

## Original article

# Global map of the prevalence of symptoms of rhinoconjunctivitis in children: The International Study of Asthma and Allergies in Childhood (ISAAC) Phase Three

**Background:** Phase One of the International Study of Asthma and Allergies in Childhood (ISAAC) measured the global patterns of prevalence and severity of symptoms of rhinoconjunctivitis in children in 1993–1997.

**Methods:** International Study of Asthma and Allergies in Childhood Phase Three was a cross-sectional survey performed 5–10 years after Phase One using the same methodology. Phase Three covered all of the major regions of the world and involved 1 059 053 children of 2 age groups from 236 centres in 98 countries.

**Results:** The average overall prevalence of current rhinoconjunctivitis symptoms was 14.6% for the 13- to 14-year old children (range 1.0–45%). Variation in the prevalence of severe rhinoconjunctivitis symptoms was observed between centres (range 0.0–5.1%) and regions (range 0.4% in western Europe to 2.3% in Africa), with the highest prevalence being observed mainly in the centres from middle and low income countries, particularly in Africa and Latin America. Co-morbidity with asthma and eczema varied from 1.6% in the Indian sub-continent to 4.7% in North America. For 6- to 7-year old children, the average prevalence of rhinoconjunctivitis symptoms was 8.5%, and large variations in symptom prevalence were also observed between regions, countries and centres.

**Discussion:** Wide global variations exist in the prevalence of current rhinoconjunctivitis symptoms, being higher in high vs low income countries, but the prevalence of severe symptoms was greater in less affluent countries. Co-morbidity with asthma is high particularly in Africa, North America and Oceania. This global map of symptom prevalence is of clinical importance for health professionals.

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Phase One of the International Study of Asthma and Allergies in Childhood (ISAAC) study (1) demonstrated major worldwide variations in the prevalence of symptoms of asthma, rhinoconjunctivitis and eczema in children (2–5). The International Study of Asthma and Allergies in Childhood Phase One involved more than 700 000 children: 257 800 6- to 7-year olds from 91 centres in 38 countries and 463 801 13- to 14-year olds from 155 centres in 56 countries.

Phase One found substantial worldwide variations in the prevalence of reported symptoms of rhinoconjunctivitis in children, with up to 25-fold variations in 13- to 14-year olds (4). For both age groups, the lowest prevalence values were found in parts of Eastern Europe and in

Southern and Central Asia. In the older age group, low prevalence values were found in China and Portugal. In centres of higher prevalence, there was a greater variability between the two age groups in the proportion of rhinoconjunctivitis labelled as hay fever (4).

Ecological studies using the ISAAC Phase One data were subsequently undertaken and identified that economic development (6), dietary factors (7), climate (8), infections (9) and pollens (10) may be associated with some of the worldwide variation observed in the prevalence of symptoms of rhinoconjunctivitis.

The International Study of Asthma and Allergies in Childhood Phase Two involved a more detailed investigation of possible etiological factors in 9- to

11-year old children from 30 centres in 22 countries. Standardized child contact modules were developed and used, which included examination of flexural dermatitis, skin prick testing, bronchial challenge, blood sampling for genetic analyses and dust sampling. The prevalence of rhinoconjunctivitis symptoms varied widely worldwide (1.5–24.5%) and the population attributable fraction (PAF) varied from 0% to 71% for a positive prick test to seasonal allergens and from 0% to 41% for perennial allergens. The estimated PAF for sensitization to seasonal and perennial allergens was higher for centres in affluent countries (36% and 25%, respectively) than in nonaffluent countries (1.3% and 12.6%, respectively). Atopy only accounted for a limited proportion of the reported rhinitis symptoms suggesting that the importance of other environmental factors has been under-emphasized, particularly in less affluent countries (11).

The International Study of Asthma and Allergies in Childhood Phase Three has involved repeating the Phase One survey after 5–10 years to examine time trends in the prevalence of the three conditions and to include new centres to expand the coverage of world prevalence maps for these conditions (12). For both age groups, the findings for time trends in the prevalence of symptoms of rhinoconjunctivitis in the 110 Phase Three centres in 58 countries, who completed both Phase One and Phase Three (Phase Three A centres) have been reported in the previous publications (13, 14). However, in addition to the centres that completed both phases, there were also 127 new centres in 64 countries (Phase Three B centres) that conducted the survey for the first time. In this article, we present the findings for symptoms of rhinoconjunctivitis symptoms for 236 Phase Three centres in 98 countries and we thereby present a new and greatly enlarged world map of symptom prevalence.

## Methods

The detailed methodology has already been published (12) and will only be described briefly here. As for the Phase One survey (1), ISAAC Phase Three (12) involved two age groups of children. Written questionnaires were self completed at school by 13- to 14-year olds and completed at home by parents of 6- to 7-year olds (1, 12). Cluster samples of 3000 children for each age group (with a minimum of 1000) within each centre were selected by randomly sampling schools within the study area. In some smaller centres, all schools were included in the study. Within each school, children were selected by surveying the grade, level or school year(s) in which a majority of children were of the required age range, or by specifically surveying only children of the target age ranges. Almost all centres studied the 13- to 14-year age group, but only some centres studied the optional 6- to 7-year age group. Data checks were undertaken by the ISAAC International Data Centre (IIDC) in Auckland, New Zealand which ensured adherence to the protocol.

The standardized core symptom questionnaire was the same as that used in Phase One, and comprised six questions on symptoms relating to rhinitis or rhinoconjunctivitis (1, 12). These questions were as follows:

1. Have you (has your child) ever had a problem with sneezing or a runny or blocked nose, when you (he or she) DID NOT have a cold or 'the flu'?
2. In the past 12 months, have you (has your child) had a problem with sneezing or a runny or blocked nose, when you (he or she) DID NOT have a cold or 'the flu'?
3. In the past 12 months, has this nose problem been accompanied by itchy-watery eyes?
4. In which of the past 12 months did this nose problem occur? (Month names listed).
5. In the past 12 months, how much did this nose problem interfere with your (child's) daily activities? (Not at all, a little, a moderate amount, a lot).
6. Have you (has your child) ever had hay fever?

Question 2 was used to estimate the prevalence of current nose symptoms, question 3 was used to estimate the prevalence of current nose and eye symptoms, and question 6 was used to estimate the prevalence of 'hay fever ever'. Questions 2 and 3 were combined to assess current rhinoconjunctivitis symptoms. Questions 2 and 3 and the answer 'A LOT' to question 5 were used to assess the prevalence of severe rhinoconjunctivitis symptoms. The English language questionnaire was translated wherever required, following detailed guidelines (3), and a back translation to English was provided. Of the 54 languages, English was the most common (21% of centres) followed by Spanish (20%), Portuguese (11%), Arabic (7%), Italian (6%), French (5%) and Chinese (4%).

Associations between the prevalence values of selected variables were examined using Spearman's (rank) correlation coefficients. We also grouped countries according to their level of gross national income (GNI) to assess whether the level of GNI was associated with the level of rhinoconjunctivitis symptom prevalence. This analysis used a generalized linear mixed model with a logit link and the centre as a random effect to examine the association between country level GNI, and the centre level symptom data. The GNI data were categorized into low, middle and high based on the World Bank cut off values (15). All analyses were carried out using SAS version 9.1. (SAS Institute Inc., Cary, NC, USA).

## Results

### Participating centres, response rate and sample size

Details of the participating centres, response rates and sample sizes will be published in the corresponding ISAAC Phase Three asthma symptoms world map paper (C Lai, unpublished data). The International Study of Asthma and Allergies in Childhood Phase Three covered all the major regions of the world. The 13- to 14-year age group involved 670 242 children in 232 centres in 97 countries, and the mean response rate was 91.1%. The 6- to 7-year age group involved 388 811 children in 144 centres in 61 countries and the mean response rate was 84.5%. In four centres data were available only for the 6- to 7-year age group. In total, the survey involved 1 059 053 children from 236 centres in 98 countries.

### Prevalence patterns in 13- to 14-year olds

The prevalence rates of positive responses to each question in each centre are presented for 13- to 14-year olds in

# Global map of the prevalence of symptoms of rhinoconjunctivitis in children

Table 1. ISAAC Phase Three World Map Data, Symptoms of Rhinitis, 13- to 14-year age group

| Centre                           | Year | N      | Current Nose Symptoms |      | Current Nose and Eye Symptoms |      | Hay Fever Ever |      | Current Rhinoconjunctivitis |      | Severe Rhinoconjunctivitis |     |
|----------------------------------|------|--------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------|------|----------------------------|-----|
|                                  |      |        | n                     | %    | n                             | %    | n              | %    | n                           | %    | n                          | %   |
| Africa                           |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Algeria                          | 2002 | 4203   | 1394                  | 33.2 | 872                           | 20.7 | 439            | 10.4 | 871                         | 20.7 | 146                        | 3.5 |
| Wilaya of Algiers                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Cameroon                         | 2003 | 2983   | 678                   | 22.7 | 351                           | 11.8 | 568            | 19.0 | 264                         | 8.9  | 10                         | 0.3 |
| Yaounde                          |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Congo                            | 2002 | 1012   | 551                   | 54.4 | 384                           | 37.9 | 603            | 59.6 | 337                         | 33.3 | 52                         | 5.1 |
| Brazzaville                      |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Cote d'Ivoire                    | 2001 | 3342   | 1565                  | 46.8 | 924                           | 27.6 | 1117           | 33.4 | 921                         | 27.6 | 57                         | 1.7 |
| Urban Cote d'Ivoire              |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Ethiopia                         | 2003 | 3195   | 887                   | 27.8 | 335                           | 10.5 | 141            | 4.4  | 316                         | 9.9  | 21                         | 0.7 |
| Addis Ababa                      |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Gabon                            | 2003 | 3166   | 1129                  | 35.7 | 612                           | 19.3 | 1020           | 32.2 | 523                         | 16.5 | 55                         | 1.7 |
| Port-Gentil                      |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Kenya                            | 2001 | 3289   | 1032                  | 31.4 | 792                           | 24.1 | 1281           | 38.9 | 738                         | 22.4 | 85                         | 2.6 |
| Eldoret                          | 2001 | 3023   | 1052                  | 34.8 | 600                           | 19.8 | 1105           | 36.6 | 600                         | 19.8 | 81                         | 2.7 |
| Nairobi                          | 2001 | 6312   | 2084                  | 33.0 | 1392                          | 22.1 | 2386           | 37.8 | 1338                        | 21.2 | 166                        | 2.6 |
| Country total                    |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Morocco                          | 1999 | 1008   | 297                   | 29.5 | 241                           | 23.9 | 304            | 30.2 | 195                         | 19.3 | 45                         | 4.5 |
| Benslimane                       | 2002 | 1254   | 242                   | 19.3 | 125                           | 10.0 | 230            | 18.3 | 104                         | 8.3  | 18                         | 1.4 |
| Boulmene                         | 2001 | 1777   | 763                   | 42.9 | 572                           | 32.2 | 539            | 30.3 | 500                         | 28.1 | 84                         | 4.7 |
| Casablanca                       | 2002 | 1689   | 446                   | 26.4 | 310                           | 18.4 | 278            | 16.5 | 249                         | 14.7 | 46                         | 2.7 |
| Marrakech                        | 2001 | 5728   | 1748                  | 30.5 | 1248                          | 21.8 | 1351           | 23.6 | 1048                        | 18.3 | 193                        | 3.4 |
| Country total                    |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Nigeria                          | 2001 | 3142   | 1057                  | 33.6 | 578                           | 18.4 | 602            | 19.2 | 515                         | 16.4 | 61                         | 1.9 |
| Ibadan                           |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Republique Democratique du Congo | 2003 | 2930   | 683                   | 23.3 | 368                           | 12.6 | 2042           | 69.7 | 346                         | 11.8 | 21                         | 0.7 |
| Kinshasa                         |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Reunion Island                   | 2000 | 2362   | 1119                  | 47.4 | 645                           | 27.3 | 340            | 14.4 | 645                         | 27.3 | 54                         | 2.3 |
| Reunion Island                   |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| République de Guinée             | 1997 | 3115   | 1030                  | 33.1 | 750                           | 24.1 | 1501           | 48.2 | 669                         | 21.5 | 81                         | 2.6 |
| Conakry                          |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| South Africa                     | 2002 | 5037   | 1939                  | 38.5 | 1223                          | 24.3 | 2088           | 41.5 | 1043                        | 20.7 | 136                        | 2.7 |
| Cape Town*                       | 2004 | 4660   | 1594                  | 34.2 | 1073                          | 23.0 | 689            | 39.4 | 846                         | 18.2 | 111                        | 2.4 |
| Polokwane*                       | 2003 | 9697   | 3533                  | 36.4 | 2296                          | 23.7 | 2777           | 40.9 | 1889                        | 19.5 | 247                        | 2.5 |
| Country total                    |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Sudan                            | 2003 | 2896   | 344                   | 11.9 | 316                           | 10.9 | 7              | 0.2  | 208                         | 7.2  | 42                         | 1.5 |
| Khartoum                         |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Togo                             | 2001 | 3090   | 802                   | 26.0 | 732                           | 23.7 | 890            | 28.8 | 450                         | 14.6 | 0                          | 0.0 |
| Lome                             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Tunisia                          | 2001 | 6119   | 1866                  | 30.5 | 1671                          | 27.3 | 1495           | 24.4 | 897                         | 14.7 | 85                         | 1.4 |
| Grand Tunis                      | 2001 | 3042   | 1881                  | 61.8 | 804                           | 26.4 | 1041           | 34.2 | 706                         | 23.2 | 72                         | 2.4 |
| Sousse                           | 2001 | 9161   | 3747                  | 40.9 | 2475                          | 27.0 | 2536           | 27.7 | 1603                        | 17.5 | 157                        | 1.7 |
| Country total                    | 2002 | 66 334 | 22 351                | 33.7 | 14 278                        | 21.5 | 18 320         | 28.9 | 11 943                      | 18.0 | 1363                       | 2.1 |
| Region total                     |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Asia-Pacific                     |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| China                            | 2001 | 3530   | 1265                  | 35.8 | 364                           | 10.3 | 270            | 7.6  | 361                         | 10.2 | 15                         | 0.4 |
| Beijing                          | 2001 | 3514   | 1601                  | 45.6 | 390                           | 11.1 | 145            | 4.1  | 375                         | 10.7 | 9                          | 0.3 |
| Guangzhou                        | 2001 | 2878   | 153                   | 5.3  | 45                            | 1.6  | 39             | 1.4  | 41                          | 1.4  | 2                          | 0.1 |
| Tibet                            | 2001 | 3542   | 433                   | 12.2 | 118                           | 3.3  | 205            | 5.8  | 118                         | 3.3  | 0                          | 0.0 |
| Tong Zhou                        | 2001 | 3884   | 1152                  | 29.7 | 312                           | 8.0  | 325            | 8.4  | 310                         | 8.0  | 3                          | 0.1 |
| Wulumuqi                         | 2001 | 17 348 | 4604                  | 26.5 | 1229                          | 7.1  | 984            | 5.7  | 1205                        | 6.9  | 29                         | 0.2 |
| Country total                    |      |        |                       |      |                               |      |                |      |                             |      |                            |     |

