EUROPEAN RESPIRATORY journal
FLAGSHIP SCIENTIFIC JOURNAL OF ERS

Early View

Original research article

The burden of asthma, hay fever and eczema in children in 25 countries: GAN Phase I study

Luis García-Marcos, M. Innes Asher, Neil Pearce, Eamon Ellwood, Karen Bissell, Chen-Yuan Chiang, Asma El Sony, Philippa Ellwood, Guy B. Marks, Kevin Mortimer, A. Elena Martínez-Torres, Eva Morales, Virginia Perez-Fernandez, Steven Robertson, Charlotte E. Rutter, Richard J. Silverwood, David P. Strachan,

Please cite this article as: García-Marcos L, Innes Asher M, Pearce N, *et al*. The burden of asthma, hay fever and eczema in children in 25 countries: GAN Phase I study. *Eur Respir J* 2022; in press (https://doi.org/10.1183/13993003.02866-2021).

The burden of asthma, hay fever and eczema in children in 25 countries. GAN Phase I study.

Luis García-Marcos[1], M. Innes Asher[2], Neil Pearce[3], Eamon Ellwood[2], Karen Bissell[4], Chen-Yuan Chiang[5], Asma El Sony[6], Philippa Ellwood[2], Guy B. Marks[7], Kevin Mortimer[8], A. Elena Martínez-Torres[9], Eva Morales[10], Virginia Perez-Fernandez[11], Steven Robertson[3], Charlotte E. Rutter[3], Richard J. Silverwood[3,12], David P. Strachan[13] and the Global Asthma Network Phase I Study Group[14]

[1]Paediatric Allergy and Pulmonology Units, Virgen de la Arrixaca University Children's Hospital, University of Murcia and IMIB Bio-health Research Institute, Murcia; and ARADyAL Allergy Network, Murcia, Spain.

[2]Department of Paediatrics: Child and Youth Health, Faculty of Medical and Health Sciences, University of Auckland, Auckland, New Zealand

[3]Department of Medical Statistics, London School of Hygiene & Tropical Medicine, London, United Kingdom

[4]School of Population Health, Faculty of Medical and Health Sciences, University of Auckland, Auckland, New Zealand

[5]International Union Against Tuberculosis and Lung Disease, Paris, France; and Division of Pulmonary Medicine, Department of Internal Medicine, Wan Fang Hospital, Taipei Medical University; and Division of Pulmonary Medicine, Department of Internal Medicine, School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan

[6]Epidemiological Laboratory (Epi-Lab) for Public Health, Research and Development, Khartoum, Sudan

[7]Respiratory & Environmental Epidemiology, University of New South Wales, Sydney, Australia

[8]Department of Medicine, University of Cambridge, Cambridge, United Kingdom; and Liverpool University Hospitals NHS Foundation Trust, Liverpool, United Kingdom

[9] Paediatric Allergy and Pulmonology Units and Nurse Research Group, Virgen de la Arrixaca University Children's Hospital; and IMIB Bio-health Research Institute, Murcia, Spain

[10]Department of Public Health Sciences, University of Murcia, and IMIB Bio-health Research Institute, Murcia, Spain

[11]Department of Biostatistics, University of Murcia, and IMIB Bio-health Research Institute, Murcia, Spain

[12]Centre for Longitudinal Studies, UCL Social Research Institute, University College London, London, United Kingdom

[13]Population Health Research Institute, St George's, University of London, London, United Kingdom

[14]Global Asthma Network Phase I Study Group listed at the end of the report

Corresponding author
Luis Garcia-Marcos
Department of Paediatrics
University of Murcia
Edificio Departamental-LAIB, Avenida Buenavista s/n, 30120 El Palmar, Murcia, Spain
Phone: +34868888129
Email: lgmarcos@um.es

Take home message

There is a substantial global burden of asthma, hay fever and eczema in adolescents and children, representing a major global public health problem. Accessible, affordable, equitable and effective strategies are needed to reduce this burden.

Plain language summary

Asthma, hay fever and eczema are very frequent diseases in childhood causing enormous burden. The Global Asthma Network (GAN) Phase I study provides an update of the prevalence of those diseases in adolescents 13-14 years-old and children 6-7 years-old in many countries with different socio-economic situations. This update arrives after 15 years of the last survey carried out by the International Study of Asthma and Allergies in Childhood (ISAAC). Although with considerable variations, the overall global burden of asthma, rhinoconjunctivitis and eczema remains substantial, with around 10% of adolescents and children suffering from asthma ever; 15% of adolescents and 11% of children suffering from hay fever; and 11% and 13%, respectively, from eczema ever.

ABSTRACT

There have been no worldwide standardised surveys of prevalence and severity of asthma, rhinoconjunctivitis and eczema in school children for 15 years. The present study aims to provide this information.

Following the exact International Study of Asthma and Allergies in Childhood (ISAAC) methodology (cross-sectional questionnaire-based survey) the Global Asthma Network (GAN) Phase I was carried out between 2015 and 2020 in many centres worldwide.

The study included 157,784 adolescents (13-14 years of age) in 63 centres, in 25 countries; and 101,777 children (6-7 years of age) in 44 centres, in 16 countries. The current prevalence of symptoms, respectively, was: 11.0% and 9.1% for asthma; 13.3% and 7.7% for rhinoconjunctivitis; and 6.4% and 5.9% for eczema. For asthma ever, hay fever ever and eczema ever prevalence was 10.5% and 7.6%; 15.2% and 11.1%; and 10.6% and 13.4%. Centres in countries with low- or lower-middle- gross national income (LICs or L-MICs) had significantly lower prevalence of the three disease symptoms and diagnoses (except for hay fever). In children, the prevalence of asthma and rhinoconjunctivitis symptoms were higher in males, while the reverse occurred among adolescents. For eczema, while the prevalence among female adolescents was double that of males, there was no sex difference among children. Centre accounted for a non-negligible variability of all disease symptoms (10% to 20%).

The burden of asthma, rhinoconjunctivitis and eczema vary widely among the limited number of countries studied. Although symptom prevalence is lower in LICs and L-MICs, it represents a considerable burden everywhere studied.

INTRODUCTION

Asthma is the most prevalent chronic condition in childhood causing enormous morbidity and mortality worldwide [1, 2]. In the age group of 5-19 years, as calculated in 2019, it caused about 209 disability adjusted life years (DALYs) per 100,000, ranking 10th of all diseases; and 0.29 deaths per 100,000, ranking 16th among the non-communicable diseases [3]. Furthermore, when last measured by the "International Study of Asthma and Allergy in Childhood" (ISAAC), 6.9% of adolescents 13-14 years of age globally suffered from severe asthma symptoms [4]. There are about 260 million adolescents of 13-14 years in the world [5], meaning that about 18 million of them suffer from severe asthma as, according to the more recent data, asthma prevalence seems relatively stable during the last decades [6] Other allergic conditions, such as rhinoconjunctivitis and eczema, do not result directly in deaths but cause considerable morbidity [7, 8]. As with asthma, prevalence of rhinoconjunctivitis seems to remain quite stable [9]; thus, probably about 15% of adolescents globally suffer from rhinoconjunctivitis. Among those suffering the condition, a proportion of 1 in 15 have symptoms severe enough to interfere significantly with their daily activities [9, 10]. These figures indicate that 2.6 million adolescents suffer from severe rhinoconjunctivitis. Unfortunately, no data on the time trends of eczema prevalence worldwide is available at present. But if the trends are also stable, the corresponding figures derived from ISAAC would be that 3.1 million adolescents suffer from severe eczema causing sleep disturbances [11]. Figures in younger children 6-7 years old would run in parallel [10, 11].

Global Asthma Network (GAN) Phase I aims to offer an updated snapshot of the prevalence and severity of asthma, rhinoconjunctivitis and eczema symptoms from diverse centres around the world, most of which have never been surveyed before.

MATERIAL AND METHODS

The objectives and methodology of GAN has been already published elsewhere, including response rates, geographical coverage, and questionnaire details [12] and, except for a section on asthma management and control, is identical to that of ISAAC. In summary, GAN is a worldwide cross-sectional study based on written questionnaires distributed in schools. It includes two age groups: compulsory 13-14-year-olds (adolescents) and optional 6-7-year-olds (children).

Questionnaires

The definitions of indicators of the three conditions were extracted from the written (or in some instances online) questionnaires completed by adolescents at school; or at home by the parents of children. The original questionnaire was in English. Some centres included the optional video-questionnaire on asthma in adolescents [13]. Questionnaires, which were validated previously to ISAAC Phase I, were translated into the local languages according to the ISAAC protocol [14].

Definitions

<u>Asthma symptoms and diagnosis</u>

"Current wheeze" was defined by a positive answer to the question "Have you (has your child) had wheezing or whistling in the chest in the past 12 months?". "Severe asthma symptoms"

was defined as those with current wheeze who have had ≥4 attacks of wheeze, or >1 night per week sleep disturbance from wheeze, or wheeze affecting speech in the past 12 months. ''Asthma ever'' was defined as a positive answer to the question ''Have you (Has your child) ever had asthma?''. The scenes of the video-questionnaire showed five different situations which represent features of wheezing and severe wheezing. Adolescents were asked whether they had gone through the situations in the scenes during the past 12 months.

Rhinoconjunctivitis symptoms and hay fever diagnosis

"Current rhinoconjunctivitis symptoms" was defined from the positive answers to two different questions: "In the past 12 months, have you (has this child) had a problem with sneezing, or a runny or blocked nose when he/she did not have a cold or the flu?" and "In the past 12 months, has this (child's) nose problem been accompanied with itchy-watery eyes". "Severe rhinoconjunctivitis symptoms" was defined by the response "a lot" to the question "In the past 12 months, how much did this (child's) nose problem interfere with your (his/her) daily activities? (Not at all, a little, a moderate amount, a lot)". "Hay fever ever" was defined as a positive answer to: "Have you (Has your child) ever had hay fever?"

Eczema symptoms and diagnosis

"Current eczema symptoms" was defined as a positive answer to the two questions: "Have you (has this child) had this itchy rash [defined in a previous question] at any time in the past 12 months?" and "Has this itchy rash at any time affected any of the following places: the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes?". "Severe eczema symptoms" was defined as current symptoms being the cause of awakening one or more times per week in: "In the past 12 months, how often, on average, have you (has this child) been kept awake at night by this itchy rash? (Never, less than one night per week, one or more nights per week). "Eczema ever" was defined as a positive answer to: "Have you (Has your child) ever had eczema?"

Sample size and power

The study was launched in January 2015 inviting all ISAAC centres to participate. Those centres were familiar with the methods and would allow obtaining information about time trends. All students of the target age within schools (selected randomly when their number was higher than the needed to recruit the planned sample) were invited to participate and were selected by grade or by age. A sample size of 3000 was sought in each age group (with a minimum of 1000 deemed acceptable) as it would have enough power (>90%) to detect (at a significance level of 0.01) prevalence differences of 5% at the expected asthma prevalence, and to allow for testing multiple hypotheses. Additional details of the sample size and power are described elsewhere [12, 15, 16]. High participation rates were sought (response rate at least 80% for adolescents and 70% for children) and achieved [17]. Centres with a participation rate lower than 50% were excluded.

Data handling and analysis

Data handling from each centre has been described in detail elsewhere [12]. A uniform approach to data processing, checking and analysis was used, using Stata versions 13-15 [18]. For calculating participation rates the denominator was the total number of pupils in the target classrooms of the schools chosen to be surveyed in each centre and the numerator was the total number of core symptom questionnaires returned with at least some symptom data

in that centre. For prevalence estimations, positive answers to a specific symptom in the centre was divided by the number of completed questionnaires. If apparent inconsistencies were found between responses to a main question and a branched question (one dependent on the response to a main question), these were accepted and not recoded. Centres with major deviations from protocol were excluded from the analysis [19]. Where centres deviated slightly, these were noted and listed in the corresponding tables (as in Lai et al. table S1 [4]).

Income category for each country was calculated from the World Bank classification in June 2020 (https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2020-2021). As the number of centres in lower income countries (LICs) was very small, the categories of LIC and lower-middle income countries (LMICs) were merged for analyses ("LICs&L-MICs"). Prevalence variability between centres was expressed as percentiles 10, 50, and 90, together with the ratio between P90 and P10. Spearman correlation coefficient was used to assess the relationships between centre-level prevalences. Kappa statistics were used to examine the agreement between individual responses to the written and video-questionnaire. Multilevel logistic regression was used to estimate how much of the variability of each symptom's prevalence was attributable to centre (cluster) differences, additional to within-centre binomial sampling error. The model included school as second level. As the intraclass correlation coefficient was higher than 5% (ICC>0.05) in the null model in all instances, this statistical approach was used to analyse the effect of sex and GNI on the prevalence of symptoms of the three conditions, using centre and school as clusters in a three-level model.

Ethics

All centres were required to attain approval from their local ethics committee. They determined the method of consent either passive (agreeing by participation) or active (signing a written consent prior to filling in the questionnaire) from parents/caregivers; however, GAN recommended passive consent as active (written) consent could reduce response rate [20]. As adolescents should also manifest their own consent, they agreed by participating.

RESULTS

The number of participants was 157,784 adolescents in 63 centres (14 and 26 of which also performed ISAAC Phase I or Phase III, respectively), in 25 countries; and 101,777 children in 44 centres (10 and 18 also performed ISAAC Phase I or Phase III, respectively) [6], in 16 countries. For adolescents, fieldwork extended from March 2015 to May 2020, while for children it spanned from January 2016 to June 2020 (Web tables 1-7). The different periods were due mainly to children of different age groups being in different schools. Table 1 shows the prevalence of the different markers of disease grouped by GNI; and Web table 8, by sex. The grouped LICs&L-MICs showed a consistent trend that all symptoms prevalences were significantly lower. Maps of the prevalence of the three conditions in each age group are depicted in Figures 1 and 2. Centres including both age groups can be derived from web tables 1-2 and 4-7.

Asthma

The overall prevalence of current wheeze among adolescents was 11.1%. In the multilevel analysis, 12.2% of the variability of the prevalence was attributable to differences between

centres. For severe asthma symptoms, the prevalence was 5.2%, and centre accounted for 13.4% of the variability. The prevalence of asthma ever was 10.5%, with variability attributable to centre being 18.3%. For any indicator, variability was high both between countries and between centres within countries (Tables 1 and 2, Web table 1, and Figure 1), although it was higher between countries. Females had higher prevalence of current wheeze and of severe asthma symptoms, but lower of asthma ever (Web table 8).

In children, the corresponding figures for current wheeze, severe asthma symptoms and asthma ever were 9.1%, 3.9% and 7.6% (Tables 1 and 2, Web table 2, and Figure 2). Variability was also high (higher between countries), and differences between centres explained respectively 15.1%, 17.6% and 24.1% of that variability. For all three asthma indicators, the prevalence was higher in males (Web table 8).

Asthma video-questionnaire

The video-questionnaire was implemented in 35 centres with a total of 85,669 adolescents. As with the written questionnaire, the prevalence of positive responses to the different scenes were quite variable between countries and within centres in countries (Web table 3).

Agreement between written and video-questions was reasonable, similarly to ISAAC Phases I and III [4, 13, 16]. Current asthma symptoms had the highest agreement (κ=0.33; 95%CI 0.32-0.34) and coughing at night the lowest (κ=0.22; 95%CI 0.21-0.23).

Hay fever and rhinoconjunctivitis

The prevalence of current rhinoconjunctivitis symptoms, severe symptoms and hay fever are shown in Tables 1 and 2, Web table 4, and Figure 1. The overall prevalence of the three indicators was 13.3%, 0.8% and 15.2% respectively; also, highly variable between countries and between centres within countries. Centre explained 9.9% of the variability of current symptoms; 13.6% of that of severe symptoms and 22.7% of that of hay fever ever. The prevalence of hay fever indicators among females was higher than in males (Web table 8)

Among children the corresponding figures for current symptoms, severe symptoms and hay fever ever were 7.7%, 0.6%, and 11.1% (Table1 and 2, Web table 5, and Figure 2). There was also considerable variability, with centre explaining a substantial part for current symptoms (19.6%), severe symptoms (16.1%), and hay fever (25.1%). In contrast to adolescents, children had higher prevalences of hay fever indicators than females (Web table 8).

