ) between the centres; for skin rash, ever, they ranged from 15.3% to 34.2% and for eczema, ever, from 13.3% to 20.2%; they were higher in the two urban centres than in the two rural centres (Table 5).

#### Trend of prevalence of chest, nasal and skin symptoms, Phase I and Phase III studies

The prevalence of symptoms in Phase I study and the per cent change in the prevalence of symptoms per year between the Phase I and 3 studies are shown in Table 6. In Casablanca, the prevalence of all symptoms, chest,

**Table 2** Self-reported prevalence of asthma symptoms in Phase III: written questionnaire\*

	Casablanca (n = 1744) % (95%CI)	Marrakech (n = 1677) % (95%CI)	Ben Slimane (n = 1001) % (95%CI)	Boulmane (n = 1243) % (95%CI)
Wheeze				
Wheeze, ever	23.9 (23.1–24.6)	10.3 (9.4–10.5)	14.2 (13.3–15.0)	12.9 (12.1–13.7)
Wheeze, 12 months	16.2 (15.5–16.8)	4.6 (4.1–5.0)	8.9 (8.2–9.6)	6.4 (5.8–7.0)
$\geq 4$ attacks wheezing, 12 months	5.0 (4.6–5.5)	1.3 (1.1–1.6)	2.7 (2.2–3.2)	1.1 (0.7–1.3)
<4 attacks	10.4 (9.9–10.9)	3.1 (2.8–3.4)	4.9 (4.4–5.5)	5.1 (4.6–5.7)
Night awakening from wheeze, 12 months	8.3 (7.8–8.8)	2.6 (2.2–2.9)	5.5 (5.0–6.1)	4.1 (3.6–4.6)
<1 per week	4.4 (4.0–4.8)	1.3 (1.0–1.5)	3.6 (3.1–4.1)	2.4 (2.0–2.8)
>1 per week	3.9 (3.5–4.3)	1.3 (1.0–1.5)	1.9 (1.5–2.3)	1.7 (1.3–2.1)
Severe wheeze limiting speech, 12 months	3.9 (3.5–4.3)	1.2 (1.0–1.5)	3.7 (3.2–4.2)	1.9 (1.4–2.4)
Exercise wheeze, 12 months	11.6 (11.1–12.1)	3.7 (3.3–4.1)	7.8 (7.1–8.5)	10.3 (9.7–11.0)
Night cough, 12 months	24.7 (24.0–25.5)	19.2 (18.5–19.9)	25.6 (24.6–26.6)	28.3 (27.4–29.3)
Asthma, ever	14.7 (14.0–15.3)	15.1 (14.5–15.7)	8.7 (8.0–9.4)	13.9 (13.2–14.7)

\* Differences in prevalence of all symptoms were significantly different between the four centres ( $P < 0.001$  using  $\chi^2$  analysis). CI = confidence interval.

**Table 3** Prevalence of asthma symptoms in Phase III by video questionnaire by centre\*

	Casablanca (n = 1744) % (95%CI)	Marrakech (n = 1677) % (95%CI)	Ben Slimane (n = 1001) % (95%CI)	Boulmane (n = 1243) % (95%CI)
Wheezing				
Ever	16.6 (16.0–17.3)	12.6 (12.0–13.2)	17.6 (16.6–18.6)	12.6 (11.9–13.3)
12 months	13.1 (12.5–13.6)	8.7 (8.2–9.3)	10.8 (10.0–11.5)	7.3 (6.7–7.8)
Exercise, 12 months	17.2 (16.5–17.9)	10.5 (10.0–11.1)	12.7 (11.8–13.6)	9.3 (8.7–9.9)
Night wheeze				
Ever	11.1 (10.5–11.6)	6.7 (6.2–7.2)	9.2 (8.5–9.9)	4.9 (4.4–5.4)
12 months	7.5 (7.0–7.9)	4.7 (4.3–5.1)	6.2 (5.6–6.8)	2.7 (2.3–3.0)
Night cough				
Ever	25.1 (24.3–25.8)	23.1 (22.3–23.8)	21.7 (20.3–22.7)	20.1 (19.3–21.0)
12 months	18.2 (17.5–18.9)	16.7 (16.0–17.3)	11.0 (10.2–11.7)	12.8 (12.1–13.6)
Severe wheeze				
Ever	15.4 (14.8–16.1)	11.1 (10.5–11.6)	11.3 (10.5–12.0)	7.1 (6.5–7.7)
12 months	11.4 (10.8–12.0)	7.7 (7.2–8.2)	7.4 (6.7–8.1)	3.8 (3.3–4.2)

\* Prevalence of all symptoms significantly different between the four centres using  $\chi^2$  analysis.  
CI = confidence interval.