Table 1. (Continued)

| Centre                | Year | N      | Current nose symptoms |      | Current nose and eye symptoms |      | Hay fever ever |      | Current rhinoconjunctivitis |      | Severe rhinoconjunctivitis |     |
|-----------------------|------|--------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------|------|----------------------------|-----|
|                       |      |        | n                     | %    | n                             | %    | n              | %    | n                           | %    | n                          | %   |
| Hong Kong             | 2002 | 3321   | 1357                  | 40.9 | 790                           | 23.8 | 51             | 1.5  | 750                         | 22.6 | 8                          | 0.2 |
| Hong Kong             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Indonesia             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Bali                  | 2001 | 2569   | 828                   | 32.2 | 334                           | 13.0 | 1181           | 46.0 | 265                         | 10.3 | 9                          | 0.4 |
| Bandung               | 2002 | 2826   | 540                   | 19.1 | 136                           | 4.8  | 1174           | 41.5 | 136                         | 4.8  | 16                         | 0.6 |
| Semarang              | 2002 | 2435   | 448                   | 18.4 | 102                           | 4.2  | 1018           | 41.8 | 97                          | 4.0  | 4                          | 0.2 |
| Country total         | 2002 | 7830   | 1816                  | 23.2 | 572                           | 7.3  | 3373           | 43.1 | 498                         | 6.4  | 29                         | 0.4 |
| Japan                 |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Fukuoka               | 2002 | 2520   | 1154                  | 45.8 | 517                           | 20.5 | 770            | 30.6 | 443                         | 17.6 | 24                         | 1.0 |
| Tochigi               | 1995 | 4466   | 1882                  | 42.1 | 959                           | 21.5 | 1485           | 33.3 | 959                         | 21.5 | 54                         | 1.2 |
| Country total         | 1999 | 6986   | 3036                  | 43.5 | 1476                          | 21.1 | 2255           | 32.3 | 1402                        | 20.1 | 78                         | 1.1 |
| Malaysia              |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Alor Setar            | 2002 | 2941   | 1181                  | 40.2 | 561                           | 19.1 | 716            | 24.3 | 479                         | 16.3 | 29                         | 1.0 |
| Klang Valley          | 2001 | 3025   | 1300                  | 43.0 | 608                           | 20.1 | 1252           | 41.4 | 600                         | 19.8 | 50                         | 1.7 |
| Kota Bharu            | 2001 | 2989   | 1044                  | 34.9 | 443                           | 14.8 | 874            | 29.2 | 373                         | 12.5 | 30                         | 1.0 |
| Country total         | 2001 | 8955   | 3525                  | 39.4 | 1612                          | 18.0 | 2842           | 31.7 | 1452                        | 16.2 | 109                        | 1.2 |
| Philippines           |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Metro Manila          | 2001 | 3658   | 807                   | 22.1 | 406                           | 11.1 | 1737           | 47.5 | 404                         | 11.0 | 25                         | 0.7 |
| Singapore             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Singapore†            | 2001 | 4217   | 1722                  | 40.8 | 733                           | 17.4 |                |      | 696                         | 16.5 | 54                         | 1.3 |
| South Korea           |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Provincial Korea      | 2000 | 7375   | 2393                  | 32.4 | 872                           | 11.8 | 963            | 13.1 | 848                         | 11.5 | 27                         | 0.4 |
| Seoul                 | 2000 | 2888   | 896                   | 31.0 | 354                           | 12.3 | 384            | 13.3 | 344                         | 11.9 | 5                          | 0.2 |
| Country total         | 2000 | 10 263 | 3289                  | 32.0 | 1226                          | 11.9 | 1347           | 13.1 | 1192                        | 11.6 | 32                         | 0.3 |
| Taiwan                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Taipei                | 2001 | 6378   | 2762                  | 43.3 | 1142                          | 17.9 | 2139           | 33.5 | 1138                        | 17.8 | 176                        | 2.8 |
| Taoyuan               | 2002 | 3190   | 1226                  | 38.4 | 518                           | 16.2 | 758            | 23.8 | 467                         | 14.6 | 63                         | 2.0 |
| Country total         | 2002 | 9568   | 3988                  | 41.7 | 1660                          | 17.3 | 2897           | 30.3 | 1605                        | 16.8 | 239                        | 2.5 |
| Thailand              |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Bangkok               | 2001 | 4669   | 2678                  | 57.4 | 1179                          | 25.3 | 1866           | 40.0 | 1117                        | 23.9 | 194                        | 4.2 |
| Chantaburi            | 2001 | 2901   | 1181                  | 40.7 | 474                           | 16.3 | 801            | 27.6 | 412                         | 14.2 | 35                         | 1.2 |
| Chiang Mai            | 2001 | 3538   | 1648                  | 46.6 | 640                           | 18.1 | 841            | 23.8 | 608                         | 17.2 | 47                         | 1.3 |
| Chiangrai             | 1995 | 1809   | 470                   | 26.0 | 188                           | 10.4 | 287            | 15.9 | 164                         | 9.1  | 16                         | 0.9 |
| Khon Kaen             | 1999 | 3410   | 1450                  | 42.5 | 510                           | 15.0 | 1220           | 35.8 | 500                         | 14.7 | 27                         | 0.8 |
| Nakorn Pathom         | 1996 | 6975   | 2186                  | 31.3 | 680                           | 9.7  | 1434           | 20.6 | 673                         | 9.6  | 39                         | 0.6 |
| Country total         | 1999 | 23 302 | 9613                  | 41.3 | 3671                          | 15.8 | 6449           | 27.7 | 3474                        | 14.9 | 358                        | 1.5 |
| Vietnam               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Ho Chi Minh City      | 2001 | 4240   | 2868                  | 67.6 | 1034                          | 24.4 | 1165           | 27.5 | 1034                        | 24.4 | 56                         | 1.3 |
| Region total          | 2000 | 99 688 | 36 625                | 36.7 | 14 409                        | 14.5 | 23 100         | 24.2 | 13 712                      | 13.8 | 1017                       | 1.0 |
| Eastern Mediterranean |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Egypt                 |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Cairo                 | 2002 | 3047   | 666                   | 21.9 | 449                           | 14.7 | 727            | 23.9 | 314                         | 10.3 | 50                         | 1.6 |
| Iran                  |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Birjand               | 1996 | 2829   | 630                   | 22.3 | 332                           | 11.7 | 272            | 9.6  | 295                         | 10.4 | 7                          | 0.2 |
| Rasht                 | 2002 | 3004   | 607                   | 20.2 | 344                           | 11.5 | 166            | 5.5  | 215                         | 7.2  | 10                         | 0.3 |
| Tehran                | 2001 | 3119   | 783                   | 25.1 | 422                           | 13.5 | 328            | 10.5 | 384                         | 12.3 | 9                          | 0.3 |
| Zanjan                | 1996 | 2805   | 507                   | 18.1 | 294                           | 10.5 | 222            | 7.9  | 230                         | 8.2  | 8                          | 0.3 |
| Country total         | 1999 | 11 757 | 2527                  | 21.5 | 1392                          | 11.8 | 988            | 8.4  | 1124                        | 9.6  | 34                         | 0.3 |
| Jordan                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Amman                 | 2001 | 2447   | 492                   | 20.1 | 268                           | 11.0 | 193            | 7.9  | 267                         | 10.9 | 31                         | 1.3 |
| Kuwait                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Kuwait†               | 2001 | 2882   | 795                   | 27.6 | 364                           | 12.6 | 559            | 19.4 | 307                         | 10.7 |                            |     |

# Global map of the prevalence of symptoms of rhinoconjunctivitis in children

Table 1. (Continued)

| Centre               | Year | N      | Current nose symptoms |      | Current nose and eye symptoms |      | Hay fever ever |      | Current rhinoconjunctivitis |      | Severe rhinoconjunctivitis |     |
|----------------------|------|--------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------|------|----------------------------|-----|
|                      |      |        | n                     | %    | n                             | %    | n              | %    | n                           | %    | n                          | %   |
| Malta                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Malta                | 2002 | 4136   | 1770                  | 42.8 | 903                           | 21.8 | 1683           | 40.7 | 864                         | 20.9 | 31                         | 0.7 |
| Pakistan             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Islamabad            | 2002 | 4069   | 2176                  | 53.5 | 1173                          | 28.8 | 2984           | 73.3 | 1130                        | 27.8 | 94                         | 2.3 |
| Karachi              | 2001 | 2999   | 853                   | 28.4 | 565                           | 18.8 | 721            | 24.0 | 503                         | 16.8 | 40                         | 1.3 |
| Country total        | 2002 | 7068   | 3029                  | 42.9 | 1738                          | 24.6 | 3705           | 52.4 | 1633                        | 23.1 | 134                        | 1.9 |
| Palestine            |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| North Gaza           | 2000 | 3627   | 661                   | 18.2 | 320                           | 8.8  | 308            | 8.5  | 320                         | 8.8  | 33                         | 0.9 |
| Ramallah             | 2000 | 3929   | 666                   | 17.0 | 360                           | 9.2  | 350            | 8.9  | 350                         | 8.9  | 30                         | 0.8 |
| Country total        | 2000 | 7556   | 1327                  | 17.6 | 680                           | 9.0  | 658            | 8.7  | 670                         | 8.9  | 63                         | 0.8 |
| Sultanate of Oman    |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Al-Khod              | 2001 | 3747   | 1113                  | 29.7 | 570                           | 15.2 | 531            | 14.2 | 568                         | 15.2 | 61                         | 1.6 |
| Syrian Arab Republic |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Aleppo               | 2001 | 3063   | 992                   | 32.4 | 531                           | 17.3 | 276            | 9.0  | 446                         | 14.6 | 49                         | 1.6 |
| Lattakia             | 2001 | 3010   | 680                   | 22.6 | 480                           | 15.9 | 370            | 12.3 | 303                         | 10.1 | 23                         | 0.8 |
| Tartous              | 2001 | 2995   | 485                   | 16.2 | 364                           | 12.2 | 372            | 12.4 | 258                         | 8.6  | 22                         | 0.7 |
| Country total        | 2001 | 9068   | 2157                  | 23.8 | 1375                          | 15.2 | 1018           | 11.2 | 1007                        | 11.1 | 94                         | 1.0 |
| Region total         | 2001 | 51 708 | 13 876                | 26.8 | 7739                          | 15.0 | 10 062         | 19.5 | 6754                        | 13.1 | 498                        | 1.0 |
| Indian Sub-Continent |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| India                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Bangalore            | 2002 | 3440   | 950                   | 27.6 | 381                           | 11.1 | 303            | 8.8  | 360                         | 10.5 | 41                         | 1.2 |
| Bikaner              | 2001 | 3059   | 1283                  | 41.9 | 834                           | 27.3 | 1804           | 59.0 | 650                         | 21.2 | 27                         | 0.9 |
| Borivali             | 2003 | 1004   | 104                   | 10.4 | 40                            | 4.0  | 65             | 6.5  | 40                          | 3.9  | 2                          | 0.2 |
| Chandigarh           | 2001 | 3122   | 953                   | 30.5 | 480                           | 15.4 | 579            | 18.5 | 426                         | 13.6 | 15                         | 0.5 |
| Chennai (3)          | 2002 | 2181   | 460                   | 21.1 | 189                           | 8.7  | 178            | 8.2  | 123                         | 5.6  | 6                          | 0.3 |
| Davangere            | 2002 | 2945   | 305                   | 10.4 | 28                            | 1.0  |                |      | 28                          | 1.0  | 0                          | 0.0 |
| Jaipur               | 2001 | 3607   | 1523                  | 42.2 | 860                           | 23.8 | 1015           | 28.1 | 723                         | 20.0 | 34                         | 0.9 |
| Jodhpur              | 2003 | 2341   | 816                   | 34.9 | 316                           | 13.5 | 558            | 23.8 | 305                         | 13.0 | 14                         | 0.6 |
| Kottayam             | 2002 | 3685   | 991                   | 26.9 | 498                           | 13.5 | 418            | 11.3 | 488                         | 13.2 | 0                          | 0.0 |
| Lucknow              | 2001 | 3000   | 1037                  | 34.6 | 493                           | 16.4 | 602            | 20.1 | 416                         | 13.9 | 27                         | 0.9 |
| Ludhiana             | 2002 | 3108   | 1421                  | 45.7 | 740                           | 23.8 | 1098           | 35.3 | 734                         | 23.6 | 43                         | 1.4 |
| Mumbai (18)          | 2002 | 2982   | 401                   | 13.4 | 194                           | 6.5  | 379            | 12.7 | 188                         | 6.3  | 23                         | 0.8 |
| Mumbai (29)          | 2002 | 1829   | 127                   | 6.9  | 74                            | 4.0  | 76             | 4.2  | 56                          | 3.1  | 1                          | 0.1 |
| Nagpur               | 2002 | 4150   | 443                   | 10.7 | 226                           | 5.4  | 502            | 12.1 | 204                         | 4.9  | 28                         | 0.7 |
| New Delhi (7)        | 2001 | 3469   | 858                   | 24.7 | 428                           | 12.3 | 899            | 25.9 | 402                         | 11.6 | 25                         | 0.7 |
| Pimpri               | 2002 | 3128   | 130                   | 4.2  | 64                            | 2.0  | 157            | 5.0  | 58                          | 1.9  | 6                          | 0.2 |
| Pune                 | 2001 | 1983   | 272                   | 13.7 | 115                           | 5.8  | 205            | 10.3 | 102                         | 5.1  | 12                         | 0.6 |
| Rasta Peth           | 2001 | 3065   | 242                   | 7.9  | 161                           | 5.3  | 278            | 9.1  | 128                         | 4.2  | 10                         | 0.3 |
| Country total        | 2002 | 52 098 | 12 316                | 23.6 | 6121                          | 11.7 | 9116           | 18.5 | 5430                        | 10.4 | 314                        | 0.6 |
| Sri Lanka            |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Sri Lanka            | 2001 | 3717   | 1102                  | 29.6 | 565                           | 15.2 | 670            | 18.0 | 538                         | 14.5 | 37                         | 1.0 |
| Region total         | 2002 | 55 815 | 13 418                | 24.0 | 6686                          | 12.0 | 9786           | 18.5 | 5968                        | 10.7 | 351                        | 0.6 |
| Latin America        |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Argentina            |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Córdoba              | 2002 | 3445   | 1379                  | 40.0 | 587                           | 17.0 | 439            | 12.7 | 583                         | 16.9 | 26                         | 0.8 |
| Neuquén              | 2002 | 3172   | 1163                  | 36.7 | 521                           | 16.4 | 194            | 6.1  | 470                         | 14.8 | 22                         | 0.7 |
| Rosario City         | 2001 | 3099   | 706                   | 22.8 | 382                           | 12.3 | 382            | 12.5 | 351                         | 11.3 | 23                         | 0.7 |
| Salta                | 2002 | 3000   | 1194                  | 39.8 | 633                           | 21.1 | 590            | 19.7 | 627                         | 20.9 | 33                         | 1.1 |
| Country total        | 2002 | 12 716 | 4442                  | 34.9 | 2123                          | 16.7 | 1609           | 12.7 | 2031                        | 16.0 | 104                        | 0.8 |
| Bolivia              |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Santa Cruz           | 2002 | 3257   | 1210                  | 37.2 | 907                           | 27.8 | 607            | 18.6 | 730                         | 22.4 | 57                         | 1.8 |

Table 1. (Continued)

| Centre               | Year | N      | Current nose symptoms |      | Current nose and eye symptoms |      | Hay fever ever |      | Current rhinoconjunctivitis |      | Severe rhinoconjunctivitis |     |
|----------------------|------|--------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------|------|----------------------------|-----|
|                      |      |        | n                     | %    | n                             | %    | n              | %    | n                           | %    | n                          | %   |
| Brazil               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Aracaju              | 2002 | 3043   | 776                   | 25.5 | 529                           | 17.4 | 632            | 20.8 | 373                         | 12.3 | 29                         | 1.0 |
| Belo Horizonte       | 2002 | 3088   | 807                   | 26.1 | 447                           | 14.5 | 754            | 24.4 | 352                         | 11.4 | 13                         | 0.4 |
| Brasília             | 2002 | 3009   | 883                   | 29.3 | 463                           | 15.4 | 603            | 20.0 | 370                         | 12.3 | 27                         | 0.6 |
| Canaru               | 2002 | 3026   | 770                   | 25.4 | 466                           | 15.4 | 654            | 21.6 | 371                         | 12.3 | 17                         | 0.9 |
| Curitiba†            | 2001 | 3628   | 1423                  | 39.2 | 625                           | 17.2 | 444            | 34.8 | 615                         | 17.0 | 22                         | 0.6 |
| Feira de Santana     | 2002 | 1732   | 571                   | 33.0 | 298                           | 17.2 | 324            | 18.7 | 324                         | 13.9 | 17                         | 1.0 |
| Itajaí               | 2001 | 2737   | 605                   | 22.1 | 354                           | 12.9 | 523            | 19.1 | 290                         | 10.6 | 27                         | 1.0 |
| Maceió               | 2002 | 2745   | 724                   | 26.4 | 379                           | 13.8 | 304            | 11.1 | 373                         | 13.6 | 28                         | 1.0 |
| Manaus Amazonas      | 2002 | 3009   | 692                   | 23.0 | 384                           | 12.8 | 633            | 21.0 | 377                         | 12.5 | 34                         | 1.1 |
| Nova Iguaçu          | 2002 | 3185   | 554                   | 17.4 | 284                           | 8.9  | 305            | 9.6  | 280                         | 8.8  | 20                         | 0.6 |
| Passo Fundo          | 2002 | 2949   | 870                   | 29.5 | 491                           | 16.6 | 927            | 31.4 | 467                         | 15.8 | 29                         | 1.0 |
| Porto Alegre         | 2003 | 3007   | 966                   | 32.1 | 479                           | 15.9 | 1266           | 42.1 | 427                         | 14.2 | 26                         | 0.9 |
| Recife               | 2002 | 2865   | 1027                  | 35.8 | 414                           | 14.5 | 452            | 15.8 | 408                         | 14.2 | 30                         | 1.0 |
| Rural Santa Maria    | 2003 | 3057   | 628                   | 20.5 | 294                           | 9.6  | 666            | 21.8 | 238                         | 7.8  | 20                         | 0.7 |
| Salvador             | 2002 | 3020   | 1336                  | 44.2 | 736                           | 24.4 | 732            | 24.2 | 637                         | 21.1 | 36                         | 1.2 |
| Santa Maria          | 2003 | 3065   | 746                   | 24.3 | 349                           | 11.4 | 1086           | 35.4 | 307                         | 10.0 | 24                         | 0.8 |
| Santo Andre          | 2000 | 3232   | 919                   | 28.4 | 446                           | 13.8 | 938            | 29.0 | 446                         | 13.8 | 16                         | 0.5 |
| São Paulo            | 2002 | 3161   | 866                   | 27.4 | 386                           | 12.2 | 1017           | 32.2 | 446                         | 12.1 | 20                         | 0.6 |
| São Paulo West       | 2002 | 3181   | 957                   | 30.1 | 631                           | 19.8 | 602            | 18.9 | 497                         | 15.6 | 37                         | 1.2 |
| Vitória da Conquista | 2002 | 1679   | 668                   | 39.8 | 410                           | 24.4 | 320            | 19.1 | 333                         | 19.8 | 17                         | 1.0 |
| Country total        | 2002 | 58 418 | 16 788                | 28.7 | 8865                          | 15.2 | 13 182         | 23.5 | 7785                        | 13.3 | 489                        | 0.8 |
| Chile                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Calama               | 2002 | 1618   | 584                   | 36.1 | 393                           | 24.3 | 331            | 20.5 | 370                         | 22.9 | 21                         | 1.3 |
| Chiloe               | 2002 | 3000   | 1134                  | 37.8 | 587                           | 19.6 | 575            | 19.2 | 572                         | 19.1 | 24                         | 0.8 |
| Punta Arenas         | 2001 | 3044   | 984                   | 32.3 | 428                           | 14.1 | 219            | 7.2  | 428                         | 14.1 | 20                         | 0.7 |
| South Santiago       | 2001 | 3026   | 1183                  | 39.1 | 879                           | 29.0 | 722            | 23.9 | 796                         | 26.3 | 60                         | 2.0 |
| Valdivia             | 2001 | 3105   | 1330                  | 42.8 | 834                           | 26.9 | 759            | 24.4 | 816                         | 26.3 | 39                         | 1.3 |
| Country total        | 2001 | 13 793 | 5215                  | 37.8 | 3121                          | 22.6 | 2606           | 18.9 | 2982                        | 21.6 | 164                        | 1.2 |
| Colombia             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Barranquilla         | 2002 | 3204   | 1599                  | 49.9 | 979                           | 30.6 | 1084           | 33.8 | 960                         | 30.0 | 73                         | 2.3 |
| Bogotá               | 2002 | 3830   | 1386                  | 36.2 | 939                           | 24.5 | 687            | 17.9 | 854                         | 22.3 | 48                         | 1.3 |
| Cali                 | 2002 | 3100   | 1346                  | 43.4 | 861                           | 27.8 | 393            | 12.7 | 721                         | 23.3 | 56                         | 1.8 |
| Country total        | 2002 | 10 134 | 4331                  | 42.7 | 2779                          | 27.4 | 2164           | 21.4 | 2535                        | 25.0 | 177                        | 1.7 |
| Costa Rica           |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Costa Rica†          | 2002 | 2436   | 837                   | 34.4 | 452                           | 18.6 |                |      | 432                         | 17.7 | 28                         | 1.1 |
| Cuba                 |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| La Habana            | 2002 | 3026   | 1169                  | 38.6 | 609                           | 20.1 | 1159           | 38.3 | 609                         | 20.1 | 35                         | 1.2 |
| Ecuador              |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Guayaquil            | 2002 | 3082   | 1163                  | 37.7 | 744                           | 24.1 | 141            | 4.6  | 738                         | 23.9 | 44                         | 1.4 |
| Quito                | 2003 | 3014   | 1102                  | 36.6 | 697                           | 23.1 | 486            | 16.1 | 697                         | 23.1 | 20                         | 0.7 |
| Country total        | 2003 | 6096   | 2265                  | 37.2 | 1441                          | 23.6 | 627            | 10.3 | 1435                        | 23.5 | 64                         | 1.0 |
| El Salvador          |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| San Salvador         | 2003 | 3260   | 1728                  | 53.0 | 713                           | 21.9 | 188            | 5.8  | 698                         | 21.4 | 34                         | 1.0 |
| Honduras             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| San Pedro Sula       | 2002 | 2675   | 1123                  | 42.0 | 558                           | 20.9 | 403            | 15.1 | 557                         | 20.8 | 40                         | 1.5 |
| Mexico               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Ciudad Victoria      | 2003 | 3122   | 1093                  | 35.0 | 616                           | 19.7 | 91             | 2.9  | 549                         | 17.6 | 54                         | 1.7 |
| Ciudad de México (1) | 2002 | 3891   | 1144                  | 29.4 | 921                           | 23.7 | 222            | 5.7  | 509                         | 13.1 | 29                         | 0.7 |
| Ciudad de México (3) | 2002 | 3474   | 1028                  | 29.6 | 458                           | 13.2 | 78             | 2.2  | 443                         | 12.8 | 38                         | 1.1 |
| Ciudad de México (4) | 2002 | 2662   | 940                   | 35.3 | 430                           | 16.2 | 72             | 2.7  | 391                         | 14.7 | 16                         | 0.6 |
| Cuernavaca           | 2002 | 1431   | 298                   | 20.8 | 103                           | 7.2  | 152            | 10.6 | 102                         | 7.1  | 3                          | 0.2 |