Eczema

The prevalence of current eczema symptoms among the adolescents was 6.4%; of severe symptoms 1.0%; and of eczema ever 10.6%. (Tables 1 and 2, Web table 6, and Figure 1). Variation due to centre tended to be slightly lower than in the other two conditions: 9.6%, 13.0% and 18.6% respectively for the three indicators. Males had significantly lower prevalences than females in any of the indicators (Web table 8).

The prevalence of eczema indicators among children (Tables 1 and 2, Web table 7, and Figure 2) was as follows: current symptoms 5.9%, severe symptoms 0.7%, and eczema ever 13.4%. Variability was high, as previously, and centre explained 11.8%, 12.6% and 25.8%, respectively of current symptoms, severe symptoms, and eczema ever. The prevalence among males and females was similar (Web table 8).

Correlations between and within indicators of the three conditions

There was moderate to strong correlation between the prevalence of the three different diseases at the centre level, ranging from 0.29 (CI95% 0.23-0.69) between asthma ever and hay fever ever in children (Figure 3) to 0.75 (CI95% 0.57-0.92) between current symptoms of asthma and rhinoconjunctivitis in children (Web Figure 3). A complete rank correlation cross table is included in Web table 9.

DISCUSSION

Although with considerable variations at centre, country and GNI levels, the overall global burden of asthma, rhinoconjunctivitis and eczema remains substantial, with around 10% of adolescents and children suffering from asthma ever; 15% of adolescents and 11% of children suffering from hay fever; and 11% and 13%, respectively, from eczema ever. Even though the degree of asthma control is relatively high regardless of income levels, asthma control seems to be a substantial problem across the globe.

The trend found in ISAAC of English-speaking countries and Latin-American countries having relatively higher prevalence of asthma [4, 16, 21, 22] was difficult to ascertain on this occasion as the number of centres in English speaking countries was low. As in ISAAC Phase III [4, 23], there was a clear trend of asthma symptoms and its severity running in parallel in both age groups. For the complete picture of time trends of asthma symptoms, please see the recent paper by Asher et al. recently published [6].

Prevalence of asthma indicators was lower in the group of LICs&L-MICs countries in both age groups, although this may be driven by Indian centres, which tended to have the lowest prevalence, consistent with previous ISAAC surveys [4, 16]. . Usually in LICs&L-MICs hygiene conditions are poorer and contact with farm animals more frequent, thus individuals are probably more exposed to higher amounts and diversity of bacteria, which have been shown to be a protective factor for atopy and asthma [24, 25]

Consistent with asthma is the lower prevalence of rhinoconjunctivitis and severe rhinoconjunctivitis symptoms in LICs&LMICs in both age groups. This was not the case with hay fever ever and might indicate that this concept is more familiar in temperate climates than in tropical countries, including many of the LIC/LMICs in GAN. In contrast with the asthma patterns, India does not seem to be wholly responsible for the low prevalence as the other two countries in this GNI category, have quite similar prevalences. To what extent rhinoconjunctivitis is a marker of the atopic condition, which may be lower in less westernised countries, cannot be said but deserves some consideration [26]. The fact that hay fever does not follow the same pattern across countries and does not correlate well with rhinoconjunctivitis symptoms at the centre level, may reflect genuine differences in prevalence, but may also be due to diverse diagnostic criteria [27].

The prevalence of eczema indicators was also variable, but substantially higher in HICs. A higher prevalence of atopy in HICs might explain this distribution [26]. Furthermore, the different prevalence of non-atopic skin diseases, such as those caused by fungi [28], in the different GNI groups makes the epidemiological context of the diagnosis of eczema diverse.

Prevalence variability attributable to centre accounted for some proportion of the total variability in all three conditions. Risk or protective factors or even interpretation of questions at the centre and individual level are probably shared more by centres in the same countries

than by centres in different countries. This could explain the pattern of variability found for all three conditions being lower within than between countries.

The observation of asthma and rhinoconjunctivitis being more prevalent in males in children was reversed in adolescents, a finding that was previously shown in ISAAC and other studies [16, 22, 29]. The reason for this change is not clear although hormonal influences have been claimed to be involved [30, 31]. With respect to eczema symptoms, previous ISAAC surveys [11, 32] showed that they were more prevalent in girls than in boys in both age groups although this was strongest in adolescents. We only found a difference among adolescents. This higher prevalence in adolescent females has also been found in prospective cohorts [33] and might again be related to oestrogen and progesterone interacting with skin allergy [30]. The lack of difference between sexes in children might be due to the different geographical distribution of centres in GAN and ISAAC [34].

The strengths of the present study are the ample world coverage, the large numbers of new centres, and participants, and the use of the identical standardised and easy to use ISAAC methodology, which allows both robust cross-sectional inferences as well as meaningful comparisons.

The limitations include the diagnosis of any of the three conditions that may not be perfectly well addressed by a self-administered questionnaire; the lack of a specific translation of "wheezing" in many languages; or the perception of questions being different between parents and adolescents. All these circumstances may potentially lead to classification bias. However, questions have been previously validated and the translation and back-translation method of ISAAC and GAN has yielded good results [14].

Incorrect labelling is of special interest in hay fever and eczema: if the proportion of severe symptoms without a diagnosis indicates real and current conditions, their burden would be even higher. When estimating the burden of those diseases globally it might be more appropriate to use severe symptoms than diagnostic labels.

Although the perception of questions between adolescents and their parents may not be the same, the present study avoids comparing results between different age groups and focuses on the differences at centre, country or GNI levels within a specific age group. The main limitation of GAN as compared to ISAAC is the lack of representation of many countries. There are centres lacking from Northern Europe, North America or Australia which in previous studies had shown the highest prevalence of asthma and atopic diseases [4, 10, 11, 22]. Additionally, we have no information about non-participants, although high response rates help to overcome participation bias. Finally, we cannot say what would have been the results of the impact of GNI if more countries were included in all income groups.

In conclusion, the present study, an updated and unique study of the prevalence of indicators of asthma, rhinoconjunctivitis and eczema, shows the persistence of a considerable burden of those conditions among children and adolescents worldwide. Prevalence of indicators of all three diseases were consistently lower in LICs&L-MICs. The wide differences in prevalence found, higher between countries than within countries, are probably further explained by environmental risk (such as pollution) or protective factors (such as contact with bacteria) which are probably more similar in the same country.

Acknowledgements

We are grateful to the children, parents, adults who willingly participated with the help of schools and field workers in GAN Phase I.

We thank the children and parents who participated in GAN Phase I; the school staff for their assistance and help with coordination; the principal investigators and their colleagues; the many funding bodies throughout the world that supported the individual GAN centres

The GAN Global Centre in Auckland was funded by The University of Auckland with additional funding from The International Union Against Tuberculosis and Lung Disease, Boehringer Ingelheim NZ, Astra Zeneca Educational Grant. The London Data Centre was supported by a PhD studentship [to CR] from the UK Medical Research Council (grant number MR/N013638/1) and funding from the European Research Council under the European Union's Seventh Framework Programme (FP7/2007-2013, ERC grant agreement number 668954). The Murcia Data Centre was supported by the University of Murcia and by Instituto de Salud Carlos III, fund PI17/0170. We thank the NIHR Global Health Research Unit on Lung Health and TB in Africa at LSTM - "IMPALA" for helping to make this work possible. In relation to IMPALA (project reference 16/136/35) specifically: IMPALA was funded by the National Institute for Health Research (NIHR) using UK aid from the UK Government to support global health research. The views expressed in this publication are those of the author(s) and not necessarily those of the NIHR or the UK Department of Health and Social Care.

Individual centres involved in GAN Phase I data collection were funded by the following organisations: Costa Rica and Nicaragua partially funded by an unrestricted grant from Astra Zeneca for logistic purposes; India; Kottayam, New Delhi, Chandigarh, Bikaner, Jaipur, Lucknow, Pune, GAN Phase I was undertaken by Asthma Bhawan in India which was supported by Cipla Foundation; Mexico, Puerto Vallarta Centro Universitario de la Costa, Universidad de Guadalajara; New Zealand, Auckland Asthma Charitable Trust; Nigeria, Ibadan, funded by NIHR (IMPALA grant Ref 16/136/35) using UK aid from the UK Government to support GHR; South Africa, Cape Town, SA Medical Research Council, Allergy Society of South Africa; Syria; Lattakia: The Medical National Syndicate; Spain, Cartagena, Bilbao, Pamplona funded by Instituto de Salud Carlos III (grants PI17/00179, PI17/00694, PI17/00756), Cantabria by Instituto de Investigación Sanitaria Valdecilla (IDIVAL) de Cantabria PRIMVAL 17/01 y 18/01, Salamanca by Gerencia Regional de Salud de la Junta de Castilla y León (grant GRS 1239b/16) and Sociedad Española de Inmunología Clínica, Alergología y Asma Pediátrica, A Coruña by María José Jove foundation.

Global Asthma Network Study Group:

Global Asthma Network Steering Group: MI Asher, Department of Paediatrics: Child and Youth Health, Faculty of Medical and Health Sciences, University of Auckland, Private Bag 92019, Auckland, New Zealand; K Bissell, School of Population Health, Faculty of Medical and Health Sciences, University of Auckland, Auckland, New Zealand; C-Y Chiang, International Union Against Tuberculosis and Lung Disease, Paris, France; and Division of Pulmonary Medicine, Department of Internal Medicine, Wan Fang Hospital, Taipei Medical University; and Division of Pulmonary Medicine, Department of Internal Medicine, School of Medicine, College of Medicine, Taipei Medical University111 Hsin-Long Road, Section 3, Taipei, 116, Taiwan; A El Sony, Epidemiological Laboratory for Public Health and Research, Khartoum 3 Block3-Building

11, Khartoum, Sudan; E Ellwood, Department of Paediatrics: Child and Youth Health, Faculty of Medical and Health Sciences, Private Bag 92019, University of Auckland, Auckland, New Zealand; P Ellwood, Department of Paediatrics: Child and Youth Health, Faculty of Medical and Health Sciences, Private Bag 92019, University of Auckland, Auckland, New Zealand; L García-Marcos, Pediatric Allergy and Pulmonology Units, Virgen de la Arrixaca University Children's Hospital, University of Murcia and IMIB Bioresearch Institute, Murcia; and ARADyAL Allergy Network, Edificio Departamental-Laib, Avenida Buenavista s/n, 30120 El Palmar, 30394 Murcia Spain; GB Marks, Respiratory & Environmental Epidemiology, University of New South Wales, Goulburn St, Sydney 2085, Sydney, Australia; R Masekela, Department of Paediatrics and Child Health, Nelson R Mandela School of Clinical Medicine, College of Health Sciences, University of KwaZulu Natal, Durban, South Africa; E Morales, Department of Public Health Sciences, University of Murcia, and IMIB Bio-health Research Institute, Edificio Departamental-Laib, Avenida Buenavista s/n, 30120 El Palmar, Murcia, Spain; K Mortimer, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, United Kingdom; N Pearce, Department of Medical Statistics, London School of Hygiene & Tropical Medicine, Keppel Street, London WC1E 7HT, United Kingdom; DP Strachan, Population Health Research Institute, St George's, University of London, Cranmer Terrace, London SW17 0RE, United Kingdom.

Global Asthma Network International Data Centres:

GAN Global Centre: P Ellwood, E Ellwood, MI Asher, Department of Paediatrics: Child and Youth Health, Faculty of Medical and Health Sciences, Private Bag 92019, University of Auckland, Auckland, New Zealand

Murcia, Spain: L García-Marcos, Pediatric Allergy and Pulmonology Units, Virgen de la Arrixaca University Children's Hospital, University of Murcia and IMIB Bioresearch Institute, Murcia; and ARADyAL Allergy Network, Edificio Departamental-Laib, Murcia, Spain V Perez-Fernández, Department of Paediatrics, University of Murcia; and IMIB Bio-health Research Institute, Murcia, Edificio Departamental-Laib, Avenida Buenavista s/n, 30120 El Palmar, 30394 Murcia Spain E Morales, Department of Public Health Sciences, University of Murcia, and IMIB Bio-health Research Institute, Murcia, Edificio Departamental-Laib, Avenida Buenavista s/n, 30120 El Palmar, 30394 Murcia, Spain A Martinez-Torres, Paediatric Allergy and Pulmonology Units and Nurse Research Group, Virgen de la Arrixaca University Children's Hospital, University of Murcia and IMIB Bio-health Research Institute, Murcia, Edificio Departamental-Laib, Avenida Buenavista s/n, 30120 El Palmar, 30394 Murcia, Spain

London, United Kingdom: DP Strachan, Population Health Research Institute, St George's, University of London, Cranmer Terrace, London SW17 0RE, United Kingdom N Pearce, S Robertson, CE Rutter, Department of Medical Statistics, London School of Hygiene & Tropical Medicine, Keppel Street, London WC1E 7HT, United Kingdom RJ Silverwood, Department of Medical Statistics, London School of Hygiene & Tropical Medicine, Keppel Street, London WC1E 7HT, United Kingdom and Centre for Longitudinal Studies, UCL Social Research Institute, University College London, 20 Bedford Way, London WC1H 0AL, United Kingdom

Global Asthma Network Principal Investigators: Argentina: H Badellino, Clinica Regional Del Este (San Francisco); Brazil: M Urrutia-Pereira, Federal University of Pampa, UNIPAMPA (Uruguaiana); Cameroon: AE Ndikum, The University of Yaounde 1 (Yaounde); Chile: J Mallol, University of Santiago de Chile (USACH) (South Santiago); Costa Rica: ME. Soto-Martínez, Hospital Nacional de Niños "Dr. Carlos Saénz Herrera", Caja Costarricense Seguro Social -