**Table 4** Self-reported prevalence of rhinitis symptoms in Phase III: written questionnaire\*

	Casablanca (n = 1744) % (95%CI)	Marrakech (n = 1677) % (95%CI)	Ben Slimane (n = 1001) % (95%CI)	Boulmane (n = 1243) % (95%CI)
Nasal symptoms				
Ever	52.8 (51.9–53.6)	35.8 (35.0–36.6)	40.4 (39.2–41.5)	27.9 (27.0–28.9)
12 months	42.9 (42.0–43.7)	26.3 (25.5–27.1)	30.1 (29.0–31.1)	20.2 (19.3–21.0)
Eyes affected, 12 months	28.0 (27.3–28.8)	15.0 (14.4–15.6)	20.1 (19.2–21.1)	8.8 (8.1–9.4)
Time of the year				
January to March	26.3 (25.4–27.2)	18.3 (17.6–19.0)	11.8 (10.9–12.7)	13.2 (12.4–14.0)
April to June	23.2 (22.3–24.0)	6.6 (6.0–7.1)	9.5 (8.7–10.4)	5.2 (4.6–5.8)
July to September	31.0 (30.1–31.9)	7.1 (6.6–7.7)	12.2 (11.3–13.1)	5.1 (4.5–5.7)
October to December	31.4 (30.6–32.3)	12.9 (12.3–13.6)	19.8 (18.8–20.8)	7.6 (7.0–8.3)
Activities limited, 12 months				
A little	18.9 (18.2–19.5)	12.9 (12.3–13.5)	14.4 (13.5–15.2)	9.9 (9.3–10.6)
Moderately	7.0 (6.5–7.4)	5.3 (4.9–5.7)	7.1 (6.5–7.8)	3.4 (2.9–3.8)
A lot	5.8 (5.4–6.3)	3.9 (3.5–4.3)	5.4 (4.8–6.0)	2.3 (1.9–2.6)
Hay fever, ever	30.3 (29.5–31.1)	16.5 (15.9–17.2)	30.4 (29.4–31.5)	19.2 (18.3–20.0)

\* Prevalence of all symptoms significantly different between the four centres ( $P < 0.001$  using  $\chi^2$  analysis).  
CI = confidence interval.

**Table 5** Self-reported prevalence of skin symptoms in Phase III: written questionnaire\*

	Casablanca (n = 1744) % (95%CI)	Marrakech (n = 1677) % (95%CI)	Ben Slimane (n = 1001) % (95%CI)	Boulmane (n = 1243) % (95%CI)
Rash				
Ever	34.2 (33.4–35.0)	33.9 (33.1–34.7)	25.4 (24.4–26.5)	15.3 (14.6–16.1)
12 months	26.1 (25.3–26.8)	23.1 (22.3–23.8)	15.3 (14.4–16.1)	10.3 (9.6–11.0)
Flexural areas, ever	23.9 (23.2–24.6)	20.9 (20.2–21.7)	12.6 (11.7–13.3)	9.7 (9.0–10.3)
Rash clear, 12 months				
Yes	17.9 (17.2–18.5)	16.8 (16.1–17.5)	8.5 (7.8–9.2)	7.9 (7.2–8.5)
No	8.3 (7.8–8.8)	6.1 (5.6–6.5)	7.1 (6.4–7.7)	2.7 (2.3–3.1)
Night wakening from skin rash, 12 months				
<1 night/week	6.9 (6.4–7.3)	6.3 (5.8–6.7)	6.3 (5.6–6.9)	4.1 (3.6–4.5)
$\geq 1$ night/week	6.2 (5.7–6.6)	6.3 (5.9–6.8)	3.8 (3.3–4.3)	2.1 (1.7–2.5)
Eczema, ever	20.2 (19.5–20.9)	20.7 (20.0–21.4)	20.0 (19.1–21.0)	13.3 (12.5–14.1)

\* Prevalence of all symptoms significantly different between the four centres,  $P < 0.001$ .  
CI = confidence interval.