# Global map of the prevalence of symptoms of rhinoconjunctivitis in children

Table 1. (Continued)

| Centre                                        | Year | N       | Current nose symptoms |      | Current nose and eye symptoms |      | Hay fever ever |      | Current rhinoconjunctivitis |      | Severe rhinoconjunctivitis |     |
|-----------------------------------------------|------|---------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------|------|----------------------------|-----|
|                                               |      |         | n                     | %    | n                             | %    | n              | %    | n                           | %    | n                          | %   |
| Mexicali Valley                               | 2002 | 2988    | 1233                  | 41.3 | 862                           | 28.8 | 41             | 1.4  | 839                         | 28.1 | 16                         | 0.5 |
| Monterrey                                     | 2001 | 3006    | 955                   | 31.8 | 402                           | 13.4 | 138            | 4.6  | 395                         | 13.1 | 16                         | 0.5 |
| Mérida                                        | 2002 | 3019    | 1200                  | 39.7 | 474                           | 15.7 | 121            | 4.0  | 474                         | 15.7 | 42                         | 1.4 |
| Toluca                                        | 2002 | 3021    | 642                   | 21.3 | 347                           | 11.5 | 116            | 3.8  | 321                         | 10.6 | 24                         | 0.8 |
| Villahermosa                                  | 2002 | 3109    | 1228                  | 39.5 | 604                           | 19.4 | 249            | 8.0  | 551                         | 17.7 | 42                         | 1.4 |
| Country total                                 | 2002 | 29 723  | 9761                  | 32.8 | 5217                          | 17.6 | 1280           | 4.3  | 4574                        | 15.4 | 280                        | 0.9 |
| Nicaragua                                     |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Managua                                       | 2002 | 3263    | 1424                  | 43.6 | 849                           | 26.0 | 239            | 7.3  | 818                         | 25.1 | 85                         | 2.6 |
| Panama                                        |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| David-Panamá                                  | 2001 | 3183    | 910                   | 28.6 | 446                           | 14.0 | 1254           | 39.4 | 374                         | 11.7 | 16                         | 0.5 |
| Paraguay                                      |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Asunción                                      | 2002 | 3000    | 2417                  | 80.6 | 1354                          | 45.1 | 1331           | 44.4 | 1354                        | 45.1 | 119                        | 4.0 |
| Peru                                          |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Lima†                                         | 2001 | 3022    | 1032                  | 34.1 | 582                           | 19.3 |                |      | 564                         | 18.7 | 29                         | 1.0 |
| Uruguay                                       |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Montevideo                                    | 2002 | 3177    | 781                   | 24.6 | 340                           | 10.7 | 483            | 15.2 | 337                         | 10.6 | 13                         | 0.4 |
| Paysandú                                      | 2002 | 1738    | 325                   | 18.7 | 178                           | 10.2 | 116            | 6.7  | 177                         | 10.2 | 15                         | 0.9 |
| Country total                                 | 2002 | 4915    | 1106                  | 22.5 | 518                           | 10.5 | 599            | 12.2 | 514                         | 10.5 | 28                         | 0.6 |
| Venezuela                                     |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Caracas                                       | 2002 | 3000    | 1223                  | 40.8 | 829                           | 27.6 | 809            | 27.0 | 746                         | 24.9 | 55                         | 1.8 |
| Region total                                  | 2002 | 165 917 | 56 981                | 34.3 | 31 363                        | 18.9 | 28 057         | 17.7 | 28 738                      | 17.3 | 1804                       | 1.1 |
| North America                                 |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Barbados                                      |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Barbados                                      | 2001 | 2498    | 500                   | 20.0 | 298                           | 11.9 | 1078           | 43.2 | 294                         | 11.8 | 38                         | 1.5 |
| Canada                                        |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Vancouver                                     | 2003 | 2853    | 1020                  | 35.8 | 529                           | 18.5 | 694            | 24.3 | 482                         | 16.9 | 25                         | 0.9 |
| Trinidad and Tobago                           |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| St Augustine                                  | 2002 | 3512    | 1173                  | 33.4 | 691                           | 19.7 | 979            | 27.9 | 644                         | 18.3 | 57                         | 1.6 |
| Tobago                                        | 2002 | 1464    | 453                   | 30.9 | 323                           | 22.1 | 489            | 33.4 | 283                         | 19.3 | 46                         | 3.1 |
| Country total                                 | 2002 | 4976    | 1626                  | 32.7 | 1014                          | 20.4 | 1468           | 29.5 | 927                         | 18.6 | 103                        | 2.1 |
| USA                                           |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Sarasota                                      | 2003 | 1245    | 393                   | 31.6 | 191                           | 15.3 | 246            | 19.8 | 189                         | 15.2 | 11                         | 0.9 |
| Seattle                                       | 2003 | 2422    | 751                   | 31.0 | 514                           | 21.2 | 559            | 23.1 | 462                         | 19.1 | 46                         | 1.9 |
| Country total                                 | 2003 | 3667    | 1144                  | 31.2 | 705                           | 19.2 | 805            | 22.0 | 651                         | 17.8 | 57                         | 1.6 |
| Region total                                  | 2002 | 13 994  | 4290                  | 30.7 | 2546                          | 18.2 | 4045           | 28.9 | 2354                        | 16.8 | 223                        | 1.6 |
| Northern & Eastern Europe                     |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Albania                                       |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Tiranë                                        | 2001 | 2983    | 465                   | 15.6 | 178                           | 6.0  | 156            | 5.2  | 163                         | 5.5  | 19                         | 0.6 |
| Bulgaria                                      |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Sofia                                         | 2002 | 1926    | 462                   | 24.0 | 185                           | 9.6  | 232            | 12.0 | 161                         | 8.4  | 20                         | 1.0 |
| Croatia                                       |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Rijeka                                        | 2002 | 2194    | 393                   | 17.5 | 146                           | 6.7  | 230            | 10.5 | 120                         | 5.5  | 4                          | 0.2 |
| Estonia                                       |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Tallinn                                       | 2001 | 3603    | 883                   | 24.5 | 262                           | 7.3  | 259            | 7.2  | 227                         | 6.3  | 10                         | 0.3 |
| Finland                                       |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Kuopio County                                 | 2001 | 3051    | 1222                  | 40.1 | 507                           | 16.6 | 866            | 28.4 | 474                         | 15.5 | 11                         | 0.4 |
| Former Yugoslav Republic of Macedonia (FYROM) | 2002 | 3026    | 698                   | 23.1 | 174                           | 5.8  | 202            | 6.7  | 166                         | 5.5  | 4                          | 0.1 |
| Skopje                                        |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Georgia                                       |      |         |                       |      |                               |      |                |      |                             |      |                            |     |
| Kutaisi                                       | 2003 | 2650    | 405                   | 15.3 | 119                           | 4.5  | 102            | 3.8  | 118                         | 4.5  | 13                         | 0.5 |

Table 1. (Continued)

| Centre                | Year | N      | Current nose symptoms |      | Current nose and eye symptoms |      | Hay fever ever |      | Current rhinoconjunctivitis |      | Severe rhinoconjunctivitis |     |
|-----------------------|------|--------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------|------|----------------------------|-----|
|                       |      |        | n                     | %    | n                             | %    | n              | %    | n                           | %    | n                          | %   |
| Hungary               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Svábhegy              | 2003 | 4219   | 721                   | 17.1 | 409                           | 9.7  | 374            | 8.9  | 399                         | 9.5  | 46                         | 1.1 |
| Szeged                | 2003 | 2889   | 546                   | 18.9 | 289                           | 10.0 | 336            | 11.6 | 250                         | 8.7  | 20                         | 0.7 |
| Country total         | 2003 | 7108   | 1267                  | 17.8 | 698                           | 9.8  | 710            | 10.0 | 649                         | 9.1  | 66                         | 0.9 |
| Kyrgyzstan            |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Balykchi              | 2002 | 1382   | 191                   | 13.8 | 126                           | 9.1  | 134            | 9.7  | 125                         | 9.0  | 22                         | 1.6 |
| Bishkek               | 2002 | 5048   | 767                   | 15.2 | 418                           | 8.3  | 507            | 10.0 | 416                         | 8.2  | 53                         | 1.0 |
| Jalalabat             | 2003 | 2404   | 606                   | 25.2 | 332                           | 13.8 | 41             | 1.7  | 261                         | 10.9 | 13                         | 0.5 |
| Country total         | 2002 | 8834   | 1564                  | 17.7 | 876                           | 9.9  | 682            | 7.7  | 802                         | 9.1  | 88                         | 1.0 |
| Latvia                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Riga                  | 2004 | 1283   | 238                   | 18.6 | 72                            | 5.6  | 103            | 8.0  | 58                          | 4.5  | 3                          | 0.2 |
| Lithuania             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Kaunas                | 2001 | 2723   | 546                   | 20.1 | 125                           | 4.6  | 168            | 6.2  | 125                         | 4.6  | 3                          | 0.1 |
| Panevezys             | 1997 | 1187   | 403                   | 34.0 | 167                           | 14.1 | 56             | 4.7  | 166                         | 14.0 | 1                          | 0.1 |
| Siauliai              | 1997 | 3516   | 982                   | 27.9 | 222                           | 6.3  | 141            | 4.0  | 222                         | 6.3  | 7                          | 0.2 |
| Country total         | 1998 | 7426   | 1931                  | 26.0 | 514                           | 6.9  | 365            | 4.9  | 513                         | 6.9  | 11                         | 0.1 |
| Poland                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Kraków                | 2002 | 2545   | 842                   | 33.1 | 531                           | 20.9 | 761            | 29.9 | 490                         | 19.3 | 55                         | 2.2 |
| Poznan                | 2002 | 1875   | 615                   | 32.8 | 380                           | 20.3 | 611            | 32.6 | 345                         | 18.4 | 36                         | 1.9 |
| Country total         | 2002 | 4420   | 1457                  | 33.0 | 911                           | 20.6 | 1372           | 31.0 | 835                         | 18.9 | 91                         | 2.1 |
| Romania               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Cluj                  | 2001 | 3019   | 1121                  | 37.1 | 431                           | 14.3 | 94             | 3.1  | 431                         | 14.3 | 19                         | 0.6 |
| Russia                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Novosibirsk           | 2002 | 3769   | 1225                  | 32.5 | 442                           | 11.7 | 122            | 3.2  | 442                         | 11.7 | 34                         | 0.9 |
| Serbia and Montenegro |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Belgrade              | 2001 | 3228   | 821                   | 25.4 | 247                           | 7.7  | 485            | 15.0 | 246                         | 7.6  | 2                          | 0.1 |
| Nis                   | 2001 | 1207   | 384                   | 31.8 | 150                           | 12.4 | 253            | 21.0 | 137                         | 11.4 | 7                          | 0.6 |
| Novi Sad              | 2002 | 1171   | 212                   | 18.1 | 72                            | 6.1  | 154            | 13.2 | 72                          | 6.1  | 4                          | 0.3 |
| Podgorica             | 2003 | 1014   | 237                   | 23.4 | 70                            | 6.9  | 186            | 18.3 | 69                          | 6.8  | 6                          | 0.6 |
| Sombor                | 2002 | 1105   | 197                   | 17.8 | 64                            | 5.8  | 107            | 9.7  | 63                          | 5.7  | 2                          | 0.2 |
| Country total         | 2002 | 7725   | 1851                  | 24.0 | 603                           | 7.8  | 1185           | 15.3 | 587                         | 7.6  | 21                         | 0.3 |
| Sweden                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Linköping             | 2002 | 2679   | 542                   | 20.2 | 310                           | 11.6 | 619            | 23.1 | 279                         | 10.4 | 11                         | 0.4 |
| Ukraine               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Kharkiv               | 2002 | 2428   | 471                   | 19.4 | 288                           | 11.9 | 141            | 5.8  | 271                         | 11.2 | 16                         | 0.7 |
| Rural Kharkiv         | 1998 | 3988   | 676                   | 17.0 | 354                           | 8.9  | 222            | 5.6  | 303                         | 7.6  | 12                         | 0.3 |
| Country total         | 2000 | 6396   | 1147                  | 17.9 | 642                           | 10.0 | 363            | 5.7  | 574                         | 9.0  | 28                         | 0.4 |
| Region total          | 2002 | 72 092 | 16 861                | 23.4 | 7070                          | 9.8  | 7662           | 10.6 | 6599                        | 9.2  | 453                        | 0.6 |
| Oceania               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Australia             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Melbourne             | 2002 | 2192   | 836                   | 38.1 | 448                           | 20.4 | 1046           | 47.7 | 424                         | 19.3 | 21                         | 1.0 |
| Cook Islands          |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Rarotonga             | 2003 | 445    | 127                   | 28.5 | 55                            | 12.4 | 57             | 12.8 | 52                          | 11.7 | 3                          | 0.7 |
| Fiji                  |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Suva                  | 2002 | 3093   | 1354                  | 43.8 | 727                           | 23.5 | 320            | 10.3 | 727                         | 23.5 | 88                         | 2.8 |
| Kingdom of Tonga      |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Nuku'alofa            | 2002 | 2671   | 484                   | 18.1 | 262                           | 9.8  |                |      | 261                         | 9.8  | 16                         | 0.6 |
| New Zealand           |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Auckland              | 2001 | 2870   | 1155                  | 40.2 | 584                           | 20.3 | 956            | 33.3 | 540                         | 18.8 | 37                         | 1.3 |
| Bay of Plenty         | 2002 | 1976   | 623                   | 31.5 | 324                           | 16.4 | 698            | 35.3 | 302                         | 15.3 | 15                         | 0.8 |
| Christchurch          | 2003 | 3116   | 979                   | 31.4 | 497                           | 15.9 | 1412           | 45.3 | 494                         | 15.9 | 16                         | 0.5 |