Universidad de Costa Rica, San José (Costa Rica); Ecuador: A Cabrera Aguilar, Respiraclinic (Quito); Greece: K Douros, National and Kapodistrian University of Athens (Athens); Honduras: SM Sosa Ferrari, Instituto Nacional Cardiopulmonar (Tegucigalpa); India: S. Mohammad, Kothari Medical & Research Institute (Bikaner); M Singh, Postgraduate Institute of Medical Education and Research (Chandigarh); V Singh*, Asthma Bhawan (Jaipur); AG Ghoshal, National Allergy Asthma Bronchitis Institute (Kolkata); TU Sukumaran, Pushpagiri Institute of Medical Sciences and Research, Thiruvalla, Kottayam (Kottayam); S Awasthi, King George's Medical University (Lucknow); PA Mahesh, JSS Medical College, JSSAHER (Mysuru); SK Kabra, All India Institute of Medical Sciences (New Delhi (7)); S Salvi, Chest Research Foundation (Pune); Iran: M Tavakol, Alborz University of Medical Sciences (Karaj); N Behniafard, Shahid Sadoughi University of Medical Sciences (Yazd); Kingdom of Saudi Arabia: SA Alomary, Ministry of Health (Kingdom of Saudi Arabia); Kosovo: I Bucaliu-Ismajli, The principal center of family care (Ferizaj); L Pajaziti, University Hospital Clinic, Clinic of Dermatology,Prishtina,Kosovo (Gjakova); V Gashi, American Hospital in Kosovo (Gjilan); X Kurhasani, UBT College Kosovo (Peja 13-14); B Gacaferri-Lumezi, University of Prishtina Hasan Prishtina (Peja 6-7); LN Ahmetaj*, University Hospital (Prishtina); V Zhjeqi, University of Prishtina (Prizren); México: MG Sanchez Coronel, COMPEDIA (Colegio Mexicano de PediatrasEspecialistas en Inmunología y Alergia) (Aguascalientes); HL Moreno Gardea, Hospital Angeles Chihuahua (Chihuahua); G Ochoa-Lopez, Department of Pediatric Allergology (Ciudad Juárez); R García-Almaráz, Hospital Infantil de Tamaulipas (Ciudad Victoria); JA Sacre Hazouri, Instituto Privado de Alergia, (Córdoba); N Rodriguez-Perez, Instituto de Ciencias y Estudios Superiores de Tamaulipas (Matamoros); JV Mérida-Palacio, Centro de Investigacion de Enfermedades Alergicas y Respiratorias (Mexicali); BE Del Río Navarro*, Service of Allergy and Clinical Immunology, Hospital Infantil de México (México City (North Area)); LO Hernández-Mondragón, CRIT de Michoacán (Michoacán); SN González-Díaz, Universidad Autónoma de Nuevo León (Monterrey); R Garcia-Muñoz, Universidad Regional del Sureste (Oaxaca); Md Juan Pineda, Universidad de Guadalajara (Puerto Vallarta); Bd Ramos García, Instituto Mexicano del Seguro Social (San Luis Potosí); AJ Escalante-Dominguez, Hospital General Tijuana [Isesalud] (Tijuana); FJ Linares-Zapién, Centro De Enfermedades Alergicas Y Asma de Toluca (Toluca Rural); EM Navarrete-Rodriguez, Hospital Infantil de Mexico Federico Gomez (Toluca Urban Area); J Santos Lozano, Medica san Angel (Xalapa); New Zealand: I Asher, University of Auckland (Auckland); Nicaragua: JF Sánchez, Hospital Infantil Manuel de Jesús Rivera (Managua); Nigeria: AG Falade, University of Ibadan and University College Hospital (Ibadan); Poland: G Brożek, Medical University of Silesia (Katowice); Russia: K Kyzmicheva, Tyumen State Medical University (Tyumen); South Africa: HJ Zar, SA MRC Unit on Child & Adolescent Health (Cape Town); R Masekela, University of Kwazulu-Natal (Durban); Spain: A López-Silvarrey Varela, Fundacion Maria Jose Jove (A Coruña); C González Díaz, Universidad del País Vasco UPV /EHU (Bilbao); A Bercedo Sanz, Cantabrian Health Service, Valdecilla Research Institute (IDIVAL), Dobra Health Center, Torrelavega, Cantabria, Spain (Cantabria); L García-Marcos*, Pediatric Allergy and Pulmonology Units, Virgen de la Arrixaca University Children‘s Hospital, University of Murcia and IMIB Bioresearch Institute, Murcia; (Cartagena); J Pellegrini Belinchon, Universidad de Salamanca (Salamanca); Sri Lanka: JC Ranasinghe, Teaching Hospital Peradeniya (Anuradhapura); ST Kudagammana, University of Peradeniya (Peradeniya); Sudan: H El Sadig, Ministry of Health (Gadarif); M Nour, Epi-Lab (Khartoum); Syrian Arab Republic: G Alkhayer, Syrian Private University (Damascus); G Dib, National Center for research and training for chronic respiratory disease and co-morbidities, Tishreen University (Lattakia 13-14); Y Mohammad*, National Center for research and training for chronic respiratory disease and co-morbidities, Tishreen University (Lattakia 6-7); Taiwan: J Huang, Department of

Pediatrics, Chang Gung Memorial Hospital, New Taipei Municipal TuChen Hospital, and Chang Gung University (Taipei); Thailand: S Chinratanapisit, Department of Pediatrics,Bhumibol Adulyadej Hospital, Royal Thai Air Force (Bangkok)

* National Coordinators

Global Asthma Network National Co-ordinators not named above: Brazil: D Solé, Escola Paulista de Medicina, Federal University of São Paulo; Costa Rica: ME Soto-Quirós, University of Costa Rica; Kingdom of Saudi Arabia: WA Althagafi, Ministry of Health, Kingdom of Saudi Arabia; Sudan: A El Sony, Epidemiological Laboratory (Epi-Lab) for Public Health, Research and Development; Thailand: P Vichyanond, Mahidol University.

Funding

International Union Against Tuberculosis and Lung Disease, Boehringer Ingelheim New Zealand, Astra Zeneca Educational Grant, National Institute for Health Research, UK Medical Research Council, European Research Council, Instituto de Salud Carlos III, Spain.

Data sharing

The study protocol including a recommended informed consent form and statistical analysis plan are in the public domain. The GAN Phase I data, including de-identified individual participant data, will be made available on the Global Asthma Network website http://www.globalasthmanetwork.org/ within 12 months of all GAN Phase I analyses being published. Access will require a formal request, a written proposal and a signed data access agreement.

REFERENCES

1. Asher MI, Ellwood P, Gilchrist C, et al. The Global Asthma Report 2018. The Global Asthma Network, Acukland, New Zealand, 2018.
2. Meghji J, Mortimer K, Agusti A, et al. Improving lung health in low-income and middle-income countries: from challenges to solutions. Lancet 2021; 397: 928-940.
3. Global Burden of Disease. 2019 [cited 2021 11/13]; Available from: https://vizhub.healthdata.org/gbd-compare/
4. Lai CK, Beasley R, Crane J, et al. Global variation in the prevalence and severity of asthma symptoms: phase three of the International Study of Asthma and Allergies in Childhood (ISAAC). Thorax 2009; 64: 476-483.
5. United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2019 Revision. . 2021.
6. Asher MI, Rutter CE, Bissell K, et al. Worldwide trends in the burden of asthma symptoms in school-aged children: Global Asthma Network Phase I cross-sectional study. The Lancet 2021; 398: 1569-1580.
7. Blaiss MS. Allergic rhinoconjunctivitis: burden of disease. Allergy Asthma Proc 2007; 28: 393-397.
8. Silverwood RJ, Mansfield KE, Mulick A, et al. Atopic eczema in adulthood and mortality: UK population-based cohort study, 1998-2016. J Allergy Clin Immunol 2021; 147: 1753-1763.
9. Strachan DP, Rutter CE, Asher MI, et al. Worldwide time trends in prevalence of symptoms of rhinoconjunctivitis in children: Global Asthma Network Phase I. Pediatr Allergy Immunol 2021.
10. Ait-Khaled N, Pearce N, Anderson HR, et al. Global map of the prevalence of symptoms of rhinoconjunctivitis in children: The International Study of Asthma and Allergies in Childhood (ISAAC) Phase Three. Allergy 2009; 64: 123-148.
11. Odhiambo JA, Williams HC, Clayton TO, et al. Global variations in prevalence of eczema symptoms in children from ISAAC Phase Three. J Allergy Clin Immunol 2009; 124: 1251-1258 e1223.
12. Ellwood P, Asher MI, Billo NE, et al. The Global Asthma Network rationale and methods for Phase I global surveillance: prevalence, severity, management and risk factors. Eur Respir J 2017; 49: 1601605.
13. Crane J, Mallol J, Beasley R, et al. Agreement between written and video questions for comparing asthma symptoms in ISAAC. Eur Respir J 2003; 21: 455-461.
14. Ellwood P, Williams H, Ait-Khaled N, et al. Translation of questions: the International Study of Asthma and Allergies in Childhood (ISAAC) experience. Int J Tuberc Lung Dis 2009; 13: 1174-1182.
15. Asher MI, Keil U, Anderson HR, et al. International Study of Asthma and Allergies in Childhood (ISAAC): rationale and methods. Eur Respir J 1995; 8: 483-491.
16. Steering Committee ISAAC. Worldwide variations in the prevalence of asthma symptoms: the International Study of Asthma and Allergies in Childhood (ISAAC). Eur Respir J 1998; 12: 315-335.
17. Ellwood P, Ellwood E, Rutter C, et al. Global Asthma Network Phase I Surveillance: Geographical Coverage and Response Rates. J Clin Med 2020; 9: 3688.
18. Stata Statistical Software. Stata Corp. LLC, College Station, TX, 2017.
19. Ellwood P, Asher MI, Beasley R, et al. The international study of asthma and allergies in childhood (ISAAC): phase three rationale and methods. Int J Tuberc Lung Dis 2005; 9: 10-16.
20. Ellwood P, Asher MI, Stewart AW, et al. The impact of the method of consent on response rates in the ISAAC time trends study. Int J Tuberc Lung Dis 2010; 14: 1059-1065.
21. Steering Committee ISAAC. Worldwide variation in prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and atopic eczema: ISAAC. The International Study of Asthma and Allergies in Childhood (ISAAC) Steering Committee. Lancet 1998; 351: 1225-1232.

22. Asher MI, Montefort S, Bjorksten B, et al. Worldwide time trends in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and eczema in childhood: ISAAC Phases One and Three repeat multicountry cross-sectional surveys. Lancet 2006; 368: 733-743.
23. Mallol J, Crane J, von Mutius E, et al. The International Study of Asthma and Allergies in Childhood (ISAAC) Phase Three: a global synthesis. Allergol Immunopathol (Madr) 2013; 41: 73-85.
24. Ege MJ, Mayer M, Normand AC, et al. Exposure to environmental microorganisms and childhood asthma. N Engl J Med 2011; 364: 701-709.
25. Lambrecht BN, Hammad H. The immunology of the allergy epidemic and the hygiene hypothesis. Nat Immunol 2017; 18: 1076-1083.
26. Weinmayr G, Weiland SK, Bjorksten B, et al. Atopic sensitization and the international variation of asthma symptom prevalence in children. Am J Respir Crit Care Med 2007; 176: 565-574.
27. Passali D, Cingi C, Staffa P, et al. The International Study of the Allergic Rhinitis Survey: outcomes from 4 geographical regions. Asia Pac Allergy 2018; 8: e7.
28. Urban K, Chu S, Scheufele C, et al. The global, regional, and national burden of fungal skin diseases in 195 countries and territories: A cross-sectional analysis from the Global Burden of Disease Study 2017. JAAD International 2021; 2: 22-27.
29. Almqvist C, Worm M, Leynaert B, et al. Impact of gender on asthma in childhood and adolescence: a GA2LEN review. Allergy 2008; 63: 47-57.
30. Kanda N, Hoashi T, Saeki H. The Roles of Sex Hormones in the Course of Atopic Dermatitis. Int J Mol Sci 2019; 20: 4660.
31. Wei J, Gerlich J, Genuneit J, et al. Hormonal factors and incident asthma and allergic rhinitis during puberty in girls. Ann Allergy Asthma Immunol 2015; 115: 21-27 e22.
32. Williams H, Robertson C, Stewart A, et al. Worldwide variations in the prevalence of symptoms of atopic eczema in the International Study of Asthma and Allergies in Childhood. J Allergy Clin Immunol 1999; 103: 125-138.
33. Ballardini N, Kull I, Soderhall C, et al. Eczema severity in preadolescent children and its relation to sex, filaggrin mutations, asthma, rhinitis, aggravating factors and topical treatment: a report from the BAMSE birth cohort. Br J Dermatol 2013; 168: 588-594.
34. Palmer DJ. Vitamin D and the Development of Atopic Eczema. J Clin Med 2015; 4: 1036-1050.

Table 1: Prevalence of indicators of asthma, rhinoconjunctivitis and eczema in centres grouped by Gross National Income (GNI). GAN Phase I (2015-2020)

Age group	GNI	Years	Centres	No.	Current wheeze	Asthma ever	Severe asthma symptoms	Current rhinoconjunctivitis symptoms	Hay fever ever	Symptoms of severe rhinoconjunctivitis	Current eczema symptoms	Eczema ever	Symptoms of severe eczema
13-14 years	High	2015-20	11	35459	4720 (13.3)	6361 (17.6)	1995 (5.6)* (42.3)†	5483 (15.5)	6953 (19.6)	375 (1.0)* (6.8)†	3521 (9.9)	7364 (20.8)	389 (1.1)* (11.0)†
	Upper middle	2015-20	33	77746	9132 (11.7)	6832 (8.8)¶	4376 (5.6) (47.9)	11056 (14.2)	10629 (13.7)	717 (0.9) (6.5)	4545 (5.8)¶	4673 (6.0)§	791 (1.0) (17.4)
	Lower middle & Low	2017-19	19	44579	3587 (8.0)¶	3400 (7.6)§	1911 (4.3) (53.3)	4379 (9.8)‡	6423 (14.4)	219 (0.5)¶ (5.0)	1971 (4.4)§	4619 (10.4)¶	351 (0.8) (17.8)
	Total		63	157784	17439 (11.1)	16593 (10.5)	8282 (5.2) (47.5)	20918 (13.3)	24005 (15.2)	1311 (0.8) (6.3)	10037 (6.4)	16656 (10.6)	1531 (1.0) (15.3)
6-7 years	High	2016-19	8	23040	2680 (11.6)	3227 (14.0)	1012 (4.4) (37.7)	2346 (10.2)	3501 (15.2)	163 (0.7) (6.9)	2334 (10.1)	8234 (35.7)	248 (1.1) (10.6)
	Upper middle	2016-20	22	49617	4984 (10.0)	3310 (6.7)¶	2360 (4.8) (47.3)	4345 (8.8)	5444 (11.0)	334 (0.7) (7.7)	2799 (5.6)§	3719 (6.6)§	313 (0.6)¥ (11.1)
	Lower middle & Low	2017-19	14	29120	1623 (5.6)§	1173 (4.0)§	621 (2.1)§ (38.3)	1132 (3.9)§	2343 (8.0)	86 (0.3)¥ (6.8)	909 (3.1)§	1720 (5.9)§	116 (0.4)§ (12.8)
	Total		44	101777	9287 (9.1)	7710 (7.6)	3993 (3.9) (43.0)	7823 (7.7)	11288 (11.1)	583 (0.6) (7.6)	6042 (5.9)	13673 (13.4)	677 (0.7) (11.2)

All values as number and (percentage)

*Total participants denominator; †Current symptoms (wheeze, rhinoconjunctivitis or eczema) denominator. See text for definitions.

The base for comparisons is the group of high GNI. ¥p<0.05; ‡p<0.01; ¶p<0.005; §p<0.001

Table 2. Prevalence (%) variation of the different indicators of asthma, rhinoconjunctivitis and eczema among centres.