**Table 6** Prevalence of symptoms in Phase I and % change of symptoms compared with Phase III (written questionnaire)

	Casablanca Phase I % (% change/year)	Marrakech Phase I % (% change/year)
Wheezing		
Ever	16.4 (+1.25)*	11.8 (-0.24)
12 months	10.1 (+1.01)*	5.7 (-0.18)
Exercise wheeze, 12 months	7.6 (+0.67)*	5.1 (-0.23) <sup>†</sup>
Attack of wheezing, 12 months		
>4 attacks	3.0 (+0.4)*	1.4 (-0.02)
Night awakening, 12 months	6.4 (+0.30)*	3.0 (-0.05)
Awakening due to wheeze		
<1/week	3.5 (+0.15) <sup>†</sup>	2.0 (-0.11)
>1/week	2.9 (+0.17)	1.0 (+0.05)
Severe wheeze, 12 months	3.1 (+0.13)	2.1 (-0.18) <sup>†</sup>
Night cough, 12 months	20.7 (+0.67)*	19.2 (0)
Asthma, ever	12.3 (+0.40) <sup>†</sup>	17.4 (-0.37) <sup>†</sup>
Nasal symptoms		
Ever	37.0 (+2.63)*	30.3 (+0.94)*
12 months	27.5 (+2.56)*	19.5 (+1.11)*
Eyes affected, 12 months	17.0 (+1.83)*	11.7 (+0.54)*
Time of the year		
January to March	8.2 (+3.01)*	5.2 (+2.13)*
April to June	8.3 (+2.48)*	4.9 (+0.28) <sup>†</sup>
July to September	12.1 (+3.14)*	6.3 (+0.13)
October to December	14.2 (+2.86)*	12.2 (+0.11)
Activities limited, 12 months		
A little	13.2 (+0.95)*	11.3 (+0.26)*
Moderately	5.3 (+0.28)	4.7 (+0.10)
A lot	2.9 (+0.32)	2.0 (+0.31)
Hay fever, ever	28.2 (+0.35)	21.6 (-0.83)*
Rash		
Ever	20.5 (+2.28)*	20.4 (+2.20)*
12 months	14.2 (+1.98)*	13.1 (+1.63)*
Flexural areas, ever	12.6 (+1.88)*	9.9 (+1.79)*
Rash clear, 12 months: No	5.3 (+0.50)*	4.1 (+0.33)*
Night wakening from skin rash,		
12 months		
<1 night/week	5.2 (+0.62)*	5.0 (+0.21)*
≥1 night/week	3.2 (+0.50)*	3.8 (+0.41)*

\*  $P < 0.001$  for differences in prevalence between Phase I and III.<sup>†</sup>  $P < 0.05$ .

nose, eye and skin, increased significantly from Phase I to Phase III. In Marrakech, the prevalence of chest symptoms decreased, but significantly only for 'exercise wheeze, 12 months' and 'severe wheeze, 12 months', while the prevalence of nose, eye and skin symptoms increased significantly between the two phases of the study.

## DISCUSSION

ISAAC Phase I demonstrated that there are large variations in the prevalence of asthma symptoms throughout the world (from 20-fold to 60-fold between centres). However, there are consistently more variations in the prevalence of asthma and asthma symptoms between countries than between centres in the same country.<sup>2-5</sup> ISAAC Phase III conducted in Morocco

showed that asthma and other allergic diseases are prevalent in 13-14-year-old schoolchildren in Morocco, with considerable variations in self-reported asthma and asthma symptoms and other allergic diseases between the four centres. As the study was conducted using the same protocol and the same questionnaire, the differences in prevalence of various symptoms are likely to be real, as concordant results were found between the written questionnaire and video questionnaire, and not due to methodology differences.

In general, the prevalence of symptoms obtained by the written questionnaire was higher than those obtained by the video questionnaire, with the exception of the prevalence of 'wheeze, 12 months', which was higher in the video questionnaire. The discrepancy is difficult to explain, as the word wheeze is usually well-known in Arabic.

Differences in asthma prevalence between urban and rural areas have been well documented, demonstrating that self-reported prevalence of asthma and other allergic diseases was higher in urban than in rural areas. These studies were conducted in several developing countries<sup>8-15</sup> and also in some more industrialised countries.<sup>16-18</sup> Industrialisation and increased traffic due to increased urbanisation brought with them high air pollution.<sup>11,15</sup> These factors have been associated with increased asthma severity and increased sensitisation to allergen, respectively.<sup>8-14</sup> Moreover, a proportion of the population of Casablanca, the largest city and the economic capital of Morocco, has adopted the Western style of living, which is well-known to be associated with a high prevalence of asthma.<sup>8-11</sup> It is therefore not surprising that Casablanca has the highest prevalence of asthma and asthma symptoms as well as of other allergic diseases, such as rhinoconjunctivitis and eczema. Marrakech, an oasis in the desert with a dry climate, has the lowest prevalence of asthma symptoms despite the highest prevalence of 'asthma, ever'. Marrakech's climate is considered by doctors to be favourable for asthmatics, and many doctors send their asthma patients to this town. Thus, despite a high prevalence of 'asthma, ever' in this town, the prevalence of asthma symptoms was lowest among the four centres, as patients tend to improve once they move there. Another reason for Marrakech having the lowest prevalence of asthma symptoms could be the lower proportion (41.9%) of boys recruited compared with the other three centres. In several studies conducted in both industrialised<sup>19-23</sup> and developing countries,<sup>24-26</sup> boys have a higher prevalence of asthma than girls. It is after adolescence that more girls start to have asthma.<sup>26-28</sup>

The significant increase in allergic symptoms affecting nose, eyes and skin between Phase I and Phase III in the two Moroccan centres, Casablanca and Marrakech, and the significant increase in asthma symptoms in Casablanca, suggest that asthma and allergic disease are probably increased in other parts of

Morocco. It is possible that in Marrakech the dry climate may protect allergic individuals from developing asthma symptoms.