# Global map of the prevalence of symptoms of rhinoconjunctivitis in children

Table 1. (Continued)

| Centre              | Year | N      | Current nose symptoms |      | Current nose and eye symptoms |      | Hay fever ever |      | Current rhinoconjunctivitis |      | Severe rhinoconjunctivitis |     |
|---------------------|------|--------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------|------|----------------------------|-----|
|                     |      |        | n                     | %    | n                             | %    | n              | %    | n                           | %    | n                          | %   |
| Nelson              | 2003 | 2305   | 744                   | 32.3 | 358                           | 15.5 | 993            | 43.1 | 353                         | 15.3 | 11                         | 0.5 |
| Wellington          | 2001 | 3050   | 1421                  | 46.6 | 738                           | 24.2 | 1237           | 40.6 | 708                         | 23.2 | 28                         | 0.9 |
| Country total       | 2002 | 13 317 | 4922                  | 37.0 | 2501                          | 18.8 | 5296           | 39.8 | 2397                        | 18.0 | 107                        | 0.8 |
| Niue                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Niue Island         | 2002 | 79     | 32                    | 40.5 | 14                            | 17.7 | 20             | 25.3 | 13                          | 16.5 | 2                          | 2.5 |
| Nouvelle Calédonie  |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Nouvelle Calédonie  | 1998 | 7247   | 3340                  | 46.1 | 999                           | 13.8 | 719            | 9.9  | 999                         | 13.8 | 101                        | 1.4 |
| Polynésie Française |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Polynésie Française | 2000 | 4289   | 1864                  | 43.5 | 684                           | 15.9 | 468            | 10.9 | 661                         | 15.4 | 73                         | 1.7 |
| Samoa               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Samoa               | 2003 | 2986   | 1310                  | 43.9 | 670                           | 22.4 | 289            | 9.7  | 632                         | 21.2 |                            |     |
| Apiaš               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Tokelau             | 2003 | 66     | 37                    | 56.1 | 14                            | 21.2 |                |      | 13                          | 19.7 | 0                          | 0.0 |
| Tokelauš            | 2002 | 36 385 | 14 306                | 39.3 | 6374                          | 17.5 | 8215           | 24.4 | 6179                        | 17.0 | 411                        | 1.2 |
| Region total        |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Western Europe      |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Austria             | 2003 | 1439   | 306                   | 21.3 | 140                           | 9.7  | 245            | 17.0 | 139                         | 9.7  | 3                          | 0.2 |
| Urfahr-Umgebung     |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Belgium             | 2002 | 3250   | 1319                  | 40.6 | 555                           | 17.1 | 650            | 20.0 | 549                         | 16.9 | 42                         | 1.3 |
| Antwerp             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Channel Islands     |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Guernsey            | 2001 | 1248   | 405                   | 32.5 | 212                           | 17.0 | 458            | 36.7 | 203                         | 16.3 | 9                          | 0.7 |
| Jersey              | 2002 | 773    | 212                   | 27.4 | 108                           | 14.0 | 259            | 33.5 | 100                         | 12.9 | 4                          | 0.5 |
| Country total       | 2002 | 2021   | 617                   | 30.5 | 320                           | 15.8 | 717            | 35.5 | 303                         | 15.0 | 13                         | 0.6 |
| Germany             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Münster             | 1999 | 4132   | 1304                  | 31.6 | 657                           | 15.9 | 993            | 24.0 | 620                         | 15.0 | 17                         | 0.4 |
| Isle of Man         |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Isle of Man         | 2001 | 1716   | 630                   | 36.7 | 369                           | 21.5 | 723            | 42.1 | 347                         | 20.2 | 18                         | 1.0 |
| Italy               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Bari                | 2002 | 1287   | 488                   | 37.9 | 235                           | 18.3 | 287            | 22.3 | 227                         | 17.6 | 2                          | 0.2 |
| Coltetto-Tivoli     | 2002 | 1361   | 281                   | 20.6 | 138                           | 10.1 | 274            | 20.1 | 136                         | 10.0 | 2                          | 0.1 |
| Cosenza             | 2002 | 925    | 140                   | 15.1 | 89                            | 9.6  | 137            | 14.8 | 86                          | 9.3  | 0                          | 0.0 |
| Emilia-Romagna      | 2002 | 1347   | 463                   | 34.4 | 188                           | 14.0 | 315            | 23.4 | 182                         | 13.5 | 2                          | 0.1 |
| Empoli              | 2002 | 1229   | 407                   | 33.1 | 154                           | 12.5 | 264            | 21.5 | 150                         | 12.2 | 3                          | 0.2 |
| Firenze             | 2002 | 1383   | 456                   | 33.0 | 222                           | 16.1 | 336            | 24.3 | 217                         | 15.7 | 3                          | 0.2 |
| Mantova             | 2002 | 1114   | 391                   | 35.1 | 202                           | 18.1 | 254            | 22.8 | 198                         | 17.8 | 3                          | 0.3 |
| Milano              | 2002 | 1410   | 450                   | 31.9 | 278                           | 19.7 | 395            | 28.0 | 261                         | 18.5 | 4                          | 0.3 |
| Palermo             | 2002 | 1221   | 397                   | 32.5 | 230                           | 18.8 | 264            | 21.6 | 225                         | 18.4 | 8                          | 0.7 |
| Roma                | 2002 | 1325   | 499                   | 37.7 | 305                           | 23.0 | 355            | 26.8 | 294                         | 22.2 | 6                          | 0.5 |
| Siena               | 2002 | 1082   | 415                   | 38.4 | 218                           | 20.1 | 250            | 23.1 | 216                         | 20.0 | 4                          | 0.4 |
| Torino              | 2002 | 1180   | 448                   | 38.0 | 215                           | 18.2 | 264            | 22.4 | 206                         | 17.5 | 3                          | 0.3 |
| Trento              | 2002 | 1311   | 230                   | 17.5 | 130                           | 9.9  | 213            | 16.2 | 128                         | 9.8  | 1                          | 0.1 |
| Country total       | 2002 | 16 175 | 5065                  | 31.3 | 2604                          | 16.1 | 3608           | 22.3 | 2526                        | 15.6 | 41                         | 0.3 |
| The Netherlands     |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| The Netherlands     | 2003 | 6896   | 1931                  | 28.0 | 654                           | 9.5  | 1608           | 23.3 | 645                         | 9.4  | 16                         | 0.2 |
| Portugal            |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Coimbra             | 2002 | 1177   | 281                   | 23.9 | 76                            | 6.5  | 165            | 14.0 | 76                          | 6.5  | 0                          | 0.0 |
| Funchal             | 2002 | 3161   | 675                   | 21.4 | 280                           | 8.9  | 275            | 8.7  | 276                         | 8.7  | 15                         | 0.5 |
| Lisbon              | 2002 | 3024   | 878                   | 29.0 | 320                           | 10.6 | 194            | 6.4  | 317                         | 10.5 | 12                         | 0.4 |
| Portimao            | 2002 | 1109   | 241                   | 21.7 | 80                            | 7.2  | 81             | 7.3  | 79                          | 7.1  | 1                          | 0.1 |
| Porto               | 2002 | 3336   | 1056                  | 31.7 | 344                           | 10.3 | 168            | 5.0  | 342                         | 10.3 | 9                          | 0.3 |

Table 1. (Continued)

| Centre                       | Year | N       | Current nose symptoms |      | Current nose and eye symptoms |      | Hay fever ever |      | Current rhinoconjunctivitis |      | Severe rhinoconjunctivitis |     |
|------------------------------|------|---------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------|------|----------------------------|-----|
|                              |      |         | n                     | %    | n                             | %    | n              | %    | n                           | %    | n                          | %   |
| Country total                | 2002 | 11 807  | 3131                  | 26.5 | 1100                          | 9.3  | 883            | 7.5  | 1090                        | 9.2  | 37                         | 0.3 |
| Republic of Ireland          | 2003 | 3089    | 1144                  | 37.0 | 481                           | 15.6 | 973            | 31.5 | 478                         | 15.5 | 27                         | 0.9 |
| Spain                        | 2003 | 2979    | 1102                  | 37.0 | 593                           | 19.9 | 460            | 15.4 | 531                         | 17.8 | 8                          | 0.3 |
| A Coruña                     | 1996 | 4051    | 1129                  | 27.9 | 630                           | 15.6 | 425            | 10.5 | 626                         | 15.5 | 11                         | 0.3 |
| Almería                      | 2002 | 4184    | 1557                  | 37.2 | 799                           | 19.1 | 533            | 12.7 | 752                         | 18.0 | 11                         | 0.3 |
| Asturias                     | 2002 | 3066    | 716                   | 23.4 | 357                           | 11.6 | 284            | 9.3  | 321                         | 10.5 | 3                          | 0.1 |
| Barcelona                    | 2001 | 3401    | 930                   | 27.3 | 520                           | 15.3 | 548            | 16.1 | 492                         | 14.5 | 6                          | 0.2 |
| Bilbao                       | 2002 | 3998    | 1281                  | 32.0 | 697                           | 17.4 | 440            | 11.0 | 622                         | 15.6 | 7                          | 0.2 |
| Cartagena                    | 2002 | 4024    | 1441                  | 35.8 | 662                           | 16.5 | 284            | 7.1  | 639                         | 15.9 | 7                          | 0.2 |
| Castellón                    | 2002 | 2652    | 760                   | 28.7 | 549                           | 20.7 | 523            | 19.7 | 496                         | 18.7 | 12                         | 0.5 |
| Madrid                       | 2001 | 2932    | 1156                  | 39.4 | 489                           | 16.7 | 218            | 7.4  | 462                         | 15.8 | 8                          | 0.3 |
| Pamplona                     | 2002 | 1195    | 319                   | 26.7 | 164                           | 13.7 | 171            | 14.3 | 151                         | 12.6 | 3                          | 0.3 |
| San Sebastián                | 2002 | 3132    | 825                   | 26.3 | 446                           | 14.2 | 441            | 14.1 | 394                         | 12.6 | 5                          | 0.2 |
| Valencia                     | 2002 | 2944    | 1034                  | 35.1 | 547                           | 18.6 | 252            | 8.6  | 504                         | 17.1 | 5                          | 0.2 |
| Valladolid                   | 2001 | 38 558  | 12 250                | 31.8 | 6453                          | 16.7 | 4579           | 11.9 | 5990                        | 15.5 | 86                         | 0.2 |
| United Kingdom               | 2002 | 2356    | 813                   | 34.5 | 386                           | 16.4 | 932            | 39.6 | 353                         | 15.0 | 20                         | 0.8 |
| North Thames                 | 2002 | 4662    | 1604                  | 34.4 | 747                           | 16.0 | 1584           | 34.0 | 702                         | 15.1 | 29                         | 0.6 |
| Scotland                     | 2002 | 2432    | 777                   | 31.9 | 390                           | 16.0 | 928            | 38.2 | 353                         | 14.5 | 18                         | 0.7 |
| South Thames                 | 2001 | 2193    | 503                   | 22.9 | 322                           | 14.7 | 558            | 25.4 | 314                         | 14.3 | 30                         | 1.4 |
| Sunderland                   | 2002 | 5082    | 1653                  | 32.5 | 929                           | 18.3 | 2094           | 41.2 | 893                         | 17.6 | 29                         | 0.6 |
| Surrey/Sussex                | 2002 | 2501    | 795                   | 31.8 | 370                           | 14.8 | 962            | 38.5 | 317                         | 12.7 | 16                         | 0.6 |
| Wales                        | 2002 | 19 226  | 6145                  | 32.0 | 3144                          | 16.4 | 7058           | 36.7 | 2932                        | 15.3 | 142                        | 0.7 |
| Country total                | 2002 | 108 309 | 33 842                | 31.2 | 16 477                        | 15.2 | 22 037         | 20.3 | 15 619                      | 14.4 | 442                        | 0.4 |
| Region total                 | 2002 | 670 242 | 212 550               | 31.7 | 106 942                       | 16.0 | 131 284        | 20.2 | 97 866                      | 14.6 | 6562                       | 1.0 |
| Global total                 | 2002 | 622 161 | 196 092               | 31.5 | 98 445                        | 15.8 | 113 972        | 18.9 | 89 852                      | 14.4 | 6152                       | 1.0 |
| Non-English speaking centres |      | 48 081  | 16 458                | 34.2 | 8497                          | 17.7 | 17 312         | 36.0 | 8014                        | 16.7 | 410                        | 0.9 |
| English speaking centres#    |      |         |                       |      |                               |      |                |      |                             |      |                            |     |

\*The North Sotho language translation for hay fever ever question was not considered equivalent to the English language version. The prevalence value presented is for the 1747 participants who did not use North Sotho language.

†Blank cells represent cases where valid data was not available.

‡The wording of the question for hay fever ever was changed during sampling. The prevalence value presented is for the 1277 participants who answered the standard form question.

§Blank cells represent cases where the specific translation was not considered equivalent to the English language question.

#Centres in Australia, Canada, Channel Islands, Isle of Man, New Zealand, Republic of Ireland, United Kingdom and USA.

Table 1. The average prevalence of current rhinoconjunctivitis symptoms across all centres was 14.6% for the 13- to 14-year old children. However, substantial variation in the prevalence of positive responses within regions, countries and centres was observed (centre prevalence values range from 1% in Davangere, India to 45.1% in Asunción, Paraguay) (Figs 1 and 2).

The highest regional prevalence rates of current rhinoconjunctivitis were observed in Africa (18.0%) and Latin America (17.3%) and the lowest in Northern & Eastern Europe (9.2%). In each region, there were major differences in prevalence between countries.

In all regions, there were instances where large variations were observed between centres within the same country (Table 1, Fig. 1). For example, large variations in prevalence of current rhinoconjunctivitis in the 13- to 14-year age group were found between centres in Morocco (8.3–28.1%), Italy (9.3–22.2%), Mexico (7.1–28.1%), Thailand (9.1–23.9%), Brazil (7.8–21.1%) and India (1.0–23.6%).

High prevalence of current rhinoconjunctivitis symptoms (20% or more) was observed mainly in Africa and Latin America: nine centres in Africa (from 20.7% in

Wilaya of Algiers, Algeria to 33.3% in Brazzaville, Congo) and 18 centres in Latin America (from 20.1% in La Habana, Cuba to 45.1% in Asunción, Paraguay). High prevalence values were also observed in most of the other regions of the world: Ho Chi Minh City, Vietnam (24.4%), Bangkok, Thailand (23.9%), Hong Kong (22.6%) and Tochigi, Japan (21.5%) in Asia-Pacific; Islamabad, Pakistan (27.8%) and Malta (20.9%) in Eastern Mediterranean; Bikaner, Jaipur and Ludhiana, India (21.2%, 20% and 23.6% respectively) in Indian Sub-Continent; Suva, Fiji (23.5%), Wellington, New Zealand (23.2%) and Apia, Samoa (21.2%) in Oceania; Roma and Siena, Italy (22.2% and 20% respectively) and Isle of Man (20.2%) in Western Europe. Exceptions were North America and Northern & Eastern Europe where no centres had prevalence rates of 20% or more.

Variation in the prevalence of severe rhinoconjunctivitis symptoms was also observed between regions (range 0.4% in Western Europe to 2.1% in Africa), and between countries within regions. The prevalence of severe rhinoconjunctivitis symptoms was generally the highest (more than 1%) in centres from middle and

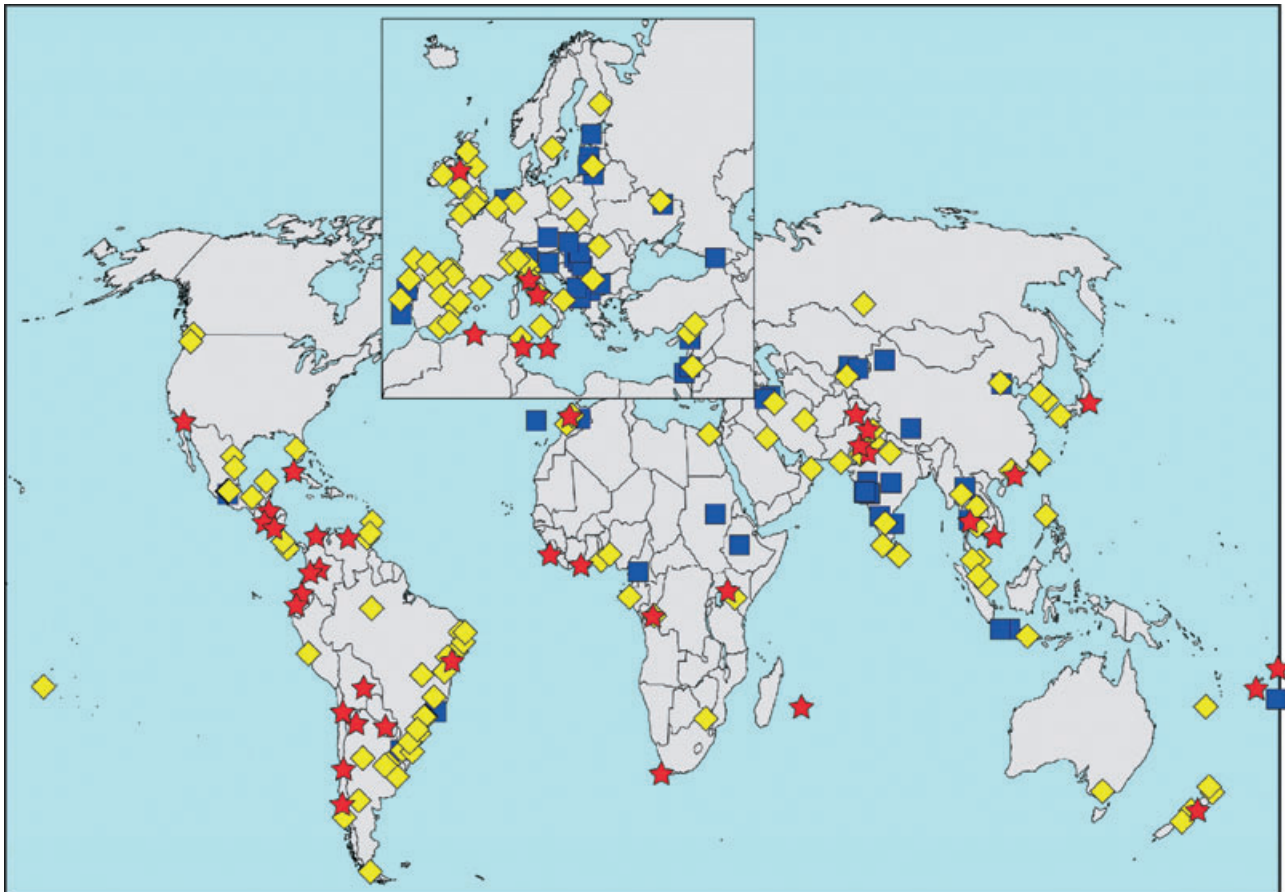


Figure 1. Map of prevalence of current symptoms of rhinoconjunctivitis, 13- to 14-year age group. Symbols indicate prevalence categories of  $\geq 20\%$  (red stars),  $\geq 10$  to  $< 20\%$  (yellow diamonds) and  $< 10\%$  (blue squares).