		Percentiles			Ratio P90 to P10
		10	50	90	
6-7 years	Current wheeze	2.7	10.4	14.0	5.2
	Asthma ever	1.7	6.1	15.0	8.8
	Severe asthma symptoms	0.8	4.2	6.8	8.5
	Current rhinoconjunctivitis symptoms	2.4	7.0	15.1	6.3
	Hay fever ever	4.5	9.5	24.6	5.5
	Symptoms of severe rhinoconjunctivitis	0.1	0.4	1.0	11.1
	Current eczema symptoms	2.3	4.8	10.2	4.4
	Eczema ever	2.6	6.6	37.4	14.4
	Symptoms of severe eczema	0.1	0.6	1.5	15.0
13-14 years	Current wheeze	4.6	11.4	18.9	4.1
	Asthma ever	2.4	9.2	19.1	8.0
	Severe asthma symptoms	1.8	5.4	9.8	5.4
	Current rhinoconjunctivitis symptoms	7.0	12.3	21.3	3.0
	Hay fever ever	4.4	13.0	33.9	7.7
	Symptoms of severe rhinoconjunctivitis	0.2	0.6	1.6	8.0
	Current eczema symptoms	2.9	5.0	10.6	3.7
	Eczema ever	2.1	7.7	18.8	9.0
	Symptoms of severe eczema	0.3	0.7	1.7	5.7

FIGURE CAPTIONS

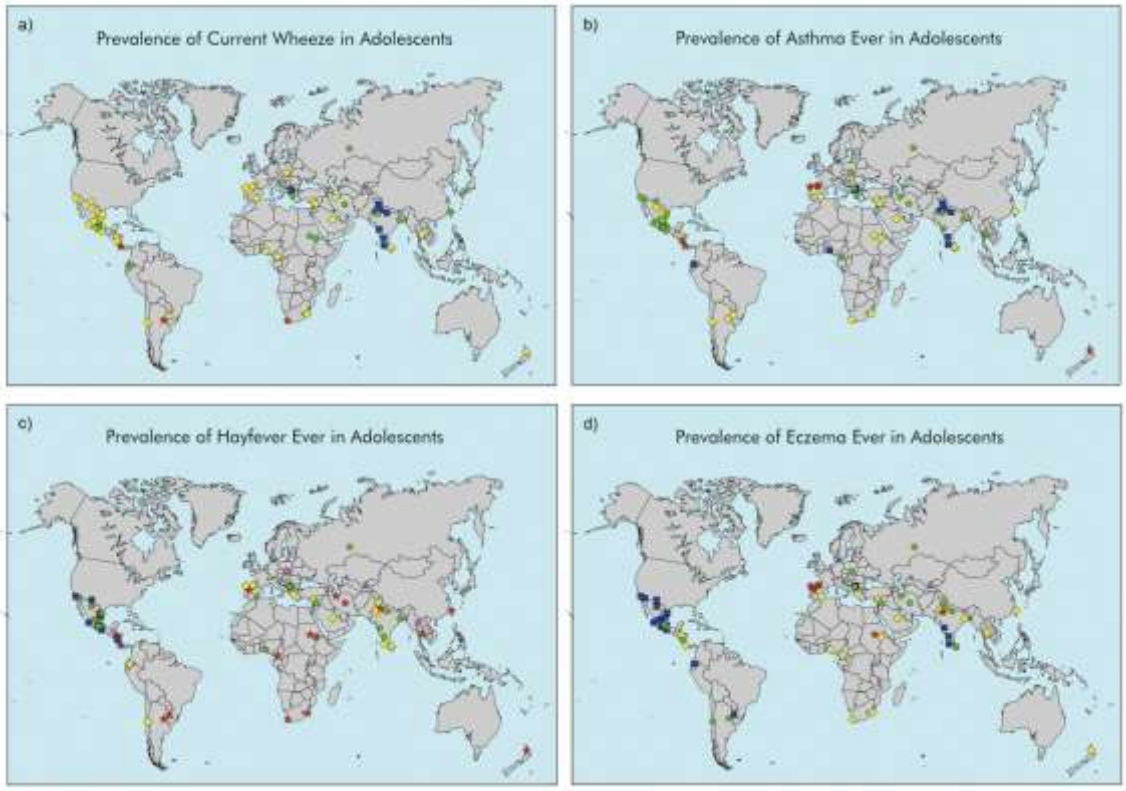


Figure 1

Maps of the prevalence of a) current wheeze, b) asthma ever, c) hay fever ever and d) eczema ever in the adolescents. The symbols indicate prevalence values of <5% (blue squares), 5 to <10% (green circle), 10 to <20% (yellow diamonds) and ≥20% (red stars).

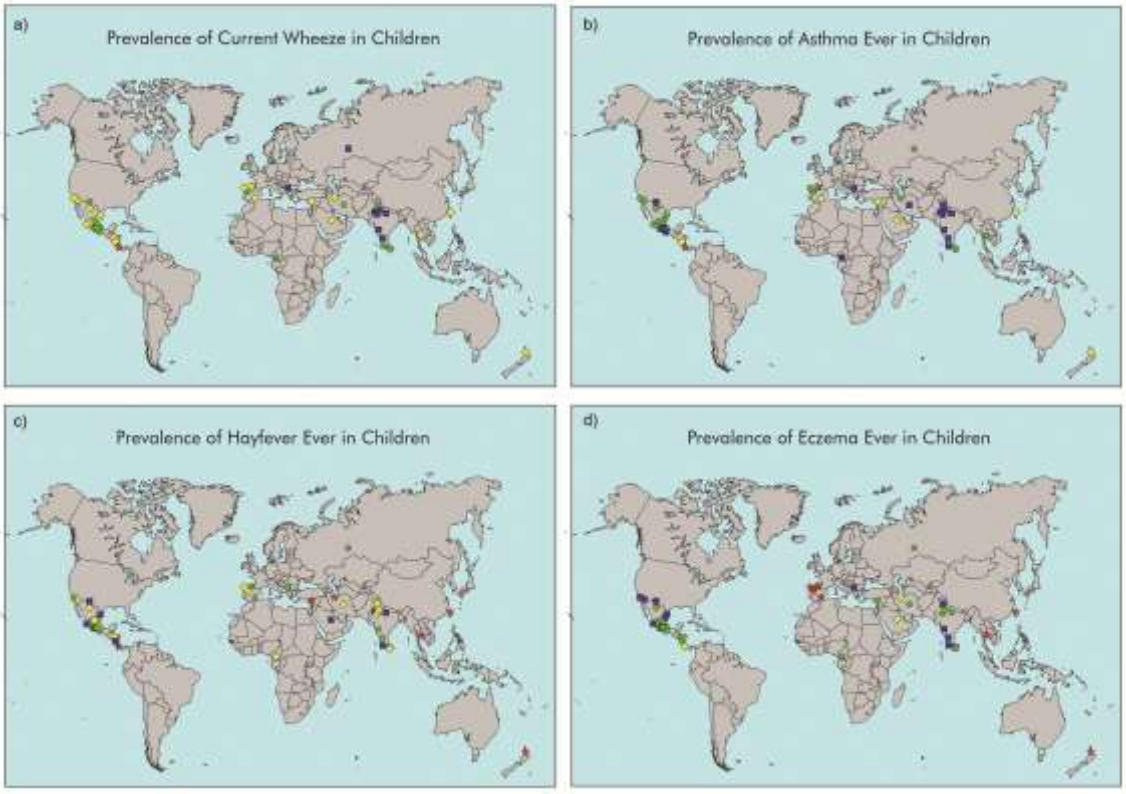


Figure 2

Maps of the prevalence of a) current wheeze, b) asthma ever, c) hay fever ever and d) eczema ever in the children. The symbols indicate prevalence values of <5% (blue squares), 5 to <10% (green circle), 10 to <20% (yellow diamonds) and ≥20% (red stars).

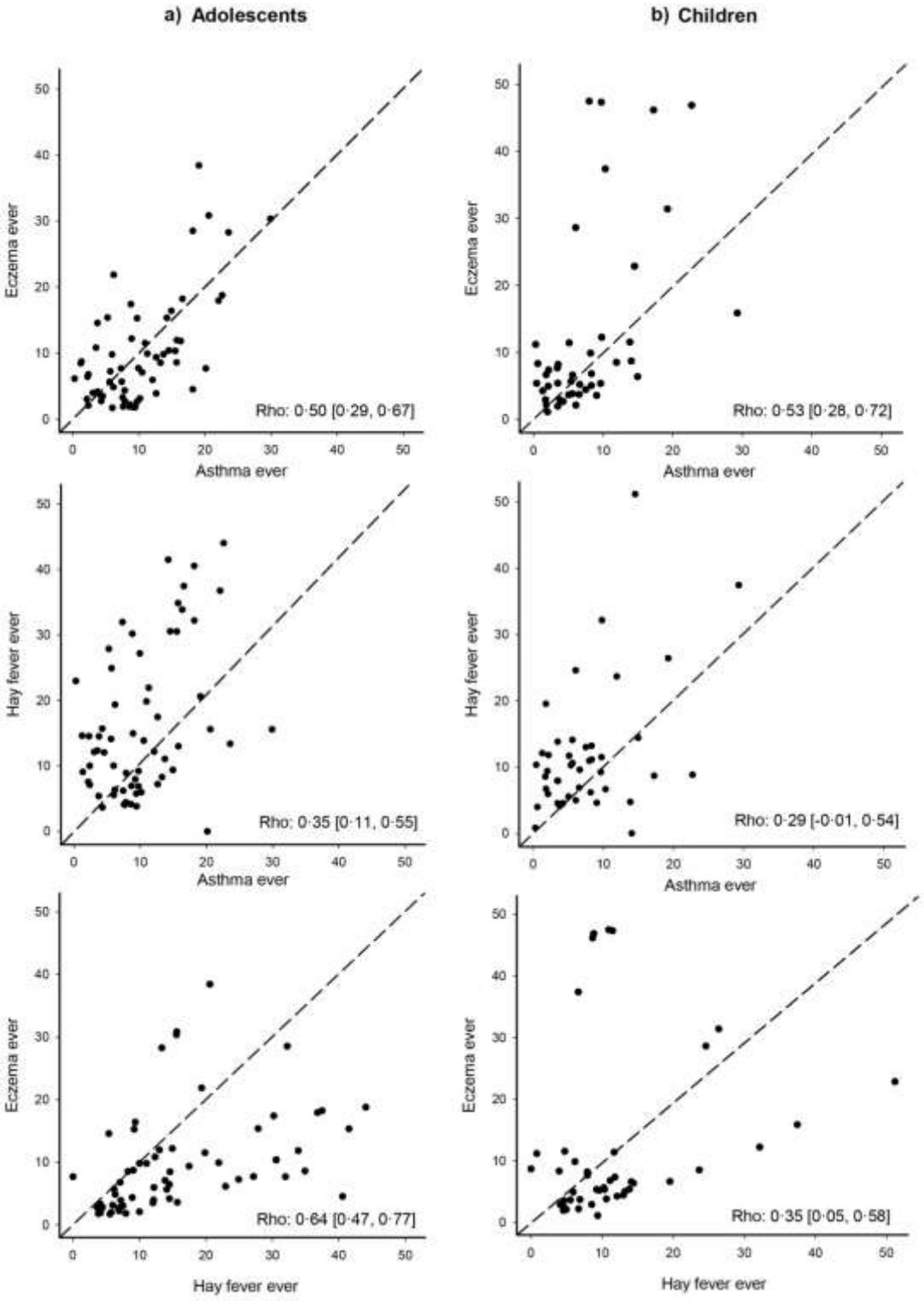
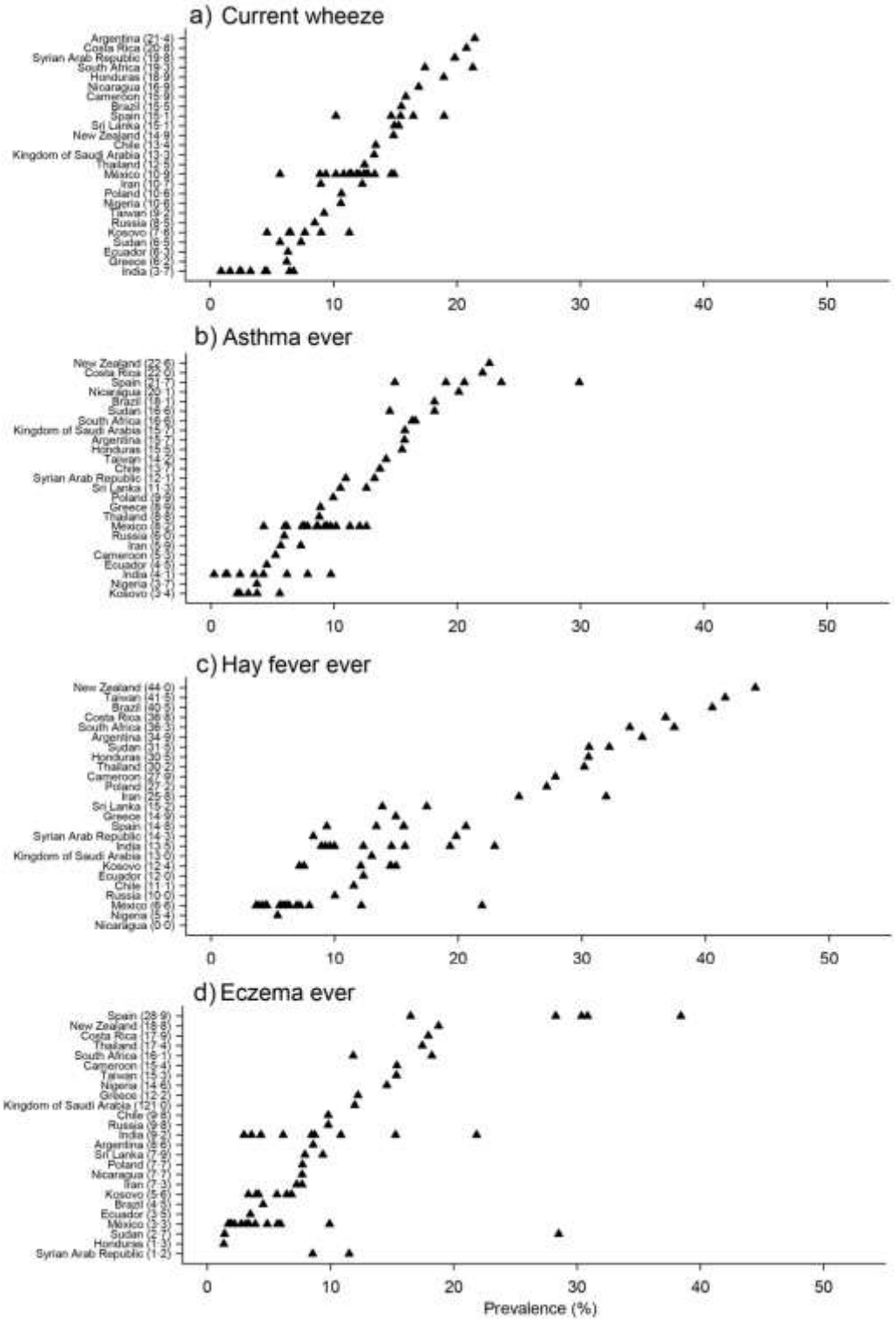


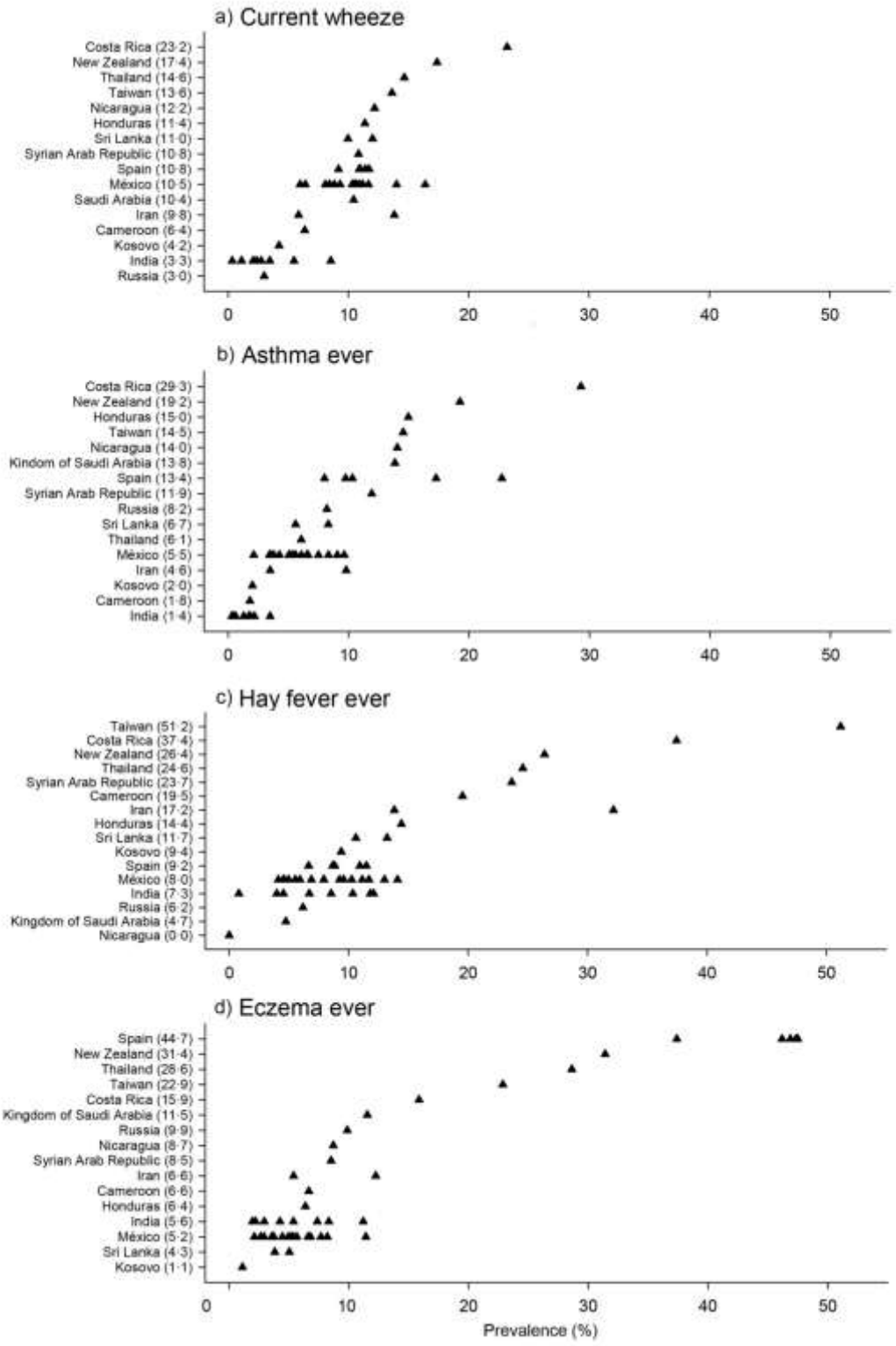
Figure 3

Rank correlation values and scatter plots of the prevalences of asthma ever, hay fever ever and eczema ever at the centre level in a) adolescents and b) children. The dashed line is the normality line. Intraclass correlation coefficient and 95%CI is shown in each graph.