There are limitations to this study. The differences in the time of the year when the study was carried out in each centre could be a reason for the differences in the prevalence of symptoms. The study was conducted in February (winter) in Marrakech and Boulmane and in October and November (autumn) in Casablanca and Ben Slimane. Although the prevalence of 'asthma, ever' should not be affected by season, respiratory symptoms due to upper respiratory tract infections are often highest in the winter months and might even trigger asthma attacks; thus the prevalence of respiratory symptoms should be highest in winter months. Despite this, the prevalence of asthma symptoms was highest in Casablanca. Another problem is the cultural differences in terminology; for example, there is no exact terminology in Arabic for 'hay fever'. Fortunately, the terms wheeze and asthma are well known in Morocco.

This study confirmed the relatively high prevalence of self-reported asthma, rhinoconjunctivitis and eczema in Morocco, with considerable differences in prevalence of these diseases and symptoms between centres in this country, which were highest in the largest city of Morocco and lowest in a city located in the desert. Between Phase I and Phase III, the prevalence of most symptoms increased in the two centres. With the increasing urbanisation of Morocco and the adoption of a Western style of living in urban areas, the prevalence of asthma and allergic symptoms will likely increase, leading to an increase in health care burden. The differences observed between centres could be due to the climatic location and to environmental factors which should be more carefully evaluated when data on environmental risk factors have been analysed.

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## R É S U M É

**SITUATION :** La prévalence de l'asthme et des autres maladies allergiques est en augmentation dans différentes régions du monde.

**OBJECTIF :** Déterminer la prévalence des symptômes d'asthme, de rhino-conjonctivite et d'allergie cutanée au Maroc dans le cadre de l' « Etude internationale de l'asthme et des maladies allergiques de l'enfant » (ISAAC).

**MÉTHODE :** Méthode standardisée ISAAC Phase III utilisée dans quatre centres du Maroc, Casablanca, Marrakech, Ben Slimane et Boulmane, chez respectivement 1777, 1689, 1008 et 1254 écoliers de 13–14 ans. Une comparaison des résultats avec ceux obtenus au cours de la Phase I de l'enquête ISAAC a été faite dans deux centres.

**RÉSULTATS :** La prévalence des symptômes rapportés de

sifflements au cours des derniers 12 mois (6,4% à 16,2%), de rhinite (27,9% à 52,8%), de rhino-conjonctivite (8,8% à 28%), et d'eczéma (13,3% à 20,2%) était différente selon les centres, et plus élevée à Casablanca, la plus grande ville du Maroc. Une augmentation significative de la prévalence de presque tous les symptômes a été trouvée dans les deux centres de Casablanca et de Marrakech entre la Phase I et la Phase III.

**CONCLUSION :** Pour l'importance du problème posé par l'asthme, le Maroc peut être classé comme un pays à prévalence intermédiaire (entre 10% et 15%). La prévalence de l'asthme et des autres maladies allergiques a augmentée durant les 5 dernières années.

## R E S U M E N

**MARCO DE REFERENCIA :** La prevalencia de asma y otras enfermedades alérgicas está aumentando en muchas regiones del mundo.

**OBJETIVO :** Determinar la prevalencia de asma, rinoconjuntivitis y síntomas de alergia cutánea en Marruecos, como parte del estudio ISAAC (*International Study of Asthma and Allergies in Childhood*).

**MÉTODO :** El estudio se realizó utilizando el método normalizado de la Fase III del estudio ISAAC, en cuatro centros de Marruecos ; se incluyeron niños escolarizados de 13 y 14 años, así 1777 en Casablanca, 1689 en Marrakech, 1008 en Ben Slimane y 1254 en Boulmane. En dos centros, se compararon los resultados de esta encuesta con los resultados obtenidos en la Fase I del estudio ISAAC.

**RESULTADOS :** La prevalencia de síntomas referidos por los pacientes difirió entre los centros y fue más alta en Casablanca, la ciudad más grande de Marruecos : sibilancias en los últimos 12 meses (entre 6,4% y 16,2%), síntomas nasales (entre 27,9% y 52,8%), rinoconjuntivitis (entre 8,8% y 28%) y eczema (entre 13,3% y 20,2%). Entre las Fases I y III se observó un aumento significativo de casi todos los síntomas, tanto en el centro de Casablanca como en el de Marrakech.

**CONCLUSIÓN :** Marruecos puede calificarse como un país con una carga intermedia de morbilidad por asma (entre el 10% y el 15%) y otras afecciones alérgicas ; la prevalencia de estos síntomas ha aumentado en los últimos 5 años.