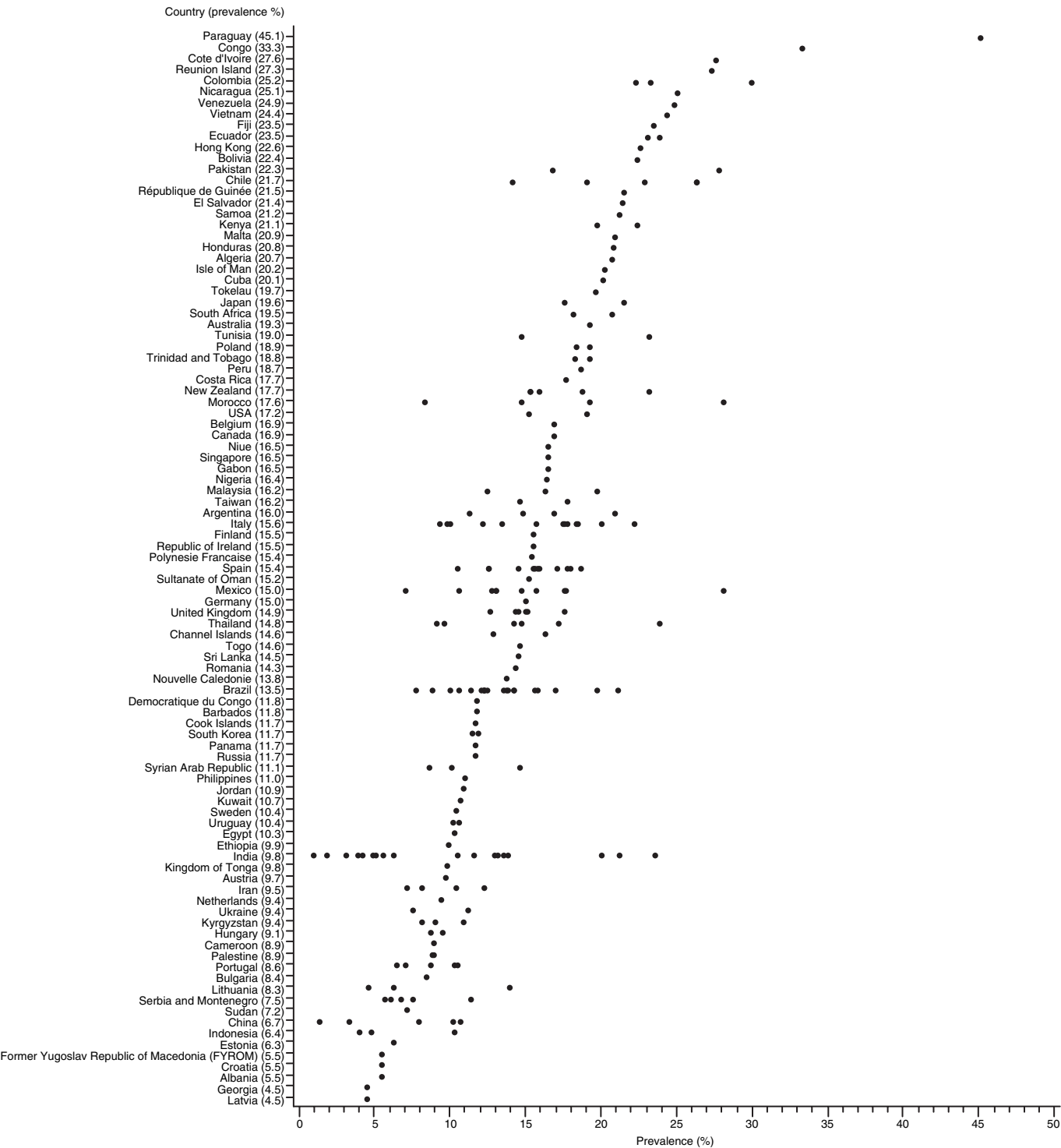


Figure 2. Prevalence of current symptoms of rhinoconjunctivitis, 13- to 14-year age group. Countries are ordered by average prevalence.

low income countries: 17 centres in Africa (from 5.1% in Brazzaville, Congo to 1.5% in Khartoum, Sudan); eight centres in Asia-Pacific (from 4.2% in Bangkok, Thailand to 1.3% in Ho Chi Minh City, Vietnam); three centres in

Eastern Mediterranean (from 2.3% in Islamabad, to 1.6% in Aleppo, Syrian Arab Republic); two centres in Indian Sub Continent (1.4% in Ludhiana and 1.2% in Bangalore, India); 20 centres in Latin America (from

# Global map of the prevalence of symptoms of rhinoconjunctivitis in children

Table 2. ISAAC Phase Three World Map Data, Symptoms of Rhinitis, 6- to 7-year age group

| Centre                | Year | N      | Current nose symptoms |      |      |      | Current nose and eye symptoms |      |      |      | Hay fever ever |     | Current rhinoconjunctivitis |   | Severe rhinoconjunctivitis |   |
|-----------------------|------|--------|-----------------------|------|------|------|-------------------------------|------|------|------|----------------|-----|-----------------------------|---|----------------------------|---|
|                       |      |        | Current nose symptoms |      |      |      | Current nose and eye symptoms |      |      |      | Hay fever ever |     | Current rhinoconjunctivitis |   | Severe rhinoconjunctivitis |   |
|                       |      |        | n                     | %    | n    | %    | n                             | %    | n    | %    | n              | %   | n                           | % | n                          | % |
| Africa                |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Nigeria               |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Ibadan                | 2002 | 2396   | 281                   | 11.7 | 133  | 5.6  | 344                           | 14.4 | 86   | 3.6  | 7              | 0.3 |                             |   |                            |   |
| South Africa          |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Polokwane*            | 2004 | 3480   | 658                   | 18.9 | 499  | 14.3 | 96                            | 20.1 | 368  | 10.6 | 58             | 1.7 |                             |   |                            |   |
| Region total          | 2003 | 5876   | 939                   | 16.0 | 632  | 10.8 | 440                           | 15.3 | 454  | 7.7  | 65             | 1.1 |                             |   |                            |   |
| Asia-Pacific          |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Hong Kong             |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Hong Kong             | 2001 | 4448   | 1661                  | 37.3 | 872  | 19.6 | 65                            | 1.5  | 789  | 17.7 | 12             | 0.3 |                             |   |                            |   |
| Indonesia             |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Bandung               | 2002 | 2503   | 274                   | 10.9 | 91   | 3.6  | 624                           | 24.9 | 91   | 3.6  | 12             | 0.5 |                             |   |                            |   |
| Japan                 |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Fukuoka               | 2002 | 2958   | 980                   | 33.1 | 317  | 10.7 | 428                           | 14.5 | 314  | 10.6 | 11             | 0.4 |                             |   |                            |   |
| Malaysia              |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Alor Setar            | 2002 | 3786   | 502                   | 13.3 | 198  | 5.2  | 412                           | 10.9 | 159  | 4.2  | 21             | 0.6 |                             |   |                            |   |
| Klang Valley          | 2001 | 3044   | 543                   | 17.8 | 216  | 7.1  | 458                           | 15.0 | 190  | 6.2  | 31             | 1.0 |                             |   |                            |   |
| Kota Bharu            | 2001 | 3110   | 438                   | 14.1 | 159  | 5.1  | 553                           | 17.8 | 130  | 4.2  | 21             | 0.7 |                             |   |                            |   |
| Country total         | 2001 | 9940   | 1483                  | 14.9 | 573  | 5.8  | 1423                          | 14.3 | 479  | 4.8  | 73             | 0.7 |                             |   |                            |   |
| Singapore             |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Singapore†            | 2001 | 5389   | 1378                  | 25.6 | 491  | 9.1  |                               |      | 467  | 8.7  | 25             | 0.5 |                             |   |                            |   |
| South Korea           |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Provincial Korea      | 2000 | 4258   | 1064                  | 25.0 | 403  | 9.5  | 798                           | 18.7 | 366  | 8.6  | 15             | 0.4 |                             |   |                            |   |
| Seoul                 | 2000 | 1760   | 490                   | 27.8 | 172  | 9.8  | 373                           | 21.2 | 159  | 9.0  | 5              | 0.3 |                             |   |                            |   |
| Country total         | 2000 | 6018   | 1554                  | 25.8 | 575  | 9.6  | 1171                          | 19.5 | 525  | 8.7  | 20             | 0.3 |                             |   |                            |   |
| Taiwan                |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Taipei                | 2001 | 4832   | 2029                  | 42.0 | 1186 | 24.5 | 1905                          | 39.4 | 1171 | 24.2 | 161            | 3.3 |                             |   |                            |   |
| Taoyuan               | 2002 | 3293   | 1223                  | 37.1 | 675  | 20.5 | 1174                          | 35.7 | 636  | 19.3 | 88             | 2.7 |                             |   |                            |   |
| Country total         | 2002 | 8125   | 3252                  | 40.0 | 1861 | 22.9 | 3079                          | 37.9 | 1807 | 22.2 | 249            | 3.1 |                             |   |                            |   |
| Thailand              |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Bangkok               | 2001 | 4209   | 1828                  | 43.4 | 603  | 14.3 | 1341                          | 31.9 | 566  | 13.4 | 59             | 1.4 |                             |   |                            |   |
| Chantaburi            | 2001 | 3321   | 913                   | 27.5 | 306  | 9.2  | 870                           | 26.2 | 255  | 7.7  | 18             | 0.5 |                             |   |                            |   |
| Chiang Mai            | 2001 | 3106   | 731                   | 23.5 | 217  | 7.0  | 611                           | 19.7 | 192  | 6.2  | 24             | 0.8 |                             |   |                            |   |
| Chiangrai             | 1995 | 1677   | 374                   | 22.3 | 95   | 5.7  | 357                           | 21.3 | 88   | 5.2  | 5              | 0.3 |                             |   |                            |   |
| Khon Kaen             | 1999 | 2658   | 891                   | 33.5 | 251  | 9.4  | 924                           | 34.8 | 246  | 9.3  | 24             | 0.9 |                             |   |                            |   |
| Nakorn Pathom         | 1996 | 1821   | 461                   | 25.3 | 122  | 6.7  | 451                           | 24.8 | 117  | 6.4  | 16             | 0.9 |                             |   |                            |   |
| Country total         | 1999 | 16 792 | 5198                  | 31.0 | 1594 | 9.5  | 4554                          | 27.1 | 1464 | 8.7  | 146            | 0.9 |                             |   |                            |   |
| Vietnam               |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Ho Chi Minh City      | 2001 | 3879   | 1405                  | 36.2 | 395  | 10.2 | 880                           | 22.7 | 393  | 10.1 | 30             | 0.8 |                             |   |                            |   |
| Region total          | 2000 | 60 052 | 17 185                | 28.6 | 6769 | 11.3 | 12 224                        | 22.4 | 6329 | 10.5 | 578            | 1.0 |                             |   |                            |   |
| Eastern Mediterranean |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Iran                  |      |        |                       |      |      |      |                               |      |      |      |                |     |                             |   |                            |   |
| Birjand               | 1996 | 2693   | 247                   | 9.2  | 90   | 3.3  | 99                            | 3.7  | 65   | 2.4  | 4              | 0.1 |                             |   |                            |   |
| Rasht                 | 2001 | 3057   | 343                   | 11.2 | 120  | 3.9  | 74                            | 2.4  | 74   | 2.4  | 4              | 0.1 |                             |   |                            |   |

Table 2. (Continued)

| Centre               | Year | N      | Current nose symptoms |      | Current nose and eye symptoms |      | Hay fever ever |      | Current rhinoconjunctivitis |     | Severe rhinoconjunctivitis |     |
|----------------------|------|--------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------|-----|----------------------------|-----|
|                      |      |        | n                     | %    | n                             | %    | n              | %    | n                           | %   | n                          | %   |
| Tehran               | 2001 | 3008   | 269                   | 8.9  | 65                            | 2.2  | 62             | 2.1  | 57                          | 1.9 | 3                          | 0.1 |
| Zanjan               | 1996 | 2777   | 407                   | 14.7 | 228                           | 8.2  | 237            | 8.5  | 135                         | 4.9 | 13                         | 0.5 |
| Country total        | 1999 | 11 535 | 1266                  | 11.0 | 503                           | 4.4  | 472            | 4.1  | 331                         | 2.9 | 24                         | 0.2 |
| Jordan               |      |        |                       |      |                               |      |                |      |                             |     |                            |     |
| Amman                | 2001 | 2598   | 433                   | 16.7 | 156                           | 6.0  | 133            | 5.1  | 156                         | 6.0 | 13                         | 0.5 |
| Malta                |      |        |                       |      |                               |      |                |      |                             |     |                            |     |
| Malta                | 2001 | 3795   | 932                   | 24.6 | 354                           | 9.3  | 848            | 22.3 | 339                         | 8.9 | 15                         | 0.4 |
| Pakistan             |      |        |                       |      |                               |      |                |      |                             |     |                            |     |
| Islamabad            | 2002 | 3966   | 872                   | 22.0 | 295                           | 7.4  | 2994           | 75.5 | 290                         | 7.3 | 25                         | 0.6 |
| Karachi              | 2002 | 2113   | 262                   | 12.4 | 128                           | 6.1  | 243            | 11.5 | 96                          | 4.5 | 6                          | 0.3 |
| Country total        | 2002 | 6079   | 1134                  | 18.7 | 423                           | 7.0  | 3237           | 53.2 | 386                         | 6.3 | 31                         | 0.5 |
| Palestine            |      |        |                       |      |                               |      |                |      |                             |     |                            |     |
| North Gaza           | 2000 | 3575   | 608                   | 17.0 | 197                           | 5.5  | 215            | 6.0  | 188                         | 5.3 | 28                         | 0.8 |
| Ramallah             | 2000 | 3754   | 544                   | 14.5 | 180                           | 4.8  | 167            | 4.4  | 176                         | 4.7 | 24                         | 0.6 |
| Country total        | 2000 | 7329   | 1152                  | 15.7 | 377                           | 5.1  | 382            | 5.2  | 364                         | 5.0 | 52                         | 0.7 |
| Sultanate of Oman    |      |        |                       |      |                               |      |                |      |                             |     |                            |     |
| Al-Khod              | 2001 | 4130   | 794                   | 19.2 | 293                           | 7.1  | 225            | 5.4  | 290                         | 7.0 | 23                         | 0.6 |
| Syrian Arab Republic |      |        |                       |      |                               |      |                |      |                             |     |                            |     |
| Lattakia             | 2003 | 2373   | 243                   | 10.2 | 102                           | 4.3  | 95             | 4.0  | 95                          | 4.0 | 4                          | 0.2 |
| Tartous              | 2001 | 2734   | 414                   | 15.1 | 155                           | 5.7  | 246            | 9.0  | 137                         | 5.0 | 11                         | 0.4 |
| Country total        | 2002 | 5107   | 657                   | 12.9 | 257                           | 5.0  | 341            | 6.7  | 232                         | 4.5 | 15                         | 0.3 |
| Region total         | 2000 | 40 573 | 6368                  | 15.7 | 2363                          | 5.8  | 5638           | 13.9 | 2098                        | 5.2 | 173                        | 0.4 |
| Indian Sub-Continent |      |        |                       |      |                               |      |                |      |                             |     |                            |     |
| India                |      |        |                       |      |                               |      |                |      |                             |     |                            |     |
| Bangalore            | 2003 | 2959   | 432                   | 14.6 | 115                           | 3.9  | 176            | 5.9  | 111                         | 3.8 | 9                          | 0.3 |
| Davangere†           | 2002 | 3043   | 366                   | 12.0 | 63                            | 2.1  |                |      | 55                          | 1.8 | 0                          | 0.0 |
| Jaipur               | 2001 | 2545   | 679                   | 26.7 | 275                           | 10.8 | 384            | 15.1 | 214                         | 8.4 | 16                         | 0.6 |
| Jodhpur              | 2003 | 2114   | 259                   | 12.3 | 62                            | 2.9  | 137            | 6.5  | 61                          | 2.9 | 5                          | 0.2 |
| Kottayam             | 2002 | 2619   | 395                   | 15.1 | 227                           | 8.7  | 242            | 9.2  | 226                         | 8.6 | 0                          | 0.0 |
| Lucknow              | 2002 | 3000   | 513                   | 17.1 | 191                           | 6.4  | 370            | 12.3 | 143                         | 4.8 | 16                         | 0.5 |
| Ludhiana             | 2002 | 3225   | 697                   | 21.6 | 143                           | 4.4  | 261            | 8.1  | 136                         | 4.2 | 5                          | 0.2 |
| Mumbai (16)          | 2003 | 2865   | 211                   | 7.4  | 65                            | 2.3  | 150            | 5.2  | 59                          | 2.1 | 0                          | 0.0 |
| Mumbai (18)          | 2002 | 4862   | 543                   | 11.2 | 177                           | 3.6  | 345            | 7.1  | 168                         | 3.5 | 10                         | 0.2 |
| Mumbai (29)          | 2002 | 1833   | 116                   | 6.3  | 54                            | 2.9  | 81             | 4.4  | 48                          | 2.6 | 3                          | 0.2 |
| Nagpur               | 2002 | 4294   | 350                   | 8.2  | 124                           | 2.9  | 307            | 7.1  | 117                         | 2.7 | 9                          | 0.2 |
| New Delhi (7)        | 2002 | 3706   | 547                   | 14.8 | 183                           | 4.9  | 598            | 16.1 | 166                         | 4.5 | 8                          | 0.2 |
| Pimpri               | 2002 | 3838   | 414                   | 10.8 | 221                           | 5.8  | 327            | 8.5  | 157                         | 4.1 | 9                          | 0.2 |
| Pune                 | 2001 | 2711   | 201                   | 7.4  | 62                            | 2.3  | 127            | 4.7  | 50                          | 1.8 | 3                          | 0.1 |
| Rasta Peth           | 2001 | 3147   | 293                   | 9.3  | 142                           | 4.5  | 224            | 7.1  | 90                          | 2.9 | 14                         | 0.4 |
| Country total        | 2002 | 46 761 | 6016                  | 12.9 | 2104                          | 4.5  | 3729           | 8.5  | 1801                        | 3.9 | 107                        | 0.2 |
| Sri Lanka            |      |        |                       |      |                               |      |                |      |                             |     |                            |     |
| Sri Lanka            | 2001 | 3345   | 703                   | 21.0 | 301                           | 9.0  | 529            | 15.8 | 284                         | 8.5 | 46                         | 1.4 |
| Region total         | 2002 | 50 106 | 6719                  | 13.4 | 2405                          | 4.8  | 4258           | 9.0  | 2085                        | 4.2 | 153                        | 0.3 |