Web figure 1

Ranking of centres for the prevalence of a) current wheeze, b) asthma ever, c) hay fever ever and d) eczema ever in the adolescent group.



Web figure 2

Ranking of centres for the prevalence of a) current wheeze, b) asthma ever, c) hay fever ever and d) eczema ever in the children group.

Web table 1: Prevalence of asthma indicators among adolescents in the Global Asthma Network Phase I (GAN Phase I) by centre (2015-2020).

Country	Centre	Mean date data collection	Number of participants	Wheeze in the past 12 months		Asthma ever		Severe asthma symptoms in the past 12 months			Exercise wheeze in the past 12 months		Night cough in the past 12 months	
				N	%	N	%	N	%	% of wheeze	N	%	N	%
Africa and Eastern Mediterranean														
Cameroon	Yaounde	feb-19	1066	169	15.9%	56	5.3%	85	8.0%	50.3%	268	25.1%	413	38.7%
Iran	Karaj	feb-20	754	93	12.3%	55	7.3%	26	3.4%	28.0%	217	28.8%	294	39.0%
Iran	Yazd	may-20	5141	461	9.0%	291	5.7%	102	2.0%	22.1%	816	15.9%	635	12.4%
Nigeria	Ibadan	may-18	2897	307	10.6%	108	3.7%	179	6.2%	58.3%	927	32.0%	683	23.6%
Kingdom of Saudi Arabia	Saudi Arabia	mar-19	4086	543	13.3%	643	15.7%	227	5.6%	41.8%	781	19.1%	1051	25.7%
South Africa	Cape Town	aug-17	3979	847	21.3%	660	16.6%	476	12.0%	56.2%	1431	36.0%	1648	41.4%
South Africa	Durban	feb-20	1960	341	17.4%	320	16.3%	195	9.9%	57.2%	748	38.2%	748	38.2%
Sudan	Gadarif	feb-17	1344	99	7.4%	195	14.5%	64	4.8%	64.6%	233	17.3%	395	29.4%
Sudan	Khartoum	mar-17	1785	101	5.7%	324	18.2%	62	3.5%	61.4%	501	28.1%	722	40.4%
Syrian Arab Republic	Damascus	oct-18	1100	218	19.8%	146	13.3%	148	13.5%	67.9%	245	22.3%	366	33.3%
Syrian Arab Republic	Lattakia	apr-19	1215	241	19.8%	133	10.9%	129	10.6%	53.5%	435	35.8%	661	54.4%
	Regional total		25327	3420	13.5%	2931	11.6%	1693	6.7%	49.5%	6602	26.1%	7616	30.1%
America														
Argentina	San Francisco	nov-19	1012	217	21.4%	159	15.7%	135	13.3%	62.2%	349	34.5%	416	41.1%
Brazil	Uruguaiana	jan-18	1058	164	15.5%	192	18.1%	76	7.2%	46.3%	425	40.2%	383	36.2%
Chile	South Santiago	mar-15	2750	369	13.4%	377	13.7%	107	3.9%	29.0%	459	16.7%	905	32.9%
Costa Rica	Costa Rica	feb-18	1338	278	20.8%	295	22.0%	126	9.4%	45.3%	193	14.4%	417	31.2%
Ecuador	Quito	apr-19	3000	189	6.3%	136	4.5%	90	3.0%	47.6%	545	18.2%	839	28.0%
Honduras	Tegucigalpa	jun-18	1431	271	18.9%	222	15.5%	211	14.7%	77.9%	280	19.6%	307	21.5%
México	Aguascalientes	dec-15	3336	376	11.3%	313	9.4%	214	6.4%	56.9%	573	17.2%	788	23.6%
México	Chihuahua	mar-16	2180	277	12.7%	275	12.6%	129	5.9%	46.6%	479	22.0%	517	23.7%
México	Ciudad Juárez	may-16	2443	290	11.9%	186	7.6%	170	7.0%	58.6%	465	19.0%	708	29.0%
México	Ciudad Victoria	dec-15	2468	329	13.3%	212	8.6%	142	5.8%	43.2%	410	16.6%	637	25.8%
México	Córdoba	jul-16	2991	446	14.9%	361	12.1%	213	7.1%	47.8%	593	19.8%	782	26.1%
México	Matamoros	may-16	2892	331	11.4%	267	9.2%	170	5.9%	51.4%	398	13.8%	870	30.1%
México	Mexicali	apr-16	2479	364	14.7%	215	8.7%	187	7.5%	51.4%	528	21.3%	637	25.7%
México	México City (North Area)	sep-15	3375	300	8.9%	250	7.4%	124	3.7%	41.3%	523	15.5%	498	14.8%
México	Michoacán	sep-16	2504	255	10.2%	150	6.0%	144	5.8%	56.5%	408	16.3%	516	20.6%
México	Monterrey	dec-17	2641	330	12.5%	298	11.3%	144	5.5%	43.6%	609	23.1%	824	31.2%
México	Oaxaca	may-17	2569	278	10.8%	194	7.6%	124	4.8%	44.6%	451	17.6%	509	19.8%
México	Puerto Vallarta	jun-16	2439	312	12.8%	230	9.4%	188	7.7%	60.3%	363	14.9%	718	29.4%
México	San Luis Potosí	jun-16	2580	295	11.4%	262	10.2%	140	5.4%	47.5%	551	21.4%	588	22.8%
México	Tijuana	jul-16	2601	324	12.5%	204	7.8%	165	6.3%	50.9%	496	19.1%	741	28.5%
México	Toluca Rural	mar-16	3122	293	9.4%	134	4.3%	136	4.4%	46.4%	597	19.1%	536	17.2%
México	Toluca Urban Area	oct-15	2650	150	5.7%	163	6.2%	60	2.3%	40.0%	292	11.0%	426	16.1%
México	Xalapa	nov-16	3339	403	12.1%	325	9.7%	208	6.2%	51.6%	564	16.9%	707	21.2%
Nicaragua	Managua	nov-18	3131	529	16.9%	630	20.1%	306	9.8%	57.8%	687	21.9%	1372	43.8%

	Regional total		60329	7370	12.2%	6050	10.0%	3709	6.1%	50.3%	11238	18.6%	15641	25.0%
Europe														
Greece	Athens	feb-20	1934	120	6.2%	172	8.9%	35	1.8%	29.2%	115	5.9%	277	14.3%
Kosovo	Ferizaj	oct-17	890	41	4.6%	19	2.1%	15	1.7%	36.6%	124	13.9%	160	18.0%
Kosovo	Gjakova	jun-18	676	44	6.5%	16	2.4%	16	2.4%	36.4%	311	46.0%	347	51.3%
Kosovo	Gjilan	jun-17	1200	77	6.4%	45	3.8%	33	2.8%	42.9%	194	16.2%	241	20.1%
Kosovo	Peja	may-18	1433	129	9.0%	80	5.6%	59	4.1%	45.7%	276	19.3%	406	28.3%
Kosovo	Prishtina	jul-17	1056	81	7.7%	32	3.0%	29	2.7%	35.8%	218	20.6%	210	19.9%
Kosovo	Prizren	mar-17	1427	161	11.3%	32	2.2%	64	4.5%	39.8%	266	18.6%	439	30.8%
Poland	Katowice	jun-17	3185	339	10.6%	316	9.9%	136	4.3%	40.1%	548	17.2%	742	23.3%
Russia	Tyumen	may-19	3007	255	8.5%	179	6.0%	90	3.0%	35.3%	180	6.0%	382	12.7%
Spain	A Coruña	jan-19	3462	570	16.5%	712	20.6%	282	8.1%	49.5%	737	21.3%	1236	35.7%
Spain	Bilbao	sep-18	3379	641	19.0%	1010	29.9%	326	9.6%	50.9%	910	26.9%	1194	35.3%
Spain	Cantabria	feb-18	4382	676	15.4%	1033	23.6%	323	7.4%	47.8%	981	22.4%	1378	31.4%
Spain	Cartagena	jan-16	3437	350	10.2%	513	14.9%	141	4.1%	40.3%	477	13.9%	810	23.6%
Spain	Salamanca	sep-17	3485	511	14.7%	665	19.1%	207	5.9%	40.5%	825	23.7%	997	28.6%
	Regional total		32953	3995	12.1%	4824	14.6%	1756	5.3%	44.0%	6162	18.7%	8819	26.8%
South-East Asia and Western Pacific														
Thailand	Bangkok	sep-17	3206	401	12.5%	282	8.8%	186	5.8%	46.4%	476	14.8%	961	30.0%
Taiwan	Taipei	oct-17	3474	321	9.2%	494	14.2%	115	3.3%	35.8%	870	25.0%	963	27.7%
India	Bikaner	nov-17	2702	65	2.4%	95	3.5%	42	1.6%	64.6%	236	8.7%	609	22.5%
India	Chandigarh	oct-17	3000	75	2.5%	36	1.2%	22	0.7%	29.3%	311	10.4%	1174	39.1%
India	Jaipur	nov-17	3060	207	6.8%	189	6.2%	65	2.1%	31.4%	299	9.8%	1400	45.8%
India	Kolkata	sep-17	2998	193	6.4%	292	9.7%	99	3.3%	51.3%	309	10.3%	986	32.9%
India	Kottayam	oct-17	2091	93	4.4%	89	4.3%	32	1.5%	34.4%	100	4.8%	362	17.3%
India	Lucknow	oct-17	2969	48	1.6%	39	1.3%	25	0.8%	52.1%	281	9.5%	673	22.7%
India	Mysuru (Mysore)	nov-17	3051	100	3.3%	72	2.4%	59	1.9%	59.0%	232	7.6%	371	12.2%
India	New Delhi (7)	nov-17	3024	27	0.9%	8	0.3%	15	0.5%	55.6%	199	6.6%	825	27.3%
India	Pune	oct-17	3030	139	4.6%	238	7.9%	60	2.0%	43.2%	322	10.6%	1001	33.0%
Sri Lanka	Anuradhapura	oct-18	2989	446	14.9%	314	10.5%	208	7.0%	46.6%	517	17.3%	382	12.8%
Sri Lanka	Peradeniya	nov-18	1696	259	15.3%	214	12.6%	100	5.9%	38.6%	237	14.0%	218	12.9%
New Zealand	Auckland	oct-18	1885	280	14.9%	426	22.6%	96	5.1%	34.3%	428	22.7%	469	24.9%
	Regional total		39175	2654	6.8%	2788	7.1%	1124	2.9%	42.4%	4817	12.3%	10394	26.5%
	Global total		157784	17439	11.1%	16593	10.5%	8282	5.2%	47.5%	28819	18.3%	42470	27.0%

Notes: Centres not included in the analyses: Guatemala City (Guatemala) and Salta (Argentina) due to participation rates lower than 50%; and Guadalajara (México) and Kolkata (India) due to major inconsistencies in the answers to the questionnaire. Number of participants affected by COVID (Karaj). Fieldwork affected by COVID (Durban, Lattakia, Damascus). No date of birth on questionnaire (Ibadan, Taipei). Response rates <80% (Durban, Costa Rica, Cartagena). Age and birth date showed high inconsistencies (Quito). <10 schools participated when >10 schools available (Chihuahua, Ciudad Victoria, México City North, Toluca Urban, Bangkok, Auckland). Date of birth unreliable, age used (Monterrey). No age on questionnaire (Chandigarh, New Delhi [7], Kolkata). Questionnaires completed at home by parents (Kottayam). >20% of questionnaires missing age and date of birth (Bangkok). <1000 participants (Karaj, Ferizaj, Gjakova). 68% of participants 12 years of age (Peja). Date of interview unreliable (Monterrey). Single data entry (Monterrey). >20% questionnaires missing date of birth (Puerto Vallarta).

Web table 2: Prevalence of asthma indicators among children in the Global Asthma Network Phase I (GAN Phase I) by centre (2015-2020).

Country	Centre	Mean date data collection	Number of participants	Wheeze in the past 12 months		Asthma ever		Severe asthma Symptoms in the past 12 months			Exercise wheeze in the past 12 months		Night cough in the past 12 months	
				N	%	N	%	N	%	% of wheeze	N	%	N	%
Africa and Eastern Mediterranean														
Cameroon	Yaounde	feb-19	722	46	6.4%	13	1.8%	20	2.8%	43.5%	27	3.7%	147	20.4%
Iran	Karaj	feb-20	572	79	13.8%	56	9.8%	32	5.6%	40.5%	57	10.0%	274	47.9%
Iran	Yazd	jun-20	2526	148	5.9%	88	3.5%	39	1.5%	26.4%	99	3.9%	280	11.1%
Kingdom of Saudi Arabia	Saudi Arabia	mar-19	3614	377	10.4%	500	13.8%	188	5.2%	49.9%	242	6.7%	685	19.0%
Syrian Arab Republic	Lattakia	may-19	1116	121	10.8%	133	11.9%	60	5.4%	49.6%	129	11.6%	325	29.1%
	Regional total		8550	771	9.0%	790	9.2%	339	4.0%	44.0%	554	6.5%	1711	20.0%
America														
Costa Rica	Costa Rica	jan-18	1936	449	23.2%	567	29.3%	256	13.2%	57.0%	237	12.2%	889	45.9%
Honduras	Tegucigalpa	jun-18	361	41	11.4%	54	15.0%	25	6.9%	61.0%	26	7.2%	49	13.6%
México	Aguascalientes	aug-16	3176	347	10.9%	306	9.6%	179	5.6%	51.6%	375	11.8%	622	19.6%
México	Chihuahua	may-16	1969	203	10.3%	164	8.3%	94	4.8%	46.3%	220	11.2%	425	21.6%
México	Ciudad Juárez	apr-16	2118	187	8.8%	90	4.2%	89	4.2%	47.6%	228	10.8%	418	19.7%
México	Ciudad Victoria	feb-16	2444	285	11.7%	160	6.5%	142	5.8%	49.8%	245	10.0%	555	22.7%
México	Córdoba	jul-16	2746	307	11.2%	182	6.6%	131	4.8%	42.7%	237	8.6%	540	19.7%
México	Matamoros	feb-16	806	86	10.7%	49	6.1%	41	5.1%	47.7%	54	6.7%	155	19.2%
México	Mexicali	mar-16	2001	280	14.0%	150	7.5%	152	7.6%	54.3%	296	14.8%	461	23.0%
México	México City (North Area)	jun-16	2515	266	10.6%	129	5.1%	109	4.3%	41.0%	230	9.1%	498	19.8%
México	Michoacán	oct-16	2166	175	8.1%	82	3.8%	82	3.8%	46.9%	162	7.5%	354	16.3%
México	Oaxaca	oct-17	1329	112	8.4%	47	3.5%	42	3.2%	37.5%	100	7.5%	199	15.0%
México	Puerto Vallarta	jan-17	2241	367	16.4%	203	9.1%	203	9.1%	55.3%	235	10.5%	631	28.2%
México	San Luis Potosí	jul-16	2108	178	8.4%	118	5.6%	73	3.5%	41.0%	198	9.4%	447	21.2%
México	Tijuana	apr-16	2082	218	10.5%	105	5.0%	102	4.9%	46.8%	162	7.8%	450	21.6%
México	Toluca Rural	jan-16	2976	178	6.0%	63	2.1%	75	2.5%	42.1%	214	7.2%	336	11.3%
México	Toluca Urban Area	apr-16	2712	174	6.4%	93	3.4%	79	2.9%	45.4%	177	6.5%	488	18.0%
México	Xalapa	feb-17	3717	346	9.3%	200	5.4%	168	4.5%	48.6%	273	7.3%	599	16.1%
Nicaragua	Managua	nov-18	3162	385	12.2%	444	14.0%	188	5.9%	48.8%	249	7.9%	1029	32.5%
	Regional total		42565	4584	10.8%	3206	7.5%	2230	5.2%	48.6%	3918	9.2%	9145	21.5%
Europe														
Kosovo	Peja	may-18	1441	61	4.2%	29	2.0%	17	1.2%	27.9%	30	2.1%	188	13.0%
Russia	Tyumen	apr-19	2969	89	3.0%	243	8.2%	47	1.6%	52.8%	30	1.0%	188	6.3%
Spain	A Coruña	jan-19	3407	374	11.0%	332	9.7%	151	4.4%	40.4%	166	4.9%	1054	30.9%
Spain	Bilbao	ago-18	2707	295	10.9%	615	22.7%	111	4.1%	37.6%	174	6.4%	752	27.8%
Spain	Cantabria	jan-18	2841	324	11.4%	490	17.2%	125	4.4%	38.6%	162	5.7%	851	30.0%
Spain	Cartagena	jan-16	3509	411	11.7%	362	10.3%	153	4.4%	37.2%	213	6.1%	960	27.4%
Spain	Salamanca	sep-17	2388	219	9.2%	191	8.0%	70	2.9%	32.0%	103	4.3%	544	22.8%
	Regional total		19262	1773	9.2%	2262	11.7%	674	3.5%	38.0%	878	4.6%	4537	23.5%
South-East Asia and Western Pacific														
India	Bikaner	dec-17	2600	9	0.3%	8	0.3%	1	0.0%	11.1%	7	0.3%	32	1.2%

India	Chandigarh	oct-17	2473	211	8.5%	32	1.3%	29	1.2%	13.7%	153	6.2%	780	31.5%
India	Jaipur	nov-17	2296	54	2.4%	50	2.2%	18	0.8%	33.3%	57	2.5%	456	19.9%
India	Kottayam	dec-17	2099	115	5.5%	73	3.5%	60	2.9%	52.2%	38	1.8%	439	20.9%
India	Lucknow	oct-17	2969	33	1.1%	18	0.6%	14	0.5%	42.4%	57	1.9%	200	6.7%
India	Mysuru (Mysore)	nov-17	2730	75	2.7%	47	1.7%	38	1.4%	50.7%	71	2.6%	282	10.3%
India	New Delhi (7)	jan-18	2516	87	3.5%	11	0.4%	19	0.8%	21.8%	67	2.7%	575	22.9%
India	Pune	oct-17	2404	50	2.1%	44	1.8%	17	0.7%	34.0%	105	4.4%	476	19.8%
New Zealand	Auckland	jul-18	1538	267	17.4%	296	19.2%	103	6.7%	38.6%	185	12.0%	382	24.8%
Sri Lanka	Anuradhapura	nov-18	2180	217	10.0%	122	5.6%	76	3.5%	35.0%	104	4.8%	234	10.7%
Sri Lanka	Peradeniya	nov-18	1492	179	12.0%	124	8.3%	56	3.8%	31.3%	75	5.0%	145	9.7%
Taiwan	Taipei	oct-17	3036	413	13.6%	441	14.5%	111	3.7%	26.9%	208	6.9%	995	32.8%
Thailand	Bangkok	aug-17	3067	449	14.6%	186	6.1%	208	6.8%	46.3%	93	3.0%	743	24.2%
	Regional Total		31400	2159	6.9%	1452	4.6%	750	2.4%	34.7%	1220	3.9%	5739	18.3%
	Global total		101777	9287	9.1%	7710	7.6%	3993	3.9%	43.0%	6570	6.4%	21132	20.8%

Notes: Centres not included in the analyses: Guatemala City (Guatemala), Katowice (Poland), Monterrey (México) and Salta (Argentina) due to participation rates lower than 50%; and Guadalajara (México) and Kolkata (India) due to major inconsistencies in the answers to the questionnaire. Number of participants and response rate affected by civil war (Yaounde). Number of participants affected by COVID (Karaj). No age on questionaire (New Delhi [7]). <10 schools participated when >10 schools available (Bangkok, Lattakia). >20% of questionnaires missing age and date of birth (Bangkok). Response rate <70% (Costa Rica, Bilbao, Cartagena, Kottayam, Auckland). No date of birth on questionnaire (Taipei). <1000 participants (Tegucigalpa, Matamoros).

Web table 3. Prevalence of asthma indicators among adolescents in the Global Asthma Network Phase I (GAN Phase I) video-questionnaire by centre (2015-2020).

Country	Centre	Mean date data collection	Number of participants	Wheeze in the past 12 months		Severe wheeze in the past 12 months		Night wheeze in the past 12 months		Exercise wheeze in the past 12 months		Night cough in the past 12 months	
				N	%	N	%	N	%	N	%	N	%
Africa and Eastern Mediterranean													
Cameroon	Yaounde	feb-19	1061	128	12.1%	85	8.0%	63	5.9%	297	28.0%	197	18.6%
South Africa	Cape Town	aug-17	3944	738	18.7%	404	10.2%	376	9.5%	1205	30.6%	863	21.9%
South Africa	Durban	feb-20	1949	245	12.6%	158	8.1%	167	8.6%	347	17.8%	184	9.4%
Thailand	Bangkok	sep-17	2073	56	2.7%	42	2.0%	40	1.9%	102	4.9%	90	4.3%
Kingdom of Saudi Arabia	Saudi Arabia	mar-19	3598	486	13.5%	331	9.2%	369	10.3%	495	13.8%	553	15.4%
	Regional total		12625	1653	13.1%	1020	8.1%	1015	8.0%	2446	19.4%	1887	14.9%
America													
Ecuador	Quito	apr-19	3000	402	13.4%	128	4.3%	115	3.8%	624	20.8%	412	13.7%
México	Aguascalientes	dec-15	3303	369	11.2%	155	4.7%	208	6.3%	353	10.7%	248	7.5%
México	Chihuahua	mar-16	2056	301	14.6%	182	8.9%	134	6.5%	497	24.2%	313	15.2%
México	Ciudad Juárez	may-16	2387	133	5.6%	96	4.0%	112	4.7%	118	4.9%	107	4.5%
México	Ciudad Victoria	dec-15	2459	197	8.0%	101	4.1%	95	3.9%	336	13.7%	292	11.9%
México	Córdoba	jul-16	2953	337	11.4%	158	5.4%	126	4.3%	413	14.0%	380	12.9%
México	Matamoros	may-16	952	114	12.0%	55	5.8%	75	7.9%	108	11.3%	115	12.1%
México	Mexicali	apr-16	2455	252	10.3%	146	5.9%	91	3.7%	389	15.8%	332	13.5%
México	México City (North Area)	sep-15	3164	303	9.6%	118	3.7%	118	3.7%	468	14.8%	242	7.6%
México	Michoacán	sep-16	2467	183	7.4%	93	3.8%	82	3.3%	368	14.9%	187	7.6%
México	Monterrey	dec-17	2635	322	12.2%	145	5.5%	152	5.8%	528	20.0%	390	14.8%
México	Oaxaca	may-17	2559	248	9.7%	90	3.5%	82	3.2%	344	13.4%	174	6.8%
México	Puerto Vallarta	jun-16	2352	272	11.6%	97	4.1%	189	8.0%	169	7.2%	170	7.2%
México	San Luis Potosí	jun-16	2574	277	10.8%	122	4.7%	84	3.3%	387	15.0%	309	12.0%
México	Tijuana	jul-16	2544	220	8.6%	111	4.4%	147	5.8%	313	12.3%	126	5.0%
México	Toluca Rural	mar-16	3068	231	7.5%	143	4.7%	106	3.5%	623	20.3%	284	9.3%
México	Toluca Urban Area	oct-15	2464	196	8.0%	74	3.0%	58	2.4%	315	12.8%	144	5.8%
México	Xalapa	nov-16	3298	331	10.0%	126	3.8%	134	4.1%	455	13.8%	262	7.9%
	Regional total		46690	4688	10.0%	2140	4.6%	2108	4.5%	6808	14.6%	4487	9.6%
Europe													
Kosovo	Ferizaj	oct-17	854	65	7.6%	23	2.7%	27	3.2%	89	10.4%	46	5.4%
Kosovo	Gjakova	jun-18	676	18	2.7%	17	2.5%	26	3.8%	37	5.5%	30	4.4%
Kosovo	Gjilan	jun-17	1200	56	4.7%	29	2.4%	38	3.2%	68	5.7%	52	4.3%
Kosovo	Peja	may-18	1433	80	5.6%	43	3.0%	89	6.2%	89	6.2%	101	7.0%
Kosovo	Prishtina	jul-17	1033	73	7.1%	32	3.1%	37	3.6%	139	13.5%	81	7.8%
Kosovo	Prizren	mar-17	1376	97	7.0%	46	3.3%	70	5.1%	161	11.7%	82	6.0%
Greece	Athens	feb-20	1934	73	3.8%	22	1.1%	42	2.2%	153	7.9%	149	7.7%

Spain	A Coruña	jan-19	3461	498	14.4%	327	9.4%	234	6.8%	850	24.6%	893	25.8%
Spain	Bilbao	sep-18	3361	581	17.3%	408	12.1%	248	7.4%	884	26.3%	851	25.3%
Spain	Cantabria	feb-18	4149	625	15.1%	345	8.3%	313	7.5%	984	23.7%	870	21.0%
Spain	Cartagena	feb-16	3419	256	7.5%	182	5.3%	131	3.8%	390	11.4%	580	17.0%
Spain	Salamanca	sep-17	3458	394	11.4%	262	7.6%	155	4.5%	657	19.0%	636	18.4%
	Regional total		26354	2816	10.7%	1736	6.6%	1410	5.4%	4501	17.1%	4371	16.6%
	Global total		85669	9157	10.7%	4896	5.7%	4533	5.3%	13755	16.1%	10745	12.5%

Web table 4: Prevalence of rhinoconjunctivitis indicators among adolescents in the Global Asthma Network Phase I (GAN Phase I) by centre (2015-2020).

Country	Centre	Mean date data collection	Number of participants	Rhinitis symptoms in past 12 months		Hay fever ever		Rhinoconjunctivitis symptoms in the past 12 months		Severe rhinoconjunctivitis symptoms in the past 12 months		
				N	%	N	%	N	%	N	%	% of RC
Africa and Eastern Mediterranean												
Cameroon	Yaounde	feb-19	1066	389	36.5%	297	27.9%	136	12.8%	14	1.3%	10.3%
Iran	Karaj	feb-20	754	258	34.2%	241	32.0%	90	11.9%	1	0.1%	1.1%
Iran	Yazd	may-20	5141	1869	36.4%	1281	24.9%	539	10.5%	11	0.2%	2.0%
Nigeria	Ibadan	may-18	2897	661	22.8%	156	5.4%	277	9.6%	23	0.8%	8.3%
Kingdom of Saudi Arabia	Saudi Arabia	mar-19	4086	1237	30.3%	531	13.0%	574	14.0%	55	1.3%	9.6%
South Africa	Cape Town	aug-17	3979	1831	46.0%	1491	37.5%	947	23.8%	136	3.4%	14.4%
South Africa	Durban	feb-20	1960	751	38.3%	664	33.9%	429	21.9%	63	3.2%	14.7%
Sudan	Gadarif	feb-17	1344	275	20.5%	411	30.6%	123	9.2%	7	0.5%	5.7%
Sudan	Khartoum	mar-17	1785	565	31.7%	575	32.2%	268	15.0%	28	1.6%	10.4%
Syrian Arab Republic	Damascus	oct-18	1100	438	39.8%	91	8.3%	184	16.7%	0	0.0%	0.0%
Syrian Arab Republic	Lattakia	apr-19	1215	572	47.1%	241	19.8%	366	30.1%	22	1.8%	6.0%
	Regional total		25327	8846	34.9%	5979	23.1%	3933	15.5%	360	1.4%	9.2%
America												
Argentina	San Francisco	nov-19	1012	545	53.9%	353	34.9%	280	27.7%	13	1.3%	4.6%
Brazil	Uruguaiana	jan-18	1058	642	60.7%	429	40.5%	212	20.0%	9	0.9%	4.2%
Chile	South Santiago	mar-15	2750	900	32.7%	304	11.1%	513	18.7%	33	1.2%	6.4%
Costa Rica	Costa Rica	feb-18	1338	557	41.6%	492	36.8%	339	25.3%	23	1.7%	6.8%
Ecuador	Quito	apr-19	3000	1371	45.7%	361	12.0%	713	23.8%	13	0.4%	1.8%
Honduras	Tegucigalpa	jun-18	1431	324	22.6%	437	30.5%	0	0.0%	0	0.0%	
México	Aguascalientes	dec-15	3336	815	24.4%	192	5.8%	389	11.7%	14	0.4%	3.6%
México	Chihuahua	mar-16	2180	576	26.4%	157	7.2%	305	14.0%	18	0.8%	5.9%
México	Ciudad Juárez	may-16	2443	733	30.0%	99	4.1%	371	15.2%	18	0.7%	4.9%
México	Ciudad Victoria	dec-15	2468	693	28.1%	102	4.1%	351	14.2%	30	1.2%	8.5%
México	Córdoba	jul-16	2991	918	30.7%	364	12.2%	477	15.9%	32	1.1%	6.7%
México	Matamoros	may-16	2892	810	28.0%	230	8.0%	384	13.3%	26	0.9%	6.8%
México	Méxicali	apr-16	2479	749	30.2%	172	6.9%	345	13.9%	23	0.9%	6.7%
México	México City (North Area)	sep-15	3375	723	21.4%	209	6.2%	311	9.2%	16	0.5%	5.1%
México	Michoacán	sep-16	2504	578	23.1%	139	5.6%	263	10.5%	13	0.5%	4.9%
México	Monterrey	dec-17	2641	997	37.8%	579	21.9%	562	21.3%	37	1.4%	6.6%
México	Oaxaca	may-17	2569	494	19.2%	106	4.1%	200	7.8%	7	0.3%	3.5%
México	Puerto Vallarta	jun-16	2439	582	23.9%	93	3.8%	276	11.3%	27	1.1%	9.8%
México	San Luis Potosí	jun-16	2580	742	28.8%	154	6.0%	344	13.3%	14	0.5%	4.1%
México	Tijuana	jul-16	2601	607	23.3%	115	4.4%	298	11.5%	14	0.5%	4.7%