**Global map of the prevalence of symptoms of rhinoconjunctivitis in children**

Table 2. (Continued)

| Centre               | Year | N      | Current nose symptoms |      | Current nose and eye symptoms |      | Hay fever ever |      | Current rhinoconjunctivitis |      | Severe rhinoconjunctivitis |     |
|----------------------|------|--------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------|------|----------------------------|-----|
|                      |      |        | n                     | %    | n                             | %    | n              | %    | n                           | %    | n                          | %   |
| Latin America        |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Argentina            | 2002 | 1930   | 483                   | 25.0 | 194                           | 10.1 | 175            | 9.1  | 172                         | 8.9  | 15                         | 0.8 |
| Neuquén              | 2001 | 2952   | 522                   | 17.7 | 161                           | 5.5  | 301            | 10.2 | 161                         | 5.5  | 14                         | 0.5 |
| Rosario City         | 2002 | 4882   | 1005                  | 20.6 | 355                           | 7.3  | 476            | 9.8  | 333                         | 6.8  | 29                         | 0.6 |
| Brazil               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Aracaju              | 2003 | 2443   | 487                   | 19.9 | 252                           | 10.3 | 300            | 12.3 | 227                         | 9.3  | 14                         | 0.6 |
| Itajaí               | 2001 | 1511   | 292                   | 19.3 | 156                           | 10.3 | 248            | 16.4 | 142                         | 9.4  | 20                         | 1.3 |
| Maceió               | 2002 | 1990   | 491                   | 24.7 | 225                           | 11.3 | 283            | 14.7 | 215                         | 10.8 | 30                         | 1.5 |
| Manaus Amazonas      | 2002 | 3011   | 586                   | 19.5 | 319                           | 10.6 | 404            | 13.4 | 316                         | 10.5 | 43                         | 1.4 |
| Nova Iguaçu          | 2002 | 3249   | 805                   | 24.8 | 397                           | 12.2 | 488            | 15.0 | 376                         | 11.6 | 52                         | 1.6 |
| Salvador             | 2002 | 1069   | 429                   | 40.1 | 190                           | 17.8 | 349            | 32.6 | 178                         | 16.7 | 11                         | 1.0 |
| Santo Andre          | 2000 | 2167   | 669                   | 30.9 | 285                           | 13.2 | 522            | 24.1 | 285                         | 13.2 | 27                         | 1.2 |
| São Paulo            | 2002 | 3047   | 859                   | 28.2 | 386                           | 12.7 | 891            | 29.2 | 366                         | 12.0 | 32                         | 1.1 |
| São Paulo West       | 2002 | 3312   | 958                   | 28.9 | 501                           | 15.1 | 706            | 21.3 | 441                         | 13.3 | 64                         | 1.9 |
| Country total        | 2002 | 21 799 | 5576                  | 25.6 | 2711                          | 12.4 | 4201           | 19.3 | 2546                        | 11.7 | 293                        | 1.3 |
| Chile                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Punta Arenas         | 2001 | 3052   | 857                   | 28.1 | 347                           | 11.4 | 427            | 14.0 | 343                         | 11.2 | 33                         | 1.1 |
| South Santiago       | 2001 | 3075   | 778                   | 25.3 | 467                           | 15.2 | 386            | 12.6 | 422                         | 13.7 | 44                         | 1.4 |
| Valdivia             | 2001 | 3183   | 894                   | 28.1 | 382                           | 12.0 | 430            | 13.5 | 380                         | 11.9 | 62                         | 1.9 |
| Country total        | 2001 | 9310   | 2529                  | 27.2 | 1196                          | 12.8 | 1243           | 13.4 | 1145                        | 12.3 | 139                        | 1.5 |
| Colombia             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Barranquilla         | 2002 | 3209   | 877                   | 27.3 | 594                           | 18.5 | 619            | 19.3 | 494                         | 15.4 | 28                         | 0.9 |
| Bogotá               | 2002 | 3256   | 979                   | 30.1 | 548                           | 16.8 | 588            | 18.1 | 509                         | 15.6 | 49                         | 1.5 |
| Cali                 | 2002 | 3005   | 1033                  | 34.4 | 550                           | 18.3 | 479            | 15.9 | 501                         | 16.7 | 56                         | 1.9 |
| Country total        | 2002 | 9470   | 2889                  | 30.5 | 1692                          | 17.9 | 1686           | 17.8 | 1504                        | 15.9 | 133                        | 1.4 |
| Costa Rica           |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Costa Rica†          | 2002 | 3234   | 1130                  | 34.9 | 557                           | 17.2 |                |      | 513                         | 15.9 | 37                         | 1.1 |
| Cuba                 |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| La Habana            | 2002 | 1803   | 718                   | 39.8 | 318                           | 17.6 | 695            | 38.5 | 318                         | 17.6 | 21                         | 1.2 |
| Ecuador              |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Quito                | 2003 | 3055   | 842                   | 27.6 | 445                           | 14.6 | 487            | 15.9 | 445                         | 14.6 | 31                         | 1.0 |
| El Salvador          |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| San Salvador         | 2003 | 1365   | 571                   | 41.8 | 221                           | 16.2 | 303            | 22.2 | 217                         | 15.9 | 12                         | 0.9 |
| Honduras             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| San Pedro Sula       | 2002 | 1907   | 576                   | 30.2 | 214                           | 11.2 | 260            | 13.6 | 214                         | 11.2 | 24                         | 1.3 |
| Mexico               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Ciudad Victoria      | 2003 | 2603   | 553                   | 21.2 | 190                           | 7.3  | 93             | 3.6  | 175                         | 6.7  | 12                         | 0.5 |
| Ciudad de México (1) | 2002 | 3205   | 1347                  | 42.0 | 568                           | 17.7 | 138            | 4.3  | 519                         | 16.2 | 27                         | 0.8 |
| Ciudad de México (3) | 2002 | 3493   | 1629                  | 46.6 | 640                           | 18.3 | 139            | 4.0  | 622                         | 17.8 | 46                         | 1.3 |
| Cuernavaca           | 2002 | 2579   | 539                   | 20.9 | 191                           | 7.4  | 122            | 4.7  | 186                         | 7.2  | 14                         | 0.5 |
| Mexicali Valley      | 2003 | 2568   | 695                   | 27.1 | 313                           | 12.2 | 172            | 6.7  | 290                         | 11.3 | 21                         | 0.8 |
| Monterrey            | 2001 | 3030   | 679                   | 22.4 | 252                           | 8.3  | 201            | 6.6  | 249                         | 8.2  | 15                         | 0.5 |

Table 2. (Continued)

| Centre                    | Year | N      | Current nose symptoms |      | Current nose and eye symptoms |      | Hay fever ever |      | Current rhinoconjunctivitis |      | Severe rhinoconjunctivitis |     |
|---------------------------|------|--------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------|------|----------------------------|-----|
|                           |      |        | n                     | %    | n                             | %    | n              | %    | n                           | %    | n                          | %   |
| Mérida                    | 2003 | 2896   | 1067                  | 36.8 | 392                           | 13.5 | 348            | 12.0 | 392                         | 13.5 | 45                         | 1.6 |
| Toluca                    | 2002 | 3235   | 601                   | 18.6 | 237                           | 7.3  | 130            | 4.0  | 237                         | 7.3  | 11                         | 0.3 |
| Villahermosa              | 2002 | 2678   | 867                   | 32.4 | 400                           | 14.9 | 255            | 9.5  | 373                         | 13.9 | 27                         | 1.0 |
| Country total             | 2002 | 26 287 | 7977                  | 30.3 | 3183                          | 12.1 | 1598           | 6.1  | 3043                        | 11.6 | 218                        | 0.8 |
| Nicaragua                 |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Managua                   | 2002 | 3286   | 1108                  | 33.7 | 620                           | 18.9 | 292            | 8.9  | 606                         | 18.4 | 97                         | 3.0 |
| Panama                    |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| David-Panamá              | 2001 | 2942   | 823                   | 28.0 | 413                           | 14.0 | 1154           | 39.2 | 343                         | 11.7 | 16                         | 0.5 |
| Uruguay                   |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Paysandú                  | 2002 | 1512   | 274                   | 18.1 | 103                           | 6.8  | 184            | 12.2 | 102                         | 6.7  | 4                          | 0.3 |
| Venezuela                 |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Caracas                   | 2002 | 2999   | 950                   | 31.7 | 636                           | 21.2 | 671            | 22.4 | 611                         | 20.4 | 39                         | 1.3 |
| Region total              | 2002 | 93 851 | 26 968                | 28.7 | 12 664                        | 13.5 | 13 250         | 14.6 | 11 940                      | 12.7 | 1093                       | 1.2 |
| North America             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Barbados                  |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Barbados                  | 2001 | 2759   | 310                   | 11.2 | 182                           | 6.6  | 961            | 34.8 | 177                         | 6.4  | 18                         | 0.7 |
| Canada                    |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Saskatoon                 | 2003 | 1255   | 339                   | 27.0 | 142                           | 11.3 | 154            | 12.3 | 135                         | 10.8 | 4                          | 0.3 |
| Region total              | 2002 | 4014   | 649                   | 16.2 | 324                           | 8.1  | 1115           | 27.8 | 312                         | 7.8  | 22                         | 0.5 |
| Northern & Eastern Europe |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Albania                   |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Tiranë                    | 2000 | 2896   | 397                   | 13.7 | 123                           | 4.2  | 97             | 3.3  | 113                         | 3.9  | 11                         | 0.4 |
| Bulgaria                  |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Sofia                     | 2002 | 1181   | 157                   | 13.3 | 43                            | 3.6  | 48             | 4.1  | 40                          | 3.4  | 2                          | 0.2 |
| Croatia                   |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Rijeka                    | 2002 | 1633   | 276                   | 16.9 | 92                            | 5.6  | 87             | 5.3  | 90                          | 5.5  | 6                          | 0.4 |
| Estonia                   |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Tallinn                   | 2001 | 2385   | 311                   | 13.0 | 112                           | 4.7  | 84             | 3.5  | 101                         | 4.2  | 2                          | 0.1 |
| Georgia                   |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Kutaisi                   | 2003 | 2666   | 233                   | 8.7  | 76                            | 2.9  | 75             | 2.8  | 75                          | 2.8  | 5                          | 0.2 |
| Hungary                   |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Svábhegy                  | 2003 | 2451   | 316                   | 12.9 | 131                           | 5.3  | 126            | 5.1  | 130                         | 5.3  | 21                         | 0.9 |
| Kyrgyzstan                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Bishkek                   | 2002 | 3146   | 320                   | 10.2 | 183                           | 5.8  | 93             | 3.0  | 181                         | 5.8  | 18                         | 0.6 |
| Jalalabat                 | 2003 | 1664   | 222                   | 13.3 | 88                            | 5.3  | 28             | 1.7  | 73                          | 4.4  | 5                          | 0.3 |
| Country total             | 2003 | 4810   | 542                   | 11.3 | 271                           | 5.6  | 121            | 2.5  | 254                         | 5.3  | 23                         | 0.5 |
| Lithuania                 |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Kaunas                    | 2002 | 2772   | 608                   | 21.9 | 104                           | 3.8  | 67             | 2.4  | 104                         | 3.8  | 5                          | 0.2 |
| Panevezys                 | 1997 | 1176   | 252                   | 21.4 | 31                            | 2.6  | 12             | 1.0  | 31                          | 2.6  | 0                          | 0.0 |
| Siauliai                  | 1997 | 1341   | 309                   | 23.0 | 41                            | 3.1  | 29             | 2.2  | 41                          | 3.1  | 3                          | 0.2 |
| Country total             | 1999 | 5289   | 1169                  | 22.1 | 176                           | 3.3  | 108            | 2.0  | 176                         | 3.3  | 8                          | 0.2 |