México	Toluca Rural	mar-16	3122	801	25.7%	114	3.7%	353	11.3%	13	0.4%	3.7%
México	Toluca Urban Area	oct-15	2650	608	22.9%	168	6.3%	234	8.8%	8	0.3%	3.4%
México	Xalapa	nov-16	3339	746	22.3%	229	6.9%	378	11.3%	29	0.9%	7.7%
Nicaragua	Managua	nov-18	3131	672	21.5%	0	0.0%	284	9.1%	19	0.6%	6.7%
	Regional total		60329	17183	28.5%	5598	9.3%	8182	13.6%	449	0.7%	5.5%
Europe												
Greece	Athens	feb-20	1934	463	23.9%	289	14.9%	132	6.8%	4	0.2%	3.0%
Kosovo	Ferizaj	oct-17	890	201	22.6%	67	7.5%	93	10.4%	4	0.4%	4.3%
Kosovo	Gjakova	jun-18	676	130	19.2%	48	7.1%	65	9.6%	3	0.4%	4.6%
Kosovo	Gjilan	jun-17	1200	300	25.0%	174	14.5%	134	11.2%	5	0.4%	3.7%
Kosovo	Peja	may-18	1433	389	27.1%	202	14.1%	173	12.1%	15	1.0%	8.7%
Kosovo	Prishtina	jul-17	1056	293	27.7%	128	12.1%	120	11.4%	5	0.5%	4.2%
Kosovo	Prizren	mar-17	1427	469	32.9%	207	14.5%	186	13.0%	10	0.7%	5.4%
Poland	Katowice	jun-17	3185	781	24.5%	865	27.2%	424	13.3%	46	1.4%	10.8%
Russia	Tyumen	may-19	3007	871	29.0%	301	10.0%	336	11.2%	6	0.2%	1.8%
Spain	A Coruña	jan-19	3462	1462	42.2%	540	15.6%	652	18.8%	28	0.8%	4.3%
Spain	Bilbao	sep-18	3379	1303	38.6%	526	15.6%	639	18.9%	38	1.1%	5.9%
Spain	Cantabria	feb-18	4382	1436	32.8%	586	13.4%	642	14.7%	33	0.8%	5.1%
Spain	Cartagena	jan-16	3437	860	25.0%	322	9.4%	414	12.0%	13	0.4%	3.1%
Spain	Salamanca	sep-17	3485	1291	37.0%	718	20.6%	643	18.5%	38	1.1%	5.9%
	Regional total		32953	10249	31.1%	4973	15.1%	4653	14.1%	248	0.8%	5.3%
South-East Asia and Western Pacific												
India	Bikaner	nov-17	2702	655	24.2%	333	12.3%	189	7.0%	10	0.4%	5.3%
India	Chandigarh	oct-17	3000	878	29.3%	438	14.6%	320	10.7%	11	0.4%	3.4%
India	Jaipur	nov-17	3060	1177	38.5%	592	19.3%	470	15.4%	12	0.4%	2.6%
India	Kolkata	sep-17	2998	614	20.5%	276	9.2%	164	5.5%	14	0.5%	8.5%
India	Kottayam	oct-17	2091	487	23.3%	328	15.7%	147	7.0%	11	0.5%	7.5%
India	Lucknow	oct-17	2969	372	12.5%	269	9.1%	145	4.9%	2	0.1%	1.4%
India	Mysuru (Mysore)	nov-17	3051	415	13.6%	305	10.0%	147	4.8%	8	0.3%	5.4%
India	New Delhi (7)	nov-17	3024	1013	33.5%	694	22.9%	405	13.4%	6	0.2%	1.5%
India	Pune	oct-17	3030	503	16.6%	270	8.9%	203	6.7%	8	0.3%	3.9%
New Zealand	Auckland	oct-18	1885	582	30.9%	830	44.0%	252	13.4%	17	0.9%	6.7%
Sri Lanka	Anuradhapura	oct-18	2989	673	22.5%	414	13.9%	342	11.4%	20	0.7%	5.8%
Sri Lanka	Peradeniya	nov-18	1696	517	30.5%	296	17.5%	209	12.3%	4	0.2%	1.9%
Taiwan	Taipei	oct-17	3474	1810	52.1%	1442	41.5%	598	17.2%	70	2.0%	11.7%
Thailand	Bangkok	sep-17	3206	1553	48.4%	968	30.2%	559	17.4%	61	1.9%	10.9%
	Regional total		39175	11249	28.7%	7455	19.0%	4150	10.6%	254	0.6%	6.1%
	Global total		157784	47527	30.1%	24005	15.2%	20918	13.3%	1311	0.8%	6.3%

Notes: Centres not included in the analyses: Guatemala City (Guatemala) and Salta (Argentina) due to participation rates lower than 50%; and Guadalajara (México) and Kolkata (India) due to major inconsistencies in the answers to the questionnaire. Number of participants affected by COVID (Karaj). Fieldwork affected by COVID (Durban, Lattakia, Damascus). No date of birth on questionnaire (Ibadan, Taipei). Response rates <80% (Durban, Costa Rica, Cartagena). Age and birth date showed high inconsistencies (Quito). <10 schools participated when >10 schools available (Chihuahua, Ciudad Victoria, México City North, Toluca Urban, Bangkok, Auckland). Date of birth unreliable, age used (Monterrey). No age on questionnaire (Chandigarh, New Delhi [7], Kolkata). Questionnaires completed at home by parents (Kottayam). >20% of questionnaires missing age and date of birth (Bangkok). <1000 participants (Karaj, Ferizaj, Gjakova). 68% of participants 12 years of age (Peja). Date of interview unreliable (Monterrey). Single data entry (Monterrey). >20% questionnaires missing date of birth (Puerto Vallarta).

Web table 5: Prevalence of rhinoconjunctivitis indicators among children in the Global Asthma Network Phase I (GAN Phase I) by centre (2015-2020).

Country	Centre	Mean date data collection	Number of participants	Rhinitis symptoms in past 12 months		Hay fever ever		Rhinoconjunctivitis symptoms in the past 12 months		Severe rhinoconjunctivitis symptoms in the past 12 months		
				N	%	N	%	N	%	N	%	% of RC
Africa and Eastern Mediterranean												
Cameroon	Yaounde	feb-19	722	85	11.8%	141	19.5%	32	4.4%	4	0.6%	12.5%
Iran	Karaj	feb-20	572	113	19.8%	184	32.2%	30	5.2%	1	0.2%	3.3%
Iran	Yazd	jun-20	2526	260	10.3%	349	13.8%	66	2.6%	4	0.2%	6.1%
Kingdom of Saudi Arabia	Saudi Arabia	mar-19	3614	517	14.3%	171	4.7%	204	5.6%	18	0.5%	8.8%
Syrian Arab Republic	Lattakia	may-19	1116	284	25.4%	264	23.7%	136	12.2%	18	1.6%	13.2%
	Regional total		8550	1259	14.7%	1109	13.0%	468	5.5%	45	0.5%	9.6%
America												
Costa Rica	Costa Rica	jan-18	1936	732	37.8%	725	37.4%	447	23.1%	22	1.1%	4.9%
Honduras	Tegucigalpa	jun-18	361	59	16.3%	52	14.4%	34	9.4%	1	0.3%	2.9%
México	Aguascalientes	aug-16	3176	568	17.9%	293	9.2%	307	9.7%	30	0.9%	9.8%
México	Chihuahua	may-16	1969	553	28.1%	219	11.1%	327	16.6%	26	1.3%	8.0%
México	Ciudad Juárez	apr-16	2118	338	16.0%	96	4.5%	186	8.8%	20	0.9%	10.8%
México	Ciudad Victoria	feb-16	2444	413	16.9%	168	6.9%	184	7.5%	10	0.4%	5.4%
México	Córdoba	jul-16	2746	446	16.2%	263	9.6%	190	6.9%	12	0.4%	6.3%
México	Matamoros	feb-16	806	120	14.9%	40	5.0%	45	5.6%	3	0.4%	6.7%
México	Mexicali	mar-16	2001	540	27.0%	260	13.0%	348	17.4%	21	1.0%	6.0%
México	México City (North Area)	jun-16	2515	507	20.2%	294	11.7%	240	9.5%	26	1.0%	10.8%
México	Michoacán	oct-16	2166	262	12.1%	89	4.1%	113	5.2%	9	0.4%	8.0%
México	Oaxaca	oct-17	1329	191	14.4%	105	7.9%	73	5.5%	3	0.2%	4.1%
México	Puerto Vallarta	jan-17	2241	379	16.9%	103	4.6%	162	7.2%	14	0.6%	8.6%
México	San Luis Potosí	jul-16	2108	480	22.8%	297	14.1%	217	10.3%	12	0.6%	5.5%
México	Tijuana	apr-16	2082	290	13.9%	115	5.5%	135	6.5%	19	0.9%	14.1%
México	Toluca Rural	jan-16	2976	317	10.7%	176	5.9%	160	5.4%	13	0.4%	8.1%
México	Toluca Urban Area	apr-16	2712	450	16.6%	215	7.9%	215	7.9%	23	0.8%	10.7%
México	Xalapa	feb-17	3717	633	17.0%	381	10.3%	265	7.1%	23	0.6%	8.7%
Nicaragua	Managua	nov-18	3162	604	19.1%	0	0.0%	367	11.6%	28	0.9%	7.6%
	Regional total		42565	7882	18.5%	3891	9.1%	4015	9.4%	315	0.7%	7.8%
Europe												
Kosovo	Peja	may-18	1441	158	11.0%	135	9.4%	48	3.3%	5	0.3%	10.4%
Russia	Tyumen	apr-19	2969	317	10.7%	183	6.2%	125	4.2%	8	0.3%	6.4%
Spain	A Coruña	ene-19	3407	810	23.8%	391	11.5%	326	9.6%	12	0.4%	3.7%
Spain	Bilbao	aug-18	2707	556	20.5%	239	8.8%	230	8.5%	15	0.6%	6.5%
Spain	Cantabria	jan-18	2841	574	20.2%	246	8.7%	224	7.9%	11	0.4%	4.9%
Spain	Cartagena	jan-16	3509	595	17.0%	233	6.6%	251	7.2%	13	0.4%	5.2%
Spain	Salamanca	sep-17	2388	492	20.6%	261	10.9%	223	9.3%	6	0.3%	2.7%

	Regional total		19262	3502	18.2%	1688	8.8%	1427	7.4%	70	0.4%	4.9%
South-East Asia and Western Pacific												
India	Bikaner	dec-17	2600	24	0.9%	21	0.8%	4	0.2%	0	0.0%	0.0%
India	Chandigarh	oct-17	2473	296	12.0%	299	12.1%	86	3.5%	5	0.2%	5.8%
India	Jaipur	nov-17	2296	225	9.8%	271	11.8%	56	2.4%	2	0.1%	3.6%
India	Kottayam	dic-17	2099	286	13.6%	95	4.5%	60	2.9%	7	0.3%	11.7%
India	Lucknow	oct-17	2969	61	2.1%	118	4.0%	15	0.5%	2	0.1%	13.3%
India	Mysuru (Mysore)	nov-17	2730	174	6.4%	233	8.5%	61	2.2%	3	0.1%	4.9%
India	New Delhi (7)	jan-18	2516	375	14.9%	260	10.3%	96	3.8%	0	0.0%	0.0%
India	Pune	oct-17	2404	113	4.7%	161	6.7%	24	1.0%	1	0.0%	4.2%
New Zealand	Auckland	jul-18	1538	325	21.1%	406	26.4%	159	10.3%	10	0.7%	6.3%
Sri Lanka	Anuradhapura	nov-18	2180	219	10.0%	231	10.6%	86	3.9%	9	0.4%	10.5%
Sri Lanka	Peradeniya	nov-18	1492	234	15.7%	197	13.2%	75	5.0%	6	0.4%	8.0%
Taiwan	Taipei	oct-17	3036	1434	47.2%	1554	51.2%	729	24.0%	78	2.6%	10.7%
Thailand	Bangkok	aug-17	3067	1175	38.3%	754	24.6%	462	15.1%	30	1.0%	6.5%
	Regional total		31400	4941	15.7%	4600	14.6%	1913	6.1%	153	0.5%	8.0%
	Global total		101777	17584	17.3%	11288	11.1%	7823	7.7%	583	0.6%	7.4%

Notes: Centres not included in the analyses: Guatemala City (Guatemala), Katowice (Poland), Monterrey (México) and Salta (Argentina) due to participation rates lower than 50%; and Guadalajara (México) and Kolkata (India) due to major inconsistencies in the answers to the questionnaire. Number of participants and response rate affected by civil war (Yaounde). Number of participants affected by COVID (Karaj). No age on questionaire (New Delhi [7]). <10 schools participated when >10 schools available (Bangkok, Lattakia). >20% of questionnaires missing age and date of birth (Bangkok). Response rate <70% (Costa Rica, Bilbao, Cartagena, Kottayam, Auckland). No date of birth on questionnaire (Taipei). <1000 participants (Tegucigalpa, Matamoros).

Web table 6. Prevalence of eczema indicators among adolescents in the Global Asthma Network Phase I (GAN Phase I) by centre (2015-2020).

Country	Centre	Mean date data collection	Number of participants	Flexural rash in the past 12 months		Eczema ever		Severe flexural rash in the past 12 months		
				N	%	N	%	N	%	% of rash
Africa and Eastern Mediterranean										
Cameroon	Yaounde	feb-19	1066	96	9.0%	164	15.4%	26	2.4%	27.1%
Iran	Karaj	feb-20	754	38	5.0%	58	7.7%	0	0.0%	0.0%
Iran	Yazd	may-20	5141	148	2.9%	373	7.3%	16	0.3%	10.8%
Nigeria	Ibadan	may-18	2897	135	4.7%	422	14.6%	32	1.1%	23.7%
Kingdom of Saudi Arabia	Saudi Arabia	mar-19	4086	209	5.1%	489	12.0%	38	0.9%	18.2%
South Africa	Cape Town	aug-17	3979	570	14.3%	725	18.2%	187	4.7%	32.8%
South Africa	Durban	feb-20	1960	199	10.2%	232	11.8%	46	2.3%	23.1%
Sudan	Gadarif	feb-17	1344	88	6.5%	140	10.4%	11	0.8%	12.5%
Sudan	Khartoum	mar-17	1785	188	10.5%	509	28.5%	50	2.8%	26.6%
Syrian Arab Republic	Damascus	oct-18	1100	36	3.3%	94	8.5%	10	0.9%	27.8%
Syrian Arab Republic	Lattakia	apr-19	1215	124	10.2%	140	11.5%	32	2.6%	25.8%
	Regional total		25327	1831	7.2%	3346	13.2%	448	1.8%	24.5%
America										
Argentina	San Francisco	nov-19	1012	143	14.1%	87	8.6%	14	1.4%	9.8%
Brazil	Uruguaiana	jan-18	1058	53	5.0%	48	4.5%	10	0.9%	18.9%
Chile	South Santiago	mar-15	2750	509	18.5%	270	9.8%	42	1.5%	8.3%
Costa Rica	Costa Rica	feb-18	1338	116	8.7%	240	17.9%	24	1.8%	20.7%
Ecuador	Quito	apr-19	3000	318	10.6%	105	3.5%	46	1.5%	14.5%
Honduras	Tegucigalpa	jun-18	1431	113	7.9%	148	10.3%	5	0.3%	4.4%
México	Aguascalientes	dec-15	3336	143	4.3%	66	2.0%	22	0.7%	15.4%
México	Chihuahua	mar-16	2180	92	4.2%	85	3.9%	8	0.4%	8.7%
México	Ciudad Juárez	may-16	2443	147	6.0%	47	1.9%	16	0.7%	10.9%
México	Ciudad Victoria	dec-15	2468	160	6.5%	47	1.9%	27	1.1%	16.9%
México	Córdoba	jul-16	2991	198	6.6%	178	6.0%	34	1.1%	17.2%
México	Matamoros	may-16	2892	145	5.0%	53	1.8%	34	1.2%	23.4%
México	Mexicali	apr-16	2479	99	4.0%	55	2.2%	14	0.6%	14.1%
México	México City (North Area)	sep-15	3375	130	3.9%	192	5.7%	22	0.7%	16.9%
México	Michoacán	sep-16	2504	72	2.9%	43	1.7%	9	0.4%	12.5%
México	Monterrey	dec-17	2641	248	9.4%	262	9.9%	35	1.3%	14.1%
México	Oaxaca	may-17	2569	68	2.6%	85	3.3%	15	0.6%	22.1%
México	Puerto Vallarta	jun-16	2439	87	3.6%	44	1.8%	25	1.0%	28.7%
México	San Luis Potosí	jun-16	2580	120	4.7%	81	3.1%	16	0.6%	13.3%
México	Tijuana	jul-16	2601	125	4.8%	72	2.8%	22	0.8%	17.6%
México	Toluca Rural	mar-16	3122	134	4.3%	86	2.8%	24	0.8%	17.9%
México	Toluca Urban Area	oct-15	2650	120	4.5%	129	4.9%	12	0.5%	10.0%

México	Xalapa	nov-16	3339	114	3.4%	89	2.7%	27	0.8%	23.7%
Nicaragua	Managua	nov-18	3131	178	5.7%	241	7.7%	49	1.6%	27.5%
	Regional total		60329	3632	6.0%	2753	4.6%	552	0.9%	15.2%
Europe										
Greece	Athens	feb-20	1934	110	5.7%	236	12.2%	5	0.3%	4.5%
Kosovo	Ferizaj	oct-17	890	20	2.2%	27	3.0%	0	0.0%	0.0%
Kosovo	Gjakova	jun-18	676	37	5.5%	46	6.8%	5	0.7%	13.5%
Kosovo	Gjilan	jun-17	1200	49	4.1%	50	4.2%	7	0.6%	14.3%
Kosovo	Peja	may-18	1433	72	5.0%	81	5.7%	8	0.6%	11.1%
Kosovo	Prishtina	jul-17	1056	56	5.3%	42	4.0%	5	0.5%	8.9%
Kosovo	Prizren	mar-17	1427	66	4.6%	92	6.4%	8	0.6%	12.1%
Poland	Katowice	jun-17	3185	261	8.2%	246	7.7%	21	0.7%	8.0%
Russia	Tyumen	may-19	3007	153	5.1%	295	9.8%	34	1.1%	22.2%
Spain	A Coruña	jan-19	3462	378	10.9%	1068	30.8%	41	1.2%	10.8%
Spain	Bilbao	sep-18	3379	408	12.1%	1026	30.4%	48	1.4%	11.8%
Spain	Cantabria	feb-18	4382	457	10.4%	1239	28.3%	54	1.2%	11.8%
Spain	Cartagena	jan-16	3437	217	6.3%	564	16.4%	19	0.6%	8.8%
Spain	Salamanca	sep-17	3485	523	15.0%	1339	38.4%	60	1.7%	11.5%
	Regional total		32953	2807	8.5%	6351	19.3%	315	1.0%	11.2%
South-East Asia and Western Pacific										
India	Bikaner	nov-17	2702	113	4.2%	293	10.8%	0	0.0%	0.0%
India	Chandigarh	oct-17	3000	102	3.4%	254	8.5%	11	0.4%	10.8%
India	Jaipur	nov-17	3060	151	4.9%	669	21.9%	16	0.5%	10.6%
India	Kolkata	sep-17	2998	163	5.4%	458	15.3%	24	0.8%	14.7%
India	Kottayam	oct-17	2091	66	3.2%	75	3.6%	9	0.4%	13.6%
India	Lucknow	oct-17	2969	57	1.9%	259	8.7%	8	0.3%	14.0%
India	Mysuru (Mysore)	nov-17	3051	43	1.4%	64	2.1%	5	0.2%	11.6%
India	New Delhi (7)	nov-17	3024	152	5.0%	186	6.2%	42	1.4%	27.6%
India	Pune	oct-17	3030	60	2.0%	132	4.4%	12	0.4%	20.0%
New Zealand	Auckland	oct-18	1885	116	6.2%	354	18.8%	21	1.1%	18.1%
Sri Lanka	Anuradhapura	oct-18	2989	33	1.1%	212	7.1%	3	0.1%	9.1%
Sri Lanka	Peradeniya	nov-18	1696	73	4.3%	159	9.4%	6	0.4%	8.2%
Taiwan	Taipei	oct-17	3474	333	9.6%	533	15.3%	40	1.2%	12.0%
Thailand	Bangkok	sep-17	3206	305	9.5%	558	17.4%	19	0.6%	6.2%
	Regional total		39175	1767	4.5%	4206	10.7%	216	0.6%	12.2%
	Global total		157784	10037	6.4%	16656	10.6%	1531	1.0%	15.3%

Notes: Centres not included in the analyses: Guatemala City (Guatemala) and Salta (Argentina) due to participation rates lower than 50%; and Guadalajara (México) and Kolkata (India) due to major inconsistencies in the answers to the questionnaire. Number of participants affected by COVID (Karaj). Fieldwork affected by COVID (Durban, Lattakia, Damascus). No date of birth on questionnaire (Ibadan, Taipei). Response rates <80% (Durban, Costa Rica, Cartagena). Age and birth date showed high inconsistencies (Quito). <10 schools participated when >10 schools available (Chihuahua, Ciudad Victoria, México City North, Toluca Urban, Bangkok, Auckland). Date of birth unreliable, age used (Monterrey). No age on questionnaire (Chandigarh, New Delhi [7], Kolkata). Questionnaires completed at home by parents (Kottayam). >20% of questionnaires missing age and date of birth (Bangkok). <1000 participants (Karaj, Ferizaj, Gjakova). 68% of participants 12 years of age (Peja). Date of interview unreliable (Monterrey). Single data entry (Monterrey). >20% questionnaires missing date of birth (Puerto Vallarta).

Web table 7. Prevalence of eczema indicators among children in the Global Asthma Network Phase I (GAN Phase I) by centre (2015-2020).

Country	Centre	Mean date data collection	Number of participants	Flexural rash in the past 12 months		Eczema ever		Severe flexural rash in the past 12 months		
				N	%	N	%	N	%	% of rash
Africa and Eastern Mediterranean										
Cameroon	Yaounde	feb-19	722	56	7.8%	48	6.6%	12	1.7%	21.4%
Iran	Karaj	feb-20	572	32	5.6%	70	12.2%	2	0.3%	6.3%
Iran	Yazd	jun-20	2526	61	2.4%	136	5.4%	3	0.1%	4.9%
Kingdom of Saudi Arabia	Saudi Arabia	mar-19	3614	168	4.6%	417	11.5%	28	0.8%	16.7%
Syrian Arab Republic	Lattakia	may-19	1116	34	3.0%	95	8.5%	13	1.2%	38.2%
	Regional total		8550	351	4.1%	766	9.0%	58	0.7%	16.5%
America										
Costa Rica	Costa Rica	jan-18	1936	145	7.5%	307	15.9%	30	1.5%	20.7%
Honduras	Tegucigalpa	jun-18	361	14	3.9%	23	6.4%	0	0.0%	0.0%
México	Aguascalientes	aug-16	3176	163	5.1%	170	5.4%	18	0.6%	11.0%
México	Chihuahua	may-16	1969	144	7.3%	134	6.8%	13	0.7%	9.0%
México	Ciudad Juárez	apr-16	2118	98	4.6%	56	2.6%	11	0.5%	11.2%
México	Ciudad Victoria	feb-16	2444	148	6.1%	91	3.7%	27	1.1%	18.2%
México	Cordoba	jul-16	2746	133	4.8%	143	5.2%	13	0.5%	9.8%
México	Matamoros	feb-16	806	34	4.2%	17	2.1%	3	0.4%	8.8%
México	Mexicali	mar-16	2001	101	5.0%	89	4.4%	7	0.3%	6.9%
México	México City (North Area)	jun-16	2515	178	7.1%	287	11.4%	16	0.6%	9.0%
México	Michoacán	oct-16	2166	72	3.3%	63	2.9%	11	0.5%	15.3%
México	Oaxaca	oct-17	1329	56	4.2%	109	8.2%	4	0.3%	7.1%
México	Puerto Vallarta	jan-17	2241	192	8.6%	80	3.6%	33	1.5%	17.2%
México	San Luis Potosí	jul-16	2108	118	5.6%	139	6.6%	12	0.6%	10.2%
México	Tijuana	apr-16	2082	99	4.8%	76	3.7%	15	0.7%	15.2%
México	Toluca Rural	jan-16	2976	200	6.7%	147	4.9%	20	0.7%	10.0%
México	Toluca Urban Area	apr-16	2712	163	6.0%	208	7.7%	11	0.4%	6.7%
México	Xalapa	feb-17	3717	166	4.5%	210	5.6%	15	0.4%	9.0%
Nicaragua	Managua	nov-18	3162	133	4.2%	275	8.7%	26	0.8%	19.5%
	Regional total		42565	2357	5.5%	2624	6.2%	285	0.7%	12.1%
Europe										
Kosovo	Peja	may-18	1441	33	2.3%	16	1.1%	2	0.1%	6.1%
Russia	Tyumen	apr-19	2969	102	3.4%	293	9.9%	17	0.6%	16.7%
Spain	A Coruña	jan-19	3407	347	10.2%	1613	47.3%	22	0.6%	6.3%
Spain	Bilbao	ago-18	2707	337	12.4%	1269	46.9%	24	0.9%	7.1%
Spain	Cantabria	jan-18	2841	266	9.4%	1312	46.2%	25	0.9%	9.4%
Spain	Cartagena	jan-16	3509	290	8.3%	1312	37.4%	42	1.2%	14.5%
Spain	Salamanca	sep-17	2388	217	9.1%	1134	47.5%	14	0.6%	6.5%

	Regional total		19262	1592	8.3%	6949	36.1%	146	0.8%	9.2%
South-East Asia and Western Pacific										
India	Bikaner	dec-17	2600	11	0.4%	291	11.2%	0	0.0%	0.0%
India	Chandigarh	oct-17	2473	94	3.8%	105	4.2%	12	0.5%	12.8%
India	Jaipur	nov-17	2296	96	4.2%	169	7.4%	7	0.3%	7.3%
India	Kottayam	dec-17	2099	48	2.3%	41	2.0%	3	0.1%	6.3%
India	Lucknow	oct-17	2969	38	1.3%	247	8.3%	8	0.3%	21.1%
India	Mysuru (Mysore)	nov-17	2730	55	2.0%	80	2.9%	4	0.1%	7.3%
India	New Delhi (7)	jan-18	2516	115	4.6%	135	5.4%	16	0.6%	13.9%
India	Pune	oct-17	2404	41	1.7%	53	2.2%	7	0.3%	17.1%
New Zealand	Auckland	jul-18	1538	231	15.0%	483	31.4%	28	1.8%	12.1%
Sri Lanka	Anuradhapura	nov-18	2180	82	3.8%	83	3.8%	4	0.2%	4.9%
Sri Lanka	Peradeniya	nov-18	1492	92	6.2%	75	5.0%	4	0.3%	4.3%
Taiwan	Taipei	oct-17	3036	478	15.7%	694	22.9%	65	2.1%	13.6%
Thailand	Bangkok	aug-17	3067	361	11.8%	878	28.6%	30	1.0%	8.3%
	Regional total		31400	1742	5.5%	3334	10.6%	188	0.6%	10.8%
	Global total		101777	6042	5.9%	13673	13.4%	677	0.7%	11.2%

Notes: Centres not included in the analyses: Guatemala City (Guatemala), Katowice (Poland), Monterrey (México) and Salta (Argentina) due to participation rates lower than 50%; and Guadalajara (México) and Kolkata (India) due to major inconsistencies in the answers to the questionnaire. Number of participants and response rate affected by civil war (Yaounde). Number of participants affected by COVID (Karaj). No age on questionaire (New Delhi [7]). <10 schools participated when >10 schools available (Bangkok, Lattakia). >20% of questionnaires missing age and date of birth (Bangkok). Response rate <70% (Costa Rica, Bilbao, Cartagena, Kottayam, Auckland). No date of birth on questionnaire (Taipei). <1000 participants (Tegucigalpa, Matamoros).

Web table 8: Prevalence of asthma, rhinoconjunctivitis and eczema indicators grouped by sex. GAN Phase I (2015-2020)

		Current wheeze	Asthma ever	Severe asthma symptoms	Current rhinoconjunctivitis symptoms	Hay fever ever	Severe rhinoconjunctivitis symptoms	Current eczema symptoms	Eczema ever	Severe eczema symptoms
13-14 years	Total (%)	11.1	10.5	5.2	13.3	15.2	0.8	6.4	10.6	1.0
	Male (%)	10.2	11.2	4.6	11.6	14.4	0.7	4.9	9.3	0.6
	Female (%)	11.8	9.8	5.8	16.0	15.9	0.9	7.6	11.6	1.3
	OR for males* (95%CI)	0.81 (0.78-0.84)	1.14 (1.10-1.18)	0.76 (0.72-0.79)	0.67 (0.65-0.69)	0.88 (0.86-0.91)	0.82 (0.74-0.93)	0.60 (0.58-0.63)	0.71 (0.68-0.73)	0.52 (0.46-0.58)
6-7 years	Total (%)	9.1	7.6	3.9	7.7	11.1	0.6	5.9	13.4	0.7
	Male (%)	9.9	8.4	4.2	8.0	11.9	0.6	5.9	13.5	0.7
	Female (%)	8.3	6.7	3.6	7.3	10.2	0.5	5.9	13.4	0.7
	OR for males* (95%CI)	1.24 (1.19-1.30)	1.33 (1.27-1.40)	1.20 (1.12-1.28)	1.16 (1.11-1.22)	1.18 (1.13-1.23)	1.19 (1.02-1.42)	1.01 (0.95-1.06)	1.01 (0.97-1.05)	1.03 (0.89-1.20)

All values as number and (percentage)

*Adjusted for school at second level and centre as third. See text for definitions of disease indicators.

Web table 9. Rank correlations and their 95%CI between centre prevalence rates of the indicators of the three conditions. (Upper triangle: adolescents; lower triangle: children). GAN Phase I (2015-2020)

	Current wheeze	Asthma ever	Severe asthma symptoms	Current rhinoconjunctivitis symptoms	Severe rhinoconjunctivitis symptoms	Hay fever ever	Current eczema symptoms	Eczema ever	Severe eczema symptoms
Current wheeze		0.72 (0.58-0.82)	0.93 (0.89-0.96)	0.61 (0.40-0.75)	0.53 (0.33-0.69)	0.23 (-0.02-0.45)	0.46 (0.24-0.64)	0.26 (0.01-0.48)	0.52 (0.31-0.68)
Asthma ever	0.82 (0.69-0.90)		0.67 (0.51-0.79)	0.53 (0.33-0.69)	0.51 (0.30-0.67)	0.35 (0.11-0.55)	0.58 (0.39-0.73)	0.50 (0.29-0.67)	0.51 (0.30-0.67)
Severe asthma symptoms	0.89 (0.80-0.94)	0.77 (0.61-0.87)		0.52 (0.31-0.68)	0.52 (0.31-0.68)	0.07 (-0.18-0.31)	0.39 (0.15-0.58)	0.14 (-0.11-0.37)	0.53 (0.33-0.69)
Current rhinoconjunctivitis symptoms	0.75 (0.58-0.86)	0.72 (0.53-0.84)	0.77 (0.61-0.87)		0.67 (0.51-0.79)	0.43 (0.20-0.61)	0.66 (0.49-0.78)	0.32 (0.08-0.52)	0.66 (0.50-0.78)
Severe rhinoconjunctivitis symptoms	0.60 (0.37-0.76)	0.49 (0.23-0.69)	0.68 (0.47-0.81)	0.82 (0.69-0.90)		0.30 (0.05-0.51)	0.58 (0.39-0.73)	0.25 (0.01-0.47)	0.65 (0.48-0.77)
Hay fever ever	0.39 (0.11-0.62)	0.29 (-0.01-0.54)	0.23 (-0.07-0.49)	0.40 (0.11-0.62)	0.24 (-0.06-0.50)		0.50 (0.29-0.67)	0.64 (0.47-0.77)	0.23 (-0.02-0.45)
Current eczema symptoms	0.68 (0.48-0.81)	0.57 (0.33-0.74)	0.49 (0.23-0.69)	0.67 (0.47-0.81)	0.53 (0.27-0.71)	0.40 (0.12-0.62)		0.61 (0.43-0.75)	0.72 (0.58-0.82)
Eczema ever	0.34 (0.04-0.58)	0.53 (0.28-0.72)	0.17 (-0.13-0.45	0.43 (0.15-0.65)	0.13 (-0.18-0.41)	0.35 (0.05-0.58)	0.55 (0.30-0.73)		0.36 (0.13-0.56)
Severe eczema symptoms	0.55 (0.30-0.73)	0.51 (0.25-0.70)	0.49 (0.23-0.69)	0.62 (0.40-0.77)	0.61 (0.38-0.77)	0.18 (-0.13-0.45)	0.74 (0.57-0.85)	0.46 (0.19-0.67)	