# Global map of the prevalence of symptoms of rhinoconjunctivitis in children

Table 2. (Continued)

| Centre                | Year | N      | Current nose symptoms |      | Current nose and eye symptoms |      | Hay fever ever |      | Current rhinoconjunctivitis |      | Severe rhinoconjunctivitis |     |
|-----------------------|------|--------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------|------|----------------------------|-----|
|                       |      |        | n                     | %    | n                             | %    | n              | %    | n                           | %    | n                          | %   |
| Poland                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Kraków                | 2001 | 2497   | 707                   | 28.3 | 378                           | 15.1 | 526            | 21.1 | 363                         | 14.5 | 41                         | 1.6 |
| Poznań                | 2002 | 1999   | 508                   | 25.4 | 235                           | 11.8 | 390            | 19.5 | 222                         | 11.1 | 27                         | 1.4 |
| Country total         | 2002 | 4496   | 1215                  | 27.0 | 613                           | 13.6 | 916            | 20.4 | 585                         | 13.0 | 68                         | 1.5 |
| Russia                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Novosibirsk           | 2002 | 2730   | 571                   | 20.9 | 127                           | 4.7  | 141            | 5.2  | 127                         | 4.7  | 22                         | 0.8 |
| Serbia and Montenegro |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Belgrade              | 2001 | 1932   | 375                   | 19.4 | 95                            | 4.9  | 181            | 9.4  | 95                          | 4.9  | 7                          | 0.4 |
| Nis                   | 2001 | 1002   | 123                   | 12.3 | 55                            | 5.5  | 83             | 8.3  | 50                          | 5.0  | 1                          | 0.1 |
| Novi Sad              | 2002 | 1044   | 176                   | 16.9 | 22                            | 2.1  | 48             | 4.6  | 22                          | 2.1  | 0                          | 0.0 |
| Sombor                | 2002 | 1029   | 130                   | 12.6 | 24                            | 2.3  | 55             | 5.3  | 24                          | 2.3  | 5                          | 0.5 |
| Country total         | 2002 | 5007   | 804                   | 16.1 | 196                           | 3.9  | 367            | 7.3  | 191                         | 3.8  | 13                         | 0.3 |
| Sweden                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Lindköping            | 2002 | 2089   | 255                   | 12.2 | 148                           | 7.1  | 173            | 8.3  | 144                         | 6.9  | 6                          | 0.3 |
| Ukraine               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Kharkiv               | 2002 | 1950   | 318                   | 16.3 | 155                           | 7.9  | 149            | 7.6  | 150                         | 7.7  | 10                         | 0.5 |
| Rural Kharkiv         | 1998 | 3000   | 440                   | 14.7 | 172                           | 5.7  | 116            | 3.9  | 167                         | 5.6  | 4                          | 0.1 |
| Country total         | 2000 | 4950   | 758                   | 15.3 | 327                           | 6.6  | 265            | 5.4  | 317                         | 6.4  | 14                         | 0.3 |
| Region total          | 2001 | 42 583 | 7004                  | 16.4 | 2435                          | 5.7  | 2608           | 6.1  | 2343                        | 5.5  | 201                        | 0.5 |
| Oceania               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Australia             |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Melbourne             | 2002 | 2968   | 744                   | 25.1 | 402                           | 13.5 | 587            | 19.8 | 382                         | 12.9 | 14                         | 0.5 |
| New Zealand           |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Auckland              | 2002 | 3541   | 833                   | 23.5 | 410                           | 11.6 | 525            | 14.8 | 391                         | 11.0 | 18                         | 0.5 |
| Bay of Plenty         | 2002 | 2150   | 525                   | 24.4 | 251                           | 11.7 | 342            | 15.9 | 244                         | 11.3 | 13                         | 0.6 |
| Christchurch          | 2003 | 3315   | 823                   | 24.8 | 427                           | 12.9 | 677            | 20.4 | 427                         | 12.9 | 16                         | 0.5 |
| Nelson                | 2003 | 1867   | 368                   | 19.7 | 174                           | 9.3  | 322            | 17.2 | 173                         | 9.3  | 4                          | 0.2 |
| Country total         | 2003 | 10 873 | 2549                  | 23.4 | 1262                          | 11.6 | 1866           | 17.2 | 1235                        | 11.4 | 51                         | 0.5 |
| Niue                  |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Niue Island           | 2002 | 47     | 9                     | 19.1 | 4                             | 8.5  | 2              | 4.3  | 4                           | 8.5  | 0                          | 0.0 |
| Region total          | 2002 | 13 888 | 3302                  | 23.8 | 1668                          | 12.0 | 2455           | 17.7 | 1621                        | 11.7 | 65                         | 0.5 |
| Western Europe        |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Austria               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Kärnten               | 2002 | 4847   | 523                   | 10.8 | 278                           | 5.7  | 207            | 4.3  | 275                         | 5.7  | 9                          | 0.2 |
| Urfahr-Umgebung       | 2002 | 2029   | 254                   | 12.5 | 148                           | 7.3  | 88             | 4.3  | 145                         | 7.1  | 4                          | 0.2 |
| Country total         | 2002 | 6876   | 777                   | 11.3 | 426                           | 6.2  | 295            | 4.3  | 420                         | 6.1  | 13                         | 0.2 |
| Belgium               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Antwerp               | 2002 | 5645   | 1016                  | 18.0 | 335                           | 5.9  | 338            | 6.0  | 327                         | 5.8  | 33                         | 0.6 |
| Germany               |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Münster               | 1999 | 3830   | 618                   | 16.1 | 279                           | 7.3  | 247            | 6.4  | 266                         | 6.9  | 10                         | 0.3 |
| Greece                |      |        |                       |      |                               |      |                |      |                             |      |                            |     |
| Thessaloniki          | 2000 | 1228   | 197                   | 16.0 | 51                            | 4.2  | 171            | 13.9 | 49                          | 4.0  | 3                          | 0.2 |

Table 2. (Continued)

| Centre                       | Year | N        | Current nose symptoms |      | Current nose and eye symptoms |      | Hay fever ever |      | Current rhinoconjunctivitis |      | Severe rhinoconjunctivitis |     |
|------------------------------|------|----------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------|------|----------------------------|-----|
|                              |      |          | n                     | %    | n                             | %    | n              | %    | n                           | %    | n                          | %   |
| Isle of Man                  | 2001 | 1096     | 181                   | 16.5 | 95                            | 8.7  | 136            | 12.4 | 91                          | 8.3  | 3                          | 0.3 |
| Isle of Man                  |      |          |                       |      |                               |      |                |      |                             |      |                            |     |
| Italy                        |      |          |                       |      |                               |      |                |      |                             |      |                            |     |
| Bari                         | 2002 | 1943     | 401                   | 20.6 | 130                           | 6.7  | 214            | 11.0 | 122                         | 6.3  | 6                          | 0.3 |
| Colleferro-Tivoli            | 2002 | 1143     | 176                   | 15.4 | 88                            | 7.7  | 128            | 11.2 | 82                          | 7.2  | 0                          | 0.0 |
| Emilia-Romagna               | 2002 | 2265     | 384                   | 17.0 | 160                           | 7.1  | 174            | 7.7  | 146                         | 6.4  | 2                          | 0.1 |
| Empoli                       | 2002 | 1152     | 197                   | 17.1 | 79                            | 6.9  | 146            | 12.7 | 76                          | 6.6  | 3                          | 0.3 |
| Firenze                      | 2002 | 1036     | 191                   | 18.4 | 69                            | 6.7  | 109            | 10.5 | 66                          | 6.4  | 1                          | 0.1 |
| Mantova                      | 2002 | 1288     | 216                   | 16.8 | 64                            | 5.0  | 102            | 7.9  | 62                          | 4.8  | 1                          | 0.1 |
| Milano                       | 2002 | 2249     | 421                   | 18.7 | 169                           | 7.5  | 180            | 8.0  | 160                         | 7.1  | 3                          | 0.1 |
| Roma                         | 2002 | 2224     | 446                   | 20.1 | 149                           | 6.7  | 233            | 10.5 | 142                         | 6.4  | 2                          | 0.1 |
| Torino                       | 2002 | 2361     | 444                   | 18.8 | 154                           | 6.5  | 231            | 9.8  | 146                         | 6.2  | 2                          | 0.1 |
| Trento                       | 2002 | 2359     | 303                   | 12.8 | 135                           | 5.7  | 177            | 7.5  | 129                         | 5.5  | 2                          | 0.1 |
| Country total                | 2002 | 18 020   | 3179                  | 17.6 | 1197                          | 6.6  | 1694           | 9.4  | 1131                        | 6.3  | 22                         | 0.1 |
| Portugal                     |      |          |                       |      |                               |      |                |      |                             |      |                            |     |
| Funchal                      | 2002 | 1819     | 393                   | 21.6 | 171                           | 9.4  | 122            | 6.7  | 167                         | 9.2  | 15                         | 0.8 |
| Lisbon                       | 2002 | 2477     | 651                   | 26.3 | 249                           | 10.1 | 67             | 2.7  | 247                         | 10.0 | 18                         | 0.7 |
| Portimao                     | 2001 | 1069     | 247                   | 23.1 | 88                            | 8.2  | 38             | 3.6  | 84                          | 7.9  | 7                          | 0.7 |
| Porto                        | 2002 | 2464     | 544                   | 22.1 | 186                           | 7.5  | 67             | 2.7  | 182                         | 7.4  | 8                          | 0.3 |
| Country total                | 2002 | 7829     | 1835                  | 23.4 | 694                           | 8.9  | 294            | 3.8  | 680                         | 8.7  | 48                         | 0.6 |
| Spain                        |      |          |                       |      |                               |      |                |      |                             |      |                            |     |
| A Coruña                     | 2003 | 3016     | 745                   | 24.7 | 333                           | 11.0 | 381            | 12.6 | 322                         | 10.7 | 1                          | 0.0 |
| Almería                      | 1996 | 3349     | 640                   | 19.1 | 332                           | 9.9  | 268            | 8.0  | 332                         | 9.9  | 5                          | 0.1 |
| Asturias                     | 2002 | 3193     | 711                   | 22.3 | 339                           | 10.6 | 401            | 12.6 | 329                         | 10.3 | 4                          | 0.1 |
| Barcelona                    | 2002 | 3002     | 308                   | 10.3 | 126                           | 4.2  | 246            | 8.2  | 119                         | 4.0  | 0                          | 0.0 |
| Bilbao                       | 2001 | 3157     | 635                   | 20.1 | 288                           | 9.1  | 281            | 8.9  | 281                         | 8.9  | 5                          | 0.2 |
| Cartagena                    | 2002 | 2948     | 503                   | 17.1 | 255                           | 8.6  | 230            | 7.8  | 239                         | 8.1  | 4                          | 0.1 |
| Castellón                    | 2002 | 3915     | 562                   | 14.4 | 259                           | 6.6  | 313            | 8.0  | 246                         | 6.3  | 8                          | 0.2 |
| Madrid                       | 2002 | 2347     | 546                   | 23.3 | 277                           | 11.8 | 252            | 10.7 | 261                         | 11.1 | 4                          | 0.2 |
| Pamplona                     | 2001 | 3176     | 544                   | 17.1 | 222                           | 7.0  | 261            | 8.2  | 211                         | 6.6  | 2                          | 0.1 |
| Valencia                     | 2002 | 3398     | 554                   | 16.3 | 271                           | 8.0  | 245            | 7.2  | 256                         | 7.5  | 2                          | 0.1 |
| Country total                | 2001 | 31 501   | 5748                  | 18.2 | 2702                          | 8.6  | 2878           | 9.1  | 2596                        | 8.2  | 35                         | 0.1 |
| United Kingdom               |      |          |                       |      |                               |      |                |      |                             |      |                            |     |
| Sunderland                   | 2001 | 1843     | 398                   | 21.6 | 190                           | 10.3 | 257            | 13.9 | 186                         | 10.1 | 13                         | 0.7 |
| Region total                 | 2002 | 77 868   | 13 949                | 17.9 | 5969                          | 7.7  | 6310           | 8.1  | 5746                        | 7.4  | 180                        | 0.2 |
| Global total                 | 2001 | 38 8811  | 83 083                | 21.4 | 35 229                        | 9.1  | 48 298         | 12.9 | 32 928                      | 8.5  | 2530                       | 0.7 |
| Non-English speaking centres |      | 3 70 776 | 78 872                | 21.3 | 33 138                        | 8.9  | 45 298         | 12.7 | 30 899                      | 8.3  | 2445                       | 0.7 |
| English speaking centres§    |      | 18 035   | 4211                  | 23.3 | 2091                          | 11.6 | 3000           | 16.6 | 2029                        | 11.3 | 85                         | 0.5 |

\*The North Sotho language translation for the hay fever ever question was not considered equivalent to the English language version. The prevalence value presented is for the 478 participants who did not use North Sotho language.

†Blank cells represent cases where valid data was not available.

‡Blank cells represent cases where the specific translation was not considered equivalent to the English language question.

§Centres in Australia, Canada, Isle of Man, New Zealand and United Kingdom.

## Global map of the prevalence of symptoms of rhinoconjunctivitis in children

4.0% Asunción, Paraguay to 1.1% in Costa Rica); four centres in North America (from 3.1% in Tobago, to 1.5% in Bardados); four centres in Northern & Eastern Europe (from 2.2% in Kraków, Poland to 1.1% in Svábhegy, Hungary) and four centres in Oceania (from 2.8% in Suva, Fiji to 1.3% in Auckland, New Zealand) and two centres in Western Europe (1.4% in Sunderland, UK and 1.3% in Antwerp, Belgium).

### Prevalence patterns in 6- to 7-year olds

The prevalence rates of positive responses in 6- to 7-year olds to each question in each centre are presented in Table 2 and Fig. 3. The average prevalence (across all centres that participated in Phase Three) of current rhinoconjunctivitis symptoms is 8.5% for the 6- to 7-year old children (Fig. 4).

Variation in the prevalence of current rhinoconjunctivitis symptoms was also observed between regions, ranging from 4.2% in the Indian Sub-Continent to 12.7% in Latin America with larger variations between countries. For severe rhinoconjunctivitis, the lowest prevalence was in Western Europe (0.2%) and the highest

in Latin America (1.2%), and variations were also observed between countries in the same regions.

### Correlations between symptom prevalence within age group

Within each age group, there is a moderately strong correlation between the prevalence of current rhinoconjunctivitis symptoms and the prevalence of current severe rhinoconjunctivitis symptoms (6- to 7-year age group:  $r = 0.63$ ,  $P < 0.0001$ ; 13- to 14-year age group:  $r = 0.57$ ,  $P < 0.0001$ ) (Fig. 5). In both age groups, there were also moderately strong correlations between the prevalence of current rhinoconjunctivitis symptoms and the prevalence of 'hay fever' ever (6- to 7-year age group:  $r = 0.52$ ,  $P < 0.0001$ ; 13- to 14-year age group:  $r = 0.45$ ,  $P < 0.0001$ ).

### Comparison of symptom prevalence in English centres vs non-English centres

The prevalence estimates were generally higher in English language centres compared with non-English language centres, particularly for the 6- to 7-year age group. For current rhinoconjunctivitis symptoms, the prevalence

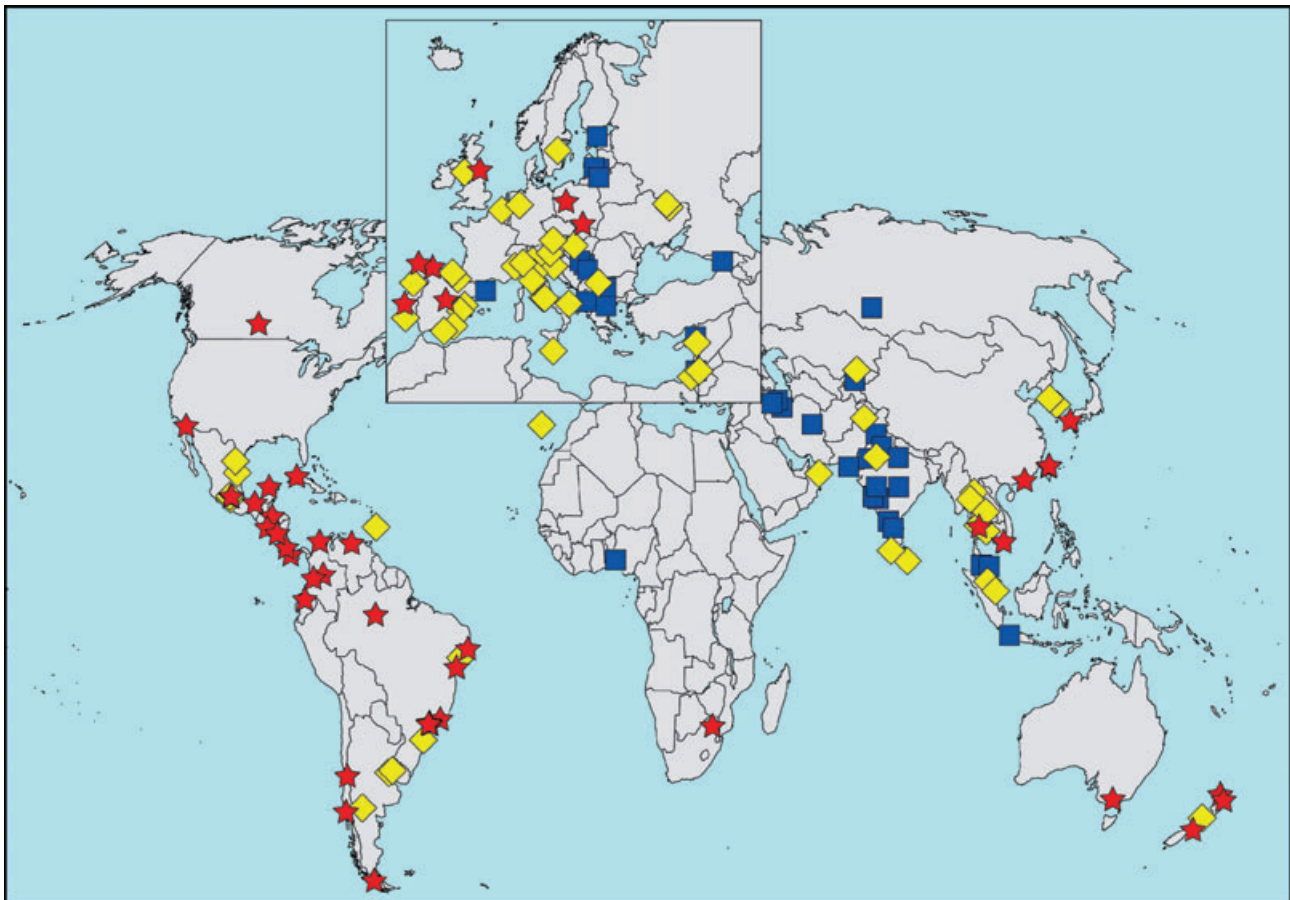


Figure 3. Map of prevalence of current symptoms of rhinoconjunctivitis, 6- to 7-year age group. Symbols indicate prevalence categories of  $\geq 10\%$  (red stars),  $\geq 5$  to  $< 10\%$  (yellow diamonds) and  $< 5\%$  (blue squares).

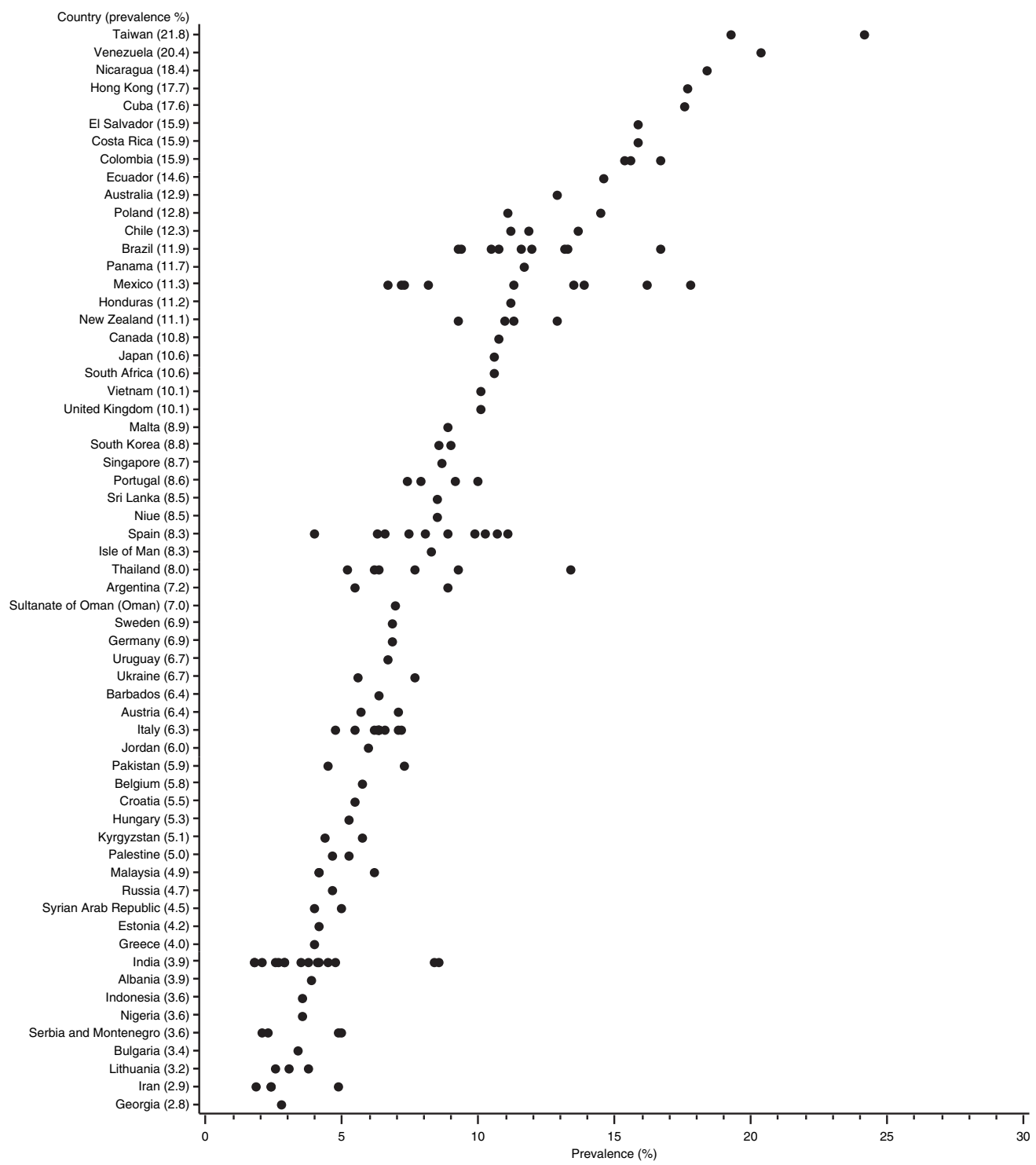


Figure 4. Prevalence of current symptoms of rhinoconjunctivitis, 6- to 7-year age group. Countries are ordered by average prevalence.

values were, respectively 11.3% and 8.3% in the 6- to 7-year age group, and 16.7% and 14.4% for the 13- to 14-year age group. Similar differences were also observed for hay fever ever: 16.6% and 12.6% in the 6- to 7-year age group, and 36.0% and 18.9% in the 13- to 14-year age group (Tables 1 and 2).

Comparison of symptom prevalence by per capita GNI

Prevalence varied by per capita GNI, but differently in the two age groups (Table 3). The prevalence of current rhinoconjunctivitis in the younger age group was the highest in the middle and high income countries (respectively

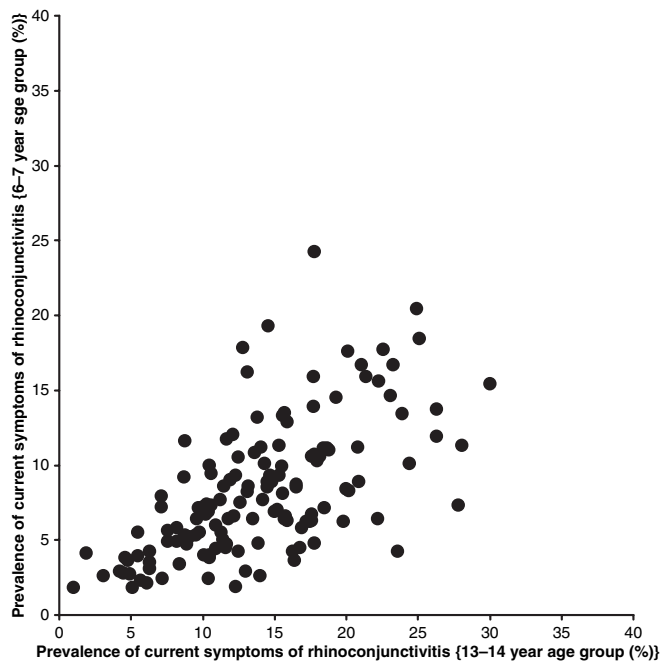


Figure 5. Scatter plot of prevalence of current symptoms of rhinoconjunctivitis, both age groups.

9.3% and 9.4%), but about half of this in low income countries (4.6%). In contrast, in the older age group, the variation in prevalence was not so large, but also relatively higher in high and middle income countries (respectively 15.2% and 14.6%) than in low income countries (13.6%).

In the 13- to 14-year age group, the prevalence of current rhinoconjunctivitis symptoms was generally lower in centres in low income countries compared with those in high income countries (OR = 0.66, 95% CI: 0.52–0.83,

$P < 0.01$ ). Centres in middle income countries had a non-significantly reduced prevalence of current rhinoconjunctivitis symptoms compared with high income (OR = 0.90, 95% CI: 0.75–1.08,  $P = 0.25$ ). In contrast, centres in low income countries had an increased prevalence of severe rhinoconjunctivitis symptoms compared with the centres in high income countries (OR = 1.67, 95% CI: 1.18–2.37,  $P < 0.01$ ). Centres in middle income countries also had an increased prevalence of severe rhinoconjunctivitis symptoms compared with the centres in high income countries (OR = 2.15, 95% CI: 1.63–2.84,  $P < 0.01$ ).

In the 6- to 7-year age group, centres in low income countries had a reduced prevalence of current rhinoconjunctivitis symptoms compared with those in high income countries (OR = 0.49, 95% CI: 0.38–0.65,  $P < 0.01$ ). Centres in middle income countries had a non-significantly reduced prevalence of current rhinoconjunctivitis symptoms compared with centres in high income countries (OR = 0.97, 95% CI: 0.78–1.19,  $P = 0.74$ ). In this age group, centres in low income countries had a non-significantly increased prevalence of severe rhinoconjunctivitis symptoms compared with centres in high income countries (OR = 1.07, 95% CI: 0.72–1.60,  $P = 0.73$ ). Centres in middle income countries had a significantly increased prevalence of severe rhinoconjunctivitis symptoms compared with centres in high income countries (OR = 2.95, 95% CI: 2.18–3.99,  $P < 0.01$ ).

Co-morbidity of rhinoconjunctivitis symptoms with asthma and/or eczema symptoms

Table 4 shows the prevalence values of symptoms of rhinoconjunctivitis alone or in combination with symptoms of asthma and/or eczema. The prevalence

Table 3. Prevalence of symptoms of rhinoconjunctivitis by level of gross national income. ISAAC Phase Three World Map centres, rhinitis questionnaire data by country income (World Bank data)

| Income category          | No. centres | N      | Current nose symptoms |      | Current nose and eye symptoms |      | Hay fever ever |      | Current symptoms of rhinoconjunctivitis |      | Current symptoms of severe rhinoconjunctivitis |     |  |
|--------------------------|-------------|--------|-----------------------|------|-------------------------------|------|----------------|------|-----------------------------------------|------|------------------------------------------------|-----|--|
|                          |             |        | Frequency             | %    | Frequency                     | %    | Frequency      | %    | Frequency                               | %    | Frequency                                      | %   |  |
|                          |             |        |                       |      |                               |      |                |      |                                         |      |                                                |     |  |
| 6- to 7-year age group   |             |        |                       |      |                               |      |                |      |                                         |      |                                                |     |  |
| Low income               | 21          | 63925  | 9378                  | 14.7 | 3326                          | 5.2  | 8311           | 13.7 | 2920                                    | 4.6  | 198                                            | 0.3 |  |
| Middle income            | 74          | 191724 | 44951                 | 23.4 | 19129                         | 10.0 | 24922          | 13.4 | 17757                                   | 9.3  | 1693                                           | 0.9 |  |
| High income              | 46          | 125786 | 27593                 | 21.9 | 12393                         | 9.9  | 14681          | 12.2 | 11883                                   | 9.4  | 587                                            | 0.5 |  |
| Unknown income*          | 3           | 7376   | 1161                  | 15.7 | 381                           | 5.2  | 384            | 5.2  | 368                                     | 5.0  | 52                                             | 0.7 |  |
| 13- to 14-year age group |             |        |                       |      |                               |      |                |      |                                         |      |                                                |     |  |
| Low income               | 33          | 100262 | 28229                 | 28.2 | 15164                         | 15.1 | 23354          | 24.0 | 13662                                   | 13.6 | 1041                                           | 1.0 |  |
| Middle income            | 126         | 370495 | 116990                | 31.6 | 60058                         | 16.2 | 65513          | 18.3 | 54009                                   | 14.6 | 4109                                           | 1.1 |  |
| High income              | 67          | 188977 | 64689                 | 34.2 | 30312                         | 16.0 | 41342          | 22.4 | 28802                                   | 15.2 | 1290                                           | 0.7 |  |
| Unknown income†          | 6           | 10508  | 2642                  | 25.1 | 1408                          | 13.4 | 1075           | 10.3 | 1393                                    | 13.3 | 122                                            | 1.2 |  |

\*World bank income data was not available for Niue and Palestine (Ramallah and North Gaza centres).

†World bank income data was not available for Cook Islands, Niue, Palestine (Ramallah and North Gaza centres), Réunion Island and Tokelau.

Table 4. Co-morbidity of rhinoconjunctivitis symptoms with symptoms of asthma and/or eczema

| Region                    | N        | Symptoms of rhinoconjunctivitis only |     | Symptoms of asthma and rhinoconjunctivitis |     | Symptoms of rhinoconjunctivitis and eczema |     | Symptoms of all 3 conditions |     |
|---------------------------|----------|--------------------------------------|-----|--------------------------------------------|-----|--------------------------------------------|-----|------------------------------|-----|
|                           |          | Frequency                            | %   | Frequency                                  | %   | Frequency                                  | %   | Frequency                    | %   |
| 6- to 7-year age group    |          |                                      |     |                                            |     |                                            |     |                              |     |
| Africa                    | 5876     | 215                                  | 3.7 | 89                                         | 1.5 | 80                                         | 1.4 | 70                           | 1.2 |
| Asia-Pacific              | 60 052   | 3520                                 | 6.2 | 1117                                       | 2.0 | 884                                        | 1.5 | 494                          | 0.9 |
| Eastern Mediterranean     | 40 573   | 1200                                 | 3.0 | 505                                        | 1.2 | 194                                        | 0.5 | 199                          | 0.5 |
| Indian Sub-Continent      | 50 106   | 1183                                 | 2.4 | 554                                        | 1.1 | 174                                        | 0.3 | 174                          | 0.3 |
| Latin America             | 93 851   | 5425                                 | 5.8 | 3518                                       | 3.7 | 1513                                       | 1.6 | 1484                         | 1.6 |
| North America             | 4014     | 111                                  | 2.8 | 100                                        | 2.5 | 37                                         | 0.9 | 64                           | 1.6 |
| Northern & Eastern Europe | 42 583   | 1266                                 | 3.0 | 569                                        | 1.3 | 270                                        | 0.6 | 238                          | 0.6 |
| Oceania                   | 13 888   | 568                                  | 4.1 | 487                                        | 3.5 | 223                                        | 1.6 | 343                          | 2.5 |
| Western Europe            | 77 868   | 2810                                 | 3.6 | 1508                                       | 1.9 | 765                                        | 1.0 | 663                          | 0.9 |
| 13- to 14-year age group  |          |                                      |     |                                            |     |                                            |     |                              |     |
| Africa                    | 66 334   | 6385                                 | 9.6 | 2272                                       | 3.4 | 2020                                       | 3.0 | 1266                         | 1.9 |
| Asia-Pacific              | 99 688   | 8581                                 | 9.3 | 2135                                       | 2.3 | 1064                                       | 1.1 | 530                          | 0.6 |
| Eastern Mediterranean     | 51 708   | 4463                                 | 8.6 | 1127                                       | 2.2 | 756                                        | 1.5 | 408                          | 0.8 |
| Indian Sub-Continent      | 55 815   | 4177                                 | 7.5 | 900                                        | 1.6 | 496                                        | 0.9 | 395                          | 0.7 |
| Latin America             | 1 65 917 | 16 038                               | 9.7 | 7076                                       | 4.3 | 3255                                       | 2.0 | 2369                         | 1.4 |
| North America             | 13 994   | 1269                                 | 9.1 | 653                                        | 4.7 | 219                                        | 1.6 | 213                          | 1.5 |
| Northern & Eastern Europe | 72 092   | 4056                                 | 5.6 | 1516                                       | 2.1 | 582                                        | 0.8 | 445                          | 0.6 |
| Oceania                   | 36 385   | 3321                                 | 9.1 | 1496                                       | 4.1 | 796                                        | 2.2 | 566                          | 1.6 |
| Western Europe            | 1 08 309 | 9169                                 | 8.5 | 3974                                       | 3.7 | 1247                                       | 1.2 | 1229                         | 1.1 |

of co-morbidity of rhinoconjunctivitis symptoms with asthma symptoms varied regionally, ranging from 1.1% in the Indian Sub-Continent to 3.5% in Oceania and 3.7% in Latin America for the 6- to 7-year old children, and from 1.6% in the Indian Sub-Continent to more than 4% (4.1% in Oceania, 4.3% in Latin America and 4.7% in North America) for the 13- to 14-year age group.

The prevalence of co-morbidity with eczema varied from 0.3% in the Indian Sub-Continent to 1.6% in Oceania and Latin America in the younger age group, and from 0.8% in Northern & Eastern Europe to 2% in Latin America, 2.2% in Oceania and 3% in Africa in the older age group. The proportion of children with all three conditions varied in the younger age group from 0.3% in the Indian Sub-Continent to 2.5% in Oceania, and in the older age group from 0.6% in Asia-Pacific and Northern & Eastern Europe to 1.9% in Africa.

## Discussion

The International Study of Asthma and Allergies in Childhood Phase Three has now considerably expanded on the number of countries and centres involved in the previous ISAAC Phase One survey, and the resulting new global map involves many more centres in regions of the world (particularly Africa and Latin America), which were not strongly represented previously (2,4).

## Main findings

Our study has shown substantial global variations in the prevalence of reported symptoms of rhinoconjunctivitis in children. The lowest prevalence values were mainly found in centres in Eastern Europe, Central Asia and the Indian Sub-Continent. Countries with lower GNI tended to have lower prevalence values of rhinoconjunctivitis symptoms, particularly in the 6- to 7-year age group. There was substantial co-morbidity with other allergic diseases. However, the average prevalence of rhinoconjunctivitis is relatively high even in non-affluent countries and could be explained by a large proportion of non-atopic rhinoconjunctivitis, as demonstrated in ISAAC Phase Two (16).

The large variations in prevalence between centres may reflect not only the differences in risk factors for rhinoconjunctivitis but also could be attributed to language or cultural differences. In both age groups, all symptoms showed a higher prevalence in English-speaking centres than in centres where the questionnaire was administered in other languages. These differences could be because of differences in environmental exposures, but could also be because of language differences. Some regions of the world (particularly in Sub-Saharan Africa) do not have a clear pollen season and this fact could explain that the label of hay fever is often misunderstood in these regions of the world.

The lack of management of rhinoconjunctivitis in a large number of low and middle income countries is partly because of the lack of availability and the poor

affordability of essential drugs for asthma and rhinoconjunctivitis (mainly for inhaled steroids) in these countries (17–21), and is compatible with the finding that the prevalence of severe rhinoconjunctivitis is higher in these countries particularly in Africa and Latin America.

This study presents for the first time the global patterns in the prevalence of co-morbidity of rhinoconjunctivitis with asthma and eczema. The co-morbidity of rhinoconjunctivitis with asthma is particularly high in the older age group in Africa and Latin America, a finding that is likely to be of clinical importance.

#### Strengths of this study

The strengths of this study include the large number of children and the use of a common protocol. These increase the reliability of comparison within centres and particularly within affluent and non-affluent countries. Furthermore, ISAAC Phase Three has a better global representation than in ISAAC Phase one, as indicated by the higher number of centres involved in Latin America and in Africa.

#### Public health and future research implications

The data presented are the most extensive, likely to be available for the foreseeable future. Therefore, these data provide a global map of symptom prevalence, which is of clinical importance for health professionals and will be important for developing and testing new hypotheses concerning the causes of rhinoconjunctivitis.

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All authors participated in the development, design, analysis and interpretation of this work and in the writing of this paper.

#### Conflicts of interest

None declared.

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